THIAGARAJAR COLLEGE OF ENGINEERING

(A Govt. Aided Autonomous Institution Affiliated to Anna University)

MADURAI - 625 015

Lab Manual [B E Mechatronics - VII SEMESTER]

21MT760 – System Integration Laboratory

Department of Mechatronics Engineering

EXP : 01 DATE:	DESIGN AND IMPLEMENTATION OF CONVEYOR MOTOR APPLICATION USING SCADA

Aim:

To design & implement a conveyor motor application using SCADA.

Apparatus Required:

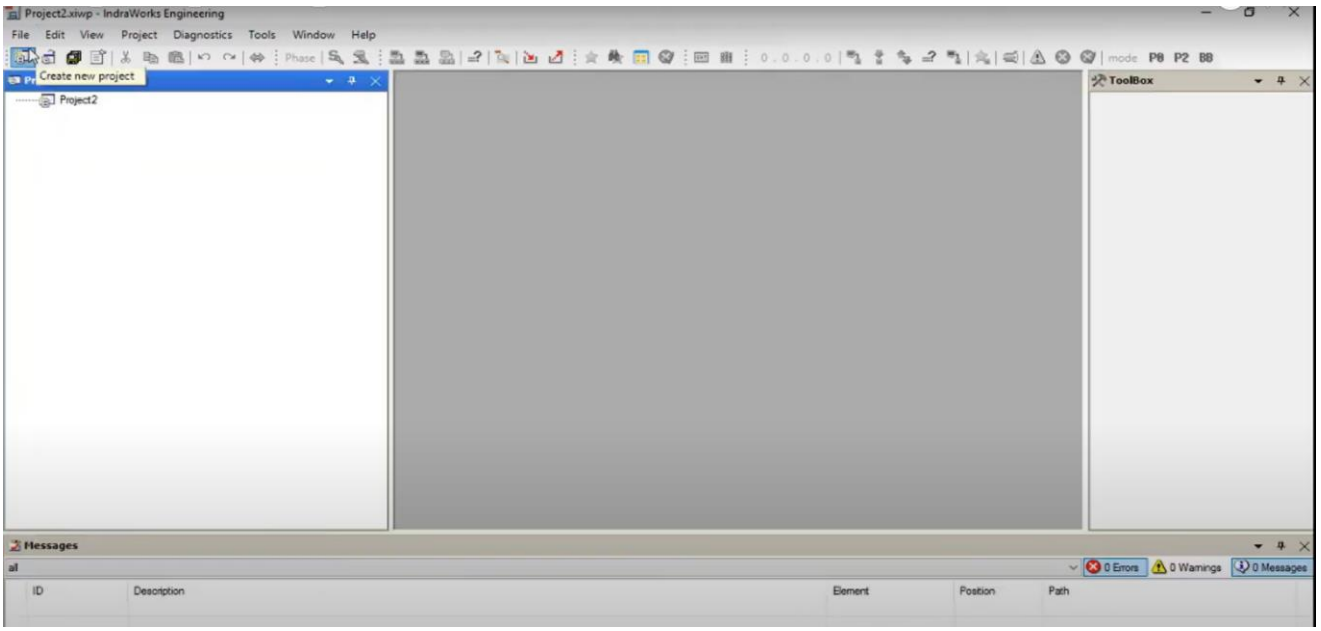
1. PC
2. PLC
3. IndraWorks Engineering Software

Procedure:

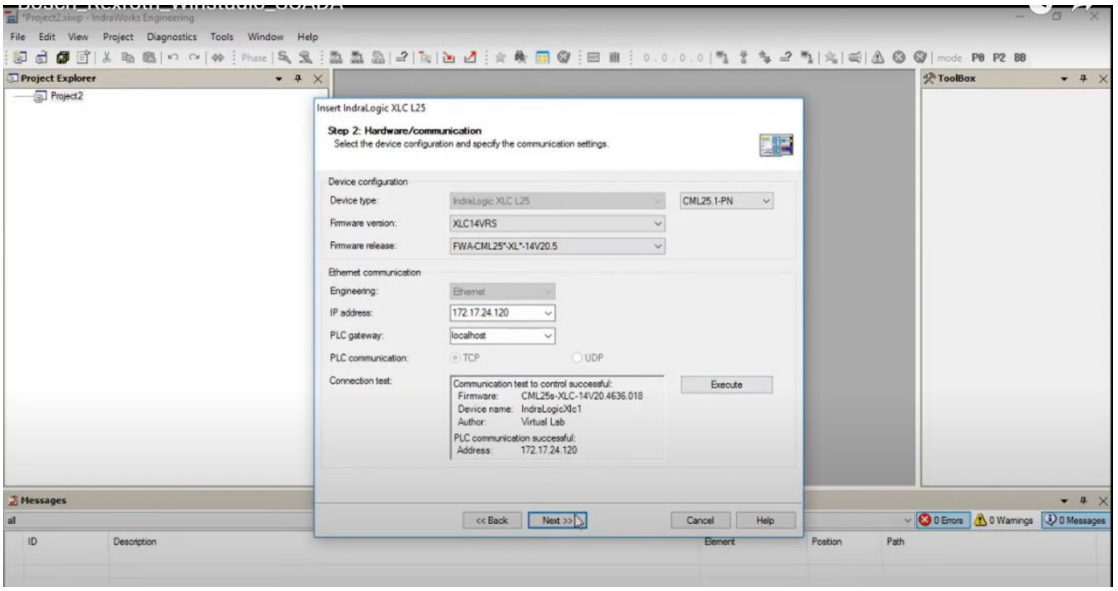
- Create a new project in IndraWorks Engineering Software & add IndraLogic XLC 25.
- Select PLC Program & add required input and output modules as per the given application.
- Parallel input and outputs are placed parallel to the input and output modules.
- Now add Win studio application.
- Create tag names to the switches and parallel inputs and outputs & place the components required in the Win studio screen.
- Link the components with the created tag names.
- Login the PLC & start the application, now simulate using the Win studio screen & verify the output.

PROCEDURE:

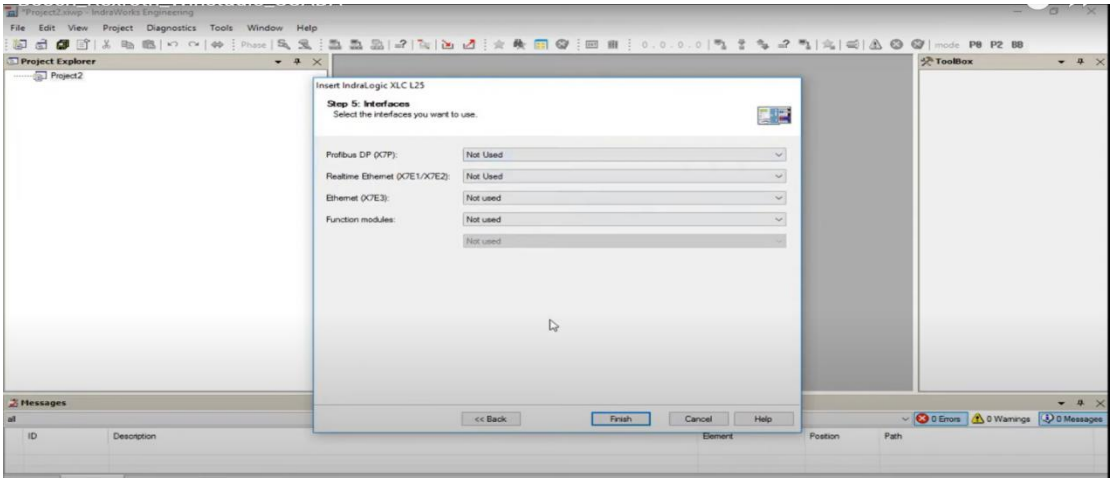
STEP 1: Create a new project in Indraworks Engineering Software



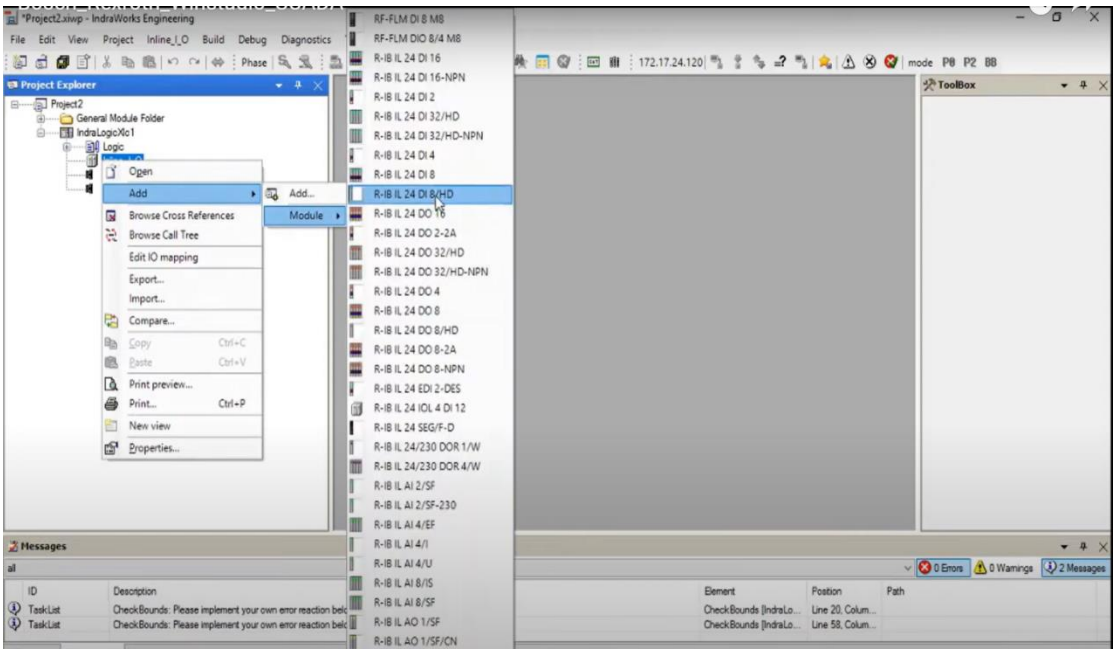
STEP 2: Give IP address and execute communication test



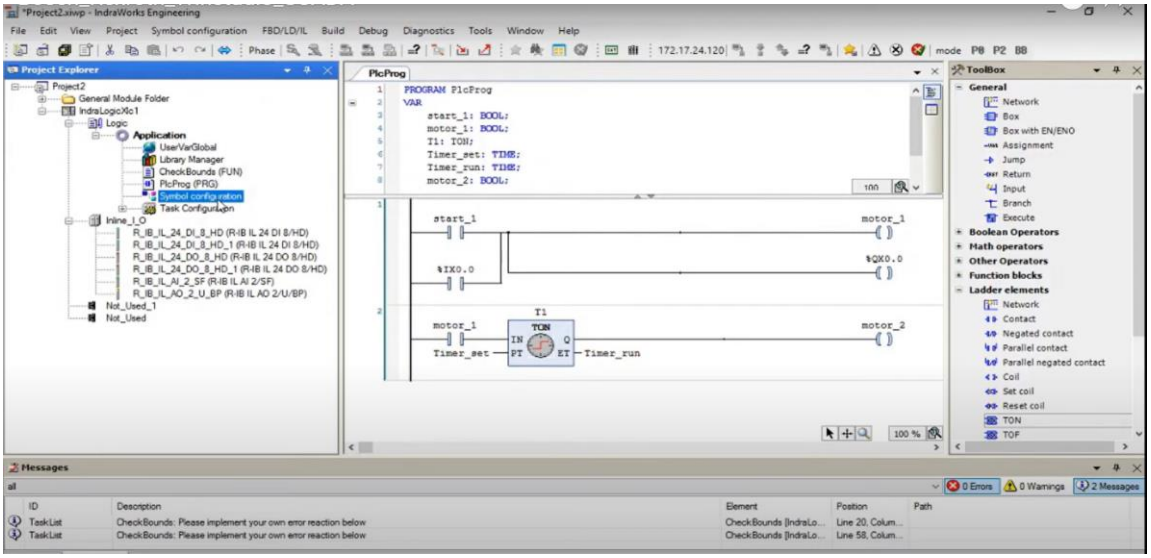
STEP 3: Update the details for XLC as shown below



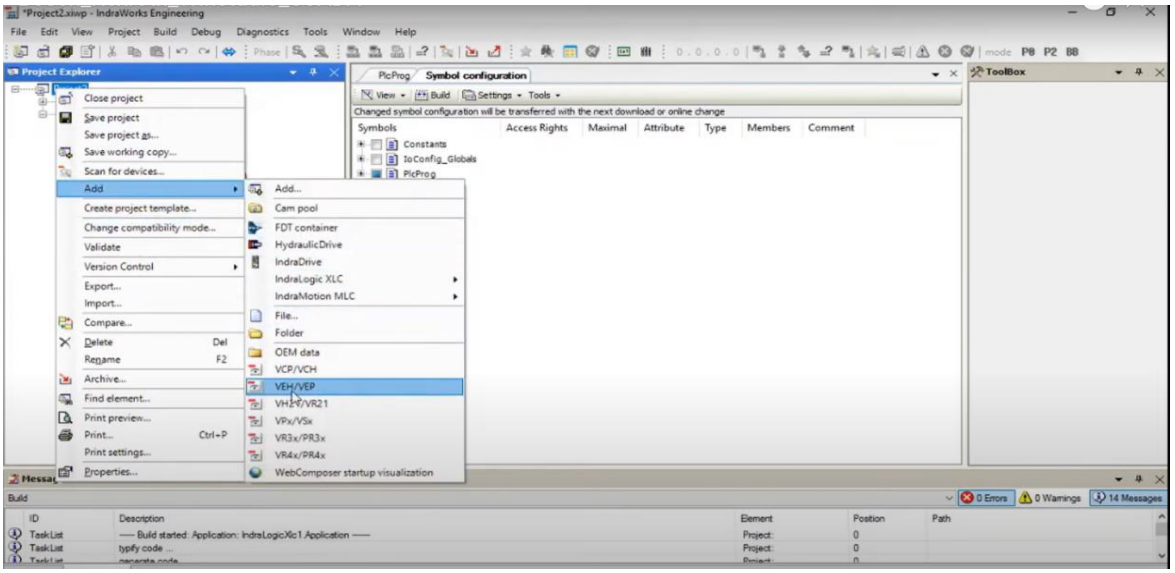
STEP 4 : Add the required I/P & O/P Modules



STEP 5: Go to PlcProg and Build logic for asked application



STEP 6: Add VEH / VEP



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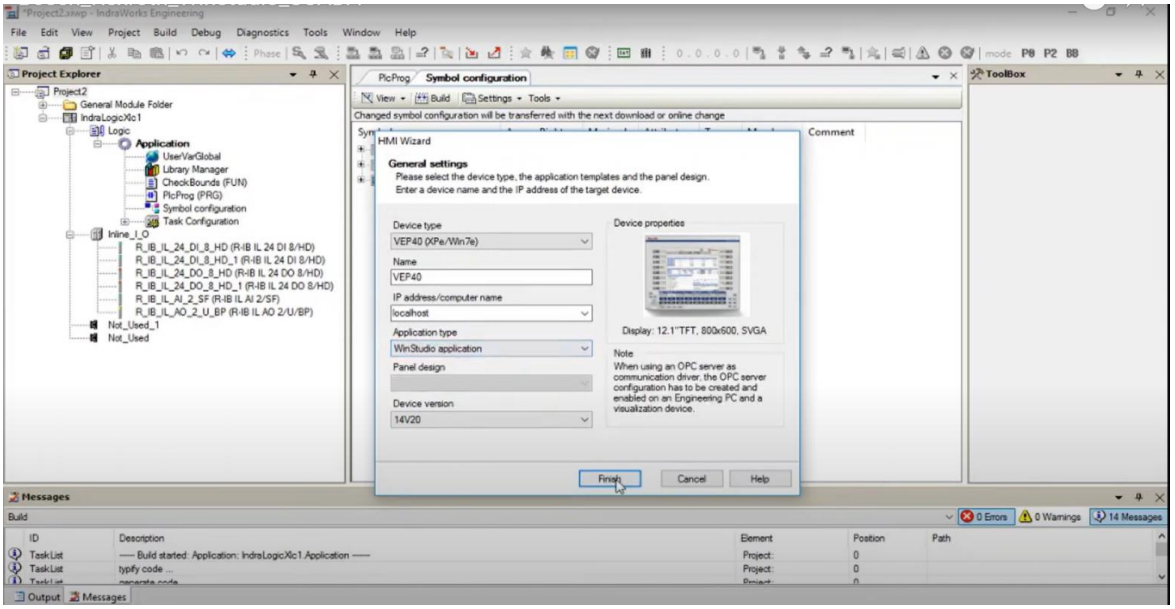
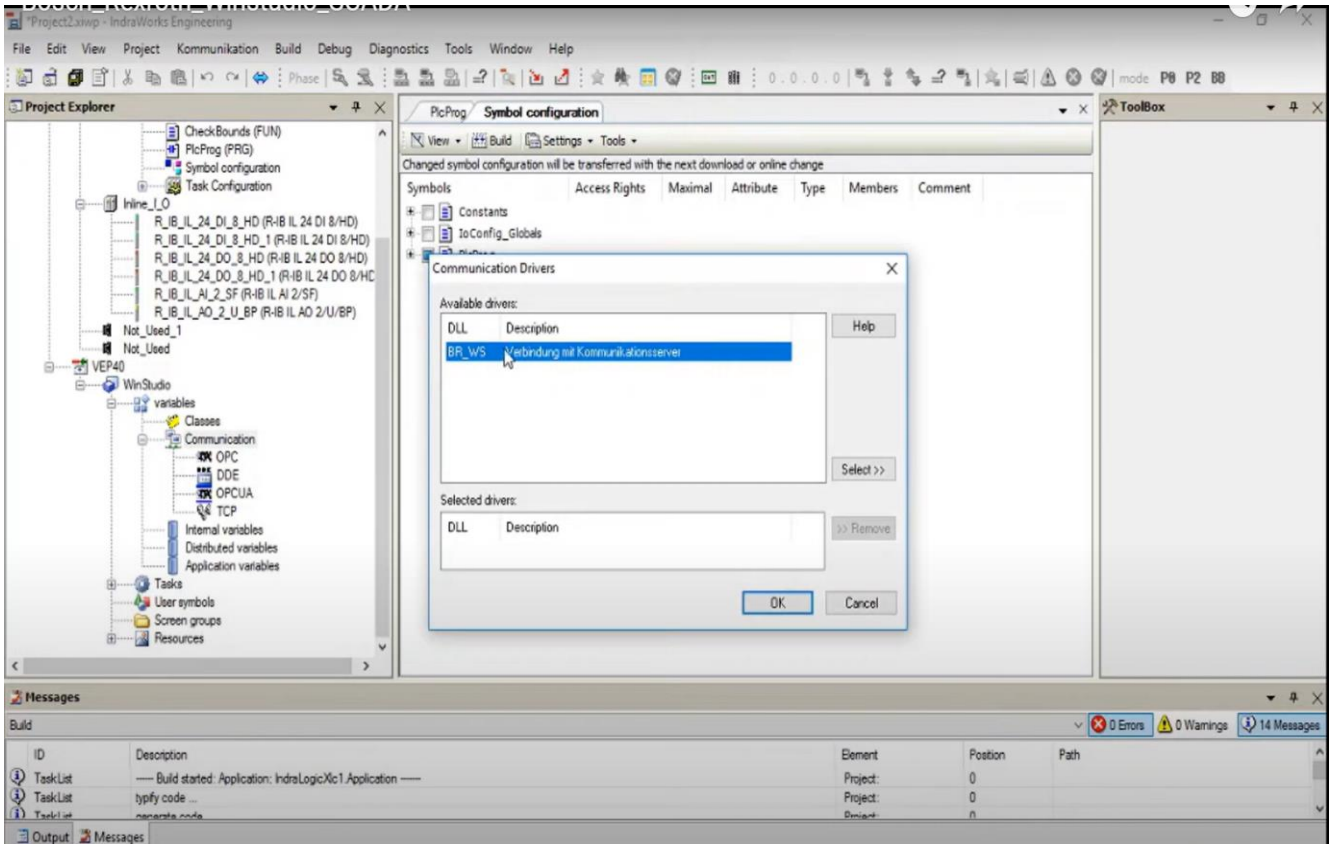
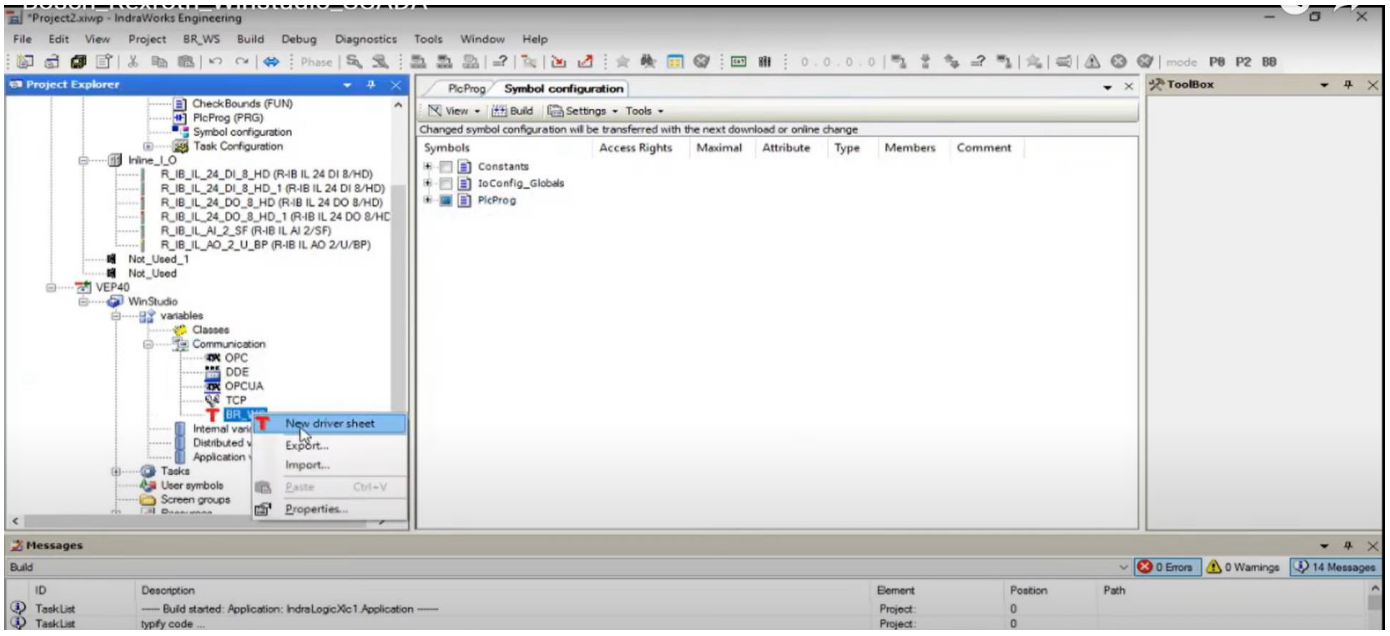
STEP 7: Add Win Studio Application



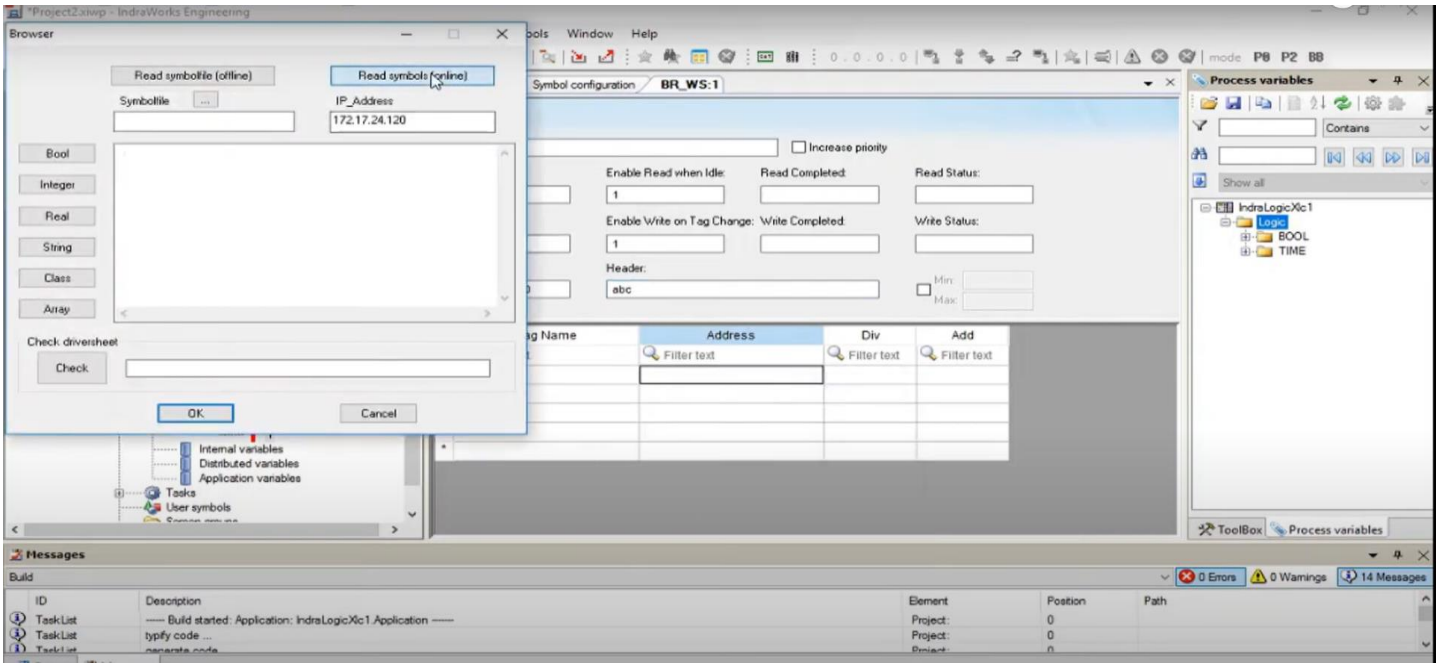
STEP 8: Create and add new driver sheet



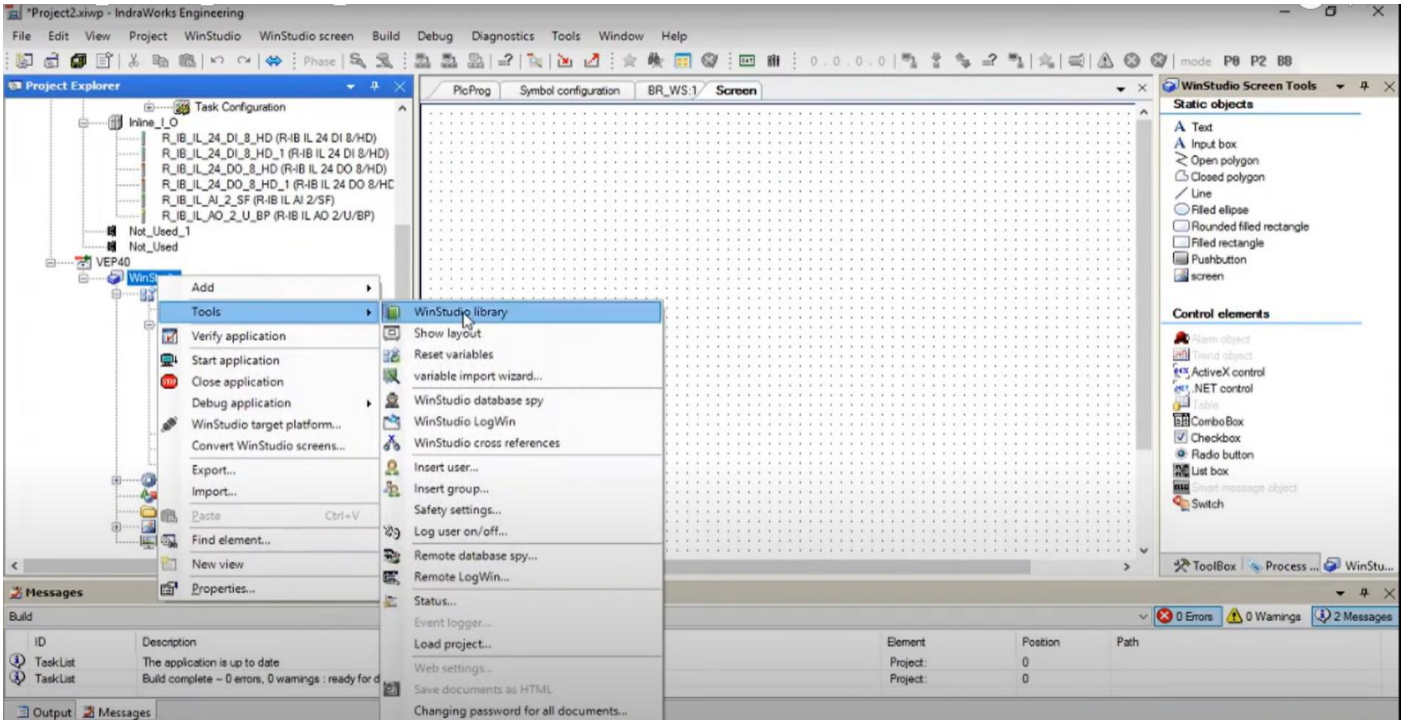
STEP 9 : Go to Symbol Configuration , Build and Generate code for the program, and include (tick) all the dummy inputs and outputs required to be displayed on the SCADA Sreen.



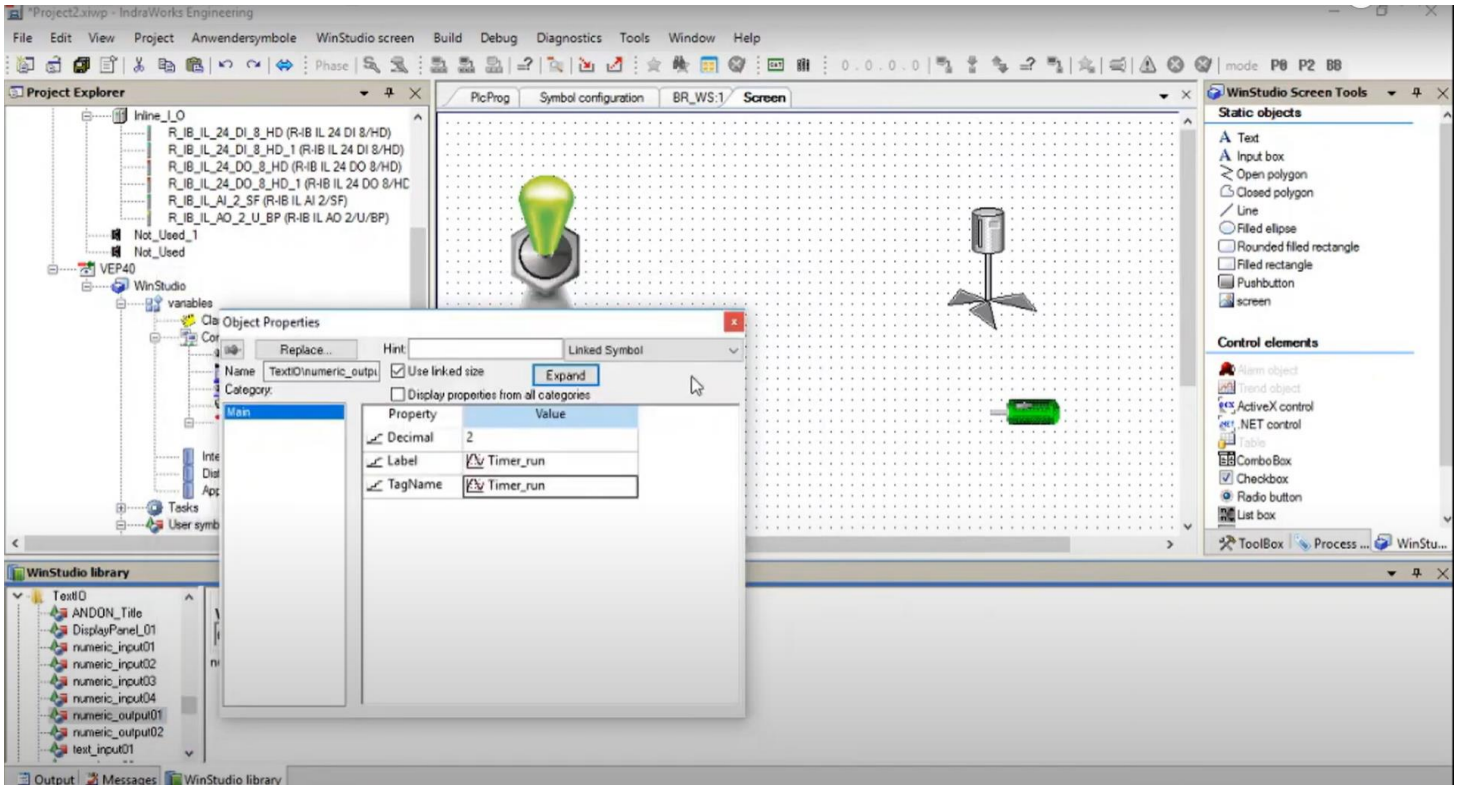
STEP 10: Now the Generated code can be located offline by clicking on Project's file name—> Properties ; or it can be simply be read online by logging in the PLC , then the inputs and outputs that was selected will be displayed in the Browser tab, just copy them.



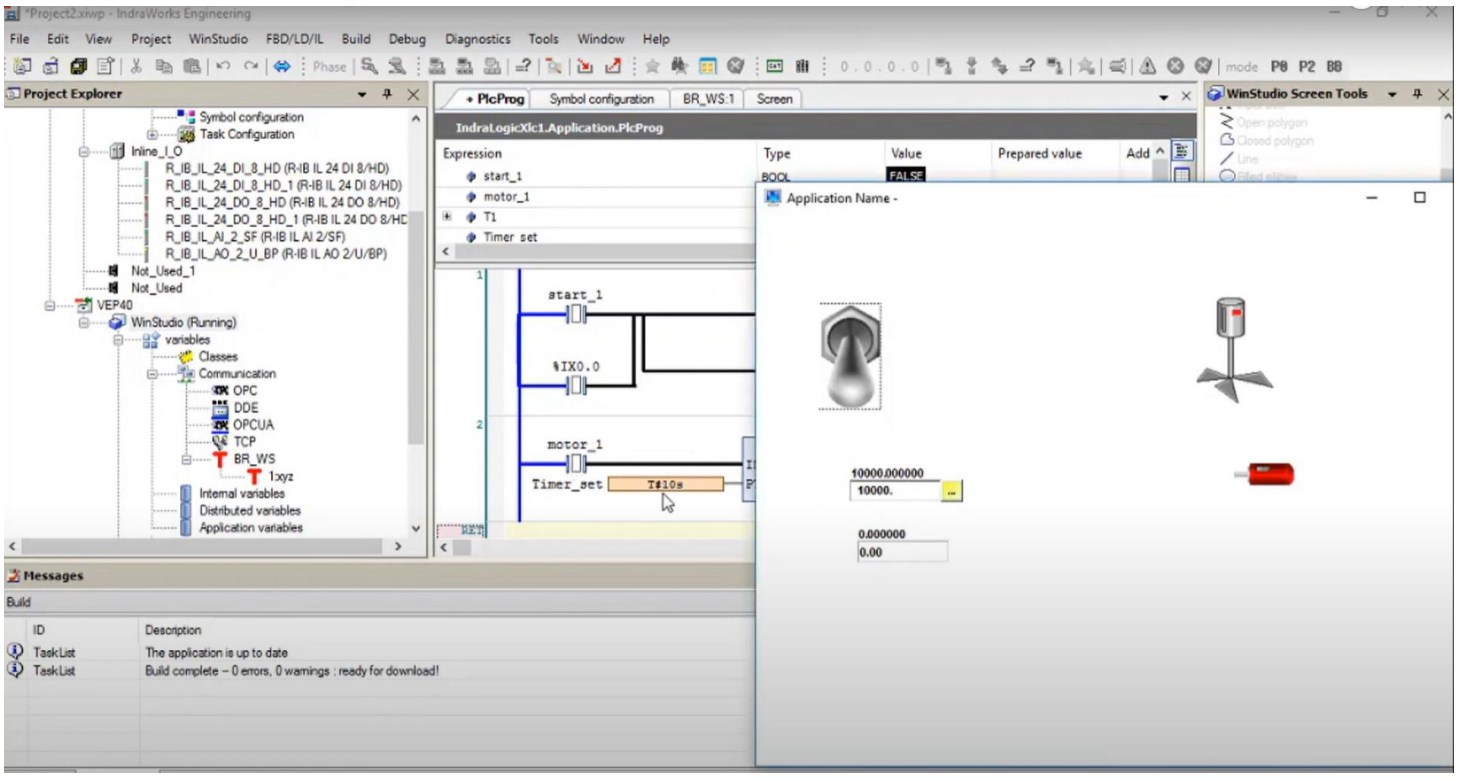
STEP 11 : Go to the Win studio library as shown in the image and select and drop the required analog & digital inputs and outputs



STEP 13: Now link the components with their tag names and tag states by double tapping on the particular component



STEP 14: Login the PLC & start the application, now simulate using the Win studio screen & verify the output.



Inference:

- From this experiment, knowledge and skills was gained regarding the implementation of SCADA and its integration with PLC ladder logic using IndraWorks Engineering Software.
- The implementation of conveyor motor applications through SCADA enables remote management and ensures timely responses to problems.
- Therefore, SCADA systems can be employed in various industries for the monitoring, controlling, and collection of data for industrial processes.

Result:

Hence, the design & implementation of conveyor motor application using SCADA was realized in IndraWorks Engineering Software.

EXP : 02 DATE:	DESIGN AND IMPLEMENTATION OF CONVEYOR MOTOR APPLICATION USING HMI

Aim:

To design and implement conveyor motor application using HMI.

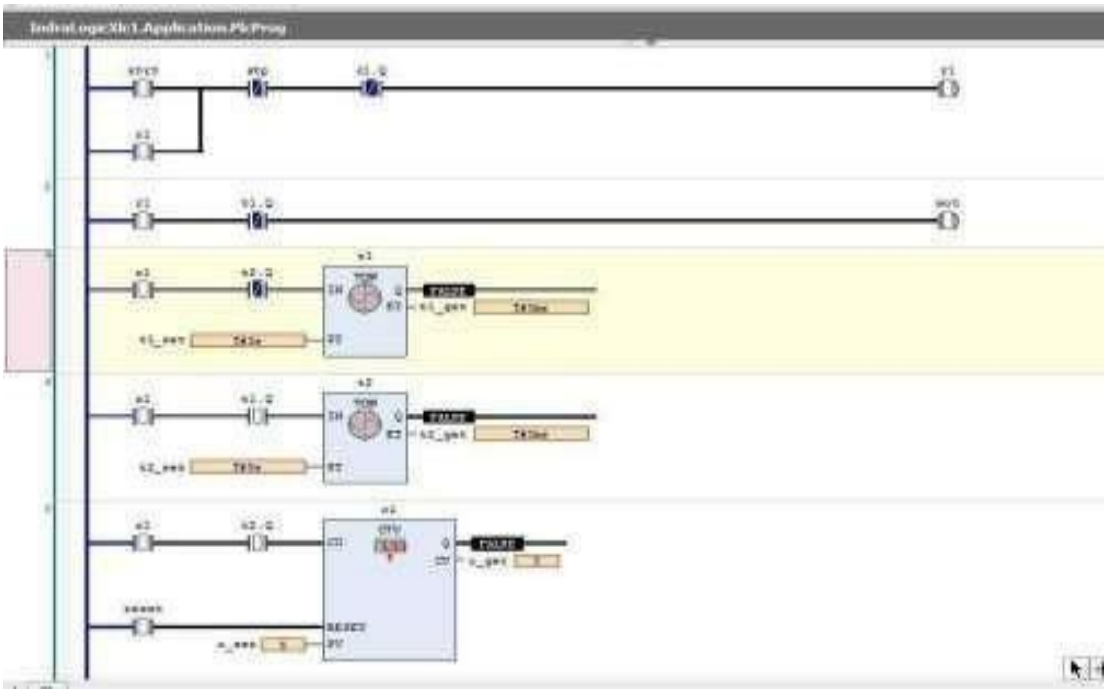
Apparatus Required:

1. PC
2. PLC
3. IndraWorks Engineering Software
4. HMI panel

Procedure:

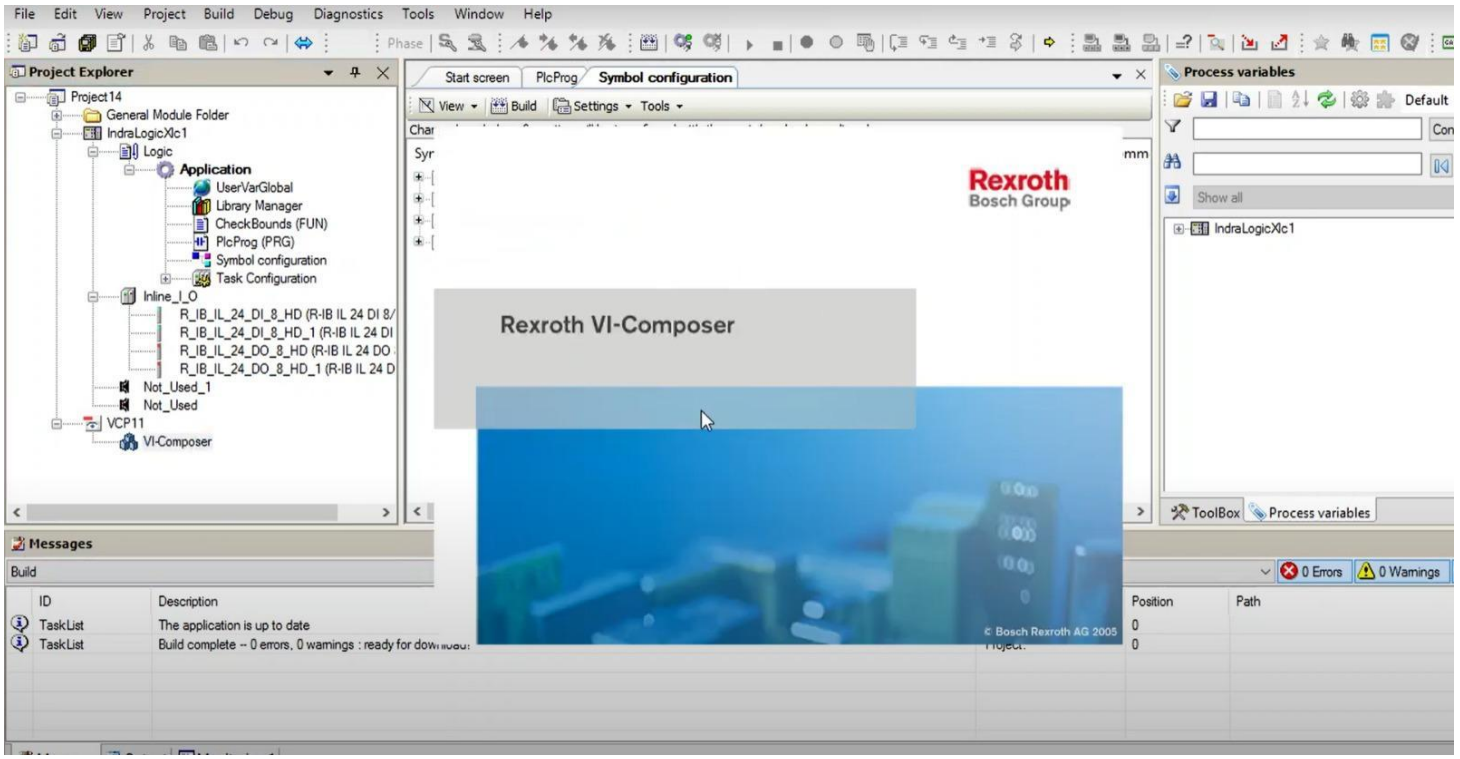
- Create a new project in IndraWorks Engineering Software and add Indralogic XL25.
- Select PLC Program and add necessary input and output module along with dummy modules as per the given application.
- Assign dummy inputs, generate the code, and add the VCP application.
- Create tag names to connect the dummy variables, then open main screen to create and link a button to the variable.
- Login the PLC and start the application
- Connect HMI screen and press the buttons to verify the output.

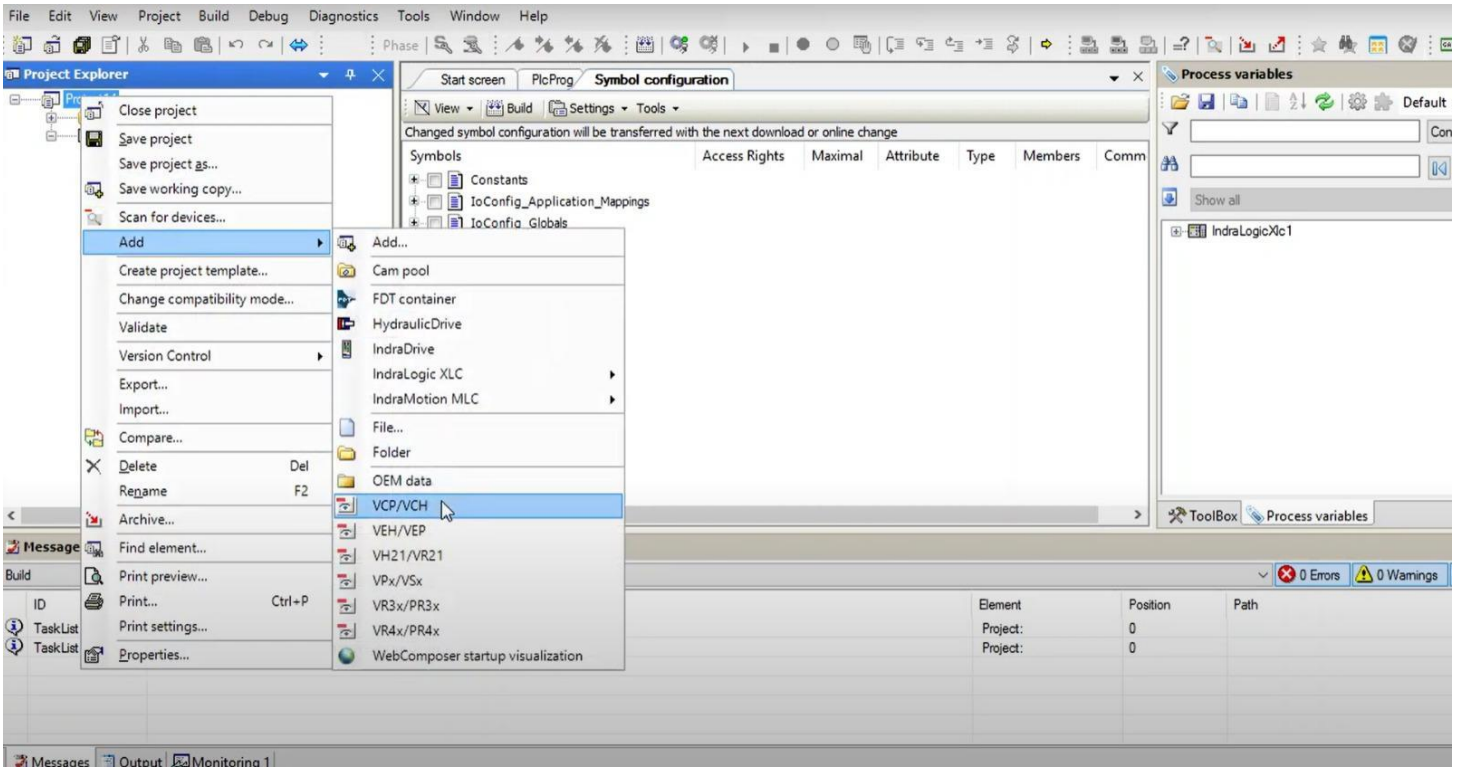
PLC Program:



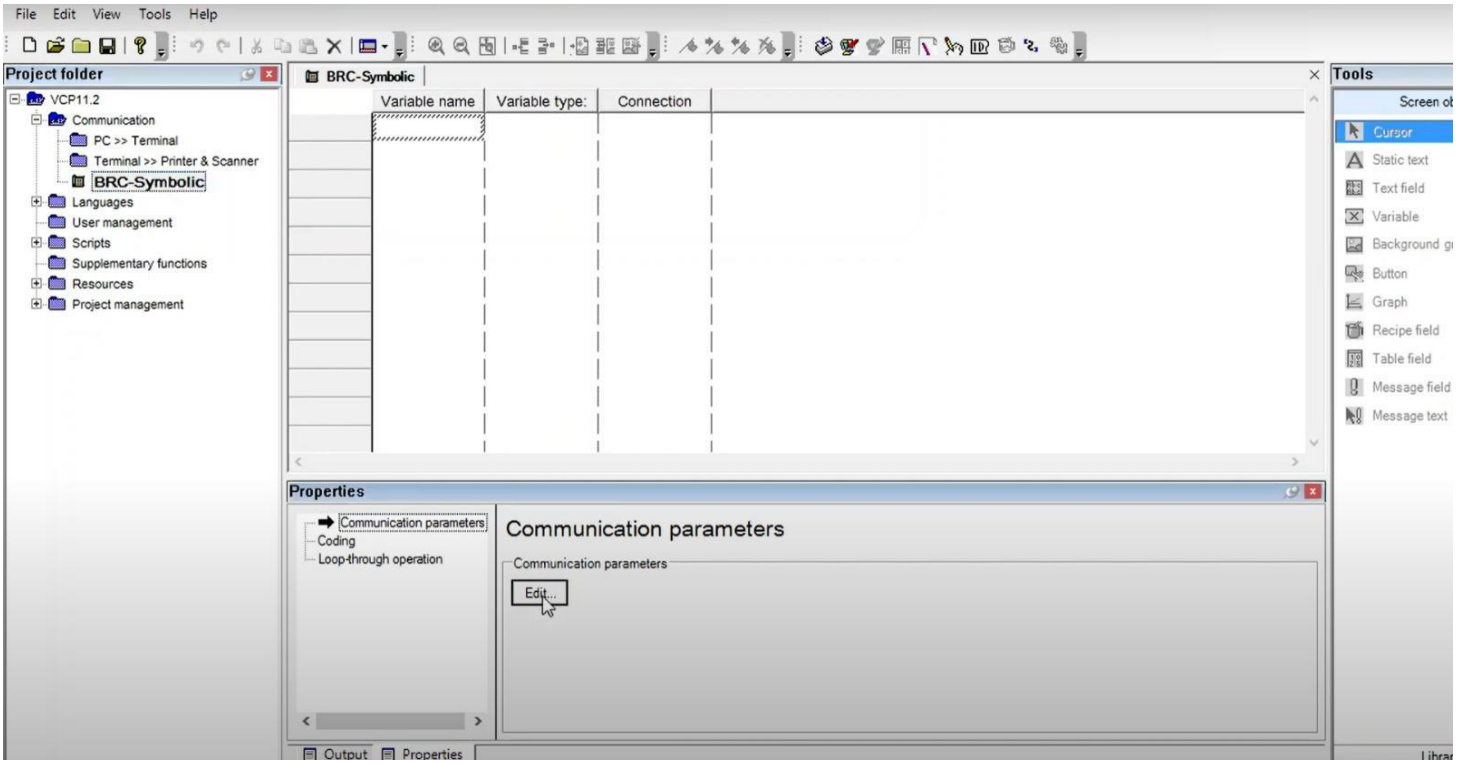
STEPS TO FOLLOW:

STEP 1: After creating the PLC program, add the VCP/VEH and the Rexroth VI-Composer will open

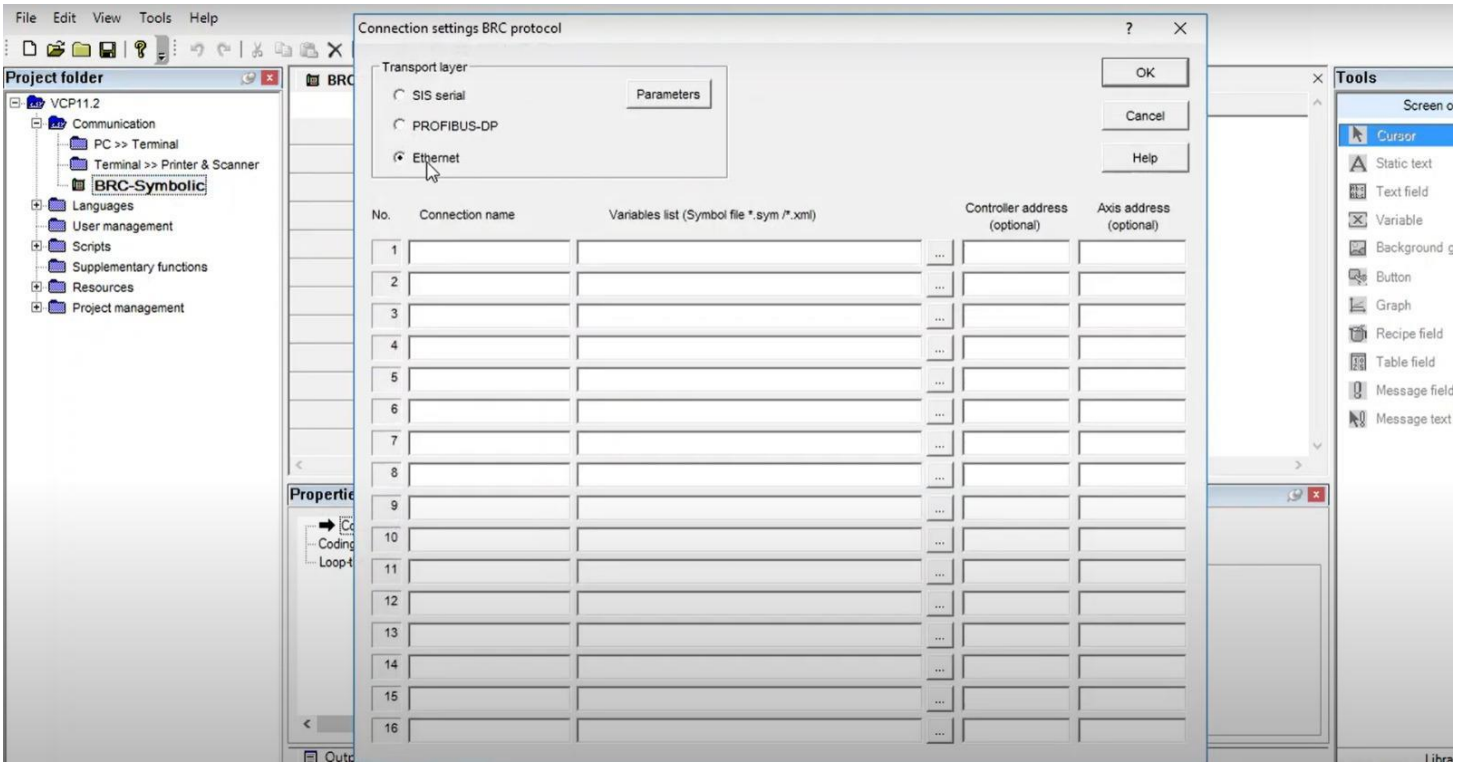




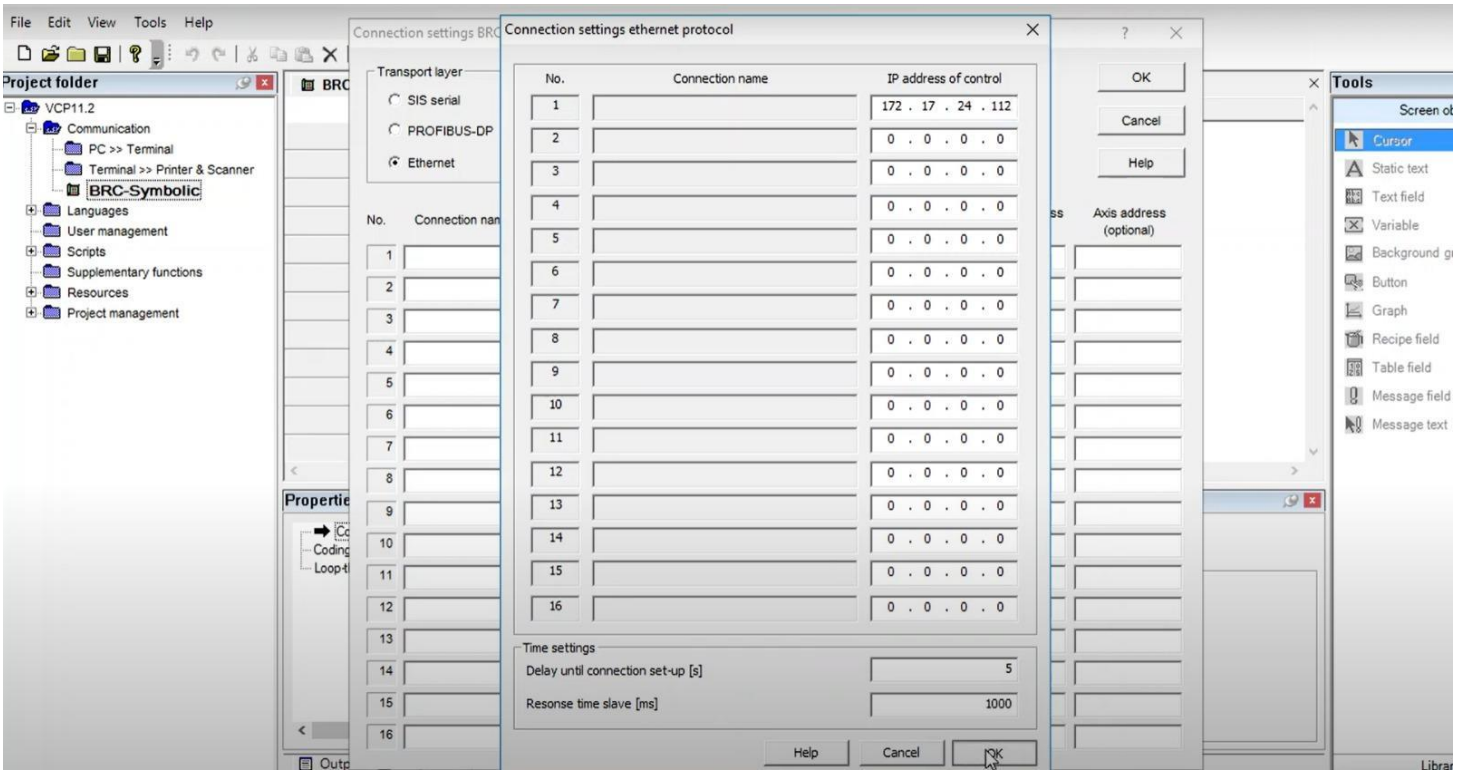
<u>STEP 2:</u> Under Communication select the BRC- Symbolic and under Communication parameters select the option to edit



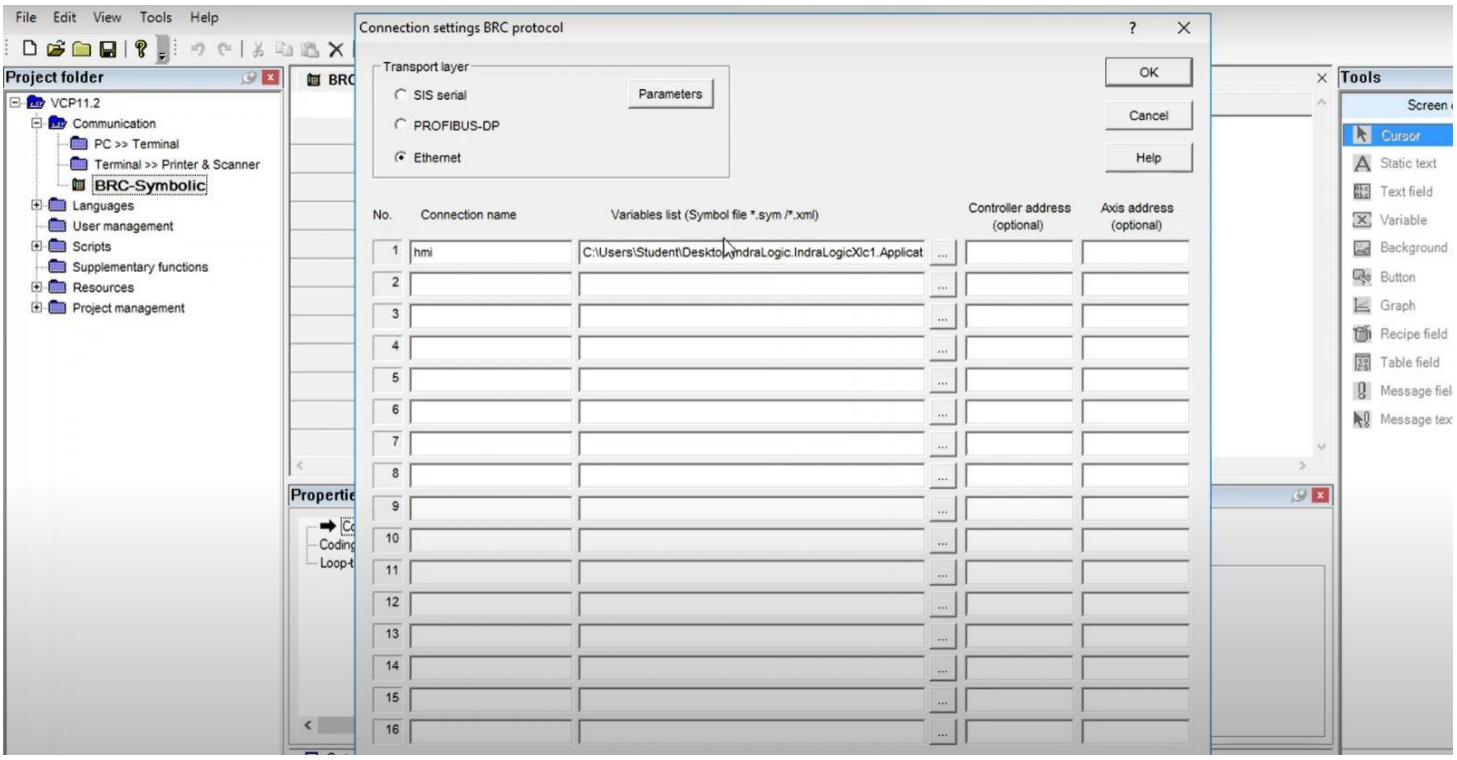
<u>STEP 3:</u> Click on Ethernet and click on parameters



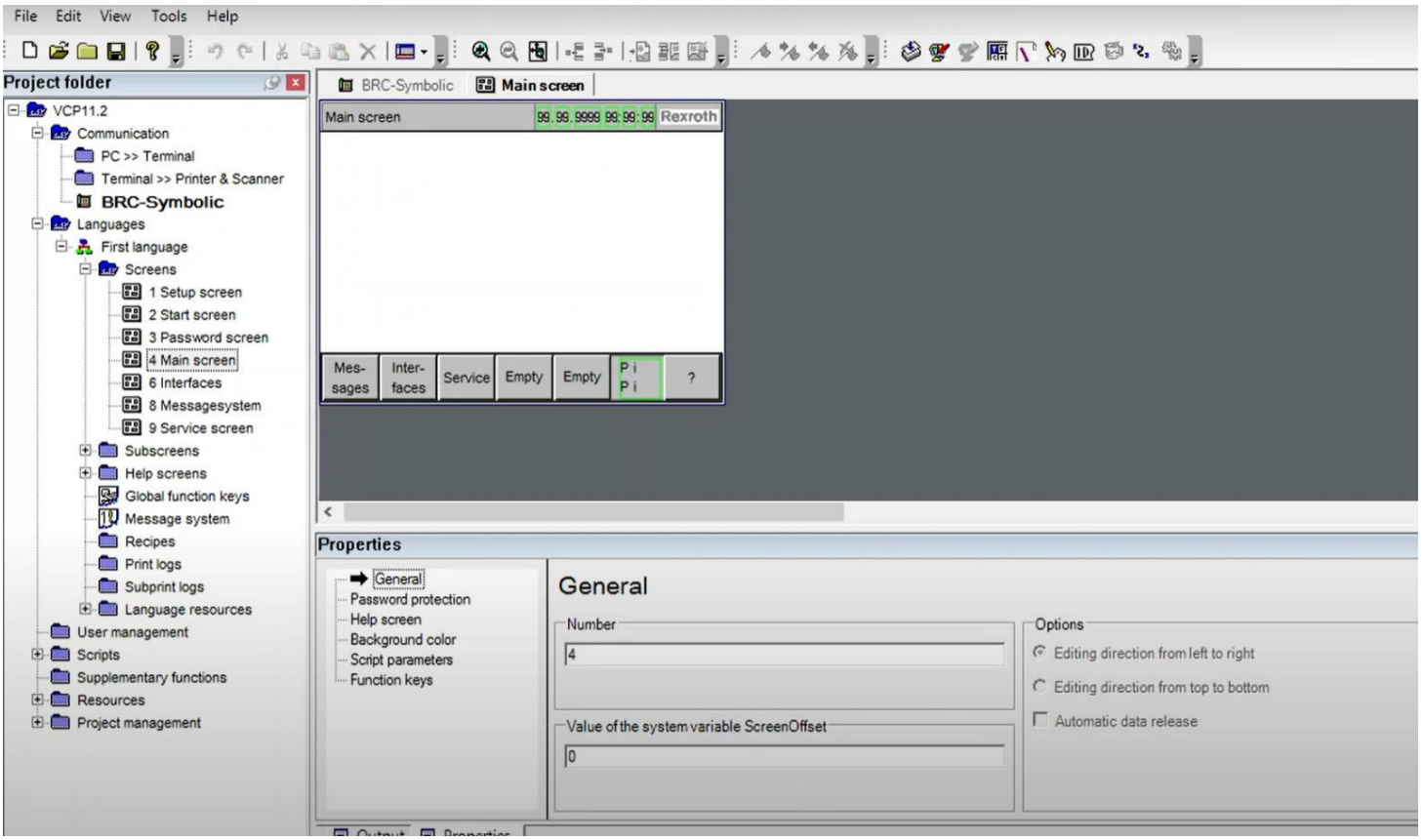
STEP 4: Enter the correct IP address and name a connection name of your choice



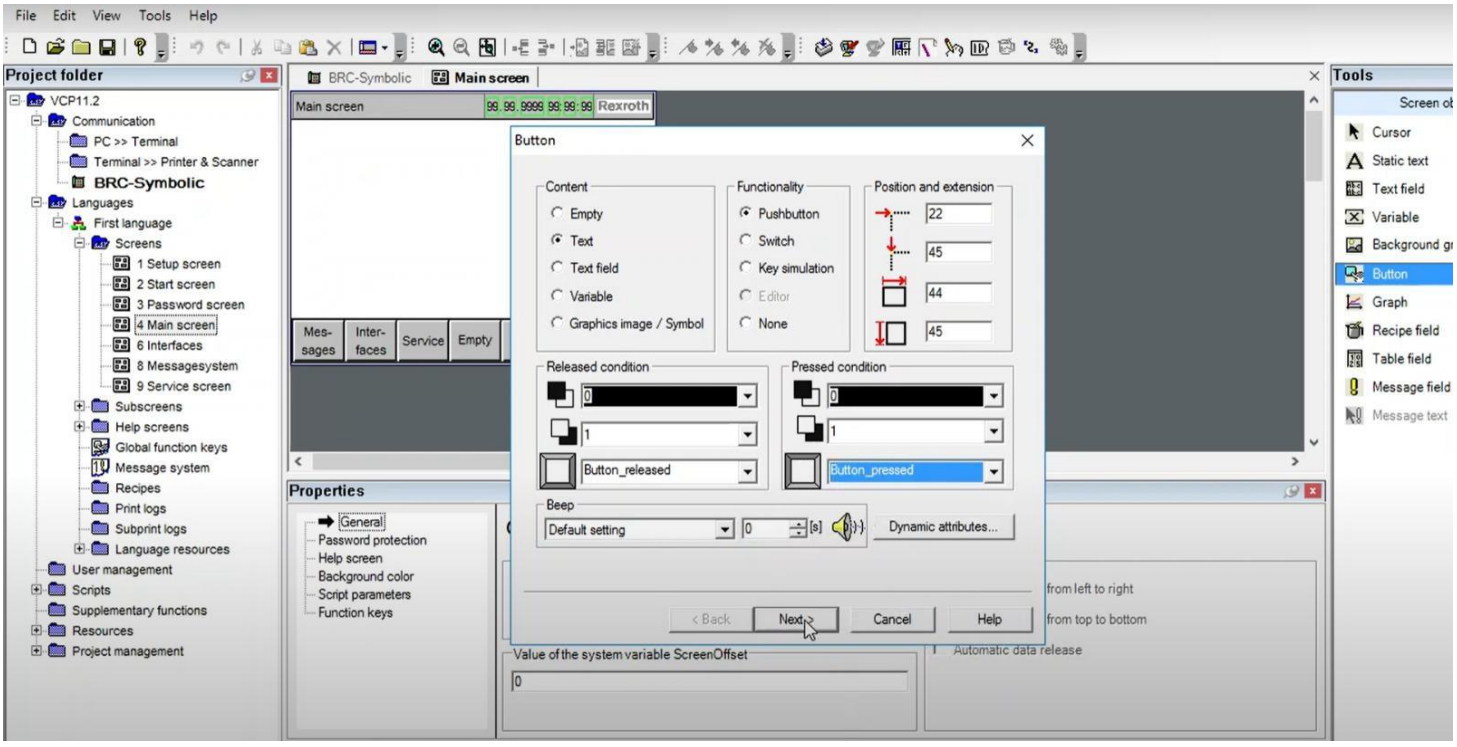
STEP 5: After that copy paste the location link of the generated code file under variables list or you can click on the three dots and navigate the location



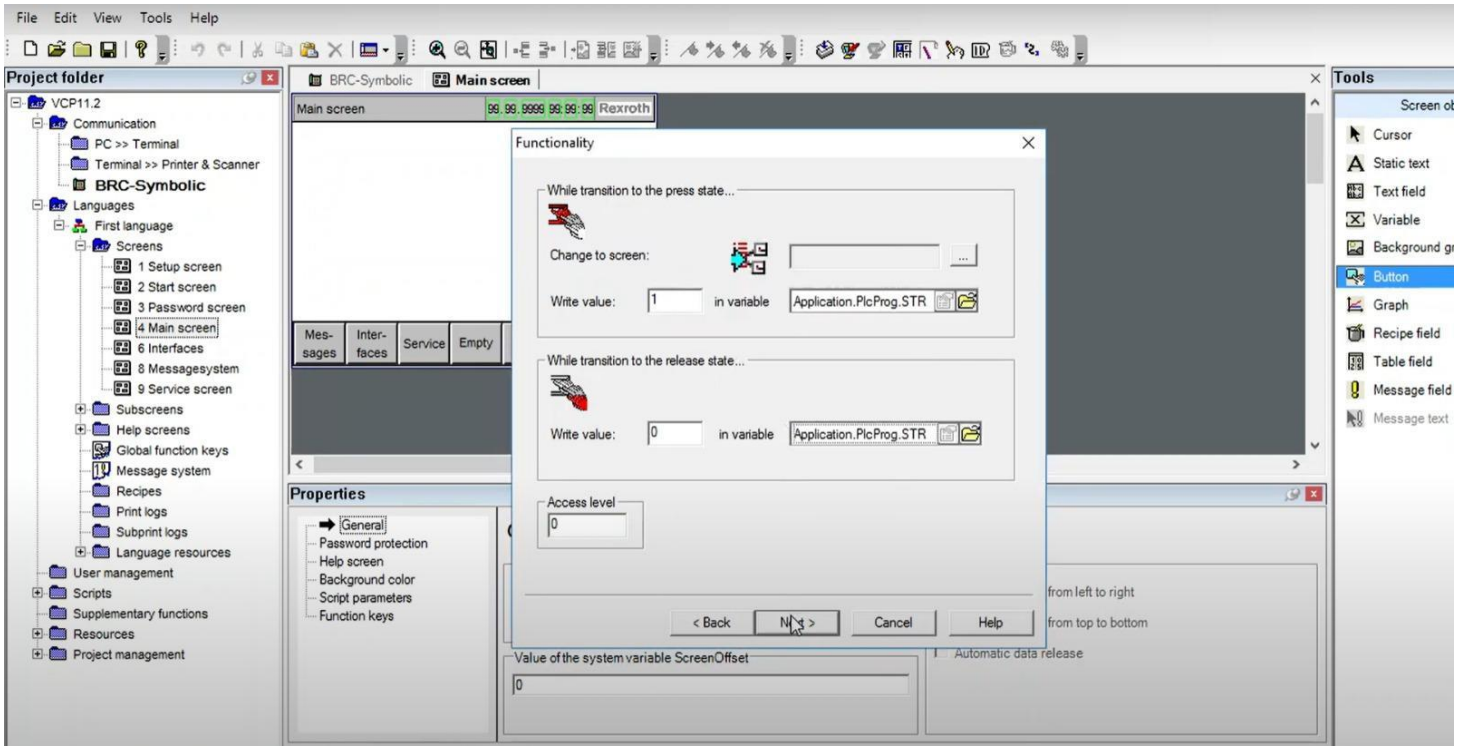
STEP 6: Now the variables will be visible on the screen, check it once and proceed with opening the 4 Main Screen

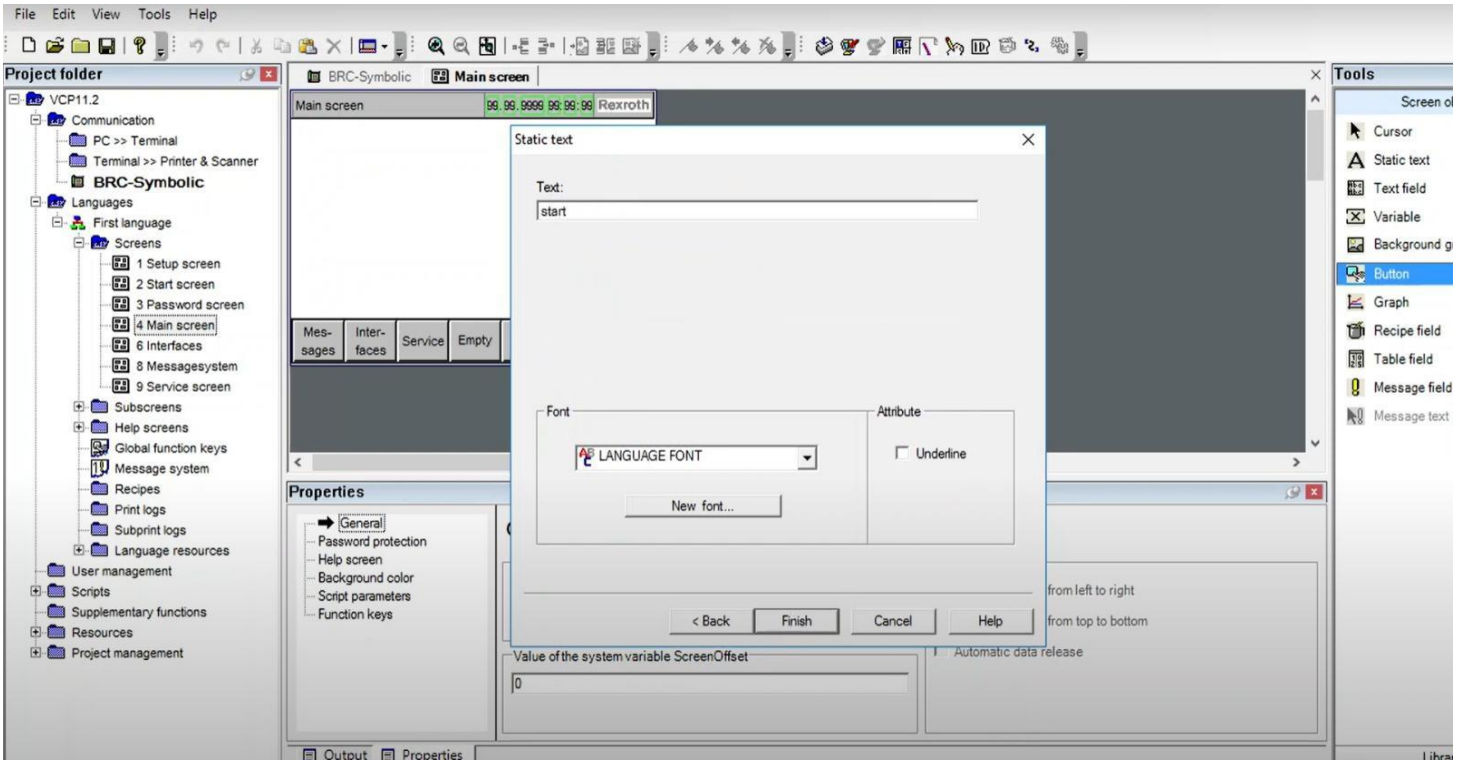


STEP 7: Add the button for push buttons and check if the following options are selected

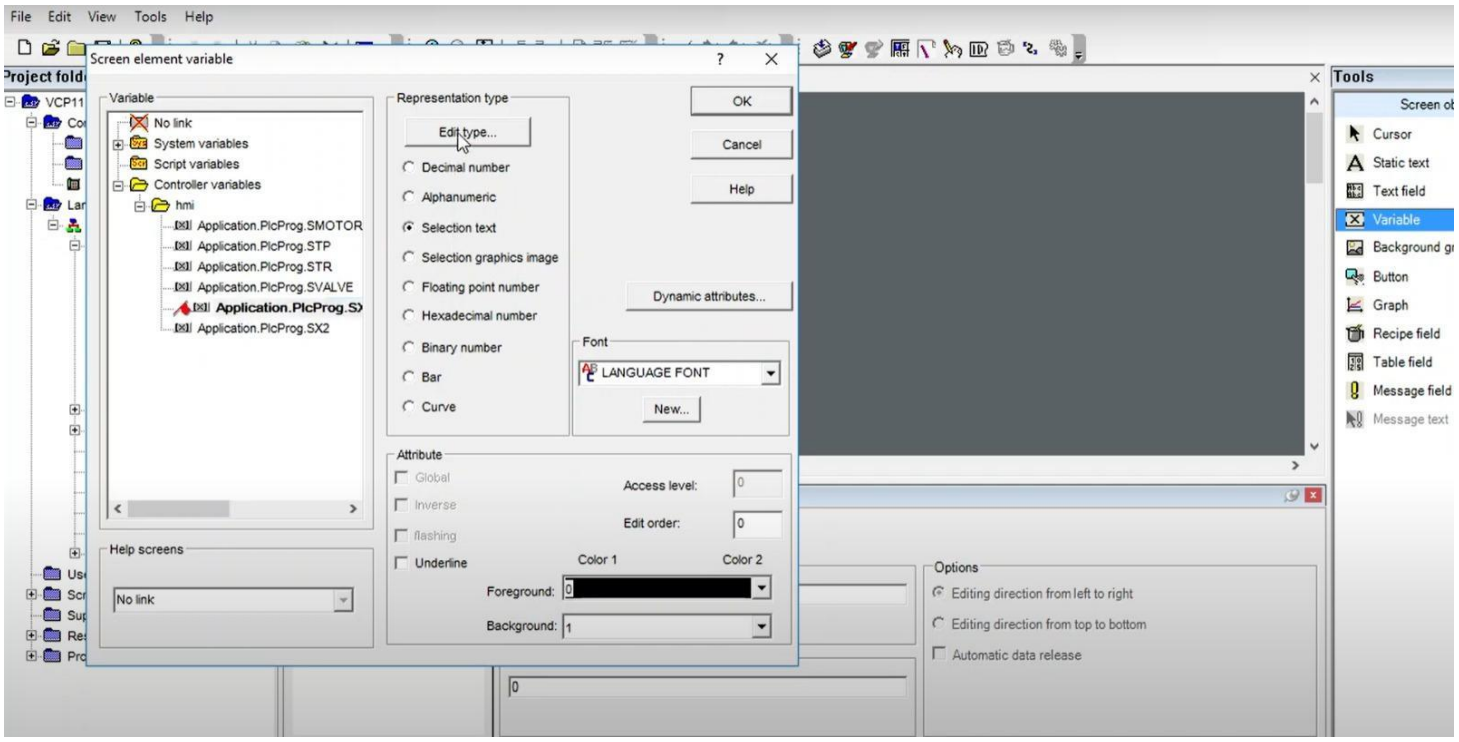


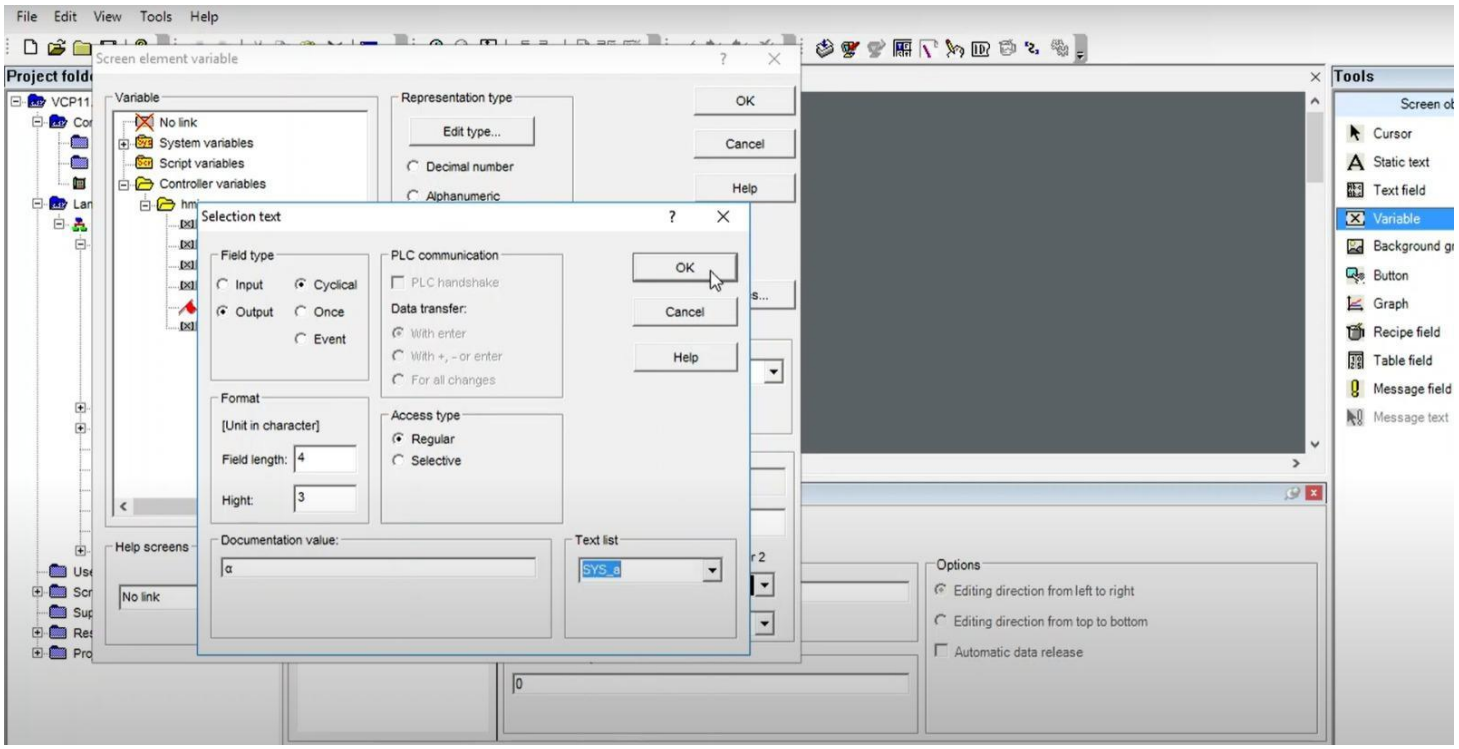
<u>STEP 8:</u> Keep following the images given below to create the push button (For all inputs add buttons and follow the same steps)



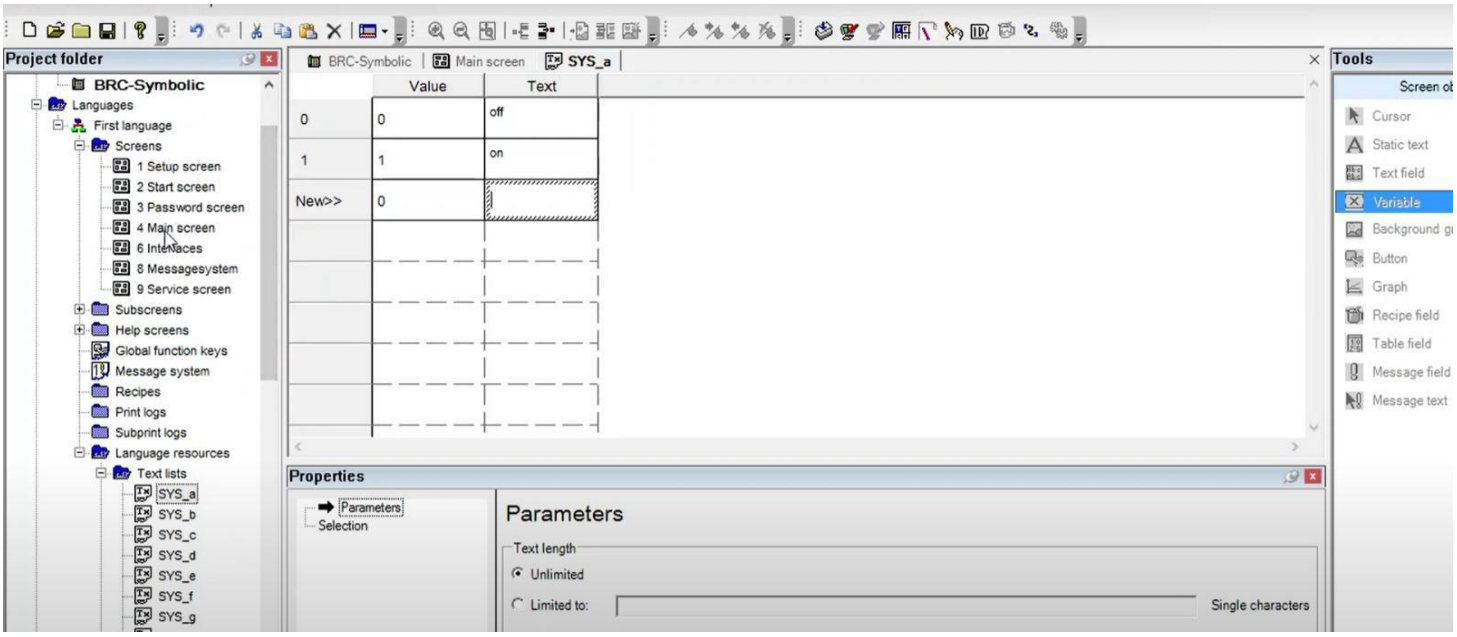


STEP 9: **For adding outputs, select the option of variable and follow the images**

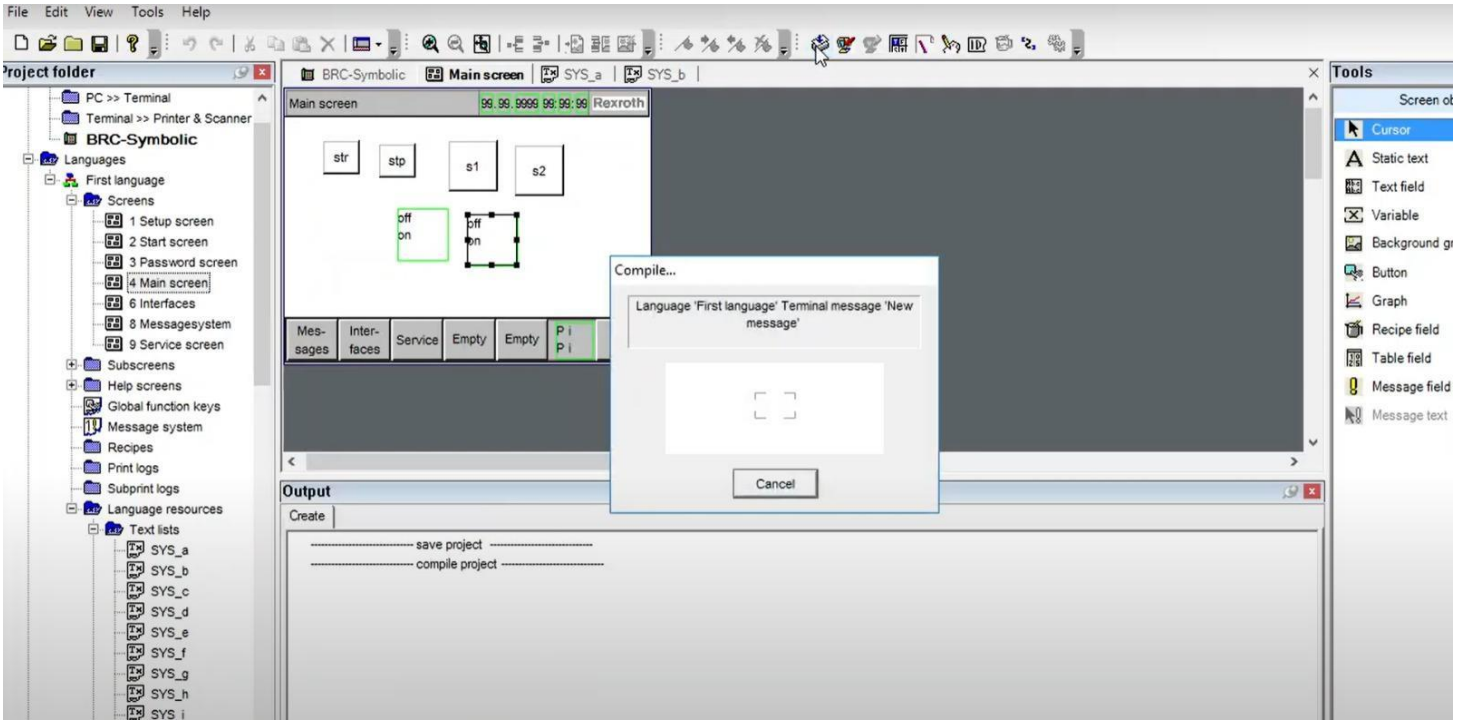




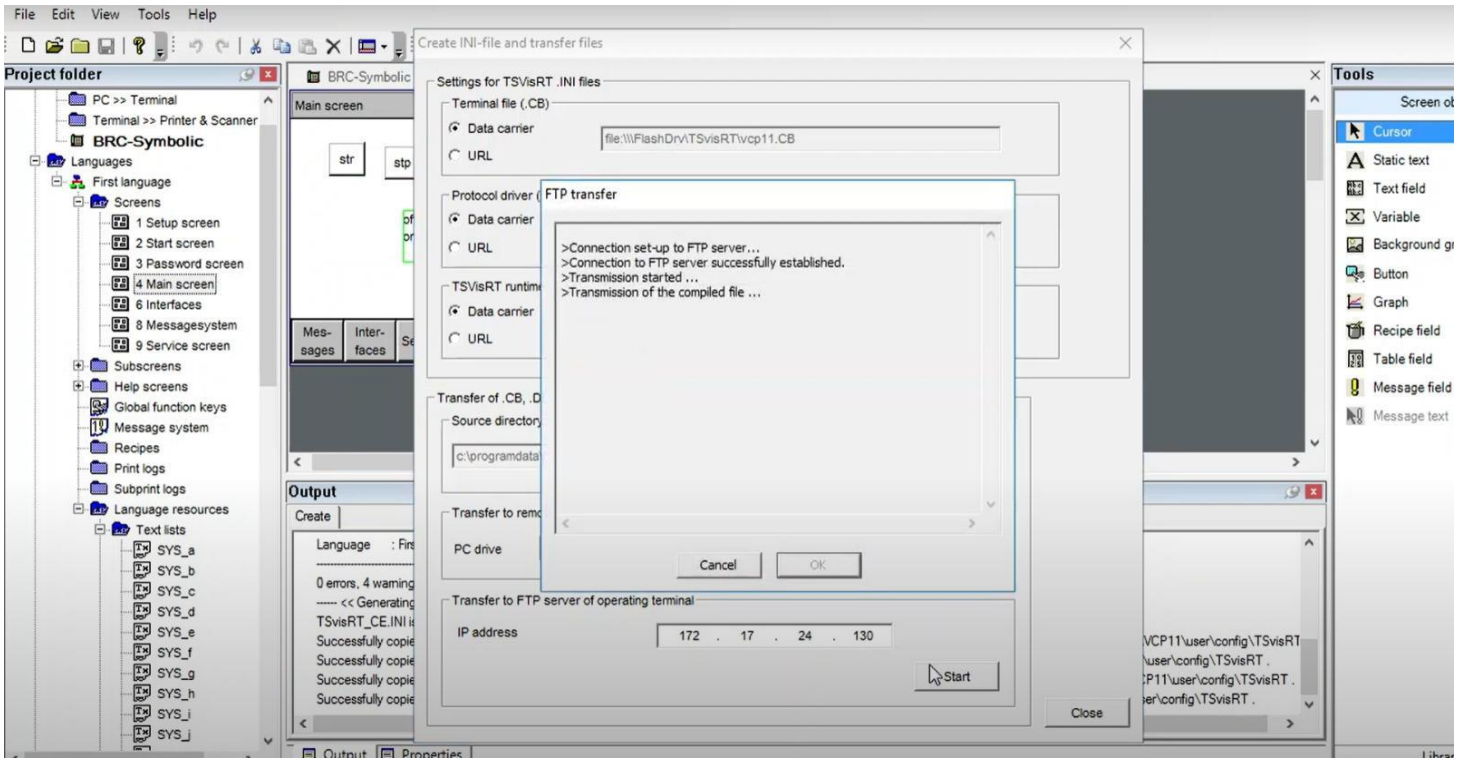
Under the language resources select SYS_a and enter the text to be shown (SYS_a is the text list selected before)



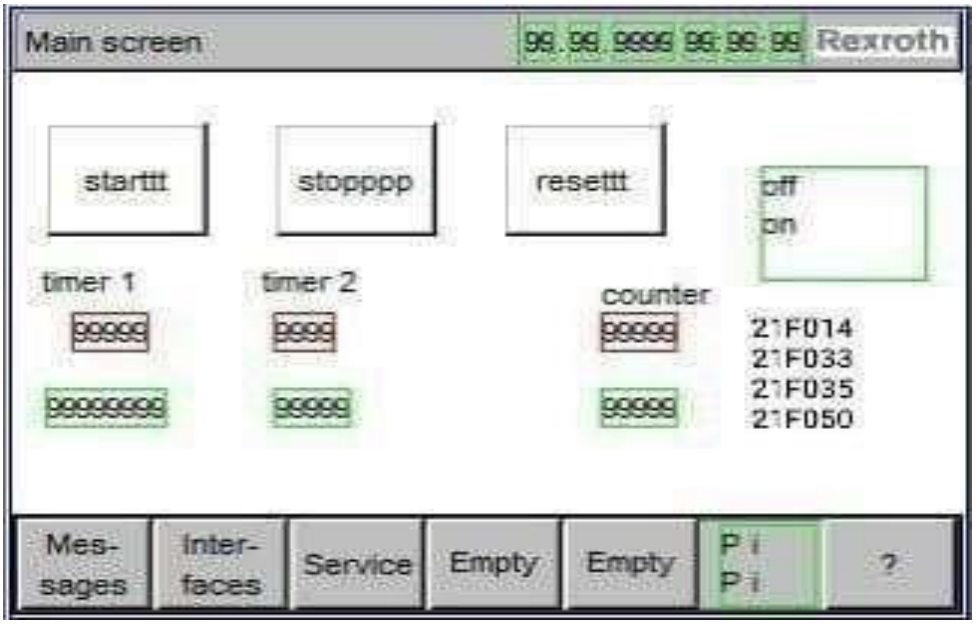
<u>STEP 10:</u> Compile the program by clicking on the icon shown below



STEP 11: Click on FP transfer and enter the IP address of the HMI and check of the connection is done and finally check the output



HMI Output:



Inference:

- Through this experiment, I learned and explored the interfacing of PLC with HMI.
- Implementing a conveyor motor application with an HMI interface allows the operator to monitor motor status and control motor functions.

Result:

Thus the design and implementation of conveyor motor application using HMI was performed.

EXP : 03 DATE:	CONTROLLING VFD USING SCADA

AIM:

To control variable frequency drive using SCADA in Indraworks Engineering Software.

APPARATUS REQUIRED:

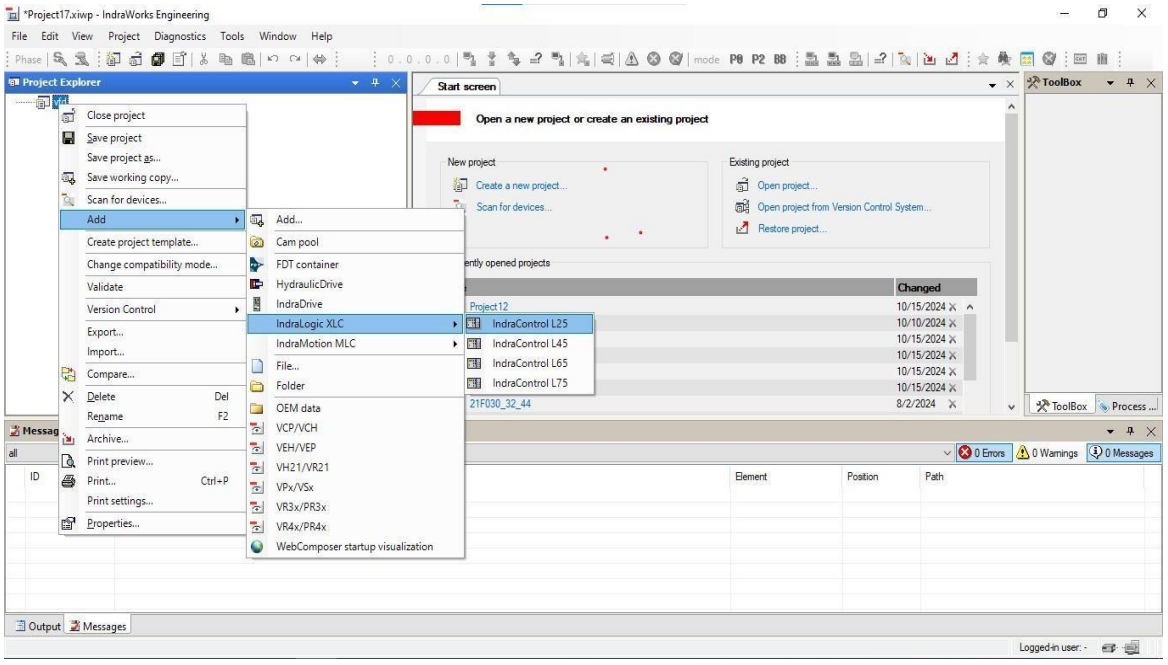
i. Variable Frequency Drive (VFD)
ii. Bosch Rexroth L25
iii. Indraworks Engineering Software

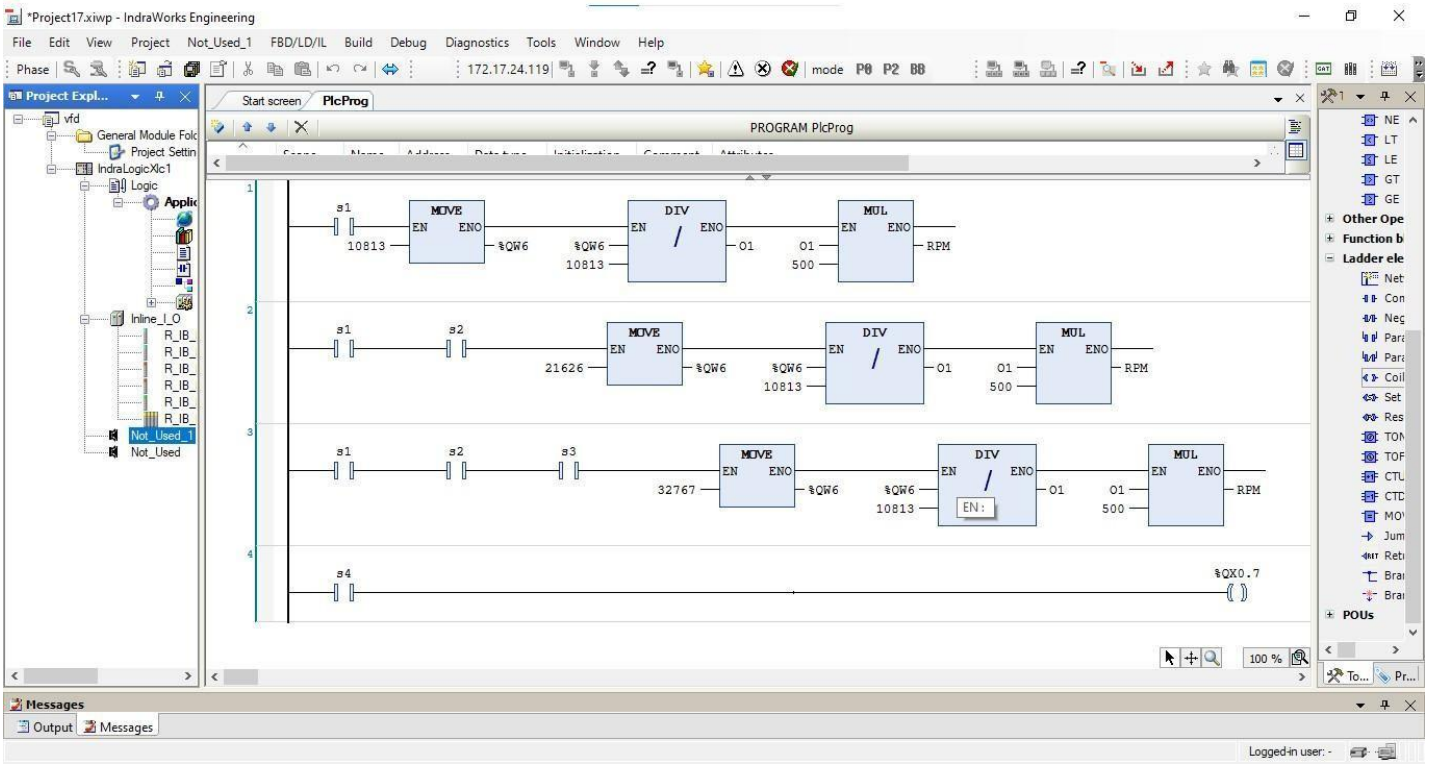
PROCEDURE:

1) Create a new project in Indraworks Engineering Software, select L25 PLC, configure the IP address of L25 PLC and test the connection.
2) Add the input and output modules in the device selection.
3) Design ladder logic to control the VFD in the PLC program and address the input and output.
4) Add the Winstudio application and read all the input and output parameters and initiate them.
5) Place the switch in Winstudio to test I/O for inputs and motor to check connectivity, then initialize the components in the screen.
6) Build the program, login and start the PLC, then start the Winstudio application.
7) Input the frequency in the box and observe the change in the VFD.

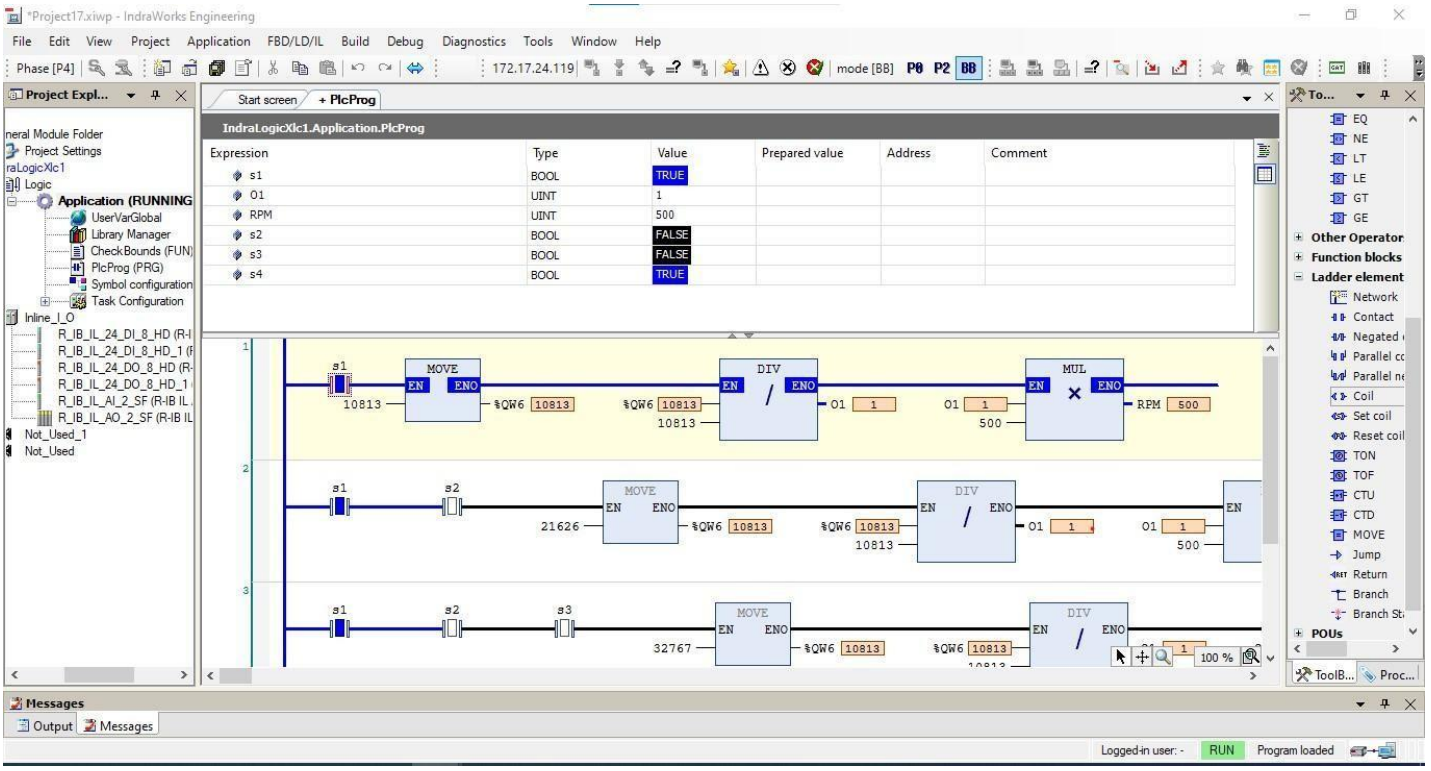
STEPS TO FOLLOW:

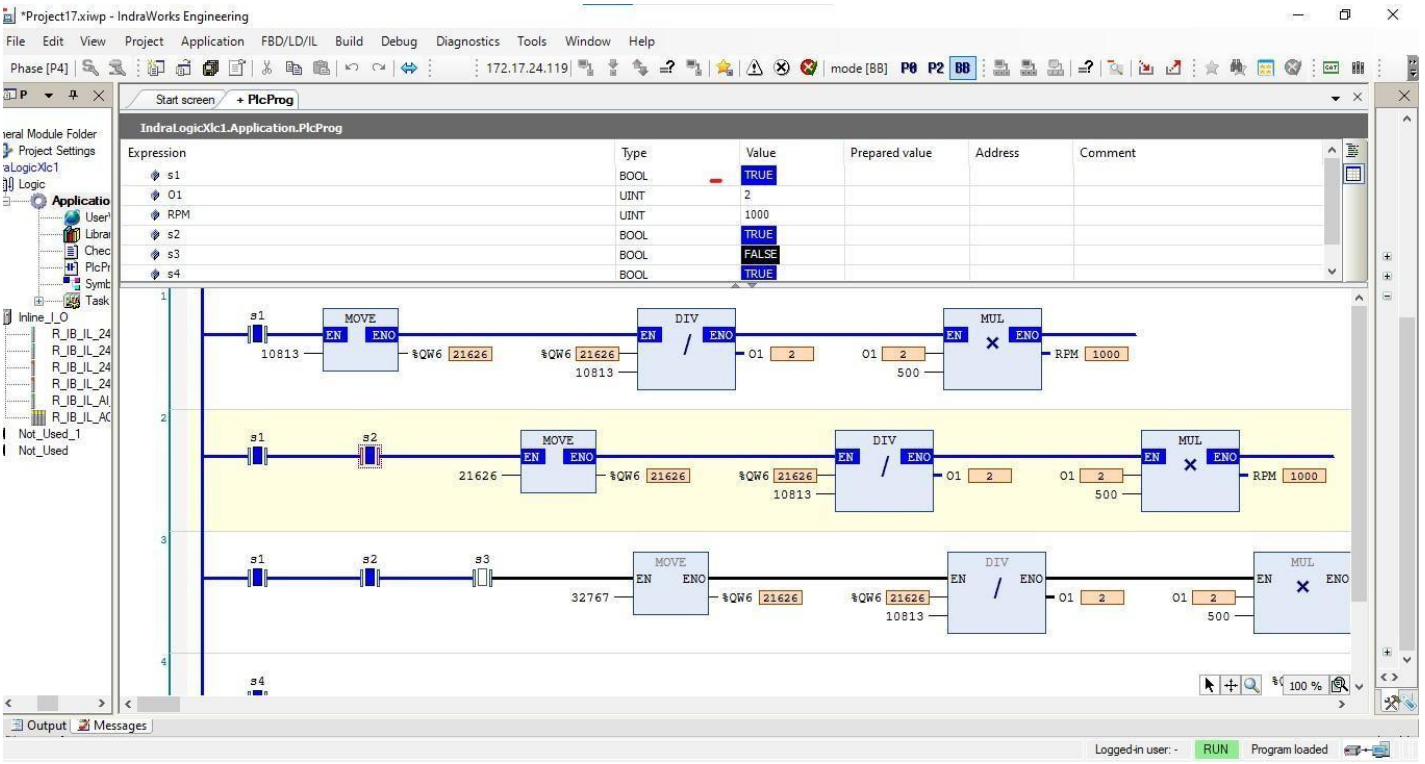
1. Create the PLC program normally

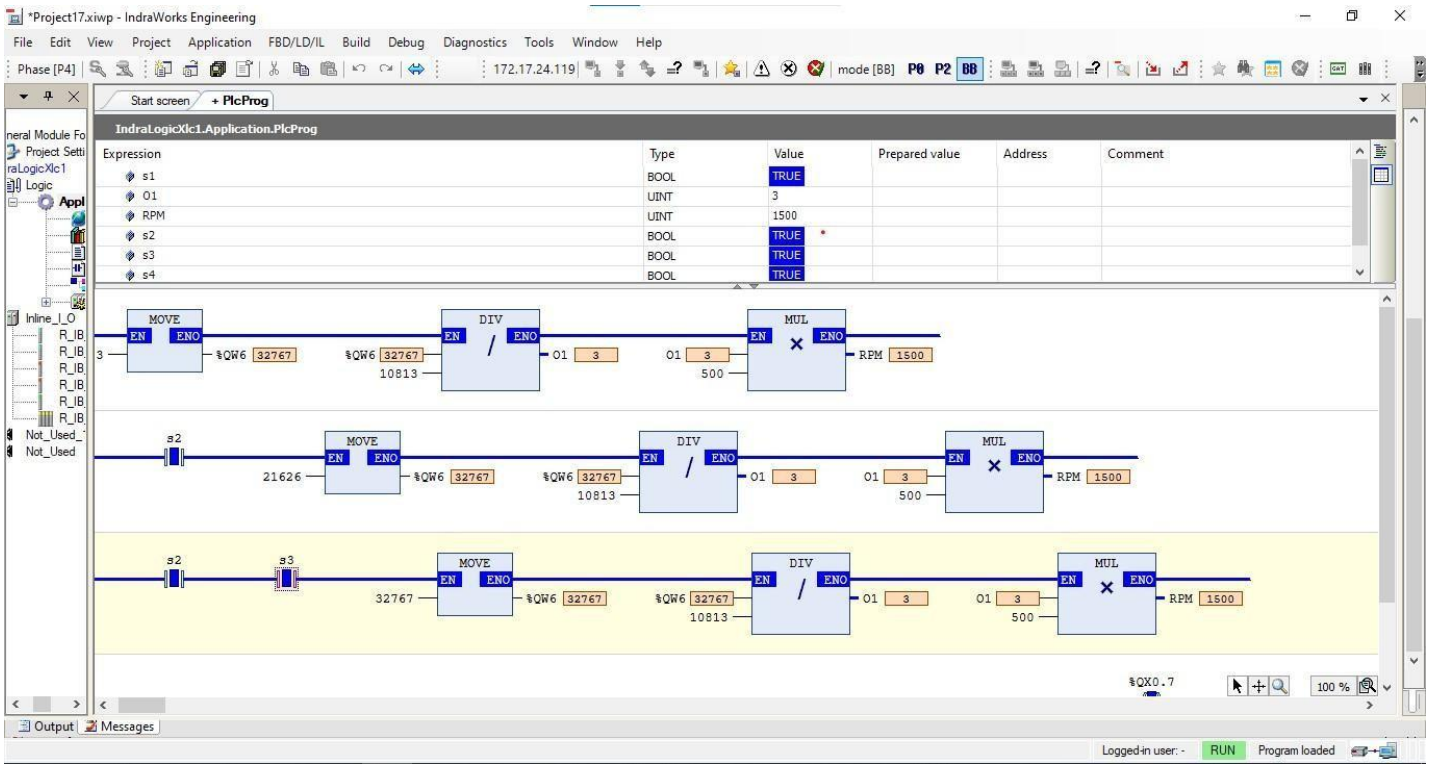




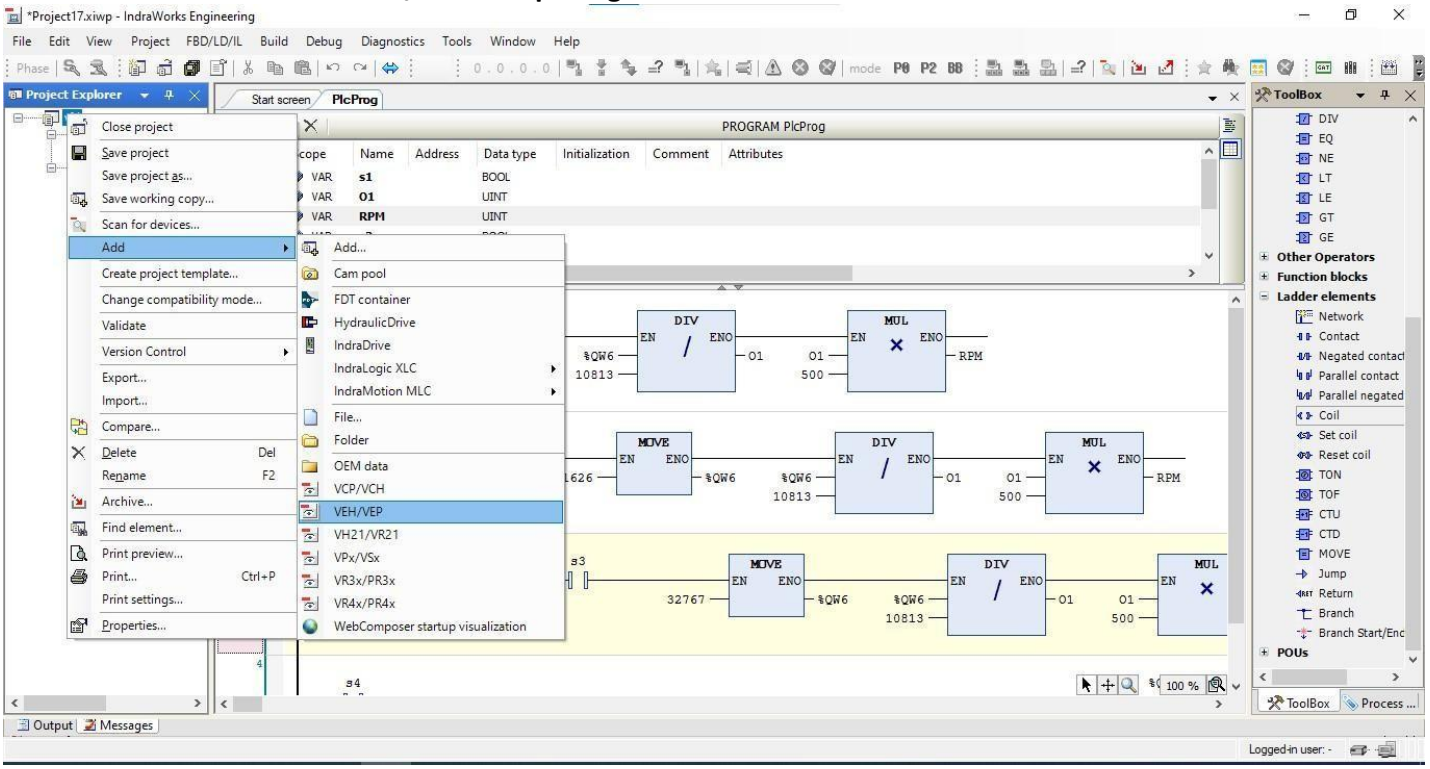
2. Check the output before creating the SCADA



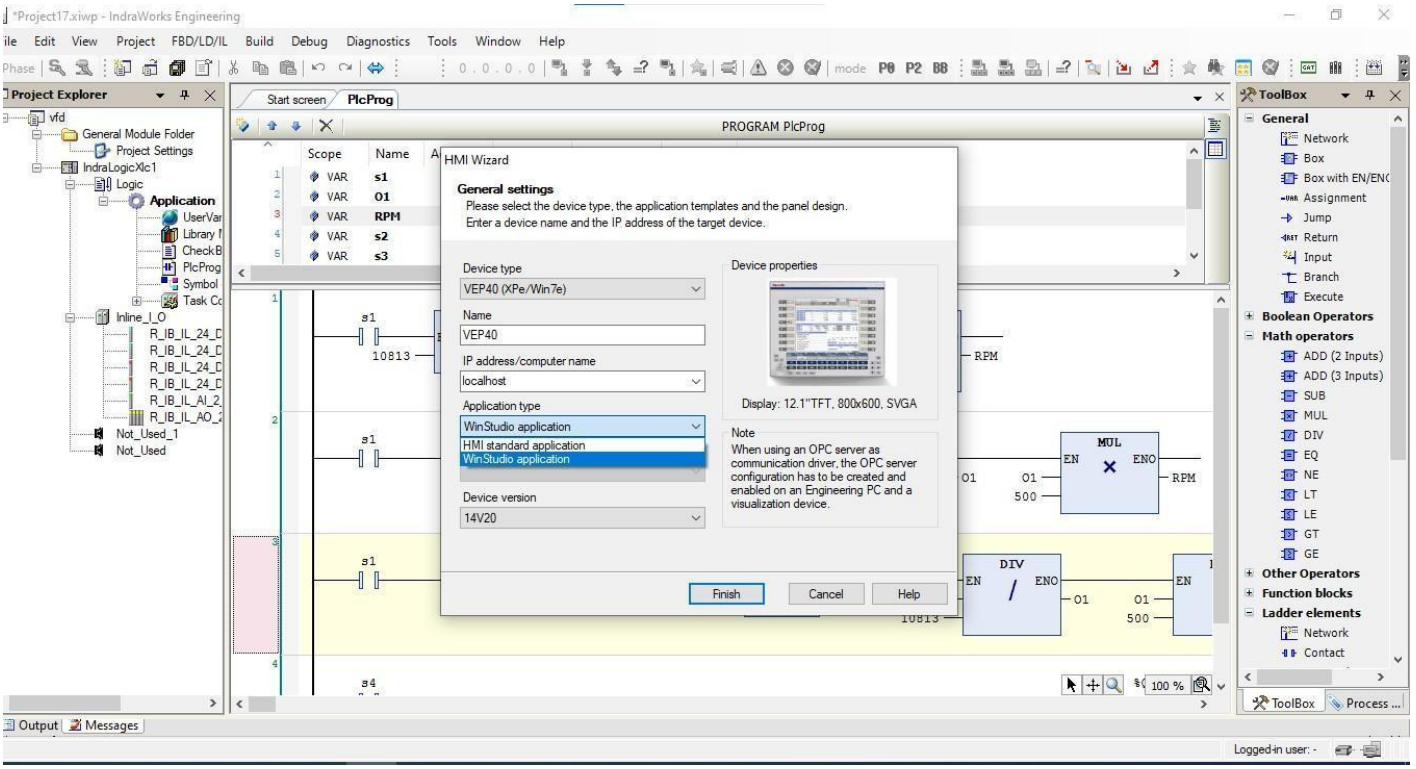

*Project17.xiwp - IndraWorks Engineering
File Edit View Project Application FBD/LD/IL Build Debug Diagnostics Tools Window Help
Start screen + PlcProg
IndraLogicXlc1.Application.PlcProg
Expression Type Value Prepared value Address Comment
s1 BOOL TRUE
O1 UINT 2
RPM UINT 1000
s2 BOOL TRUE
s3 BOOL FALSE
s4 BOOL TRUE
MOVE
DIV
MUL
10813
%QW6 21626
O1 2
500
RPM 1000
21626
32767
Output Messages
Logged-in user: - RUN Program loaded

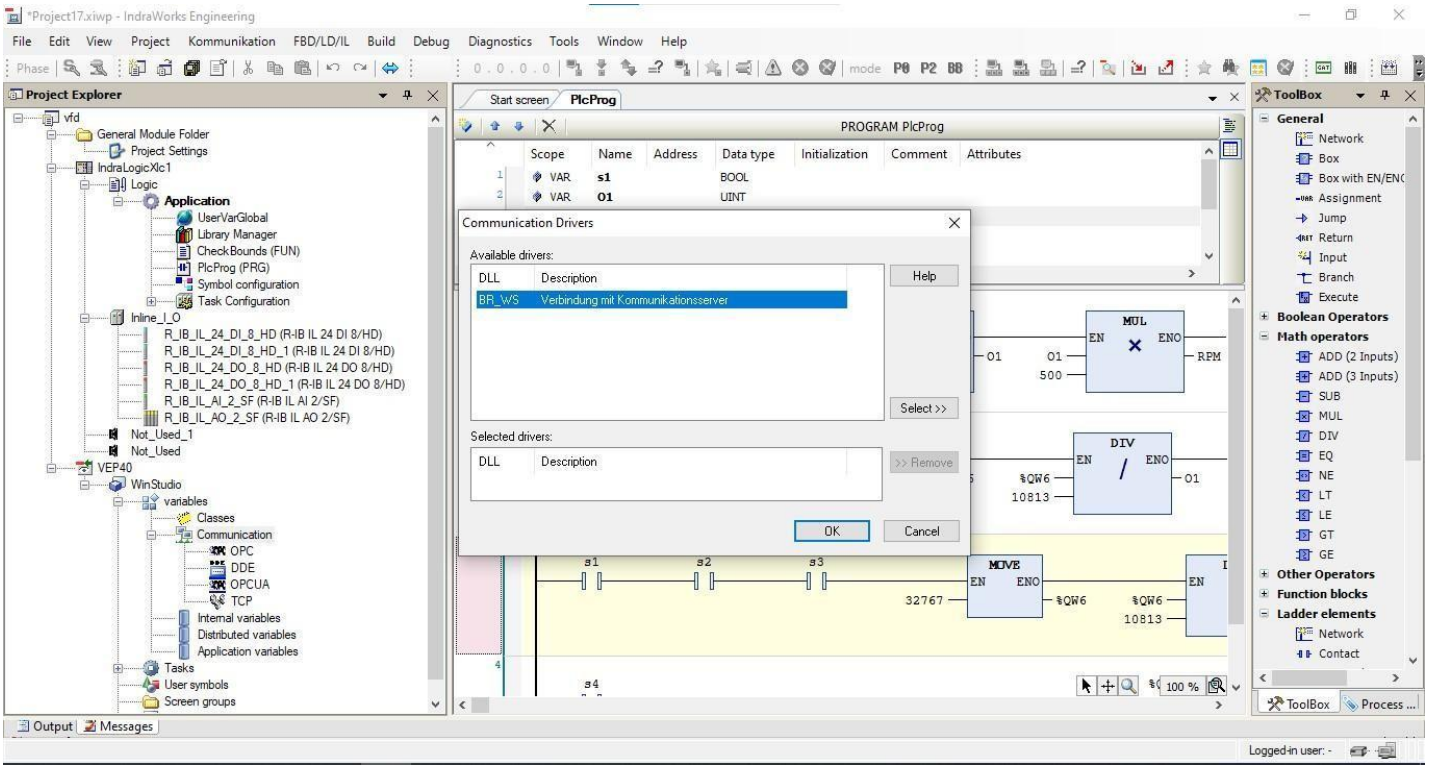

*Project17.xiwp - IndraWorks Engineering
File Edit View Project Application FBD/LD/IL Build Debug Diagnostics Tools Window Help
Start screen + PlcProg
IndraLogicXlc1.Application.PlcProg
Expression Type Value Prepared value Address Comment
s1 BOOL TRUE
O1 UINT 3
RPM UINT 1500
s2 BOOL TRUE
s3 BOOL TRUE
s4 BOOL TRUE
MOVE
DIV
MUL
%QW6 32767
O1 3
500
RPM 1500
21626
32767
%QX0.7
Output Messages
Logged-in user: - RUN Program loaded

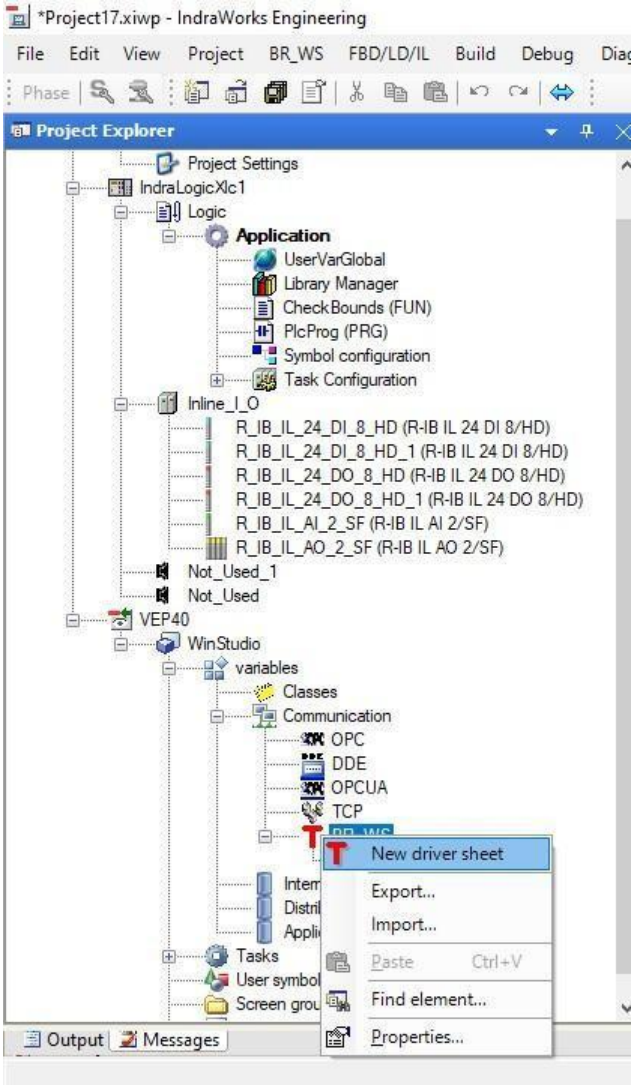
3. After that create the VEH/VEP for opening the WIN studios



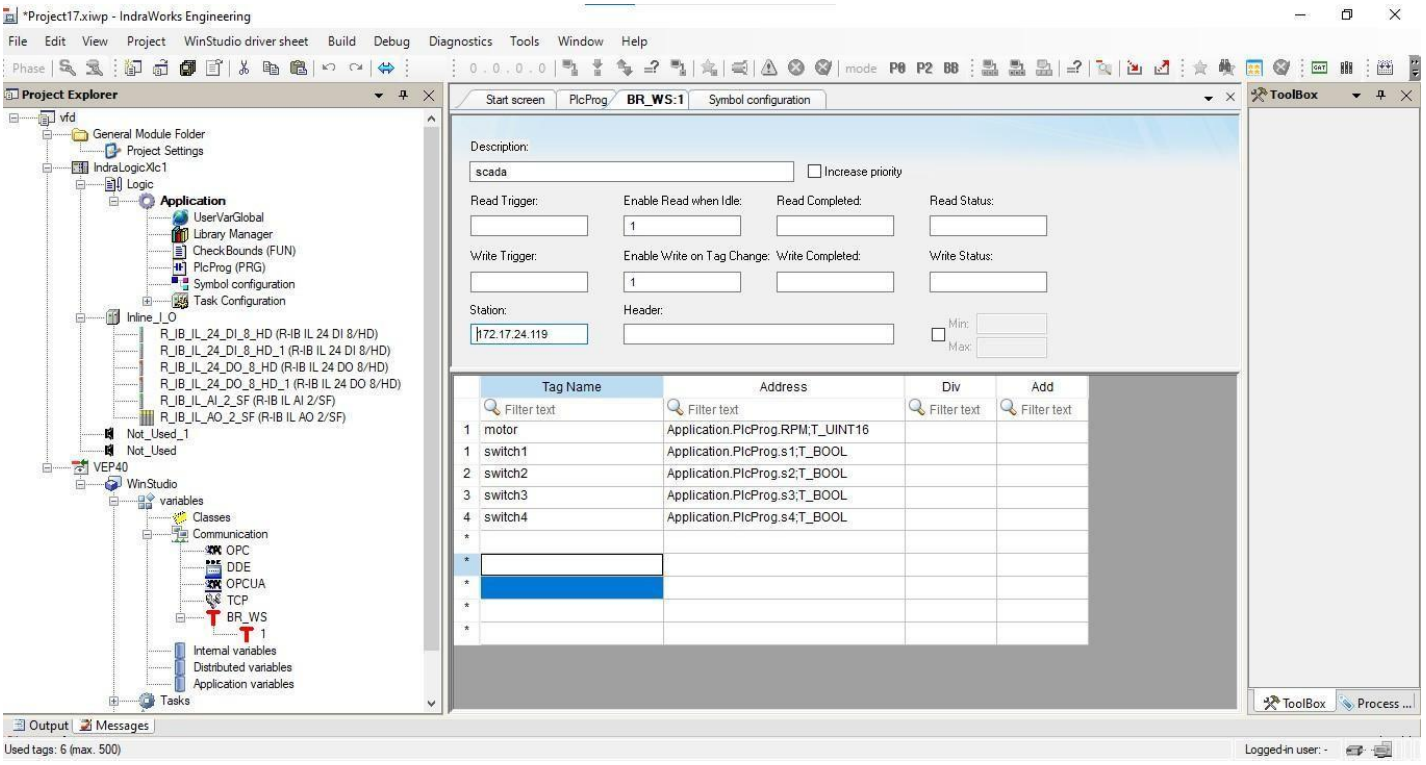
4. Select Win Studio Application and follow the images to open the driver sheet



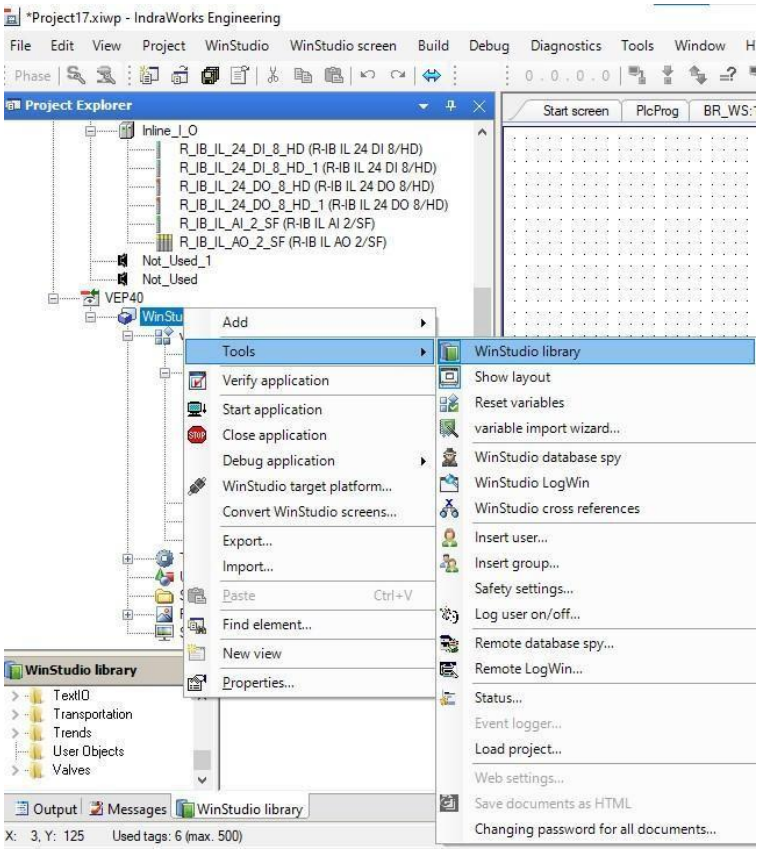

*Project17.xiwp - IndraWorks Engineering
File Edit View Project Kommunikation FBD/LD/IL Build Debug Diagnostics Tools Window Help
Project Explorer
vfd
General Module Folder
Project Settings
IndraLogicXlc1
Logic
Application
UserVarGlobal
Library Manager
CheckBounds (FUN)
PlcProg (PRG)
Symbol configuration
Task Configuration
Inline_I_O
R_IB_IL_24_DI_8_HD (R-IB IL 24 DI 8/HD)
R_IB_IL_24_DI_8_HD_1 (R-IB IL 24 DI 8/HD)
R_IB_IL_24_DO_8_HD (R-IB IL 24 DO 8/HD)
R_IB_IL_24_DO_8_HD_1 (R-IB IL 24 DO 8/HD)
R_IB_IL_AI_2_SF (R-IB IL AI 2/SF)
R_IB_IL_AO_2_SF (R-IB IL AO 2/SF)
Not_Used_1
Not_Used
VEP40
WinStudio
variables
Classes
Communication
OPC
DDE
OPCUA
TCP
Internal variables
Distributed variables
Application variables
Tasks
User symbols
Screen groups
Start screen
PlcProg
PROGRAM PlcProg
Scope Name Address Data type Initialization Comment Attributes
VAR s1 BOOL
VAR 01 UINT
Communication Drivers
Available drivers:
DLL Description
BR_WS Verbindung mit Kommunikationsserver
Help
Select >>
Selected drivers:
DLL Description
>> Remove
OK
Cancel
MUL
DIV
MOVE
32767
%QW6
10813
RPM
ToolBox
General
Network
Box
Box with EN/ENO
Assignment
Jump
Return
Input
Branch
Execute
Boolean Operators
Math operators
ADD (2 Inputs)
ADD (3 Inputs)
SUB
MUL
DIV
EQ
NE
LT
LE
GT
GE
Other Operators
Function blocks
Ladder elements
Network
Contact
Output
Messages
Logged-in user: -

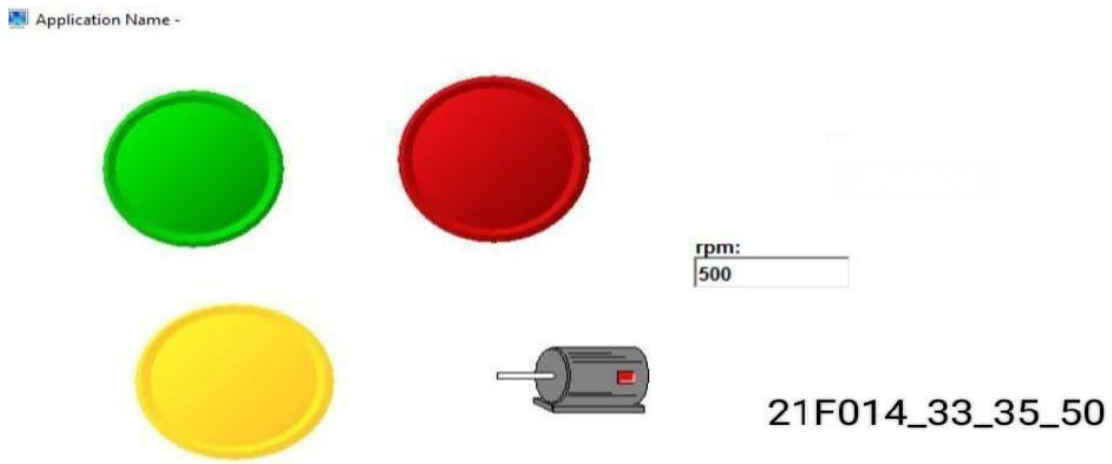

*Project17.xiwp - IndraWorks Engineering
File Edit View Project BR_WS FBD/LD/IL Build Debug
Project Explorer
Project Settings
IndraLogicXlc1
Logic
Application
UserVarGlobal
Library Manager
CheckBounds (FUN)
PlcProg (PRG)
Symbol configuration
Task Configuration
Inline_I_O
R_IB_IL_24_DI_8_HD (R-IB IL 24 DI 8/HD)
R_IB_IL_24_DI_8_HD_1 (R-IB IL 24 DI 8/HD)
R_IB_IL_24_DO_8_HD (R-IB IL 24 DO 8/HD)
R_IB_IL_24_DO_8_HD_1 (R-IB IL 24 DO 8/HD)
R_IB_IL_AI_2_SF (R-IB IL AI 2/SF)
R_IB_IL_AO_2_SF (R-IB IL AO 2/SF)
Not_Used_1
Not_Used
VEP40
WinStudio
variables
Classes
Communication
OPC
DDE
OPCUA
TCP
New driver sheet
Export...
Import...
Paste Ctrl+V
Find element...
Properties...
Tasks
Output
Messages

5. Enter the IP address and the other details on the sheet and right click on the table to load in the variables that you generated before by creating dummies and selecting them on the symbol configuration. Name the variables according to your wish

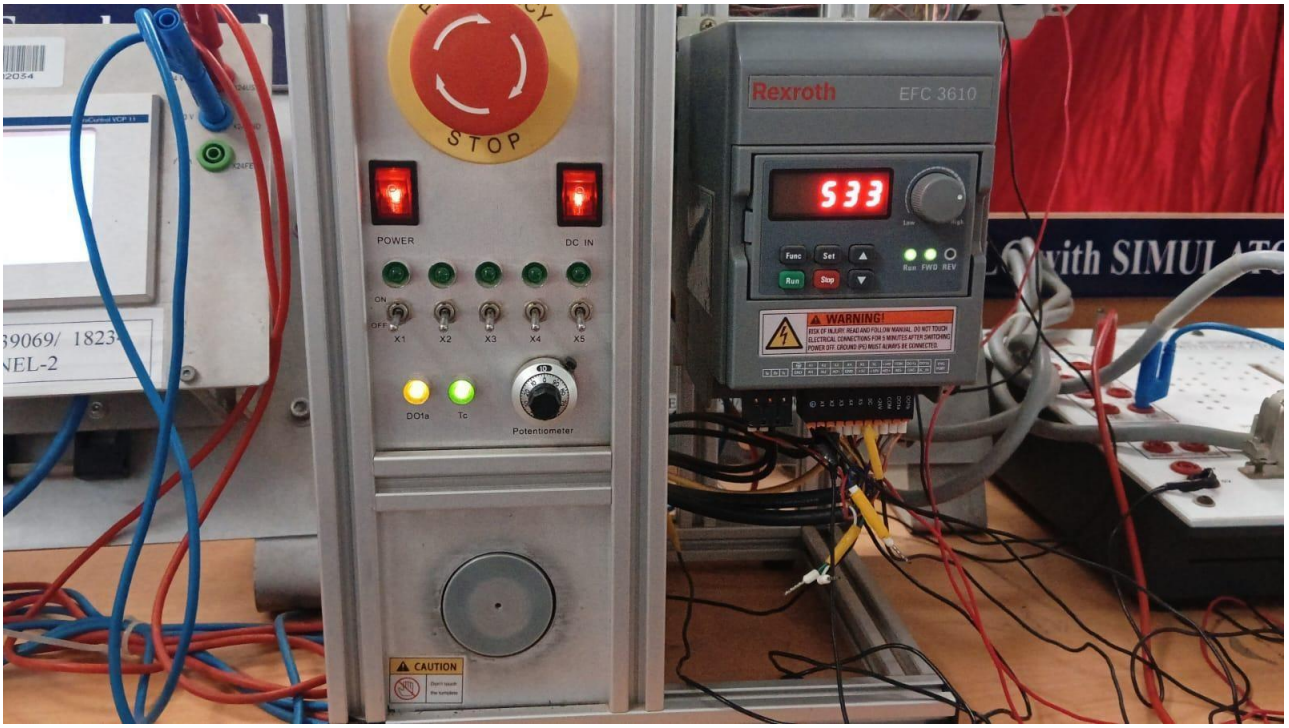


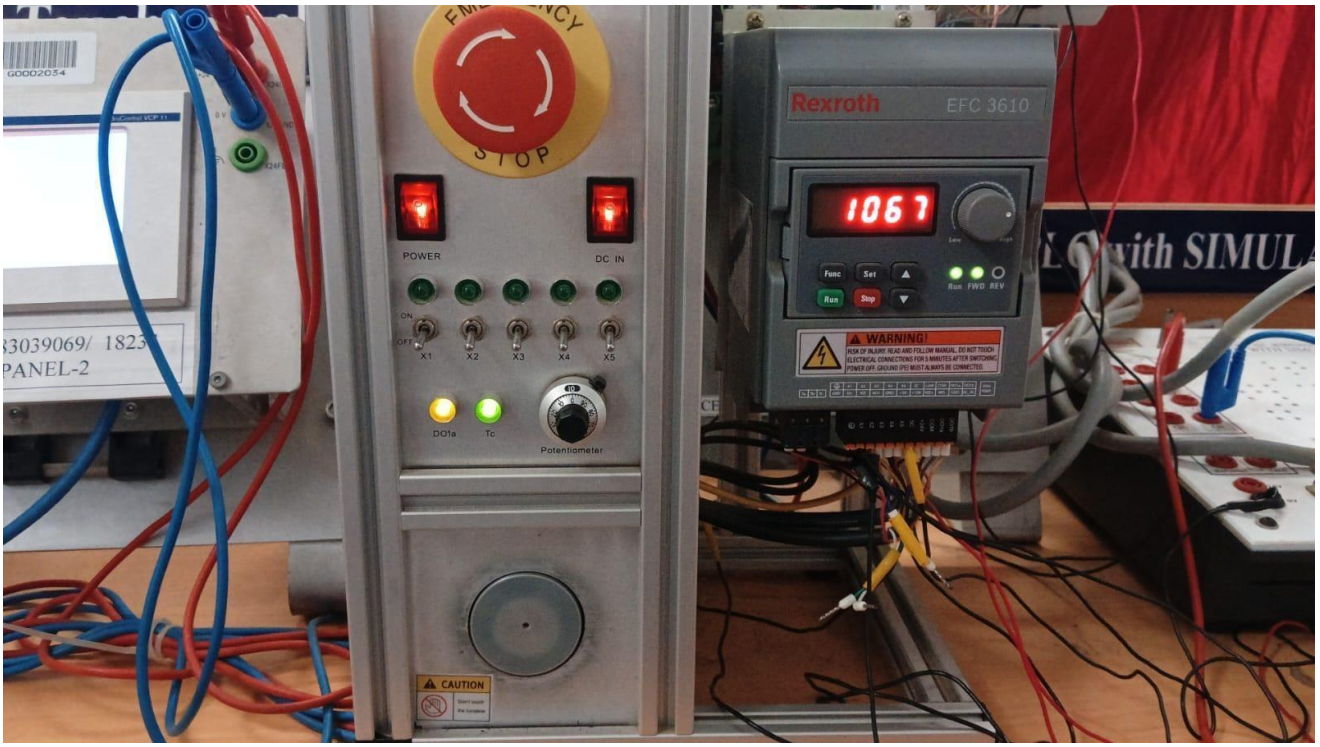
6. Select the Win Studios Screen and draw the required elements from the Win studio library and link them with their respective tag names





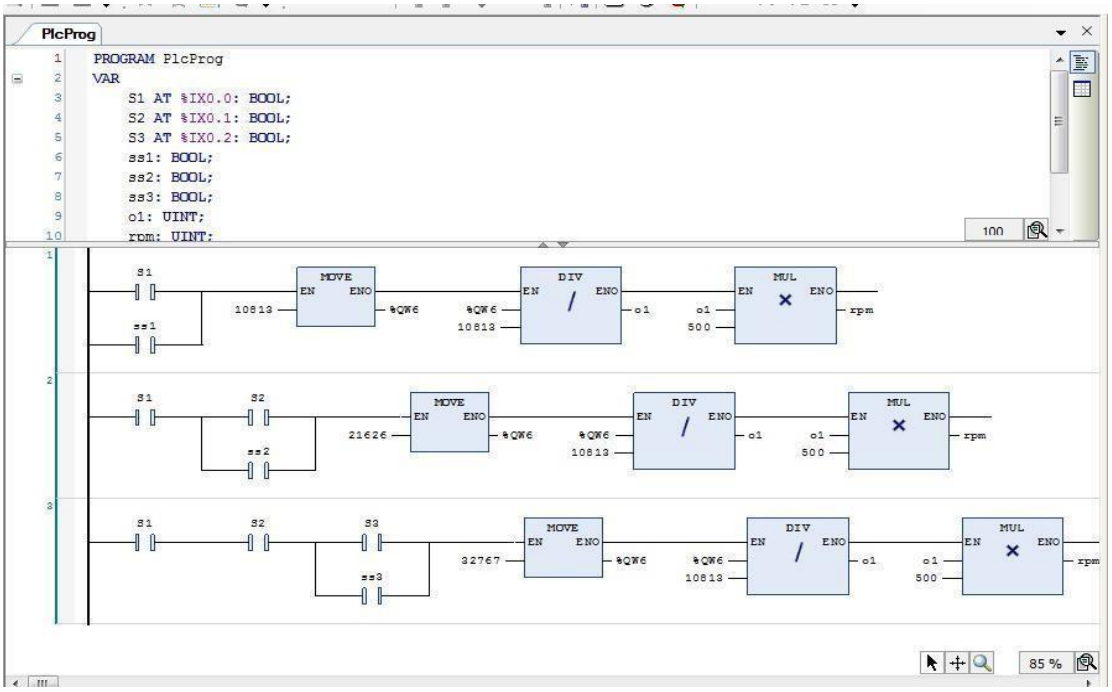
OUTPUT PICTURES:



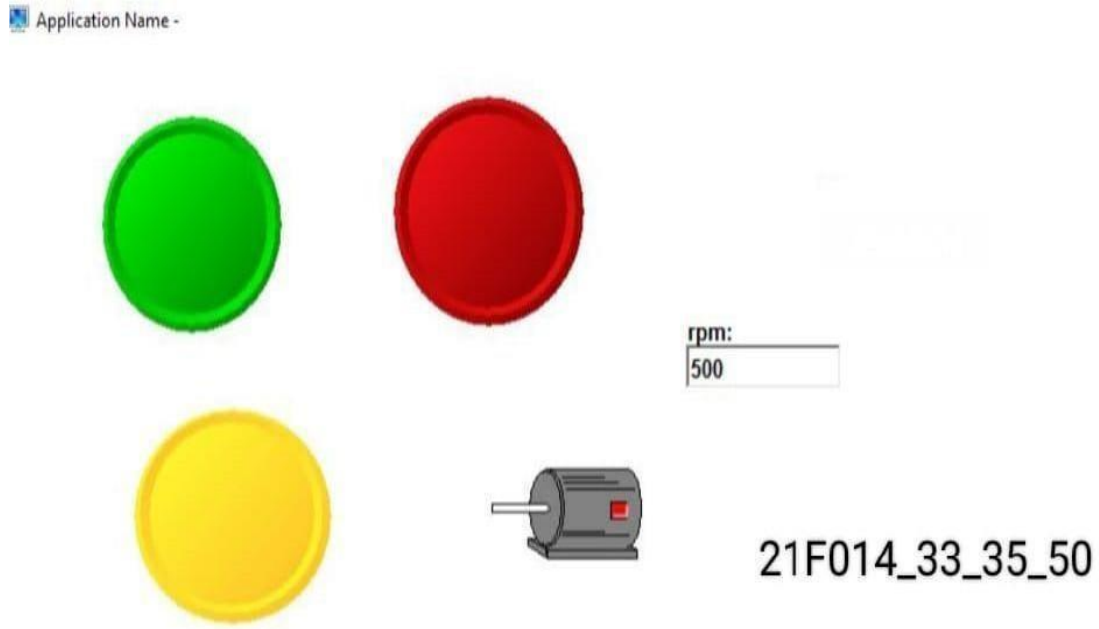

STOP
POWER
DC IN
X1
X2
X3
X4
X5
DO1a
Tc
Potentiometer
CAUTION
Rexroth
EFC 3610
1067
Func
Set
Run
Stop
Run FWD REV
WARNING!
PANEL-2


EMERGENCY
STOP
POWER
DC IN
X1
X2
X3
X4
X5
DO1a
Tc
Potentiometer
CAUTION
Rexroth
EFC 3610
1500
Func
Set
Run
Stop
Run FWD REV
WARNING!
H PANEL-2

PLC PROGRAM:



SCADA OUTPUT:



INFERENCE:

- I learned how to control motor's speed using a variable frequency drive.
- The RPM value is given in the form of a byte and then converted to word using the functional block. This value will be given to VFD that will drive the motor in that particular speed.

RESULT:

Thus the controlling of VFD using SCADA was performed.

EXP: 04 DATE:	MOTION LOGIC DRIVE USING PLC

Aim:

To design and Implement ladder diagram using Motion Logic Drive

Apparatus Required:

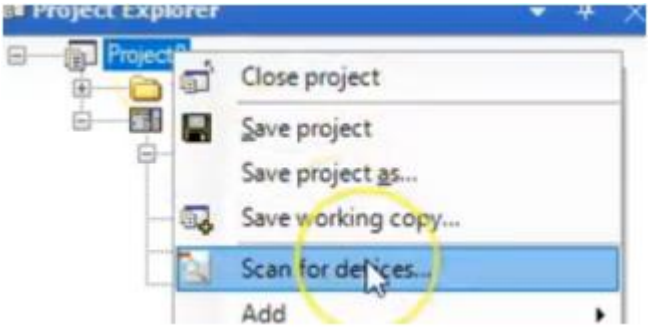
1. PC
2. IndraWorks Engineering Software
3. Motion Logic Drive Module

Procedure:

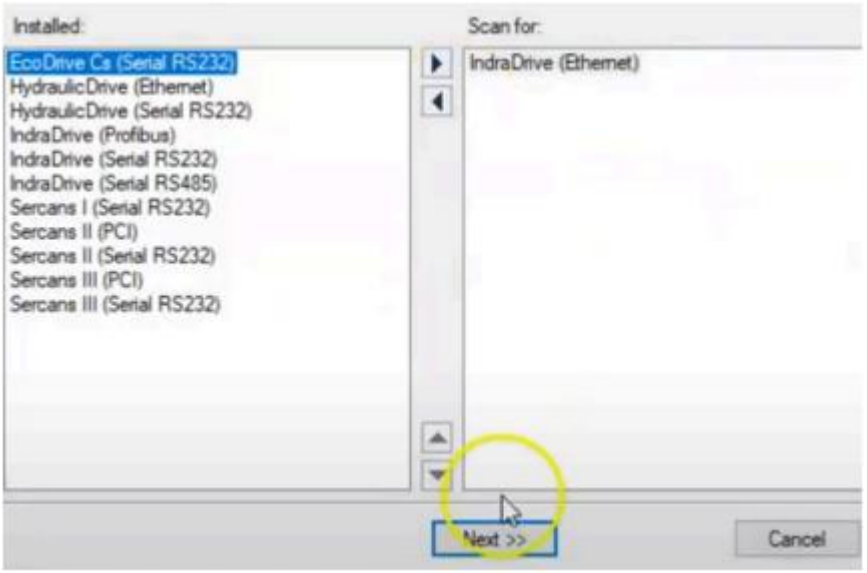
- Create a new project in Indraworks Engineering software and scan for devices. Add Ethernet, IP Address where MCD is connected.
- Check Active protocol is deactivated in Master Communication
- Load the basic parameters of Axis ,update offline parameters.
- Click start parametrization.
- Check the configuration of MLD
  1. PLC has permanent control over device
  2. PLC is in run state
- Add a POU component, Create Ladder logic program by using components such as MC power, MovVelocity,Absolute Velocity,Relative velocity, MCStop.
- Enter the Address in the required field in LD program.
- Build and Click Exit Parametrization
- Login to the MCD module.
- Run the program and then verify the output

Steps to Follow

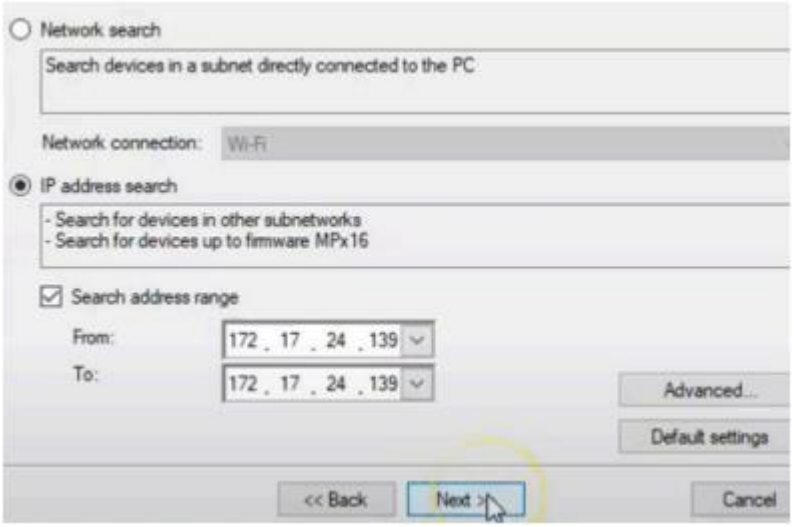
A. Create project and scan for device



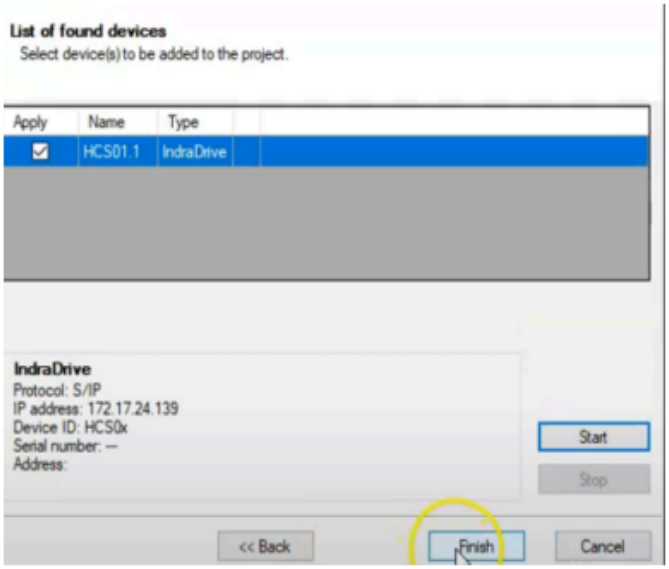
B. Select Indradrive (Ethernet)



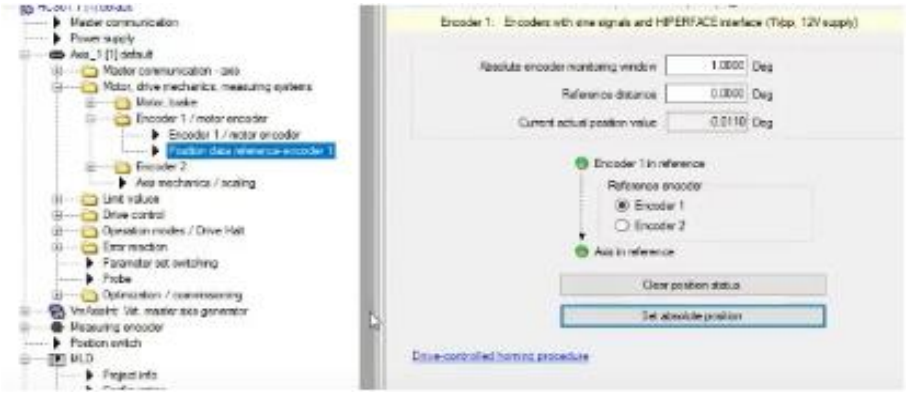
C. Enter the IP Address



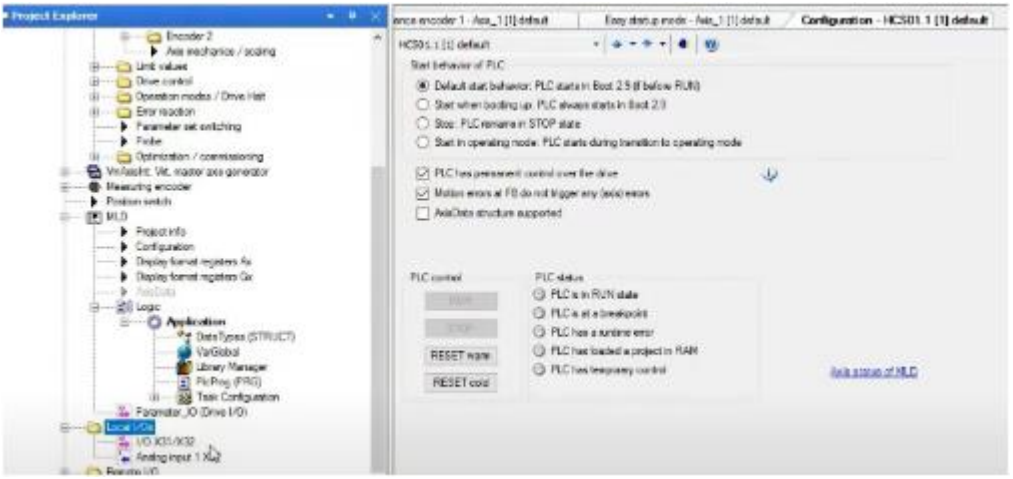
D. Finish once the drive load



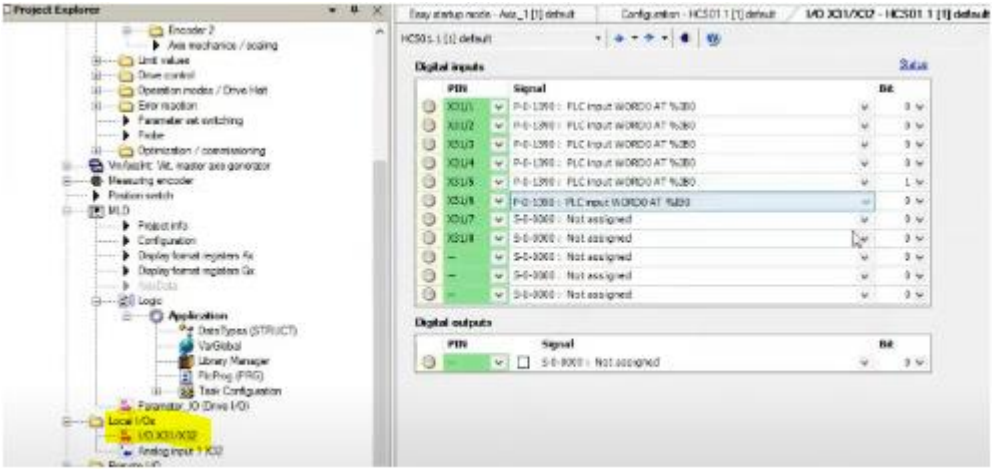
E. Right Click Axis status and load basic Parameters and start Parametrization In Encoder Click position data and Clear position status to make the axis to start in Home position



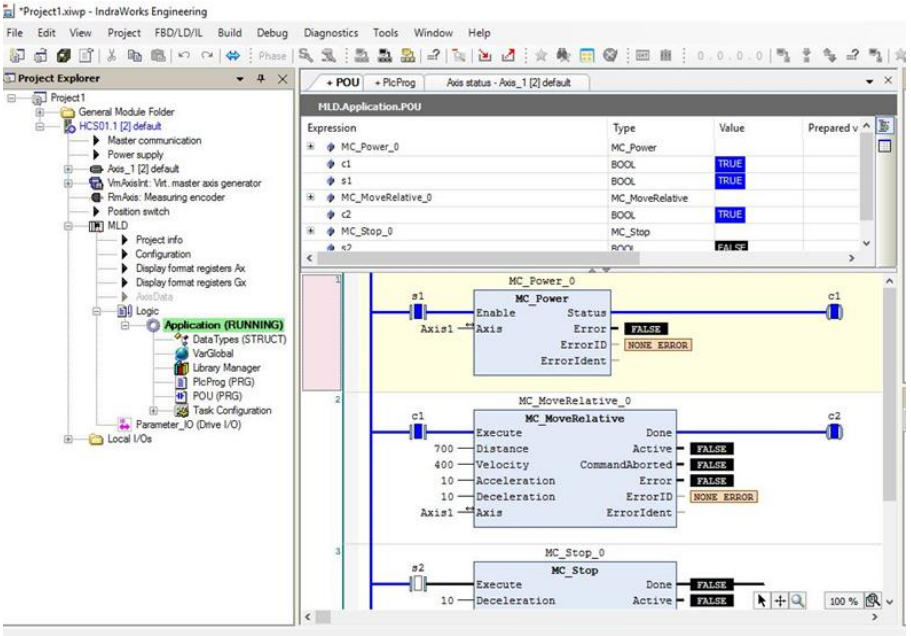
F. Right click MLD and check Configuration (PLC has permanent control over device and PLC is in run mode).

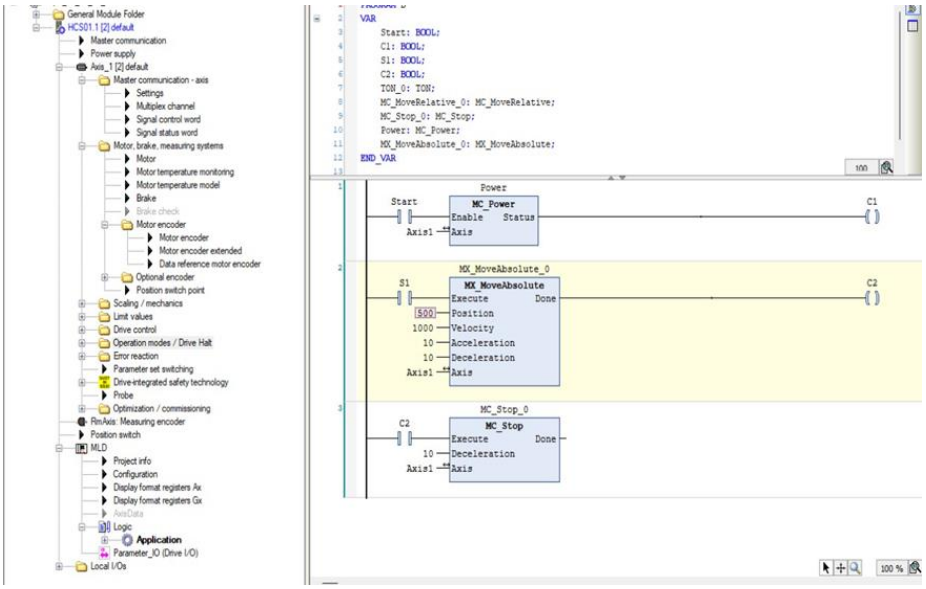


G. Check PLC input word AT%IBO in Local I/Os(P-0-1390)

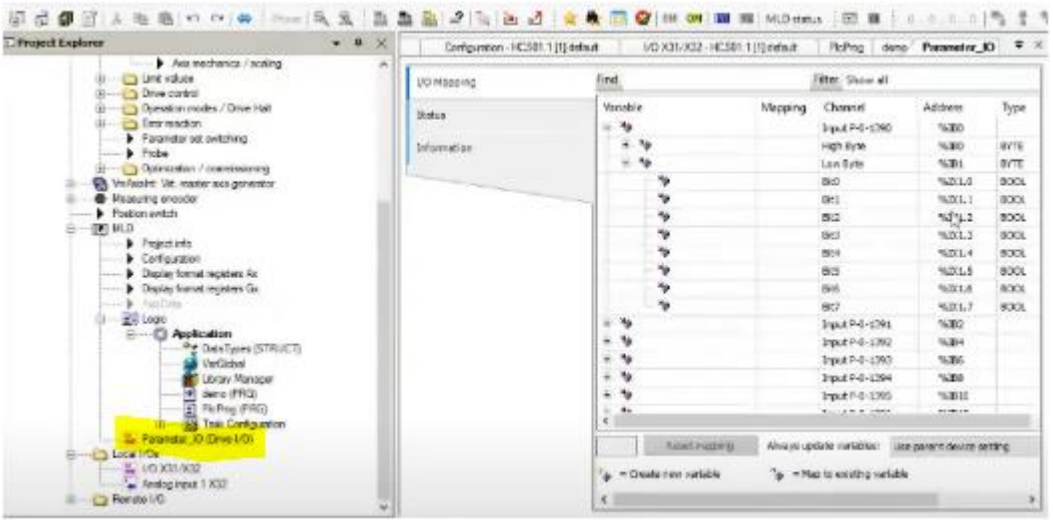


H. Add POU in PLC PRG , Write POU function in PLC PRG and Create Ladder logic program in POU



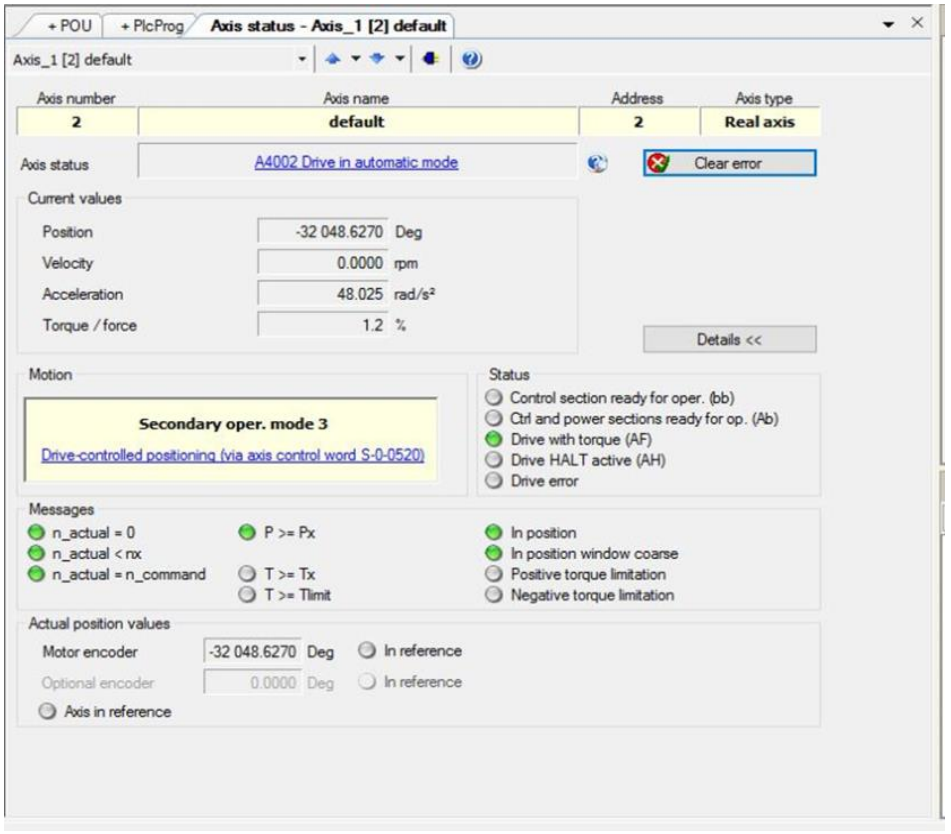


I. Check Address in Parameter IO Drive



J. While running the program check the Axis status (Right click Axis(default) – Diagnostic – Axis status)

OUTPUT:



Inference:

- From this experiment, I Learnt about controlling Speed of servo motor using MLD with ladder logic
- I learnt about the functional blocks like MoveVelocity,Absolute velocity,relative velocity , Power, and Stop.

Result:

Thus the design and implementation of ladder diagram using Motion Logic Drive is performed and Output is verified**.**

EXP : 05 DATE:	CONTROLLING THE PROPORTIONAL HYDRAULIC VALVE BY VARYING PRESSURE AND VOLTAGE

Aim:

To control the speed of the actuator in proportional hydraulics by varying the pressure and the voltage.

Apparatus Required:

1. Hydraulic Trainer kit
2. Proportional Valve
3. Control Circuit diagram
4. Proximity sensor

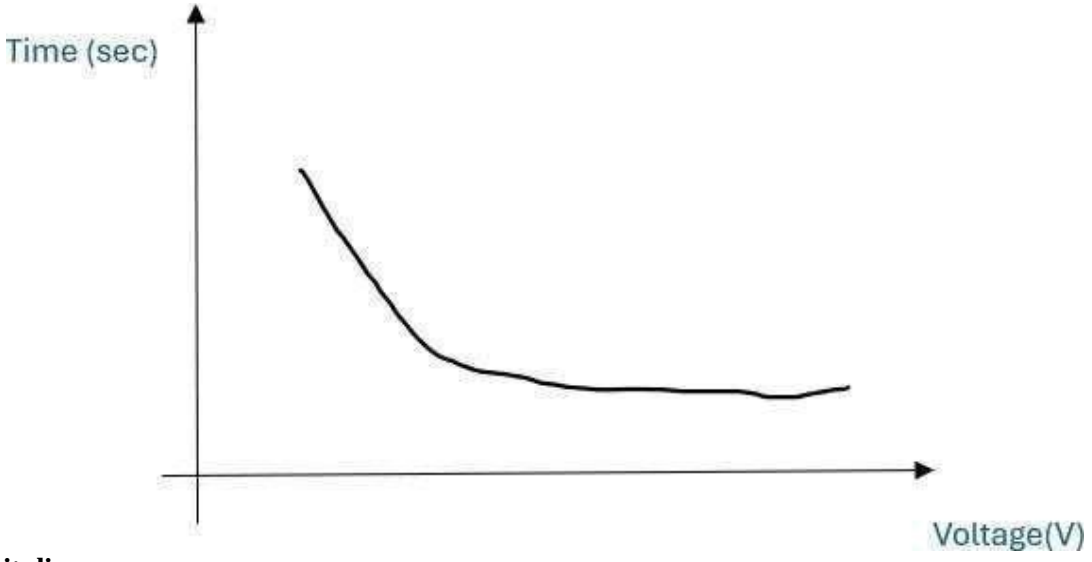
Procedure:

- Connect the power supply for the proportional valve control module ensuring current voltage and current ratings.
- Connect the control circuit unit to proportional valves to adjust its position based on input sensor.
- Wire the sensor to control unit and manually connect the circuit connections for operations
- Connect inlet proportional valve to pump and outlet to actuator.
- Attach the actuator to the valve and ensure hydraulic lines are secure and leak free
- Record the time taken for each cycle at the 2nd and 3rd proximity sensor by varying the voltage.

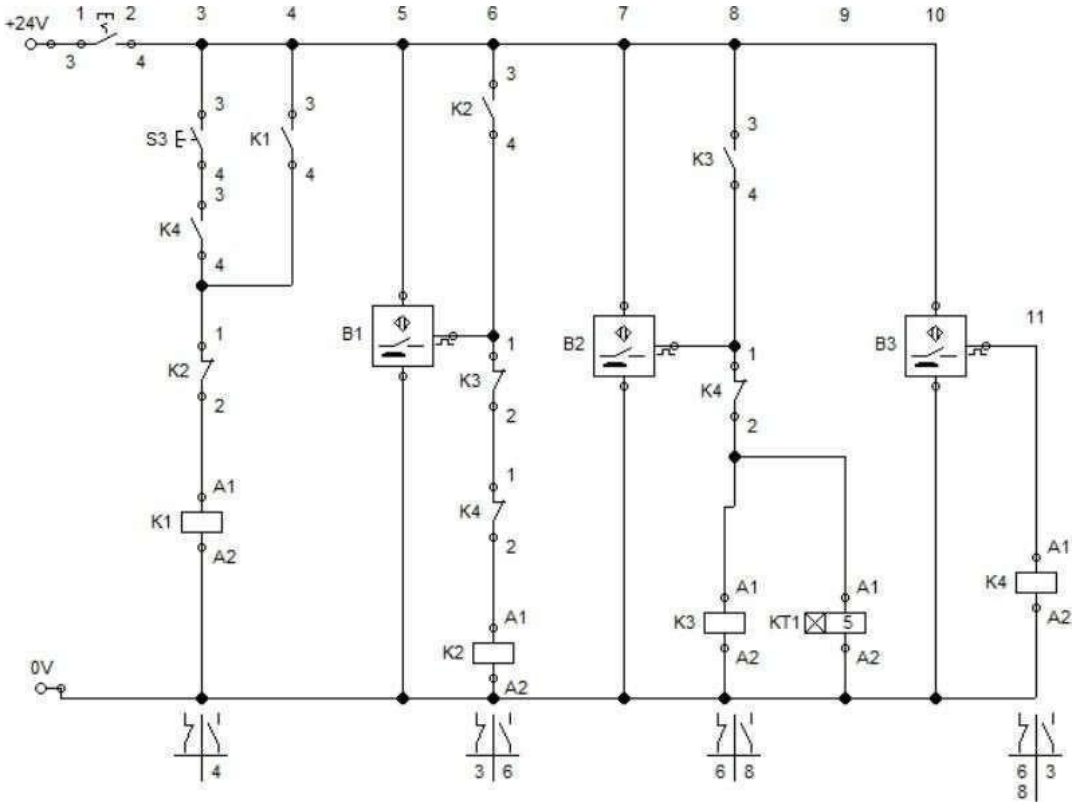
Tabulation:

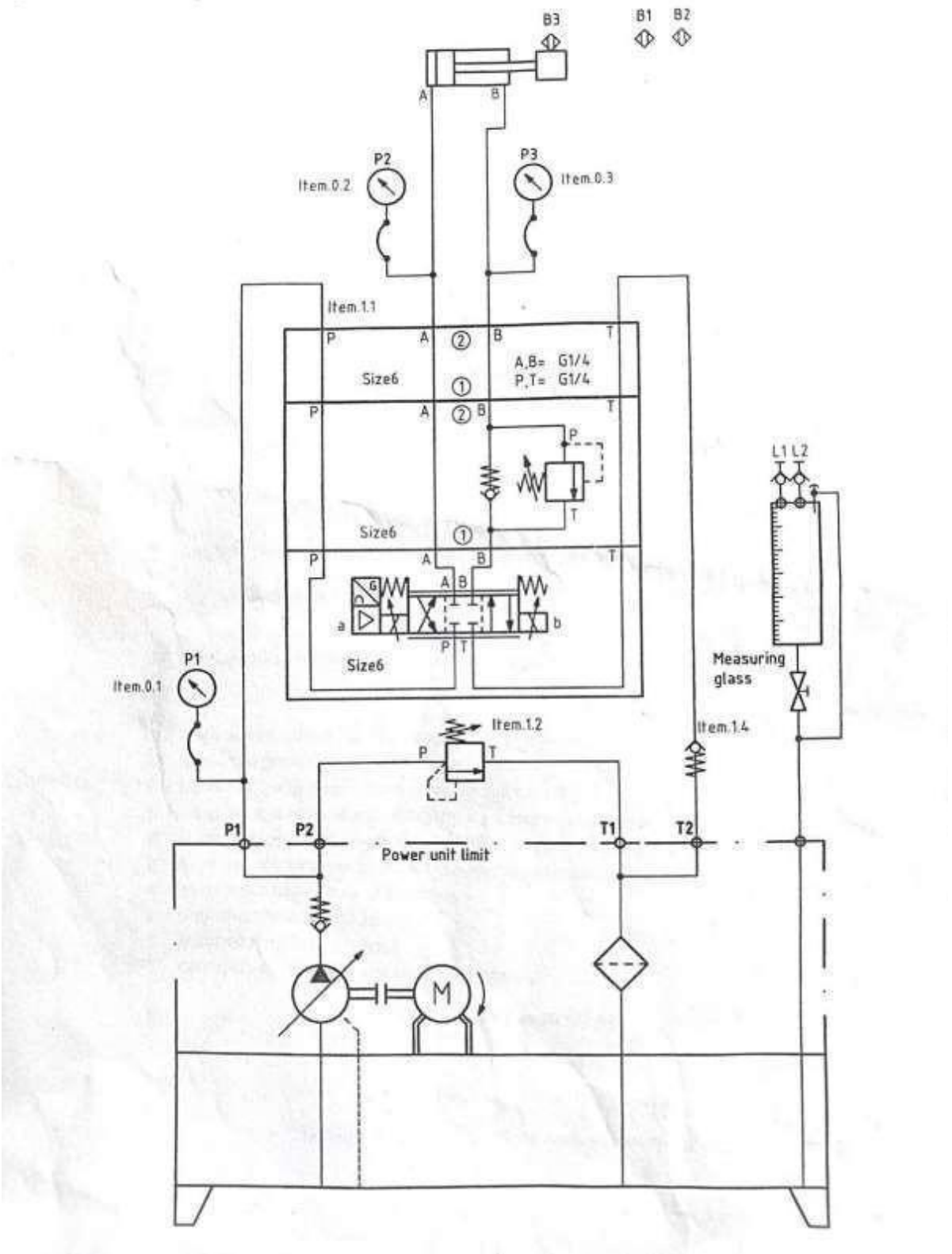
Voltage(V)	Time(sec)		
	T1	T2	T3
2			
4			
6			
8			
10			

Graph:



Circuit diagram:




B3
B1
B2
A
B
P2
Item.0.2
P3
Item.0.3
Item.1.1
P
A
B
T
Size6
A,B= G1/4
P,T= G1/4
L1 L2
Measuring glass
P1
Item.0.1
Item.1.2
Item.1.4
P1
P2
T1
T2
Power unit limit
M

Block diagram:

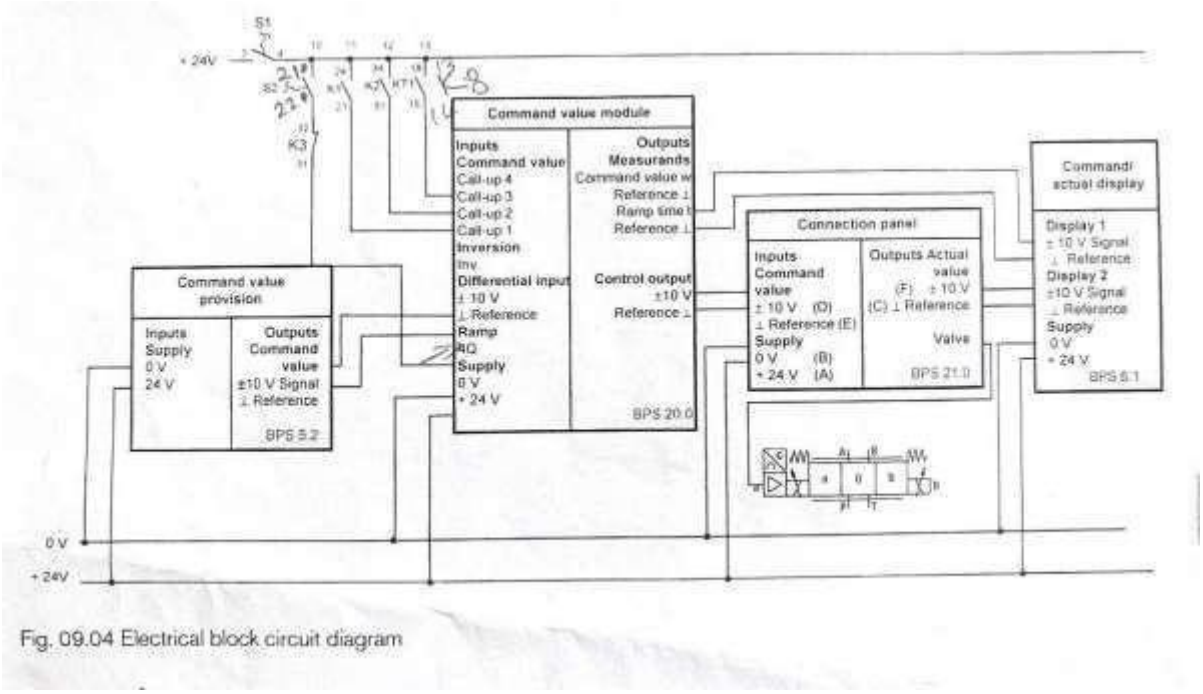


Fig. 09.04 Electrical block circuit diagram

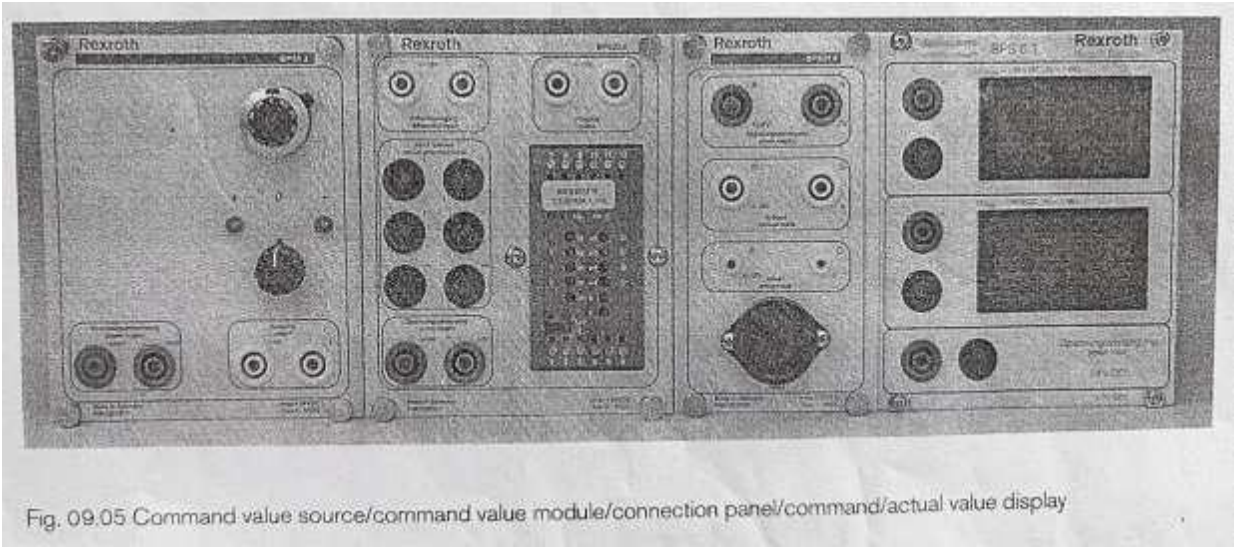


Fig. 09.05 Command value source/command value module/connection panel/command/actual value display

Inference:

- As pressure is increased, the time taken for the complete cycle is reduced.
- As voltage is reduced, the time taken for one complete cycle is increased.

Result:

Thus the proportional hydraulics was controlled for various voltages, pressure and varied speed was obtained.

EXP : 06 DATE:	CONTROL OF SERVO MOTOR USING SERCOS I/O MODULE

Aim:

To integrate motor drive and PLC using sercos

Apparatus Required:

1. PC
2. Indraworks engineering software
3. MLC Kit

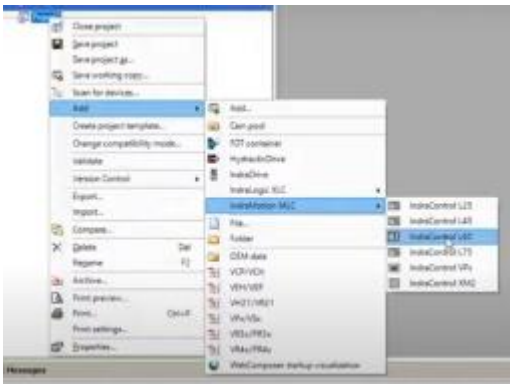
Procedure:

- Create a project in Indraworks engineering software and add Indramotion MLC of L65.
- Add devices in the sercos and download motion configuration.
- Load the basic parameters for the drive.
- Design the ladder logic PLC Programming.
- Login and run the program.
- Test its working and verify the trace.

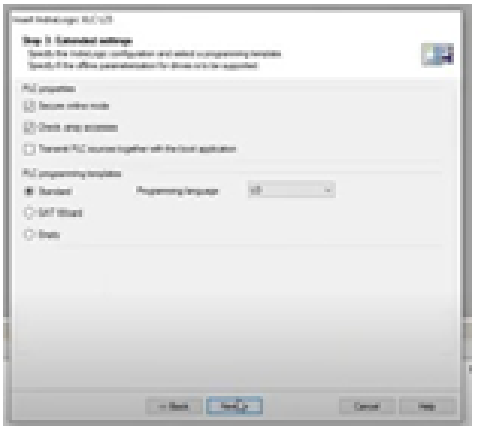
Steps to Follow:

A) Sercos can connect to plc via one serial line, so plc can connect to many 100s of field devices using the sercos protocol. Remote io module also called sercos io module Module is cheaper, less wires and easy to debug Ring network

B) Here also clear error when you see it

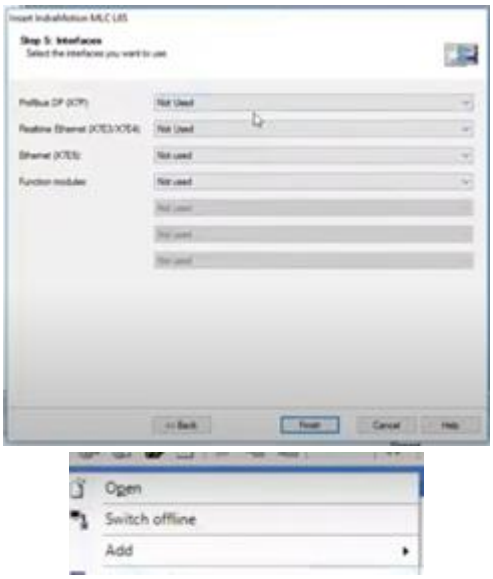


C) MLC L65 only will work

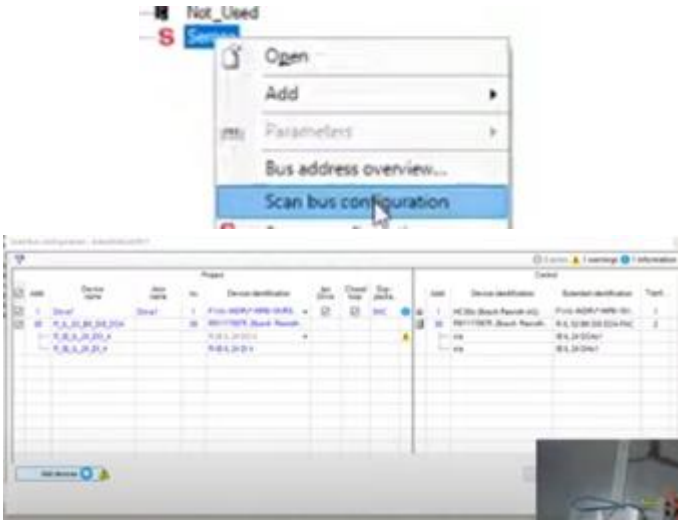


D) Ensure programming language is LD (Ladder diagram)

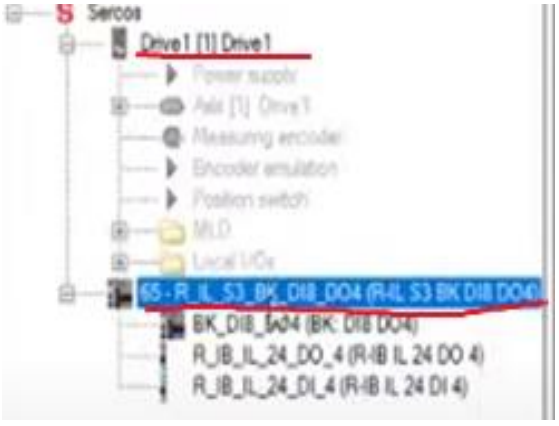
E) Give next



F) Right click sercos -> Scan bus configuration



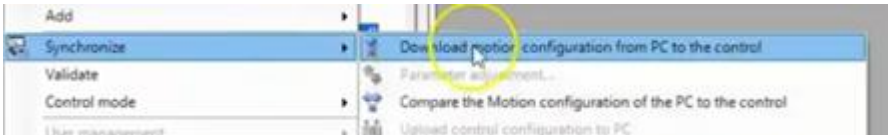
G) Add devices



H) Drive and this thing should be there

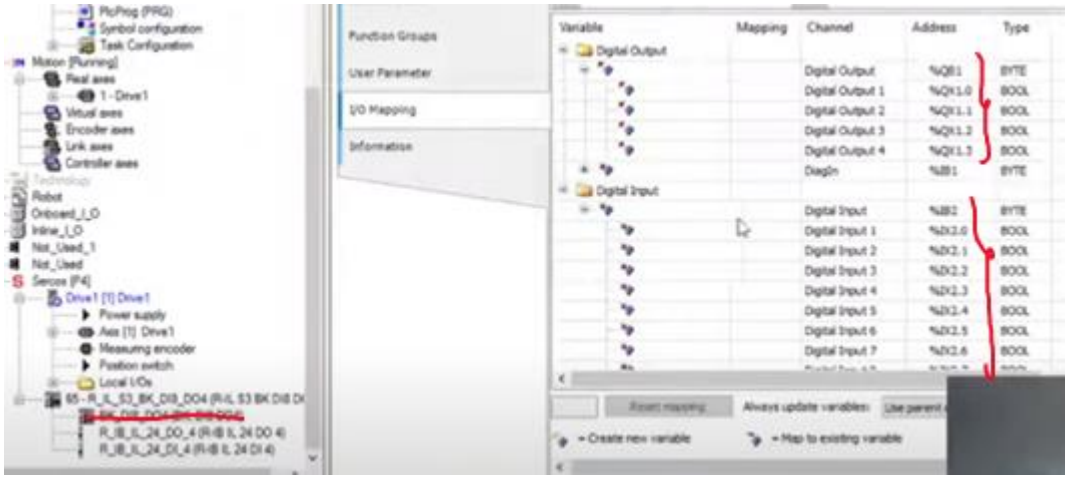
I) The real axis drive should be there

J) Click finish and switch online now. Control Mode should be P2 (Parameter Mode)

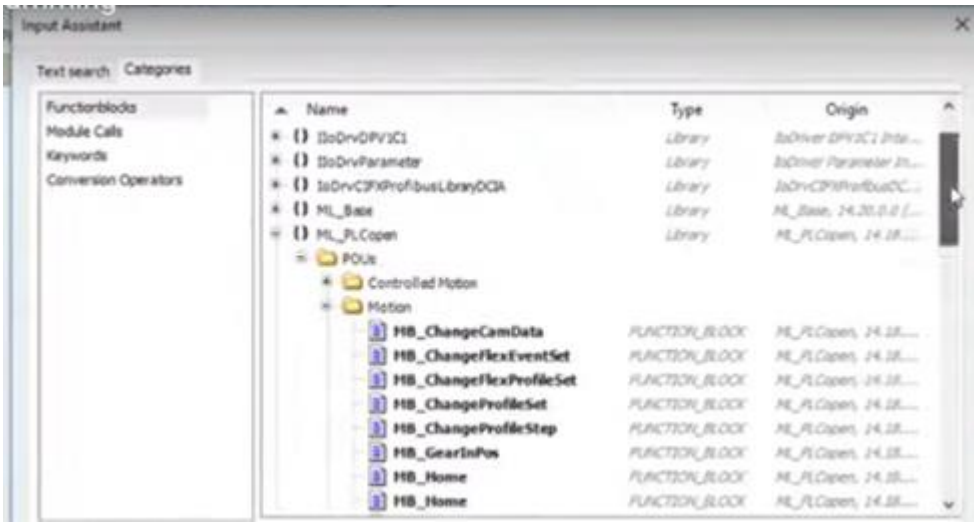


K) Right click on IndraMotionLogin and synchronize -> download motion config

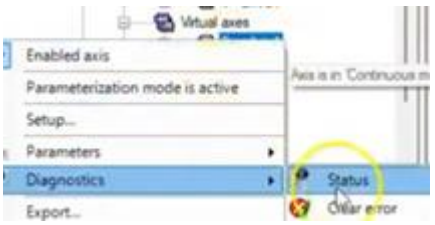
L) Set to BB run mode



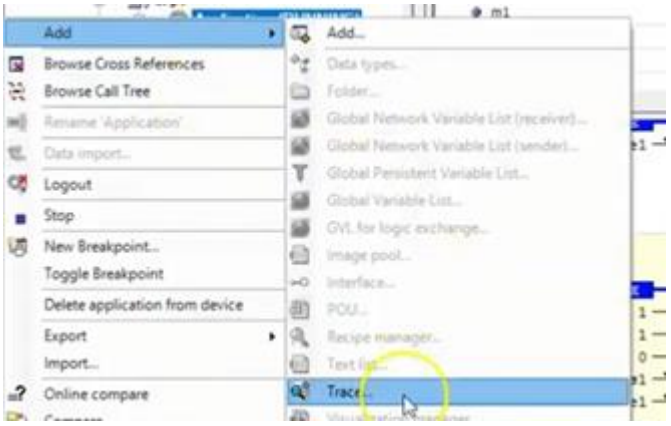
M) Click the underlined thing to see io mapping, use these io. Open PLCProg and enter the program. Rright click and insert box to see this menu



N) For all MC blocks, axis name is Drive1 same as the name under real axis and virtual axis name is vAxis1 same as the name under virtual axis

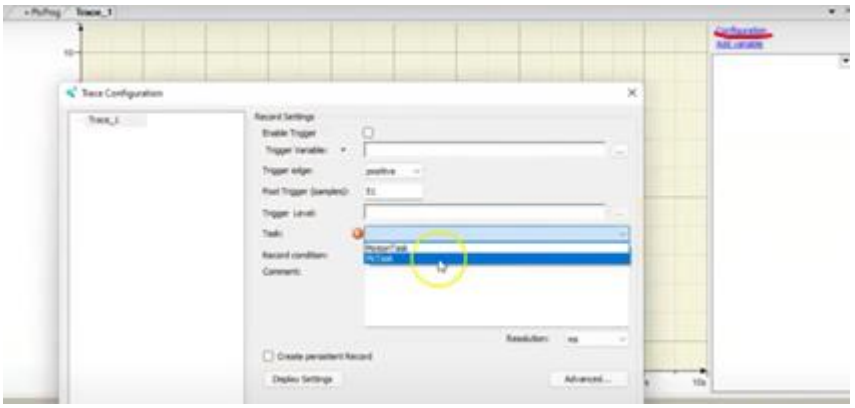


O) Right click any axis, diagnostics and status to see speed. After completing the LD circuit, login and start application



P) Right click Application -> Add -> Trace

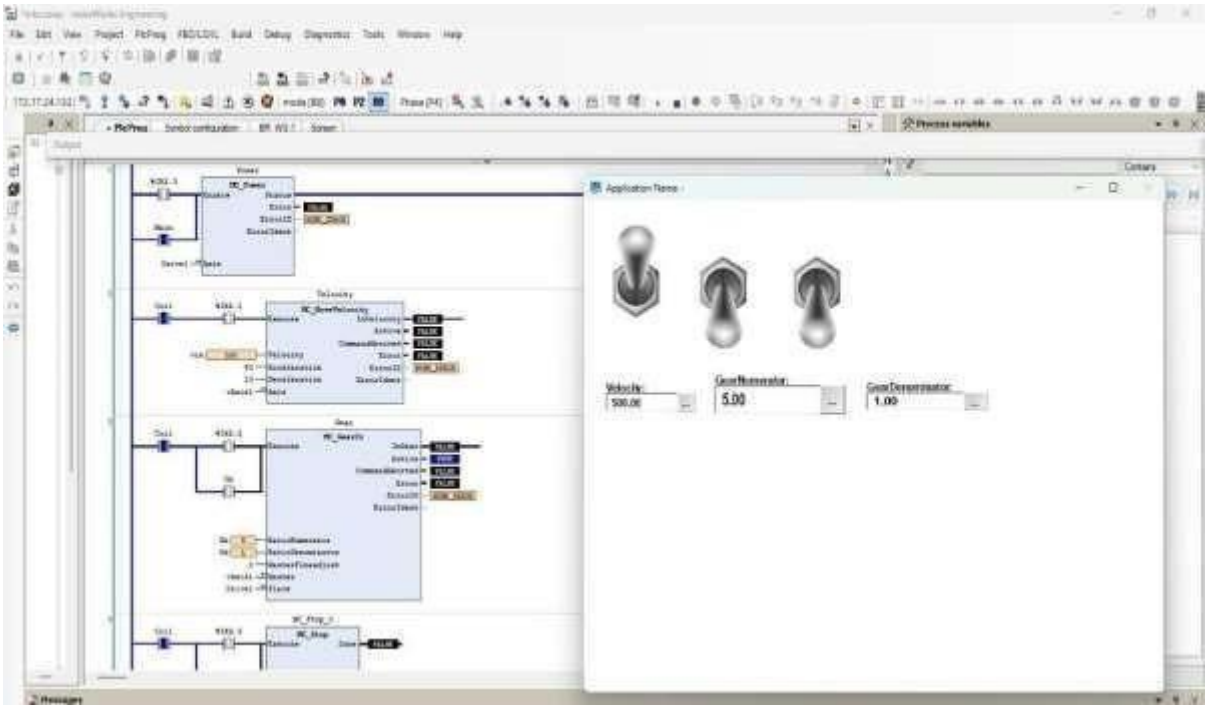
Q) Give name and finish (NAME SHOULDN'T BE SAME AS TRACE)

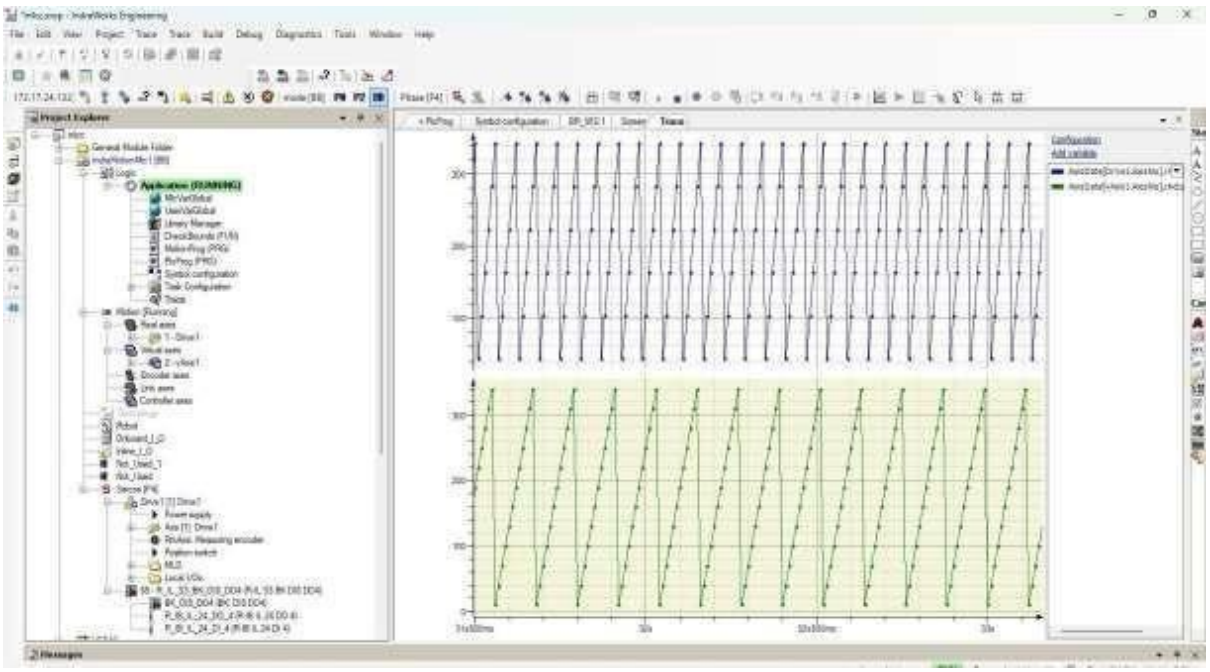


R) Click config in top right Select PlcTask,Open trace

Output:


Application Name -
Velocity:
500.00
GearNumerator:
5.00
GearDenominator:
1.00





Inference:

- Learnt about the implementation of integrating motion drive and PLC using Sercos communication protocol.
- Learn about various functional block diagram like Move velocity, Power, Stop, GearIn etc.

Result:

Thus, the integration of motion drive and PLC was performed using Sercos.

EXP : 07 DATE:	MASTER AND SLAVE DRIVE USING MOTION LOGIC DRIVE

Aim:

To design and implement ladder logic diagram in master and slave drive using motion logic drive.

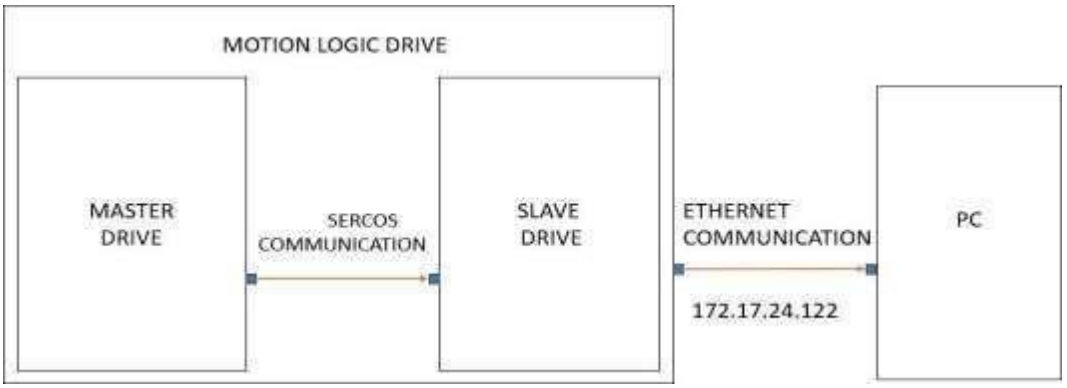
Apparatus Required:

- PC
- IndraWorks Engineering Software
- MLD Kit

Procedure:

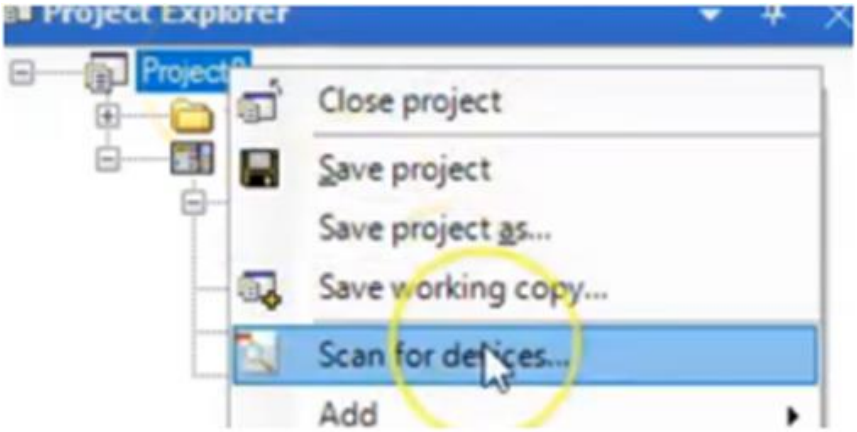
- Create a new project in IndraWorks Engineering Software and add Indra drive device with PLC project.
- Add devices in sercos and download Axis1 parallel and slave drive.
- Check the configuration of PLC behaviour and create the logic.
- Add POU with ladder logic as implementation logic.
- Design the ladder logic in PLC programming and in POU programming.
- Login and rectify the errors.
- Run the program.
- Add the output in oscilloscope to configure the Axis1 and slave axis to run the program and verify the output.

Connection Diagram:

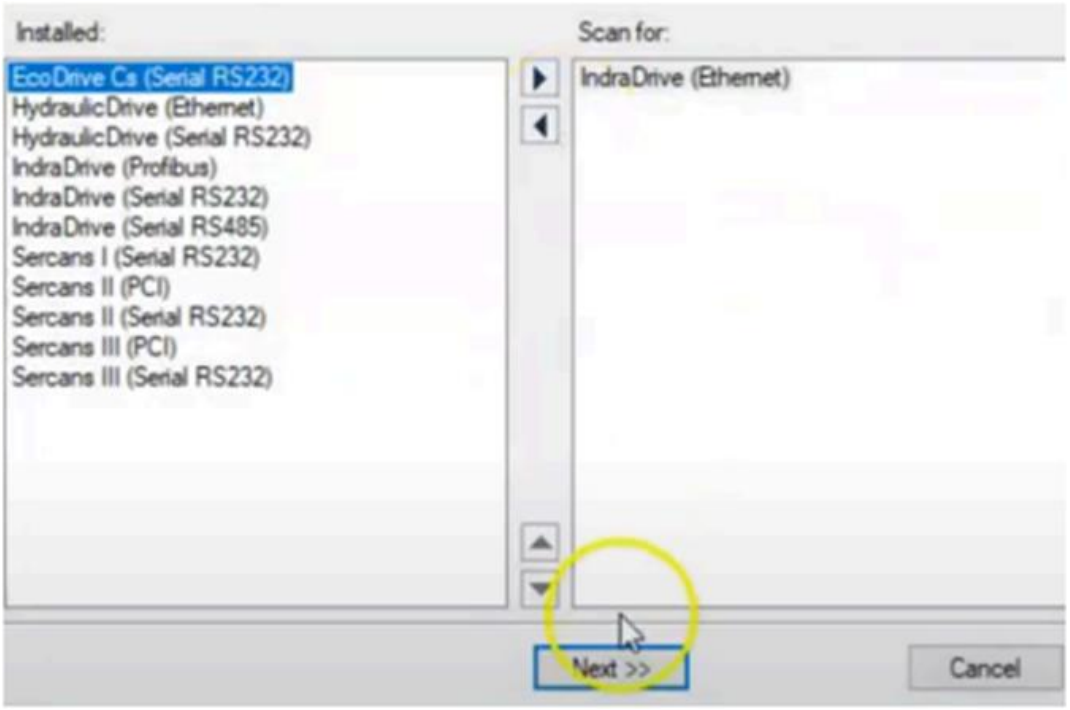


Steps to Follow

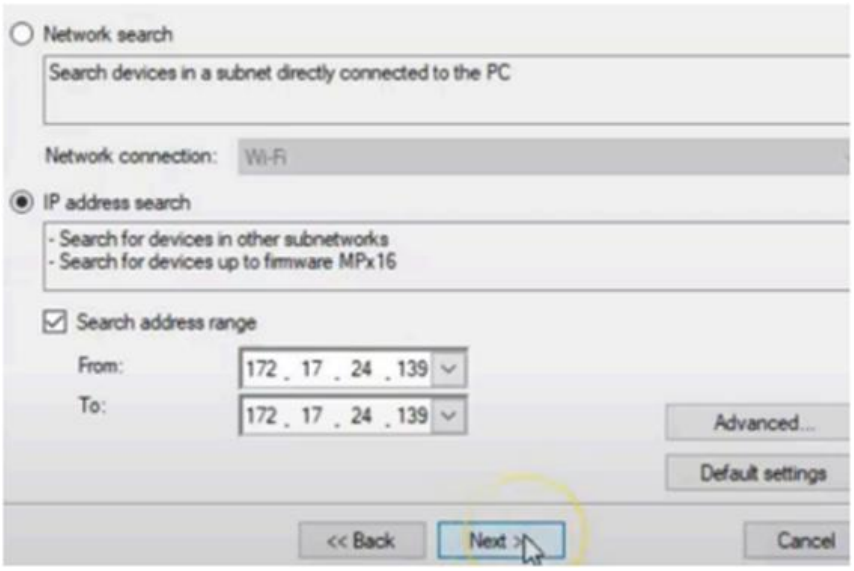
A. Create project and scan for device



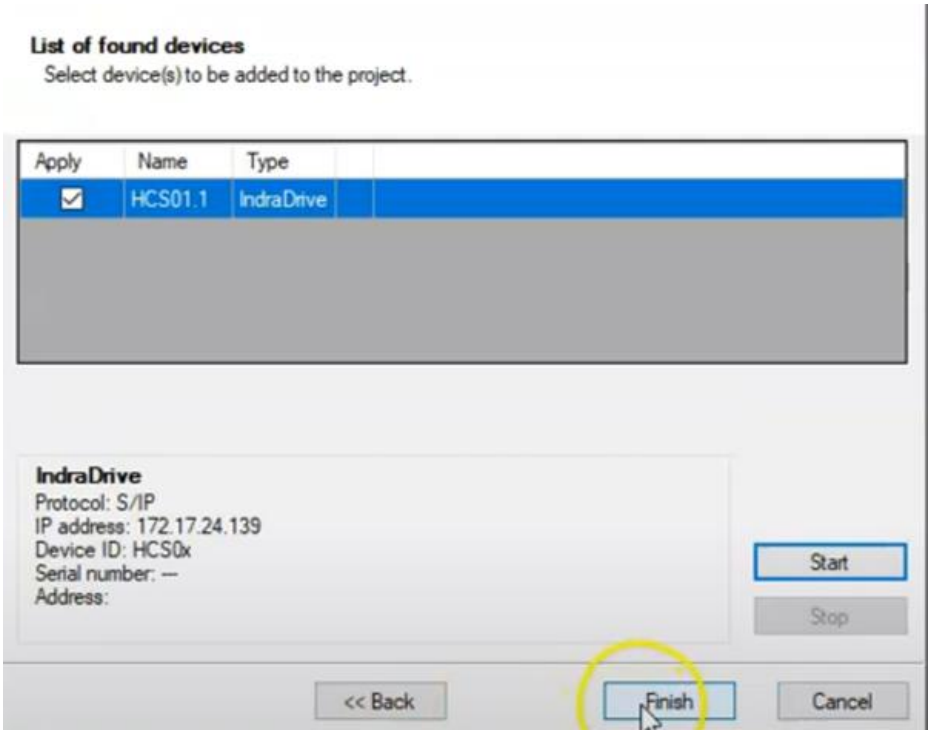
B. Select IndraDrive (Ethernet)



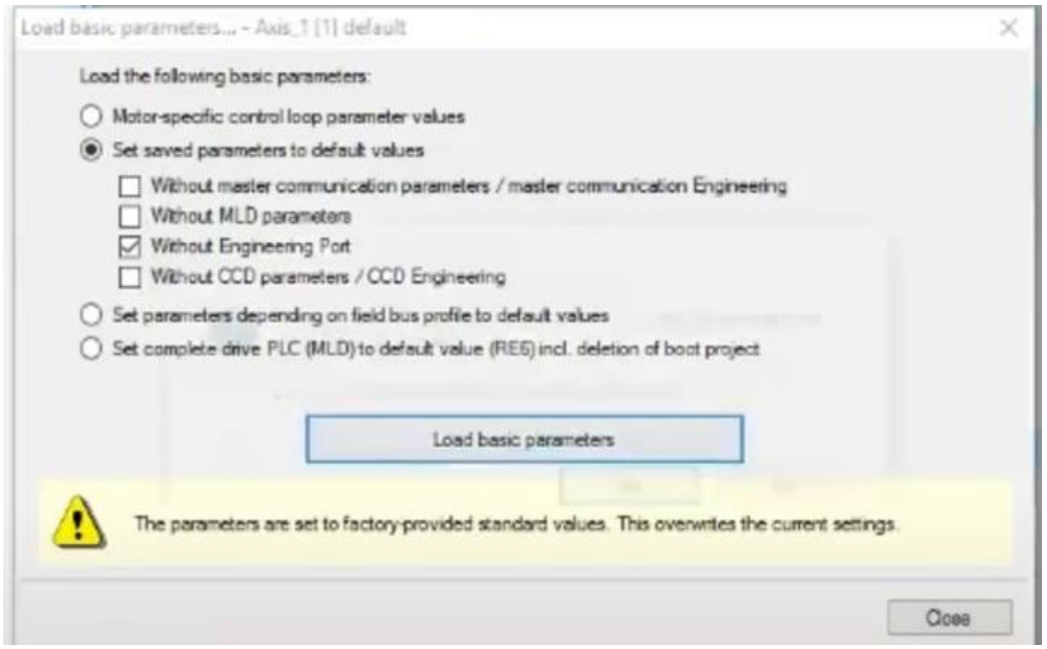
C. Enter the IP Address



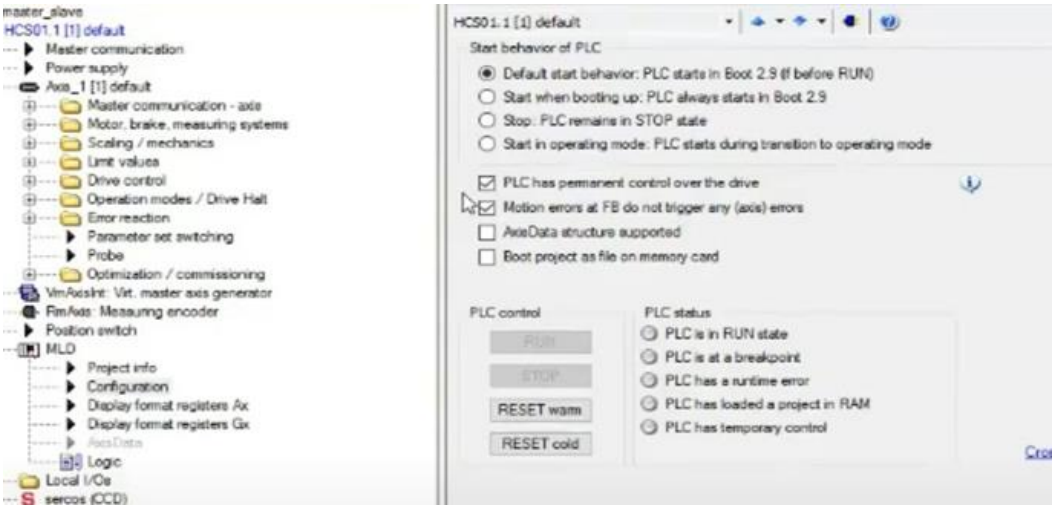
D. Finish once the drive is loaded



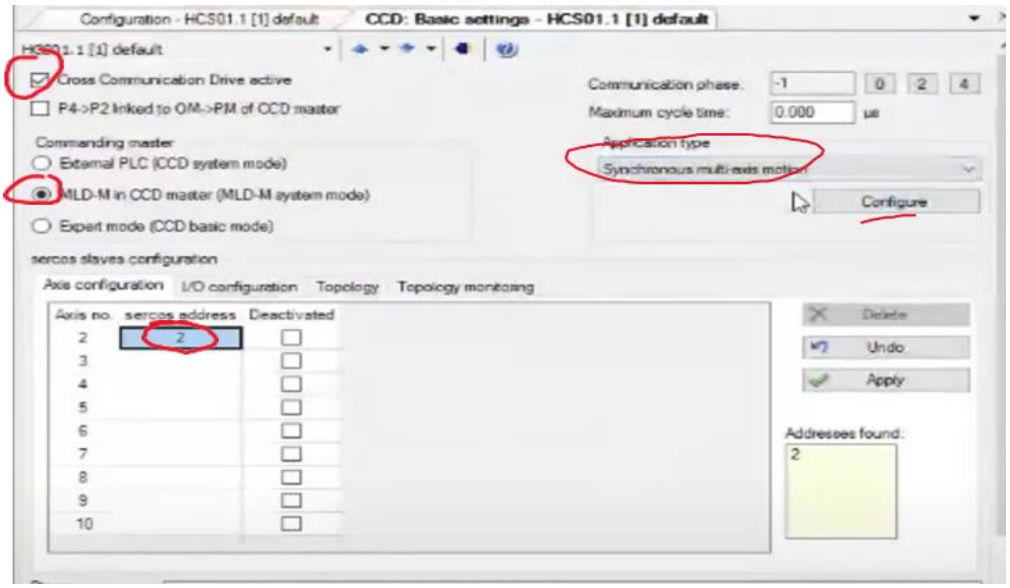
E. Load basic parameters



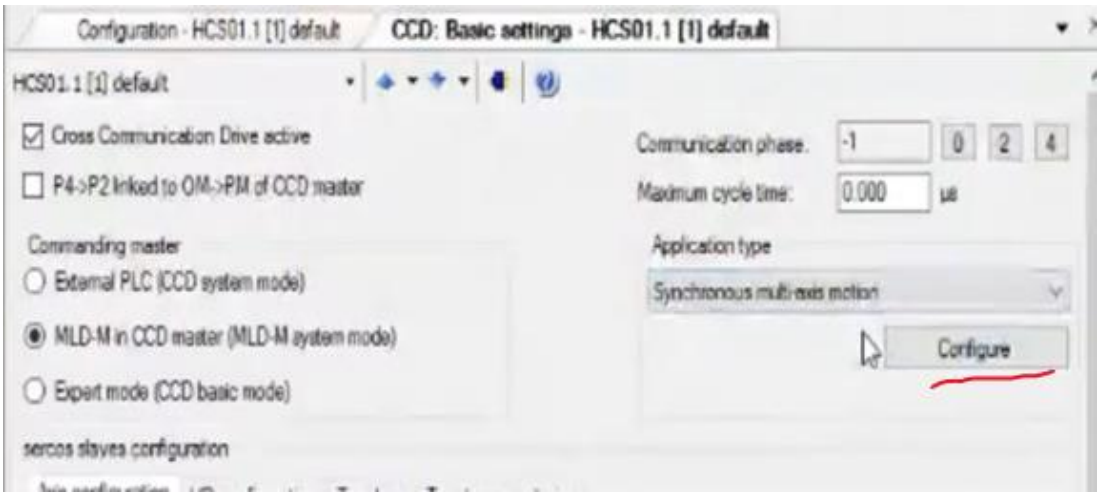
F. Right click MLD and check Configuration (PLC has permanent control over device and PLC is in run mode).



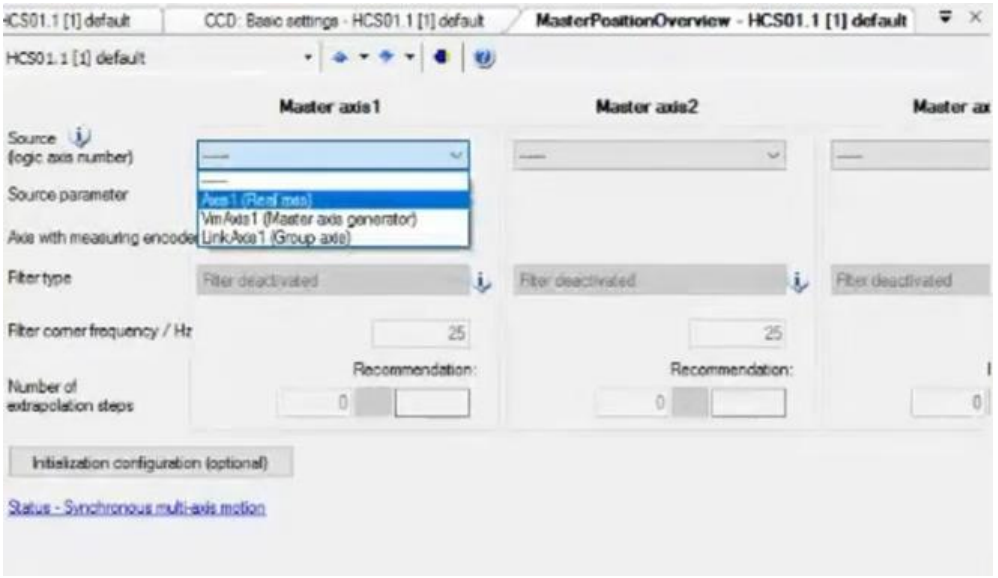
G.Select Cross Communication Drive and MLD m in CCD master and click configure



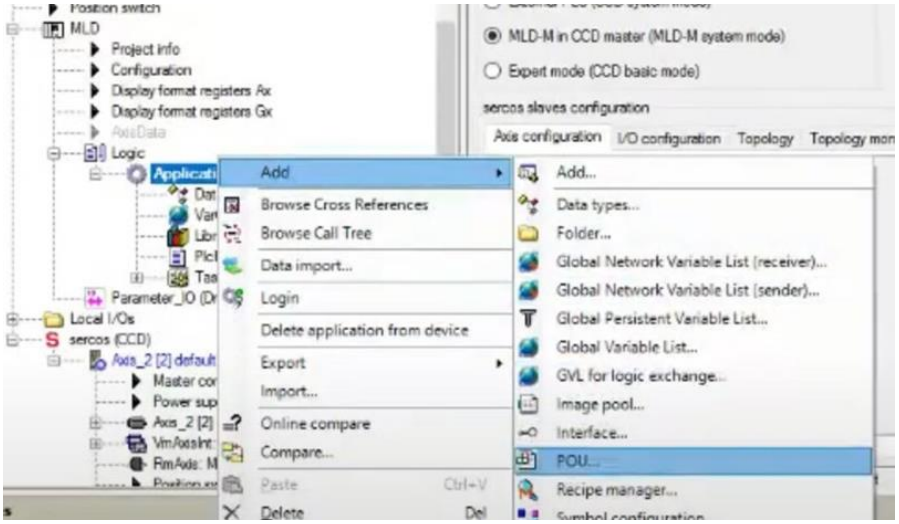
H. Click mode 2 and then click configure



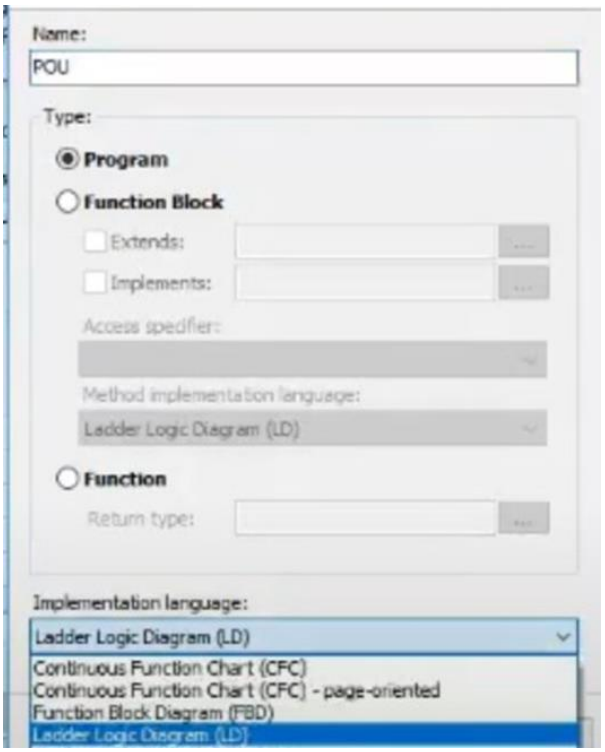
I.Set Axis 1 to Masteraxis 1



J. Add POU in PLC PRG , Write POU function in PLC PRG and Create Ladder logic program in POU

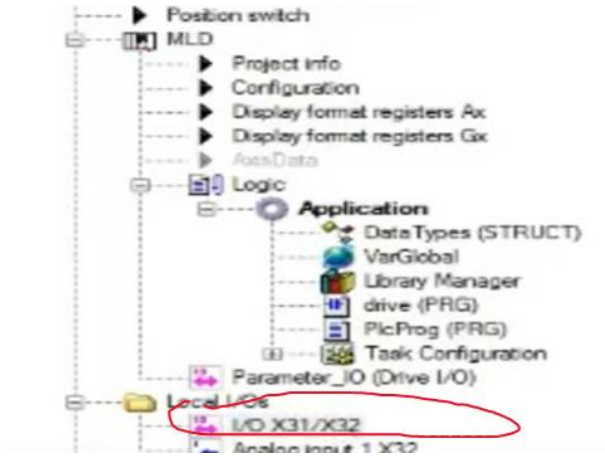


K.Select ladder lodic as language

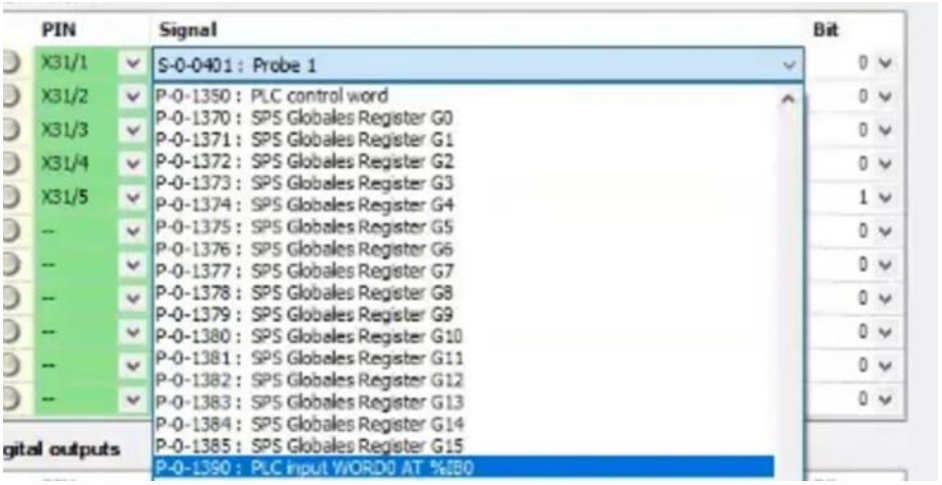


L. Draw ladder logic with Axis 1 and 2

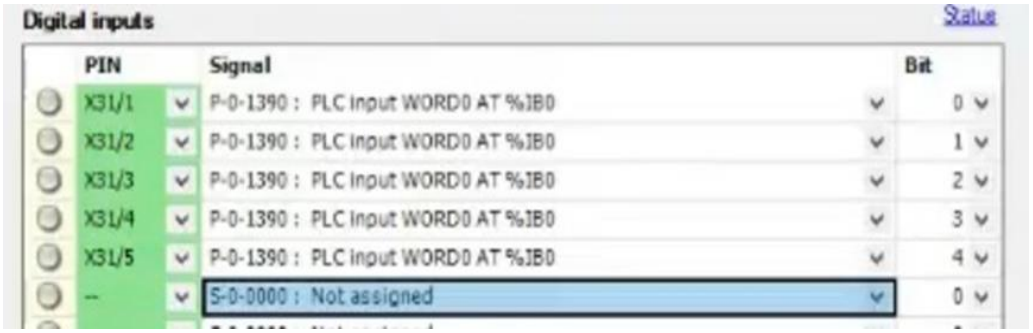
M.Select I/O from local I/O



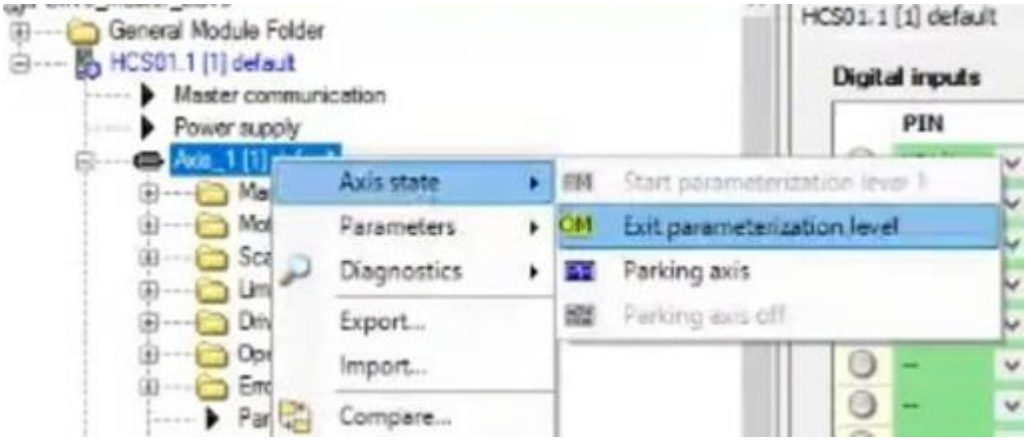
N.Select 1390 in the signal



O. Select bits from 0 to 4

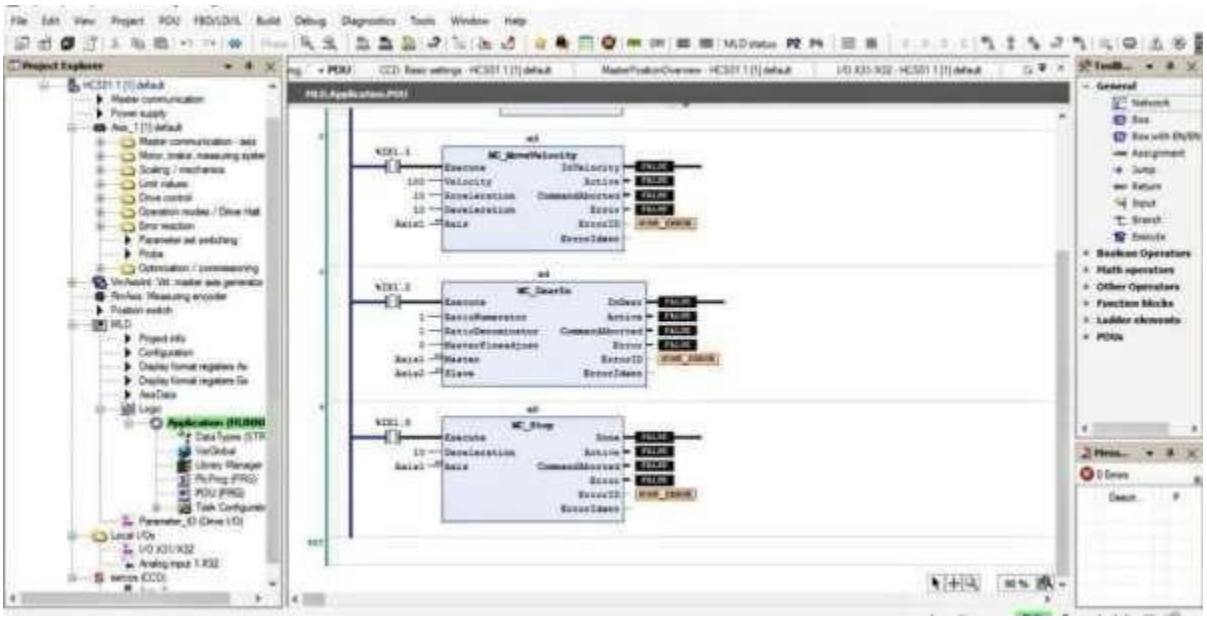


P .Exit parameterization mode



Q. Login and start the application

OUTPUT:



Inference:

- Interfacing servo motor with MLD using master slave was performed.
- Implementation of servo motor with MLD ensures slave master responds precisely to master command.
- This can be applied in conveyor system, robotic arms and other coordinated machinery movements.

Result:

Thus, design and implementation of ladder logic diagram for master and slave using motion logic drive was performed and output was verified.

EXP : 08 DATE:	COMMUNICATION OF L25 REXROTH CONTROLLER WITH INDRAWORKS DRIVE USING PROFINET

Aim:

To communicate a BOSCH REXROTH XLC-L25 Plc with another BOSCH REXROTH Plc using PROFINET communication protocol

Apparatus Required:

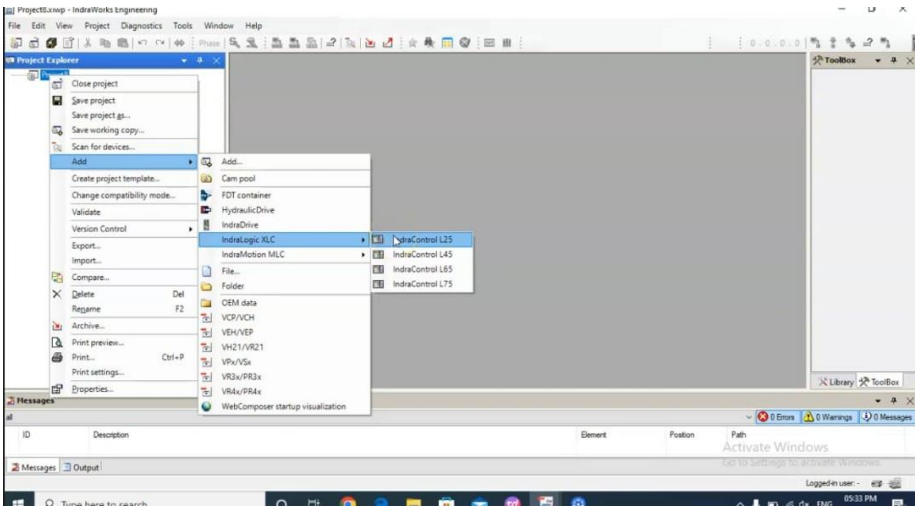
1. Bosch Rexroth PLC
2. IndraWorks Servo Drive
3. Indraworks Engineering software with PC

Procedure:

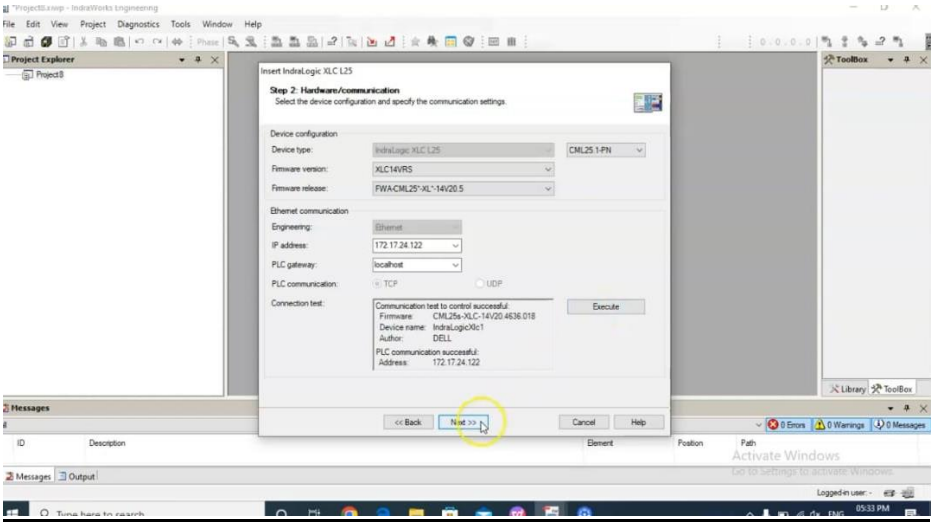
1. Launch Indraworks Engineering software.
2. Create new project with Indralogic XLC-L25 PLC, select this as Profinet Controller and interface with the PLC.
3. Create another project with the Indralogic XLC-L25 Plc and add the I/O modules of the Plc, scan for devices to connect the controller using I/P address and ethernet connection
4. Check the HCS01.1[2] default controller master communication active protocol in PROFINET and also check the field bus diagnostics.
5. Connect the Profinet I/O controller devices using scan for devices option to add IndraLogic XLC.
6. Check the output port %QW to manual input hexadecimal value to work the device forward, reverse and stop command.

Steps:

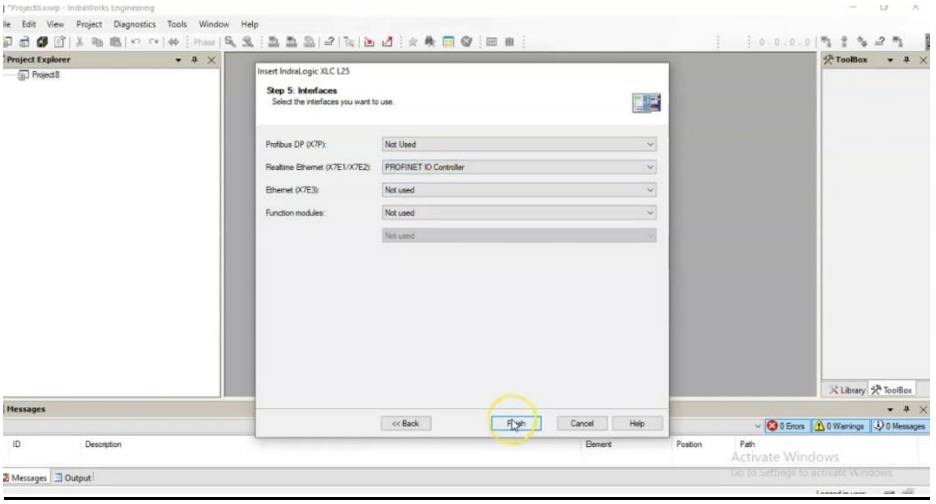
1. In a new project add IndraLogic XLC L25 control.



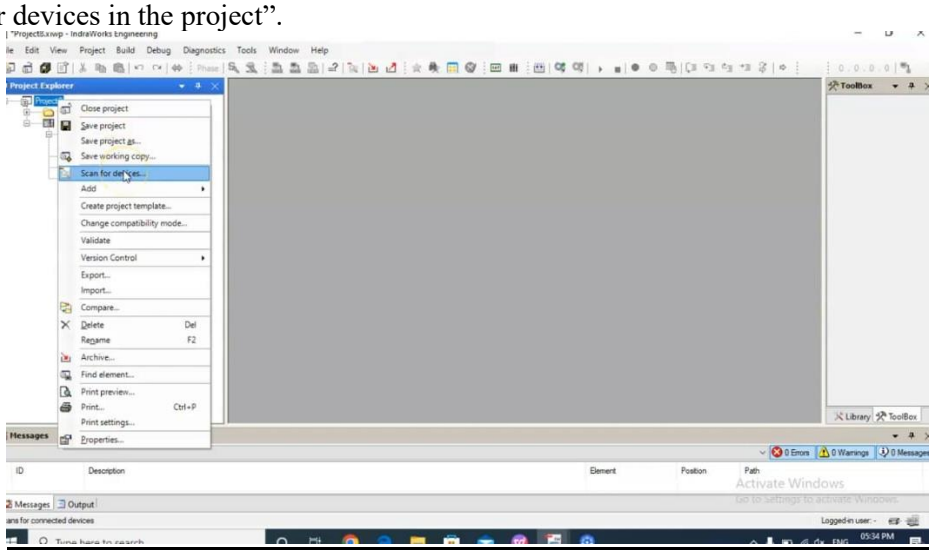
2. Give the required IP-address and ensure CML25 1-PN device type is selected. Now execute the connection and click next.



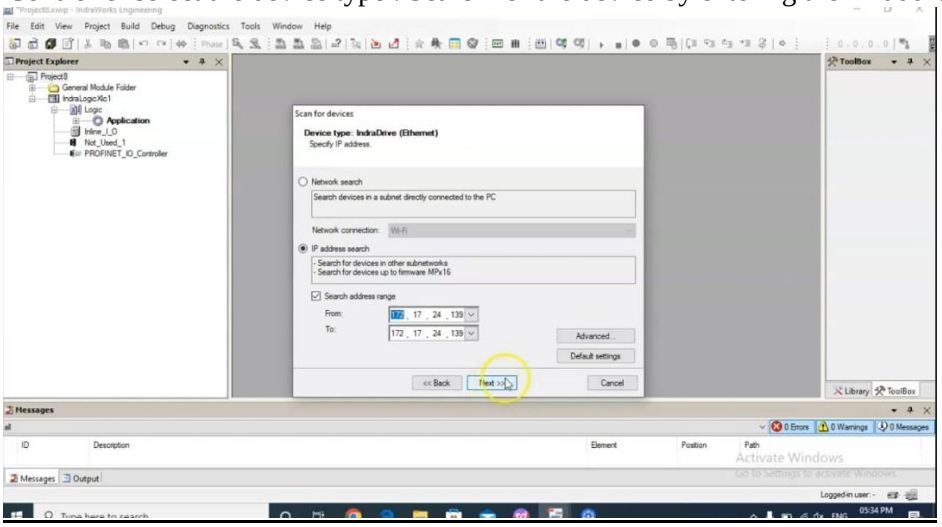
3. Ensure PROFINET IO Controller is selected.



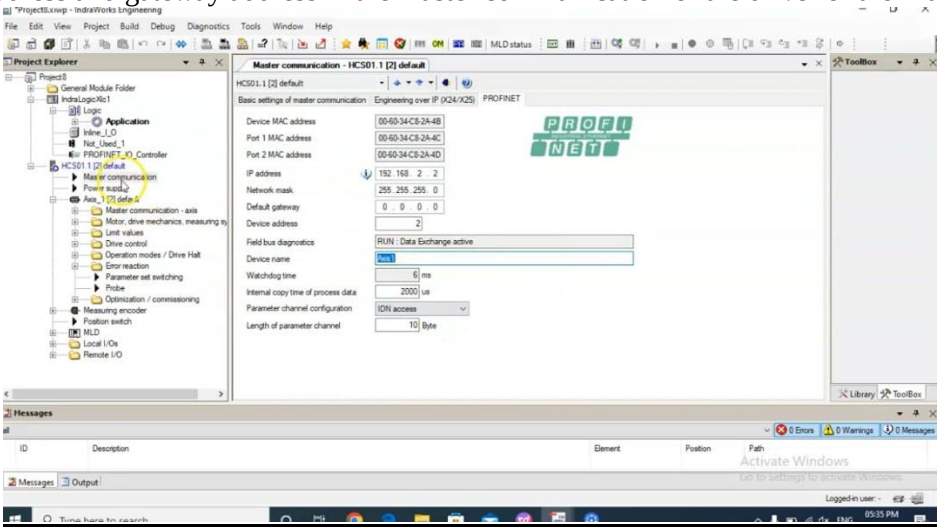
4. Click “scan for devices in the project”.



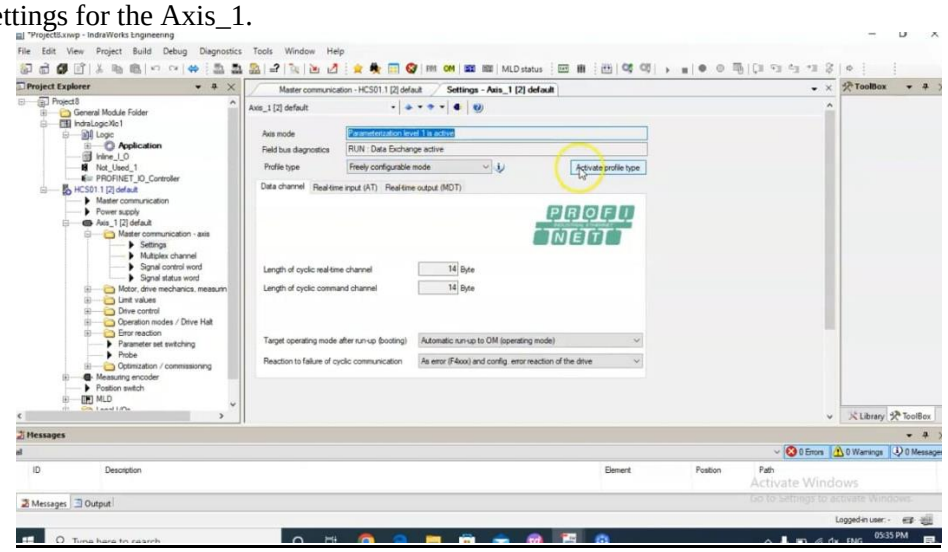
5. In the Profinet Controller select the device type . Search for the device by entering the IP-address.



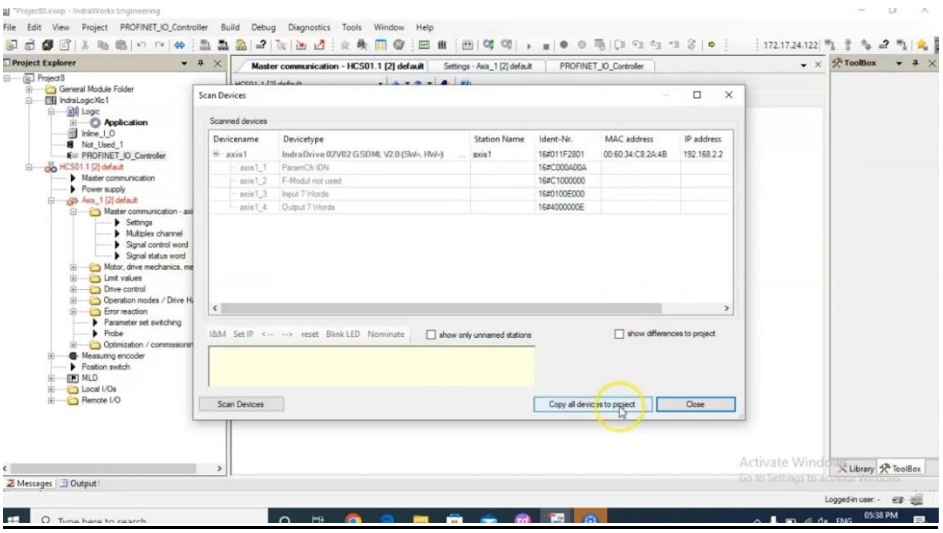
6. Enter the IP-address and gateway address in the master communication of the drive for the Master Axis (Axis_1).



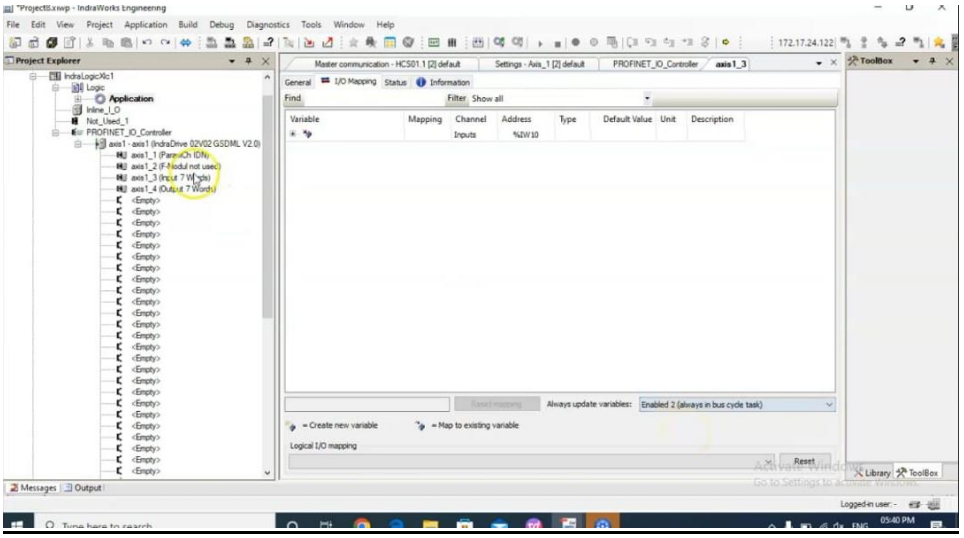
7. Change the settings for the Axis_1.



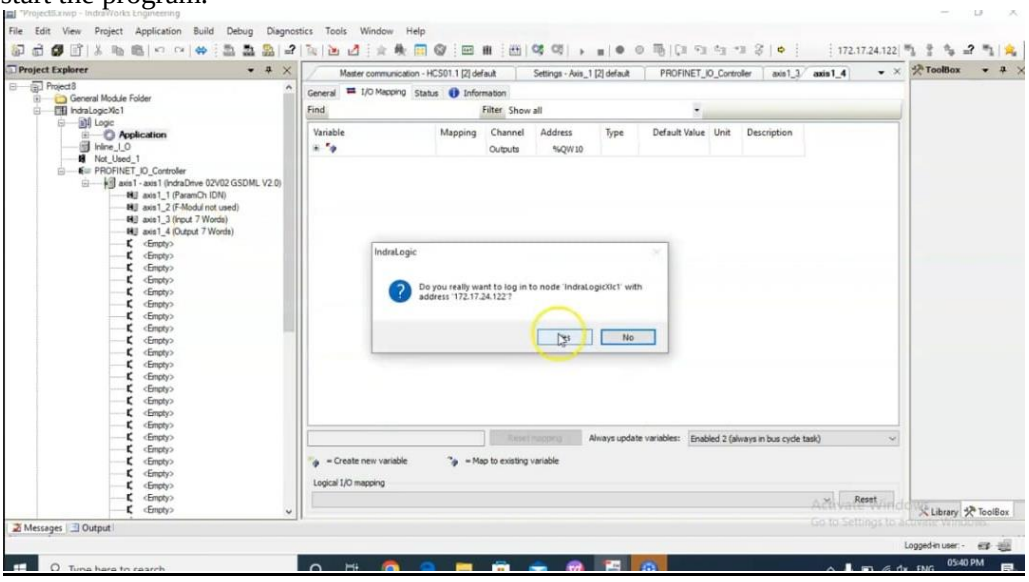
8. Select the devices in master communication, by running scan for device command and clicking “Copy all devices to project”.



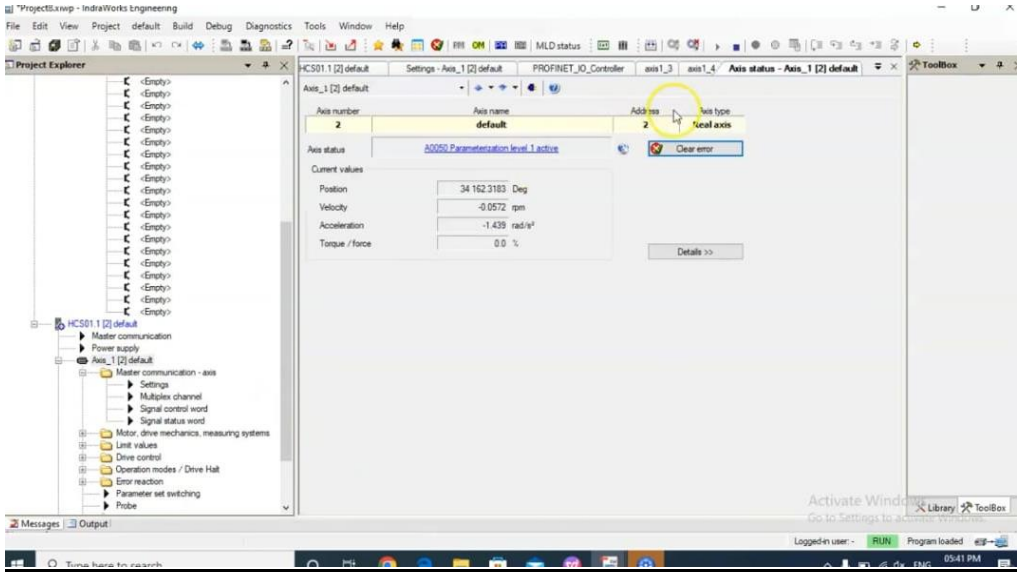
9. Once the device is added, configure the master and slave axis.



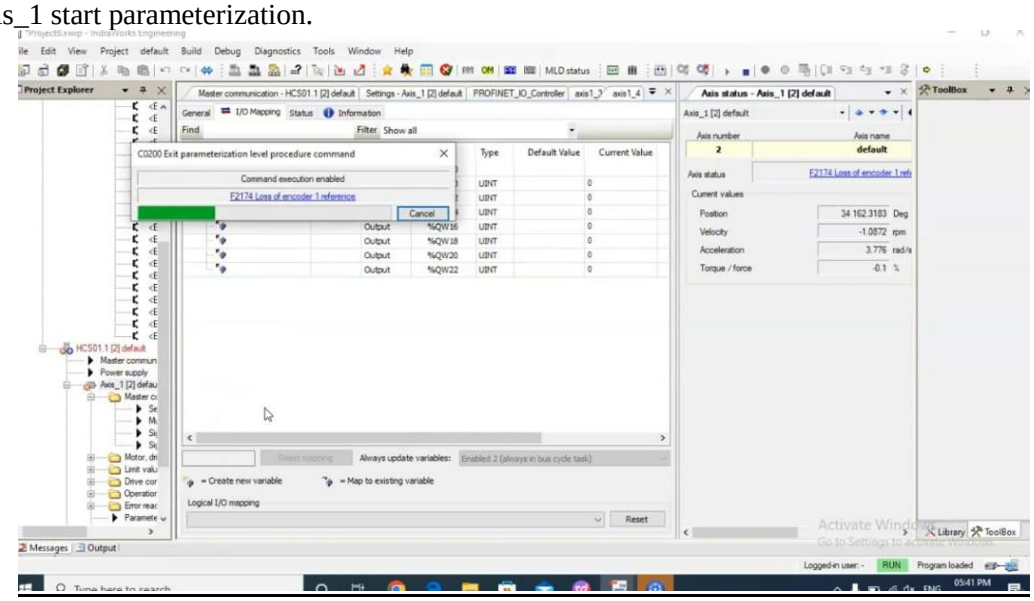
10. Login and start the program.



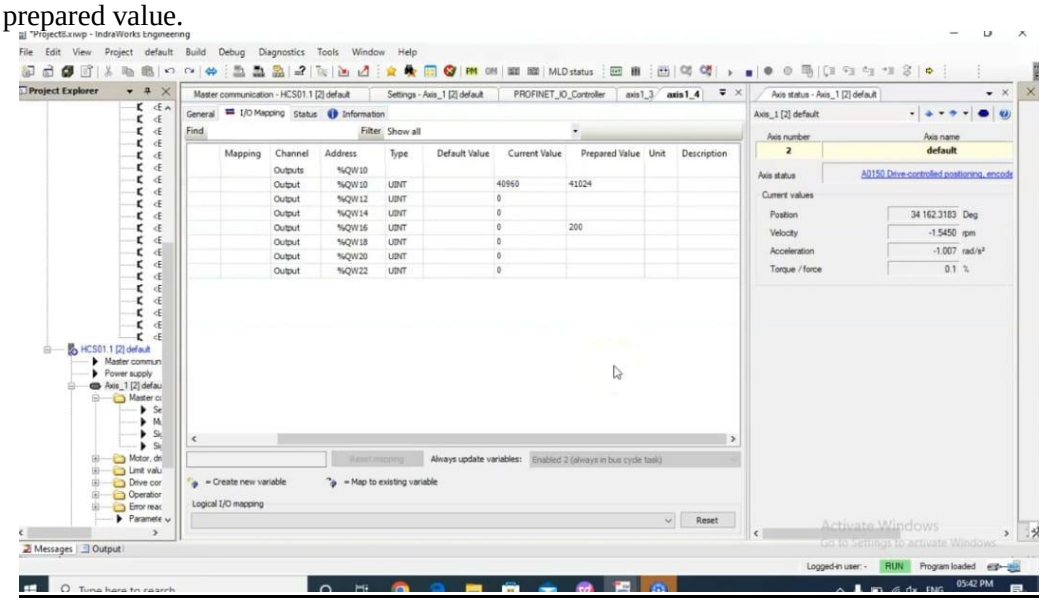
11. Check the axis status.



12. In the Axis_1 start parameterization.

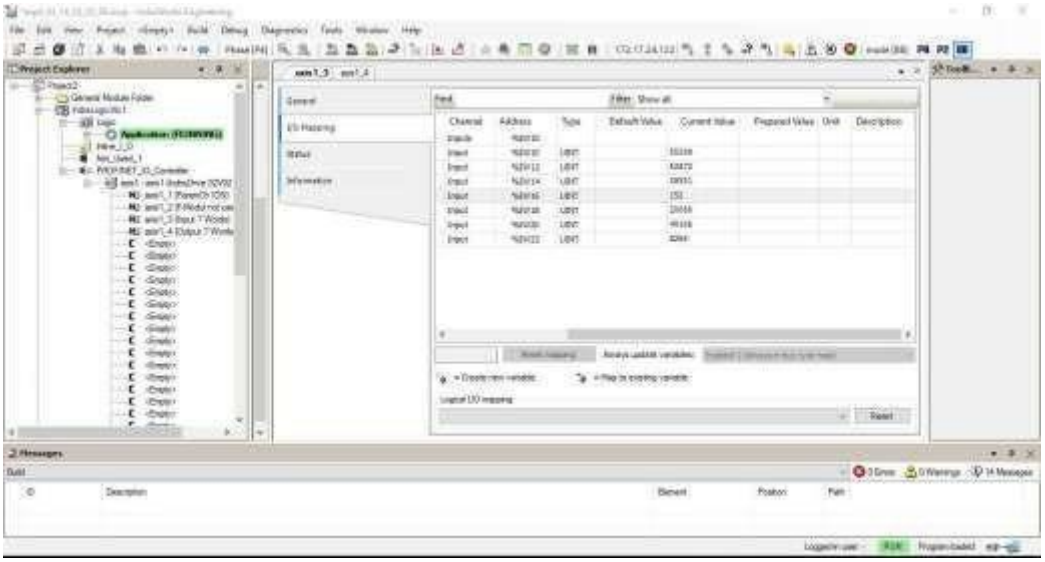


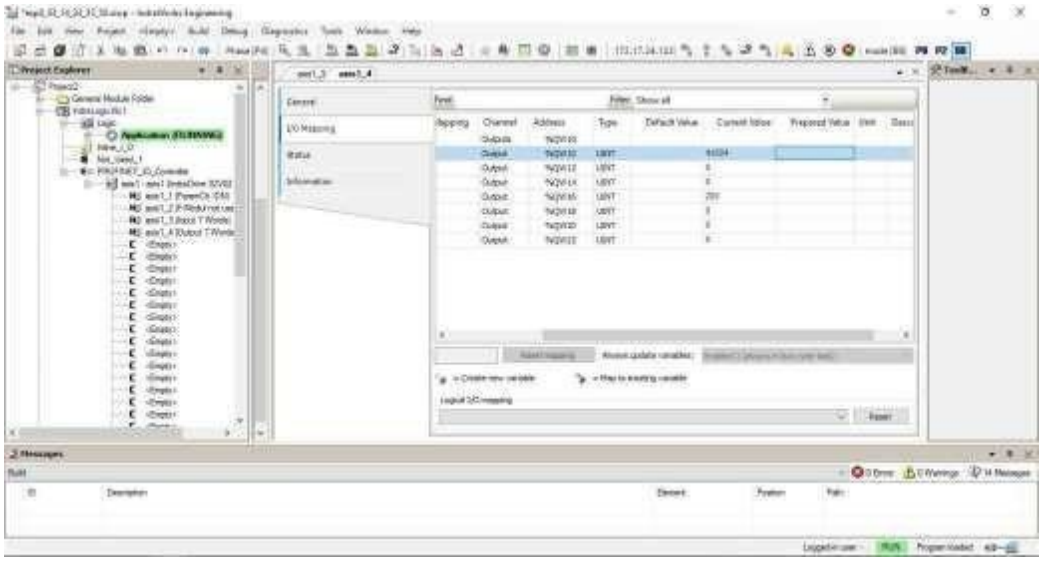
13. Enter the prepared value.



Output:

Observe the output.





Inference:

From this experiment,

- How to use Profinet.
- Interfacing of PROFINET with PLC and MLD (Motion Logic Drive).
- Control and communication with various devices.

Result:

Thus, the Profinet controller devices configuration is performed using IndraWorks software with Servo Drive and the output was verified.

EXP : 09 DATE:	COMMUNICATION OF 2 BOSCH REXROTH PLCs USING PROFINET

Aim:

To communicate a BOSCH REXROTH XLC-L25 Plc with another BOSCH REXROTH Plc using PROFINET communication protocol

Equipments and softwares used:

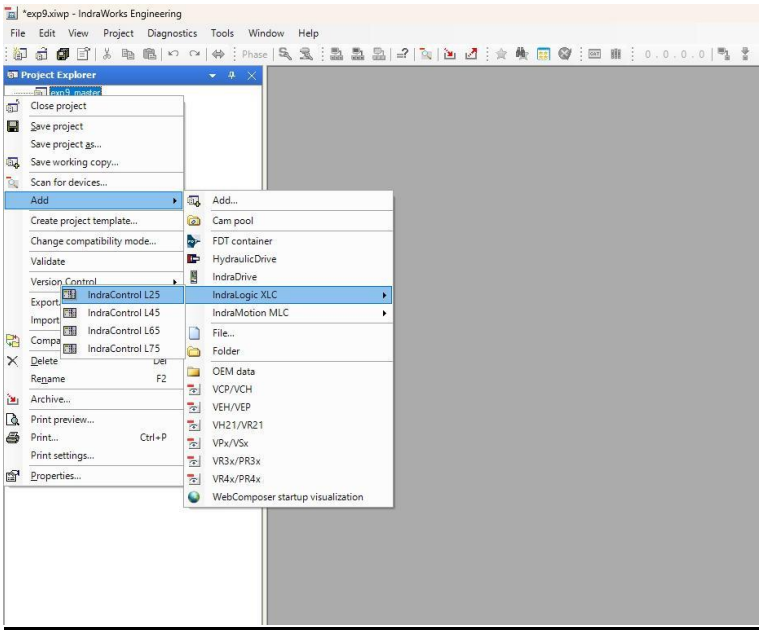
1. Bosch Rexroth PLCs
2. Indraworks Engineering software with PC

Procedure:

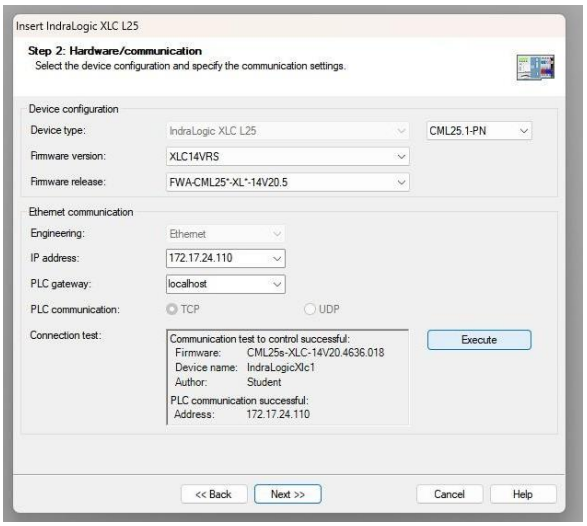
1. Launch Indraworks Engineering software.
2. Create a new project with Indralogic XLC-L25 Plc and add the I/O modules of the Plc.
3. Add the IP address of the Master Plc to the project and establish the connection test.
4. Add profinet controller to the project and right click profinet.
   and select L25_PN device from the Plc dropdown menu.
5. Add the input,output byte arrays to the project.
6. Create another project with the Indralogic XLC-L25 Plc and add the
   I/O modules of the Plc.
7. Add the IP address of the Slave Plc and add the profinet IO device to the
   project and establish connection test
8. Add the 8 byte Output and 8 byte Input modules to the profinet device.
9. Set the Respective IP address and the default gateway of the Plcs for both the projects.
10. Design ladder logic to control the slave by master and vice versa.
11. Login into both the applications and verify the output.

Steps to follow:

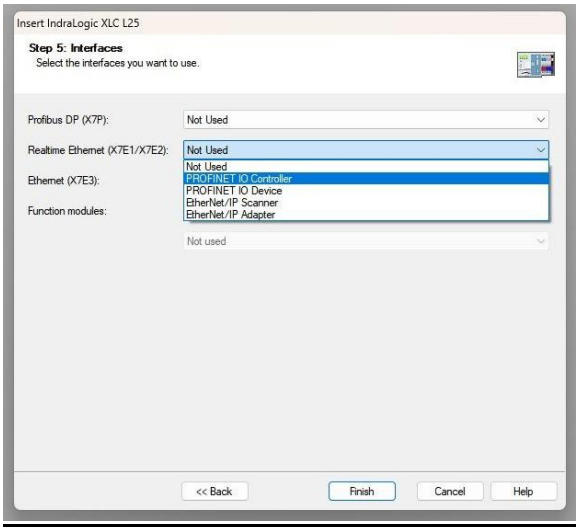
1. Create 2 new projects for both master and the slave plc and add Indracontrol L25 in Indralogic XLC



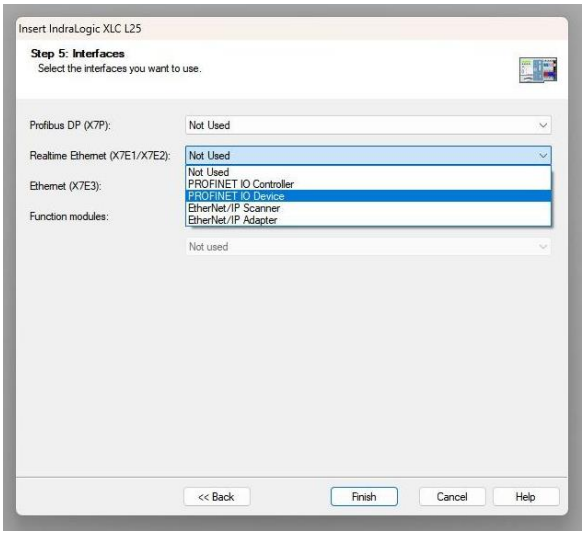
2. Give the respective IP addresses and execute the connection test



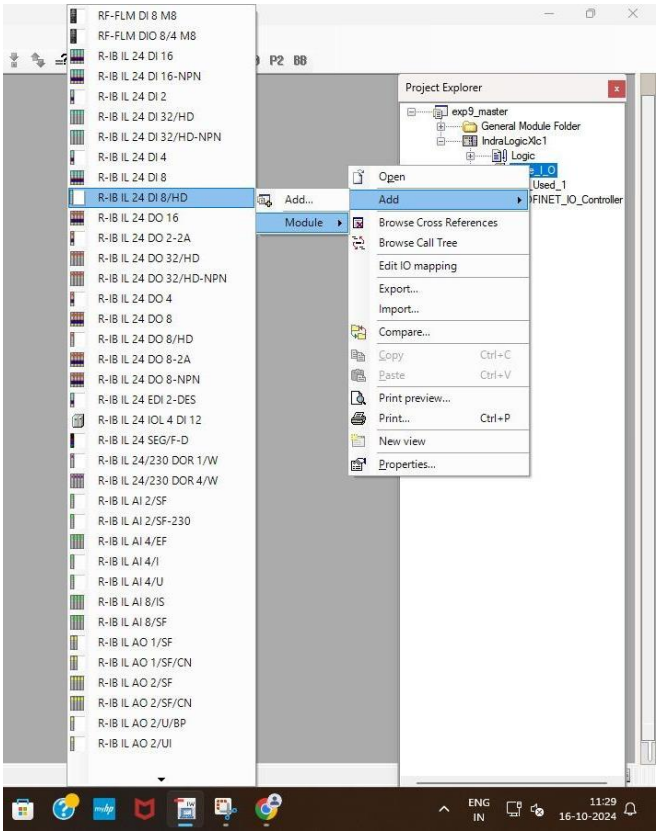
3. Add profinet IO controller for the master plc



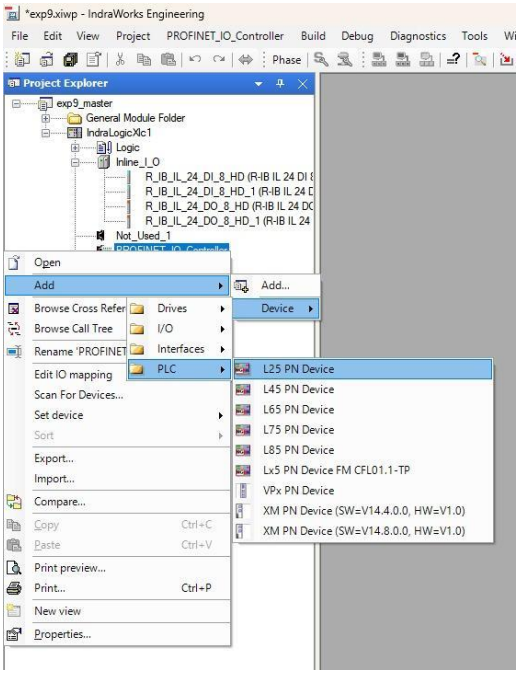
4. Add profinet IO device for the slave plc



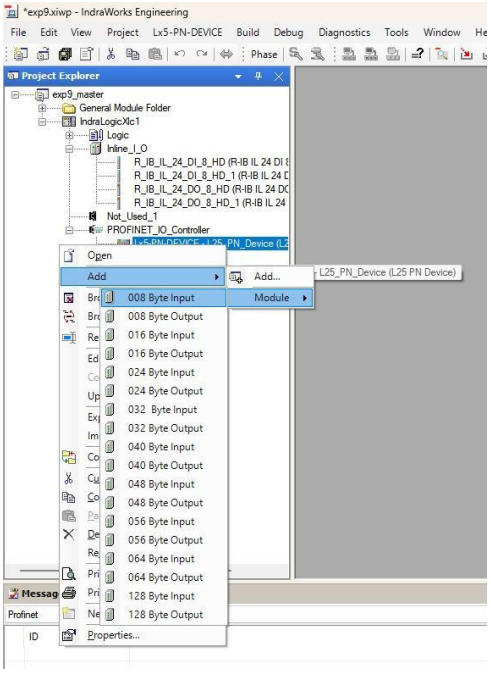
5. Add IO modules for the PLC



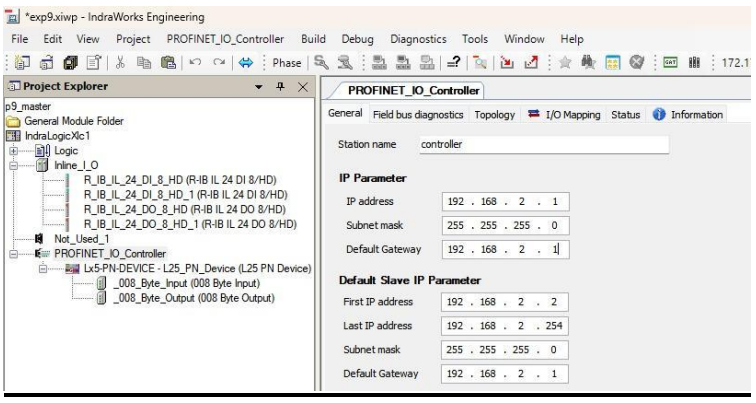
6. Add PLC L25 Device to the Profinet IO Controller



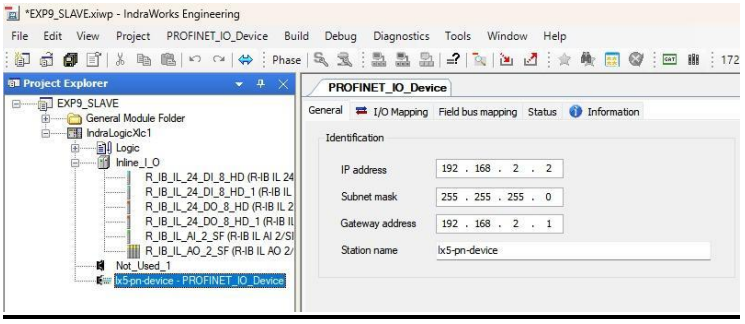
7. Add 008 Byte input,008 Byte output modules to Master PLC



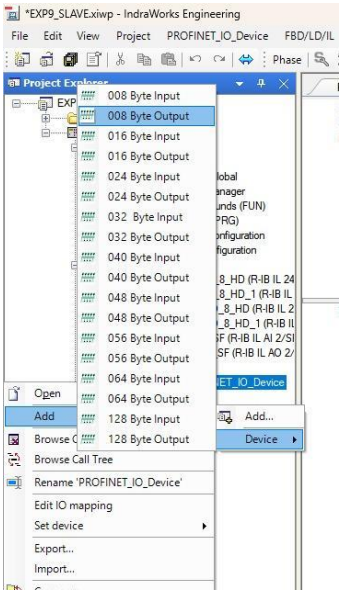
8. Give the default gateway address and subnet mask



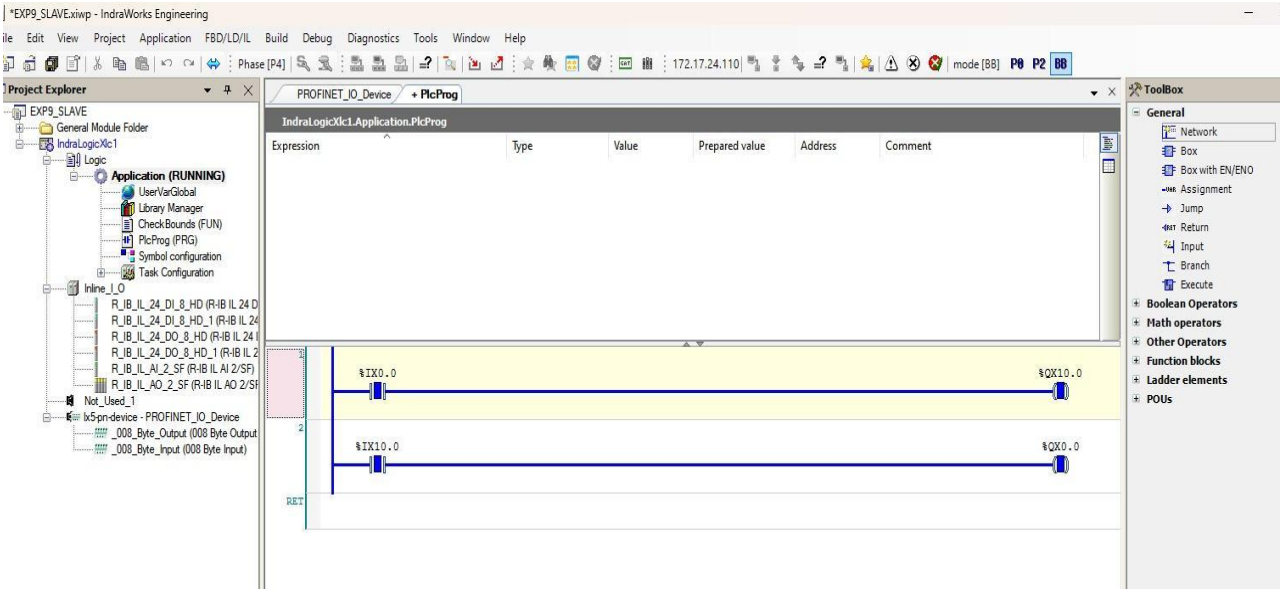
9. Give the same Default gateway for Profinet IO device

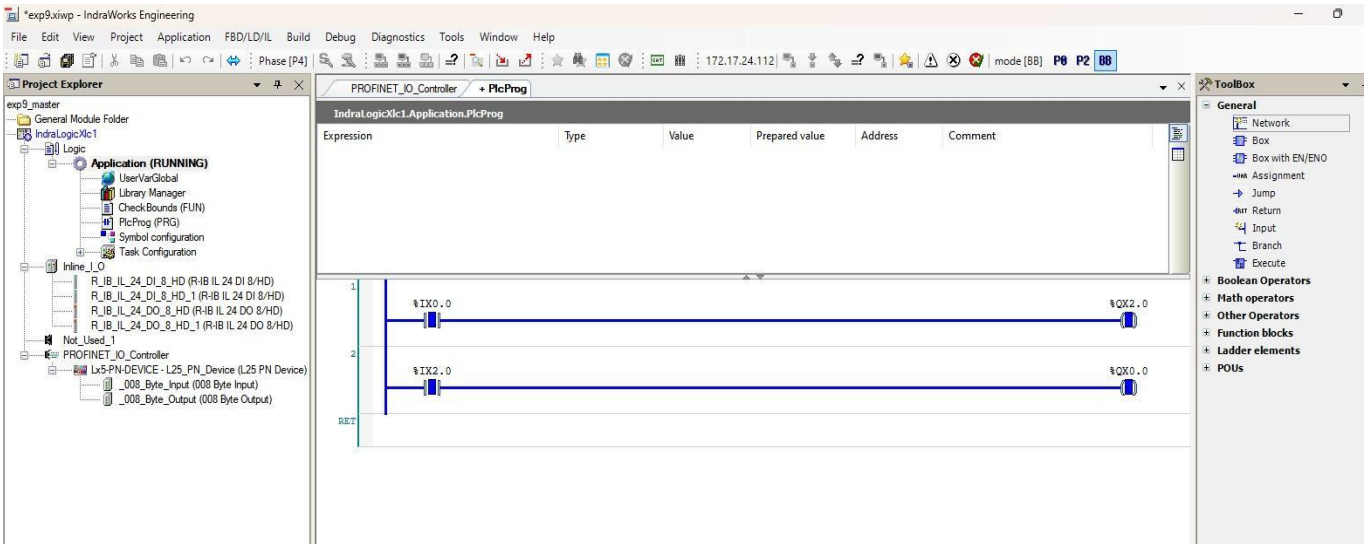


10. Add 008 Byte Output, 008 Byte input modules to Profinet IO device



Ladder Logic:





Inference:

From this experiment,

- How to establish communication between 2 PLCs was found
- The wiring for PROFINET communication was established

Result:

Thus, the profinet connection was established between both the PLCs and the output was verified.

EXP : 10 DATE:	COMMUNICATION OF BOSCH REXROTH PLC AND SIEMENS PLC USING PROFINET

Aim:

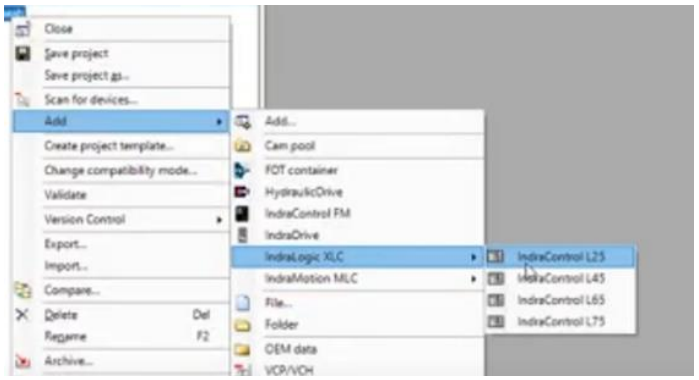
To communicate Bosch Rexroth XLC-25 with Siemens PLC using Profinet.

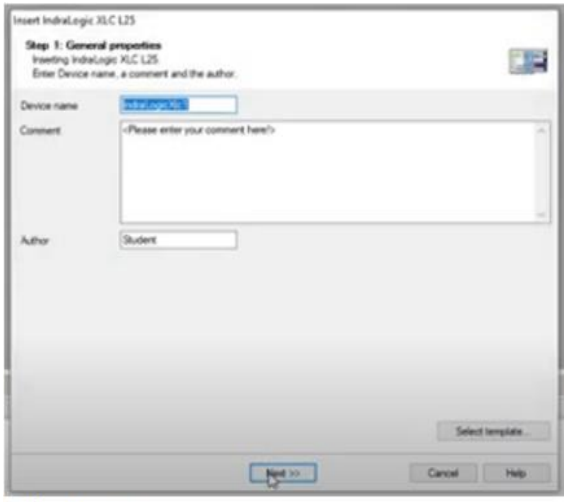
Apparatus Required:

1. Bosch Rexroth PLC
2. Siemens PLC
3. IndraWorks Engineering software
4. Siemen's TIA Portal Software

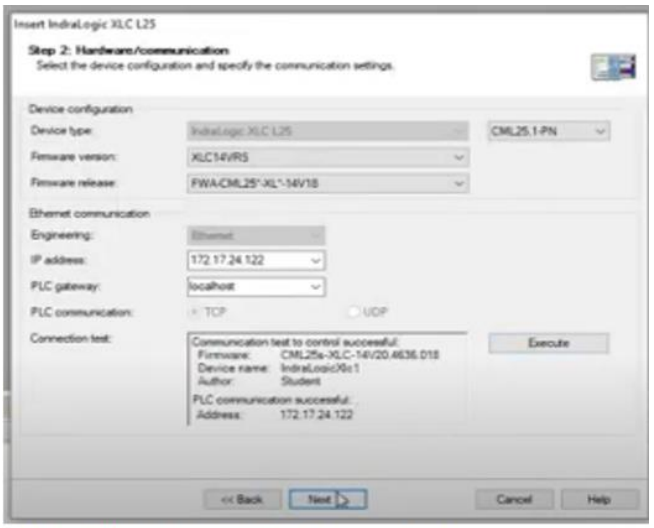
Procedure:

1. Launch the IndraWorks Engineering software and create a new project by adding XLC-25 PLC.

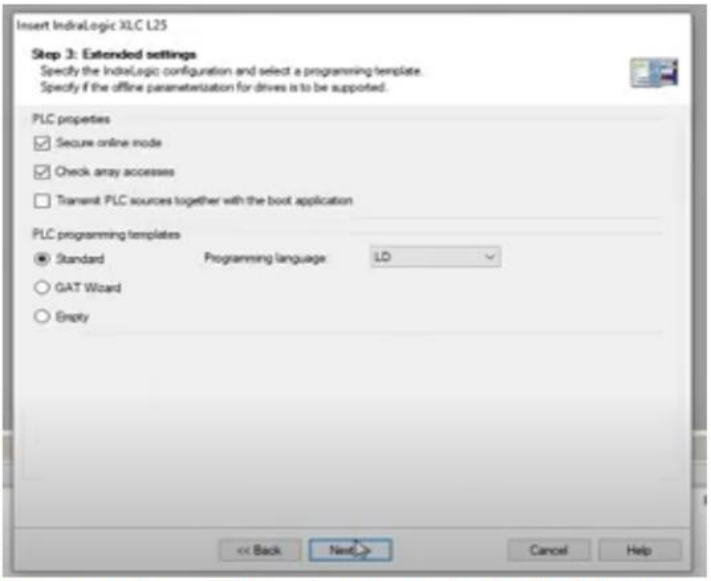




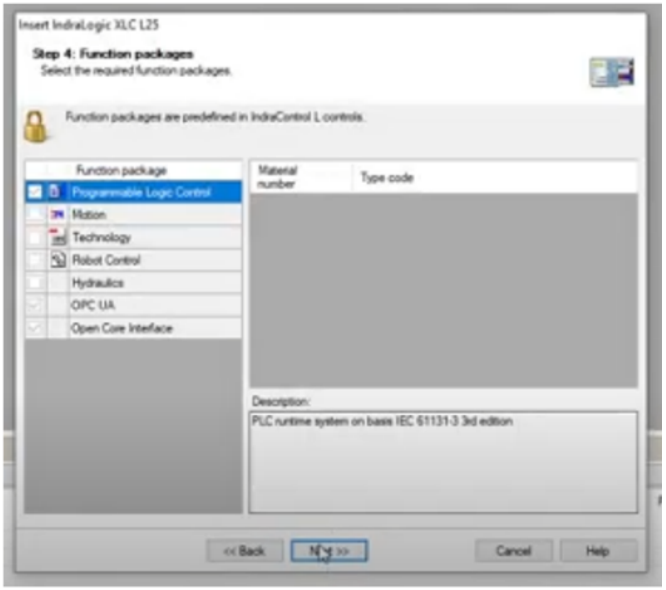
Select next



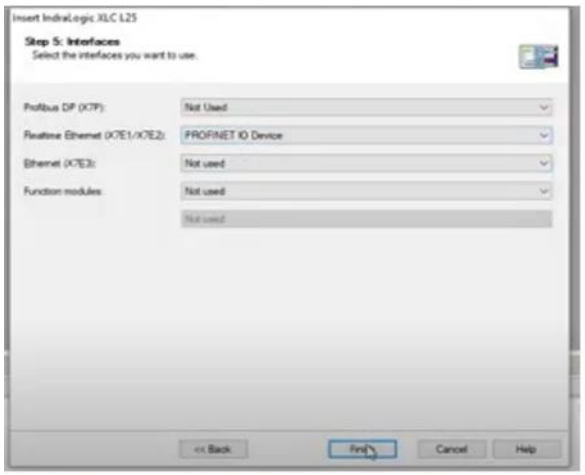
Select PN and execute comm test



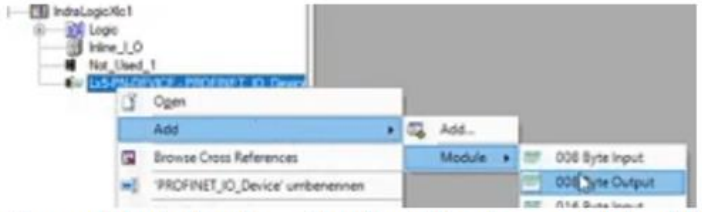
Ensure programming language is LD (Ladder diagram)



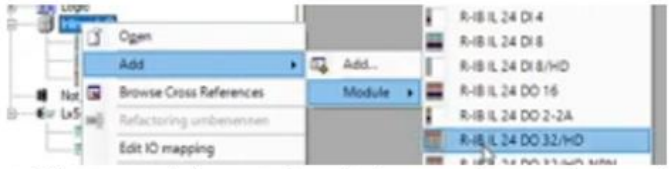
Give next



First option not used, second option is Profinet Device (Slave)



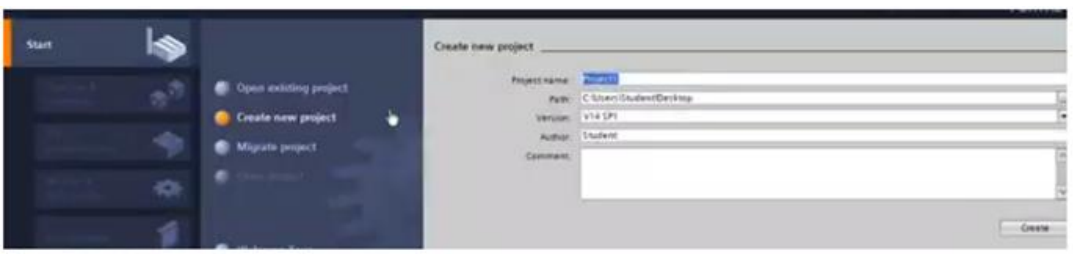
Expand IndraLogic -> Profinet Device -> Add -> Module
First add 8 byte op then 8 byte input



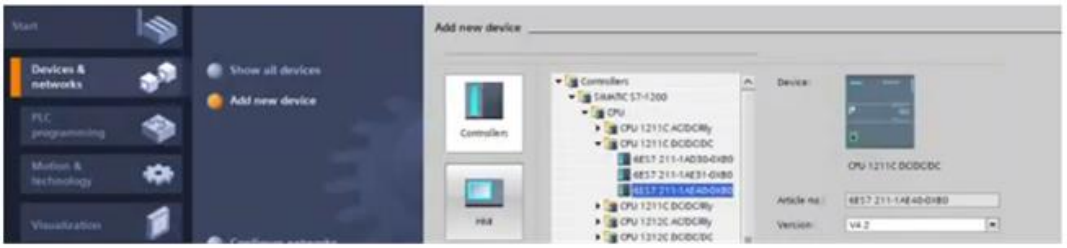
Add IO modules, right click on Indraworks to do so

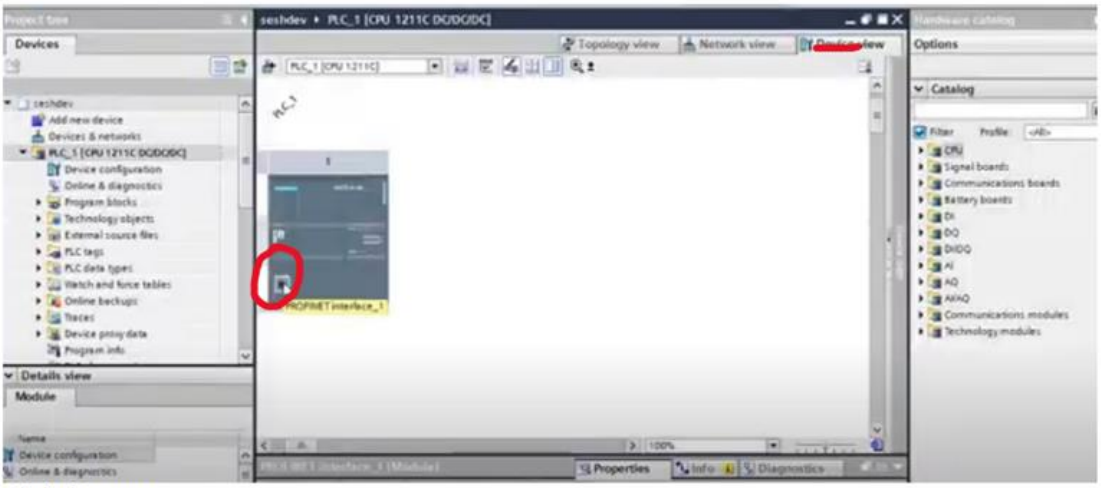
Open profinet IO device by double clicking, enter these data

2. Launch the TIA portal software and add the Siemen's PLC and create a new project.

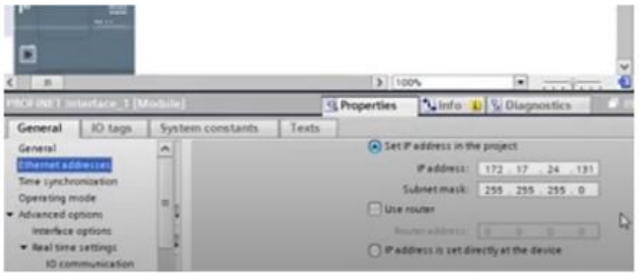


Open TIA V14, create new project





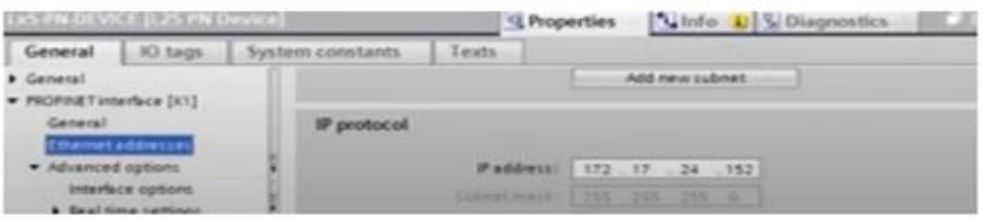
Click this port

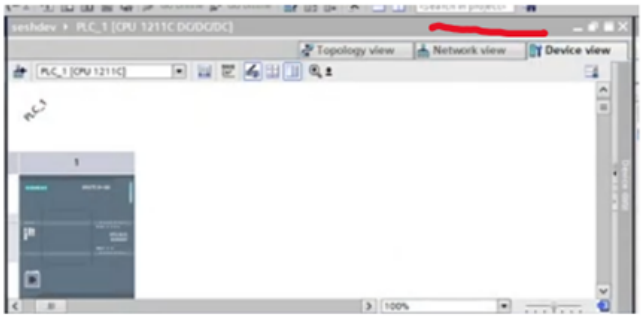


3. Select profinet controller device communication protocol in both the software..

4. Open Network view in TIA, add L25 PLC and set up IP address for profinet.

Double click on rexroth icon





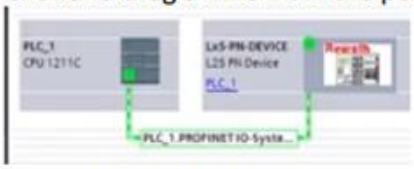
Go to network view

Open catalog menu from right side

Select this (if it's not available have to install the GSDML-V2.1 Bosh Rexroth AG Lx5 PN Device file - download from chrome)
It's called General device description file, Under Options -> manage General space and description file -> select download file and install….choose downloaded file

Double click on rexroth icon

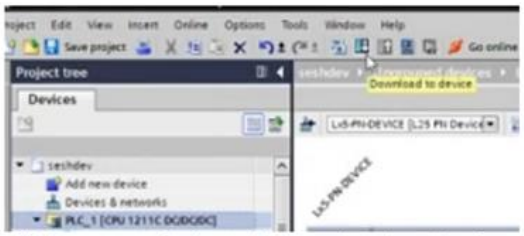
Click and drag a wire from the ports



Should be like this after

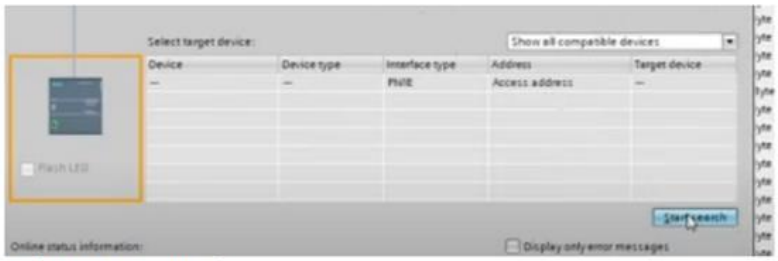
Double click rexroth icon again go to device view, open this menu using that arrow

5. Add 8 bit input and output modules in both software for the profinet.

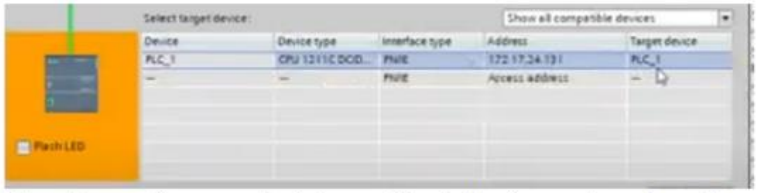


Click name of plc and download to device

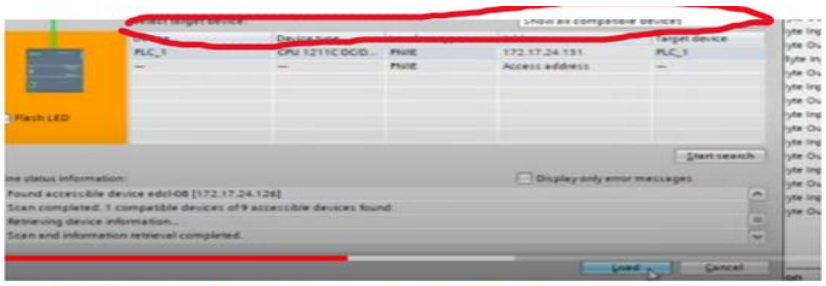
Select PN/IE here



Select start search

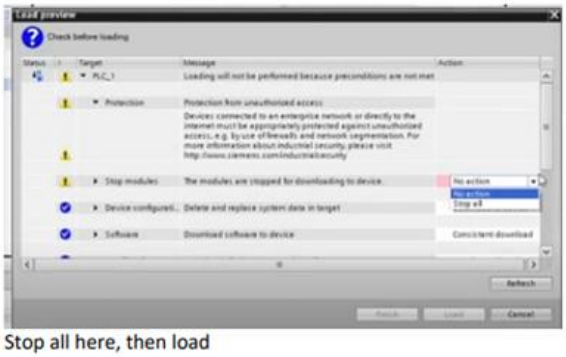


Should see siemens plc ip here, if not the ip u entered earlier might be wrong

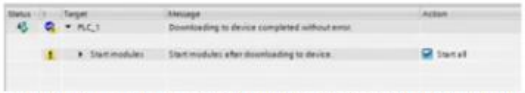


Click the plc device here once, select load

Continue without sync



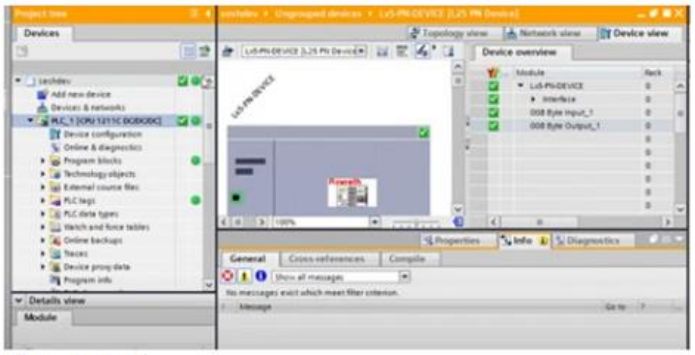
Stop all here, then load



Start all if u enable, u don't have to do it later, if not u have to do it manually afterwards, then click finish (same window as above)

Login plc in indra works now to test communication

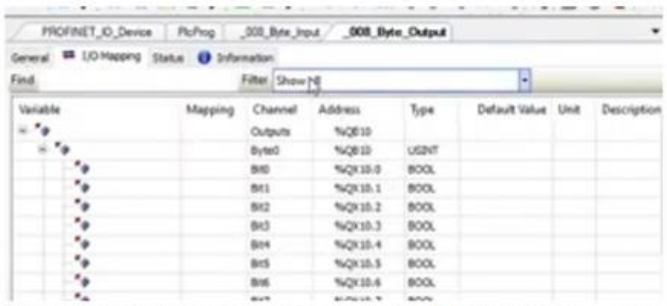
Go online here



All green = good

Now you can go offline in tia and log out in indraworks, then do the program

6. Note the digital inputs and outputs of both PLCs and write a ladder diagram.

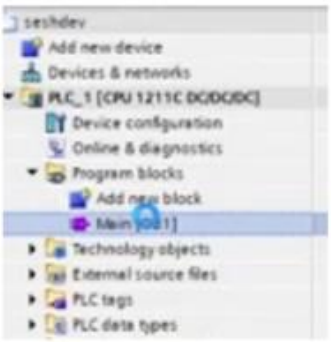


Open 8 byte input and output to check address, use that in the program

In indraworks

Physical input to profinet op and profinet input to physical output

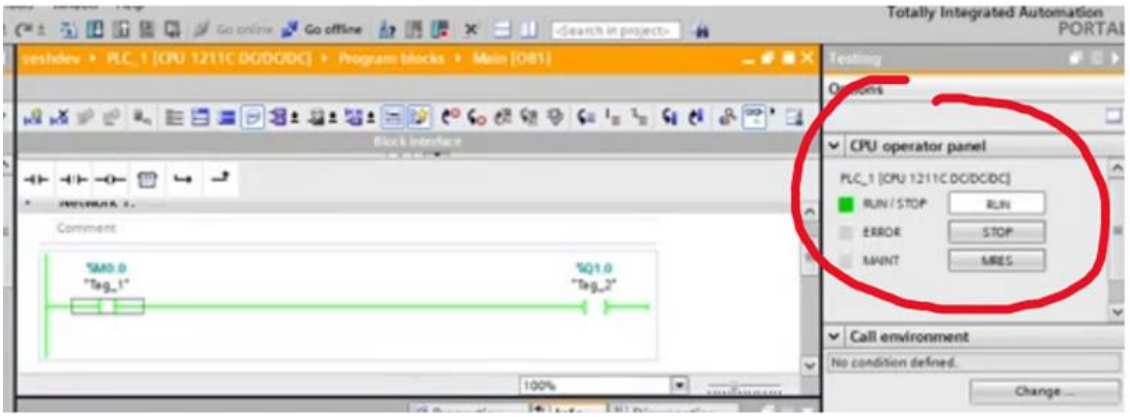
7. Write the ladder program to get the output from Siemen's PLC through the inputs of Bosch Rexroth PLC and also take the output of Bosch Rexroth PLC through the inputs of Siemen's PLC as shown in the diagram.

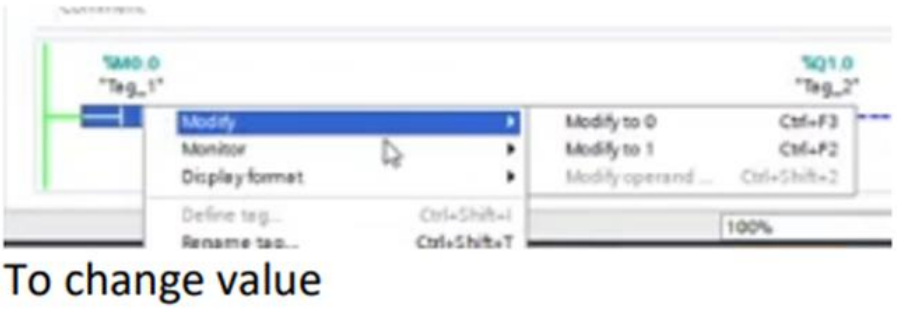


In tia to open program, press this

Drag and drop to create same circuit

8. Go online in Tia portal and click on glass icon. Also login and start application in IndraWorks Software.

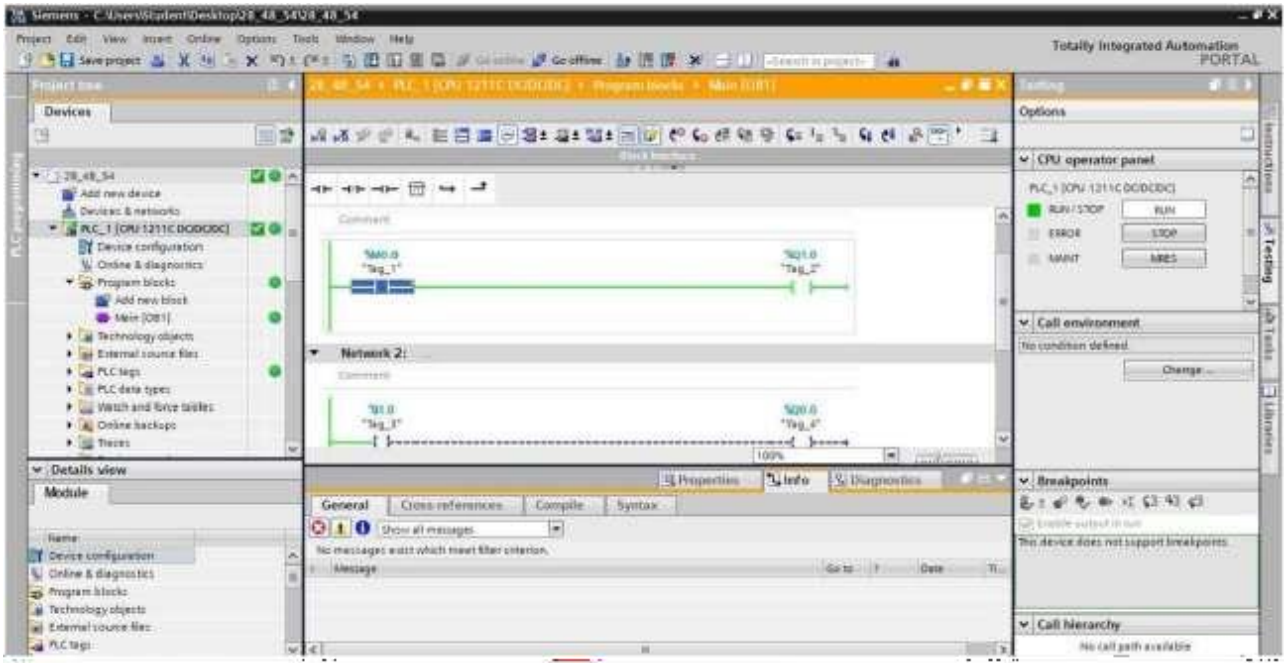


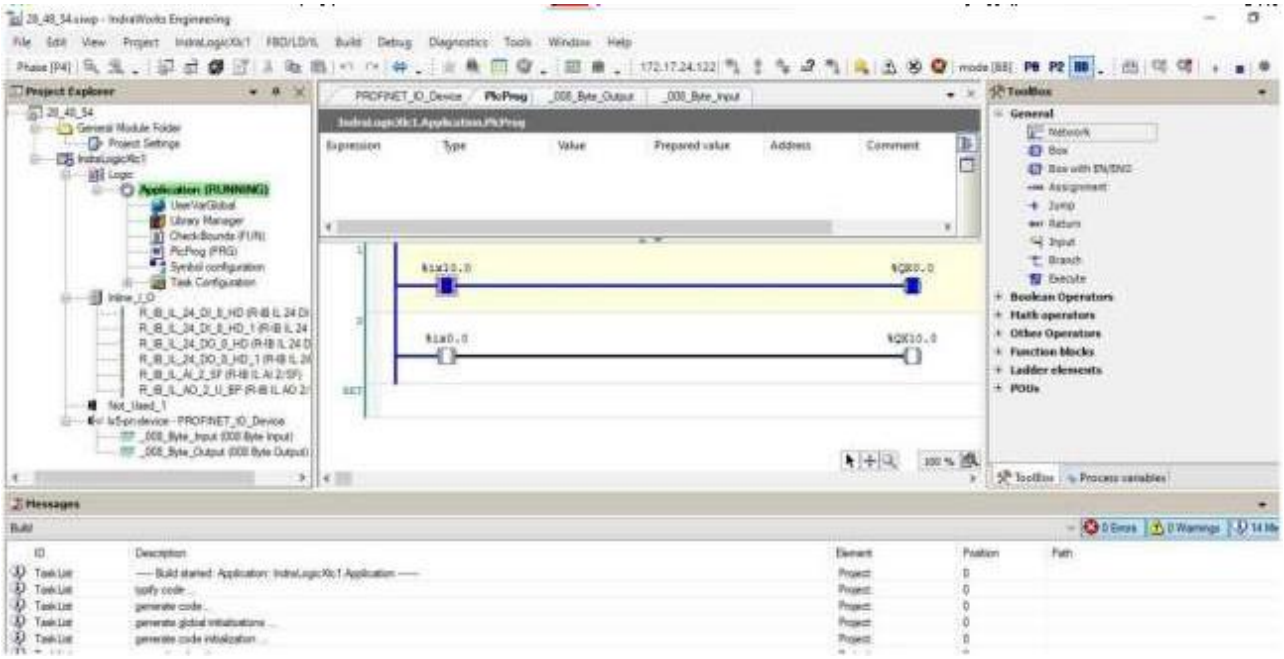


To change value

9. The program is then executed and the output from the PLC is verified.

Output





Inference:

1. From this experiment, I learnt to use TIA software to program Siemen's PLC.
2. Learnt about establishing communication between Bosch Rexroth and Siemen's
3. PLC using profinet.
4. Using profinet communication, it enables data exchange and coordinated control between 2 systems.

Result:

Thus the Bosch Rexroth PLC L125 was integrated with the Siemen's PLC using profinet communication protocol.

EXP NO: 11 DATE:	COMMUNICATION OF TWO BOSCH REXROTH PLC USING OPC-UA PROTOCOL IN MATLAB

Aim:

To communicate Two Bosch Rexroth XLC-25 PLC by using OPC-UA communication protocol through MATLAB.

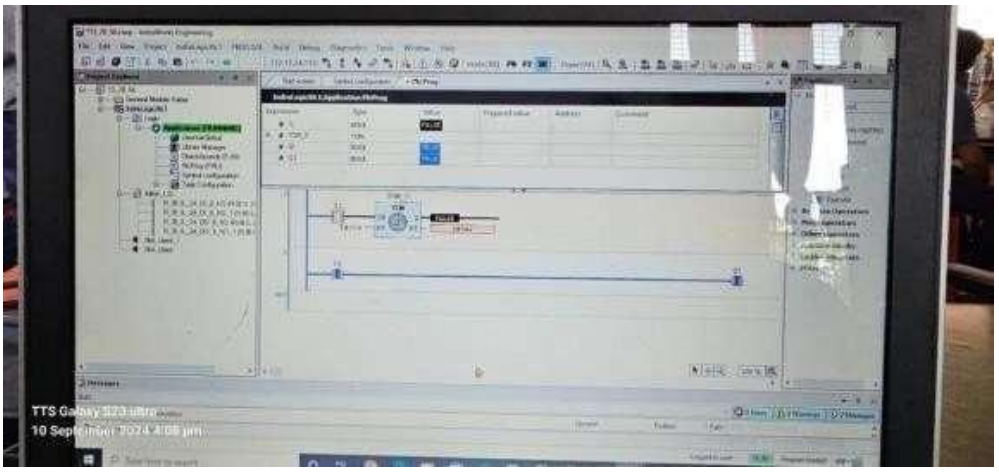
Apparatus Required:

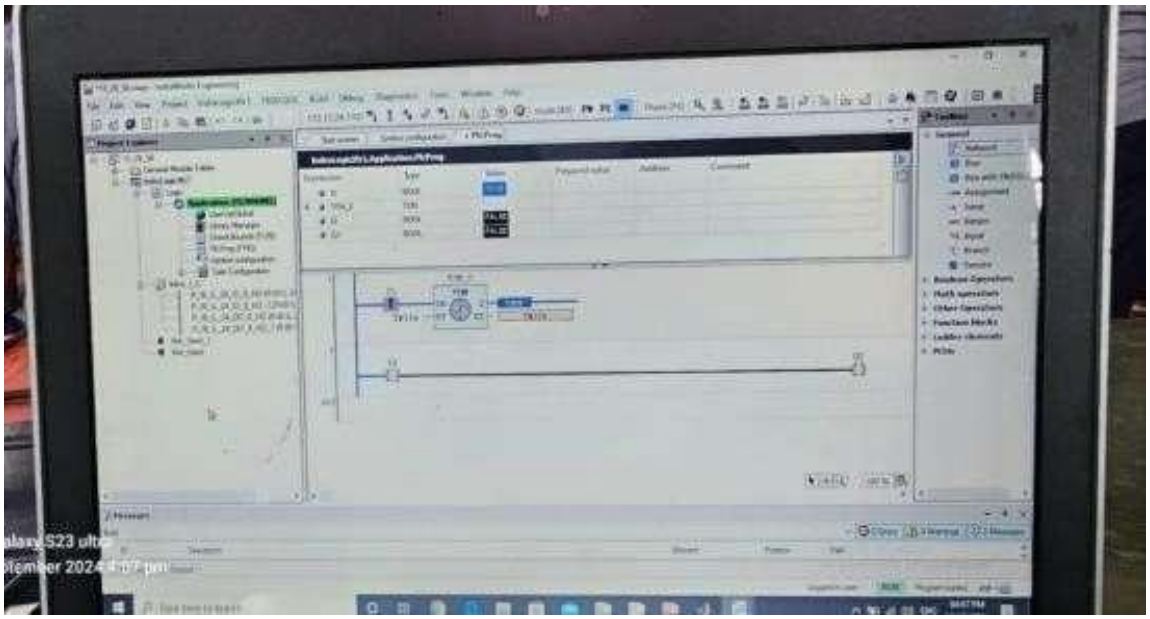
- Bosch Rexroth and Indraworks XLC-L25 PLC
- MATLAB OPC-UA package installed
- Indraworks software

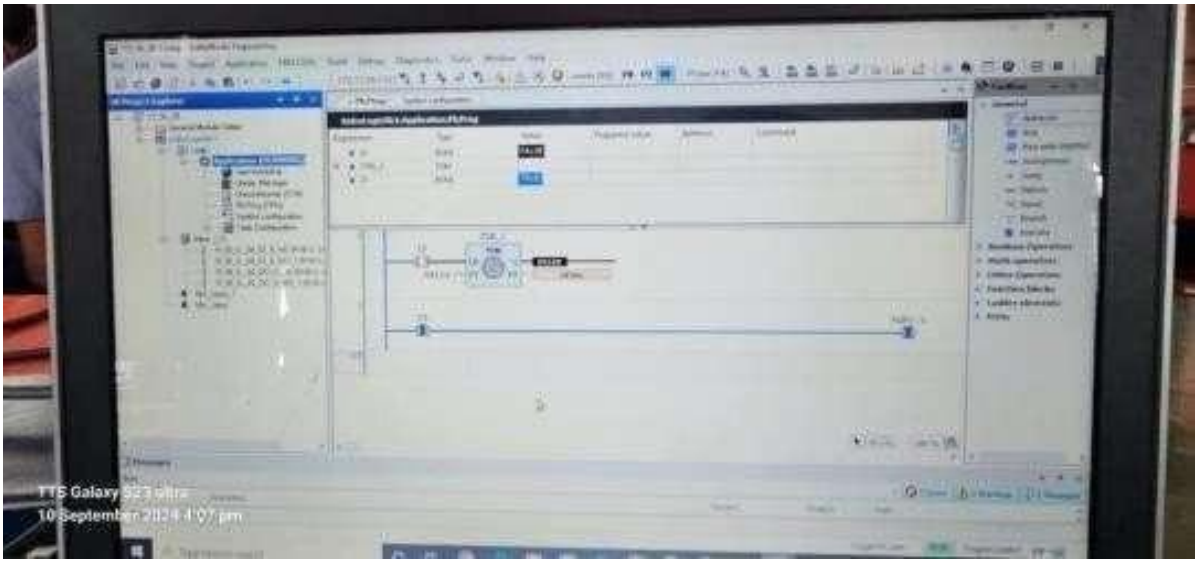
Procedure:

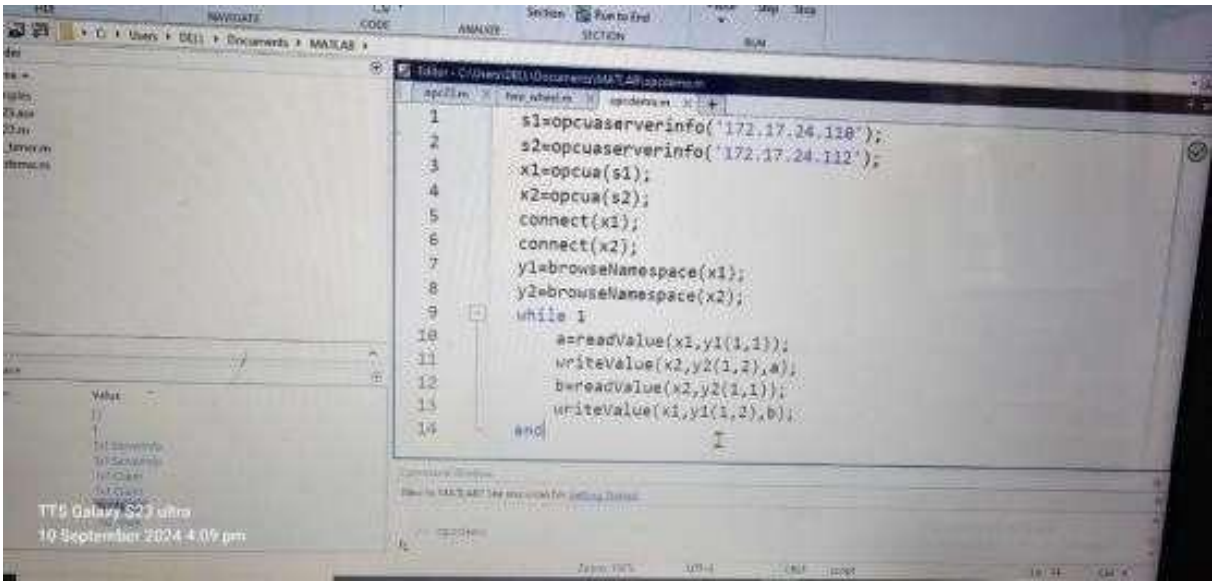
1. Launch two Indraworks software environments and connect with respective two Bosch Rexroth PLC.
2. Create the required Ladder Logic where first Indraworks software output connects to second Indraworks software's output.
3. Open MATLAB in programming mode and create a new script.
4. Create an OPC-UC communication program for the two PLC with their specific IP address and run the MATLAB script.
5. Login the two Indraworks software with PLC and verify the output from both the PLC.

Circuit Diagram:






TTS Galaxy S23 ultra
10 September 2024 4:07 pm


s1=opcuaserverinfo('172.17.24.110');
s2=opcuaserverinfo('172.17.24.112');
x1=opcua(s1);
x2=opcua(s2);
connect(x1);
connect(x2);
y1=browseNamespace(x1);
y2=browseNamespace(x2);
while 1
a=readValue(x1,y1(1,1));
writeValue(x2,y2(1,2),a);
b=readValue(x2,y2(1,1));
writeValue(x1,y1(1,2),b);
end
TTS Galaxy S23 ultra
10 September 2024 4:09 pm

Inference:

From the experiment,

- I learnt to connect two PLCs using OPC-UA.
- I learnt to use MATLAB as a back-end communication platform connecting PLC output and input for data transferring.

Result:

Thus, the communication between two Bosch Rexroth PLC using OPC-UAprotocol with the help of MATLAB is executed and verified.

EXP : 12 DATE:	INTERFACING BOSCH REXROTH PLC WITH LABVIEW

Aim:

To communicate Bosch Rexroth XLC-25 PLC control using LABVIEW .

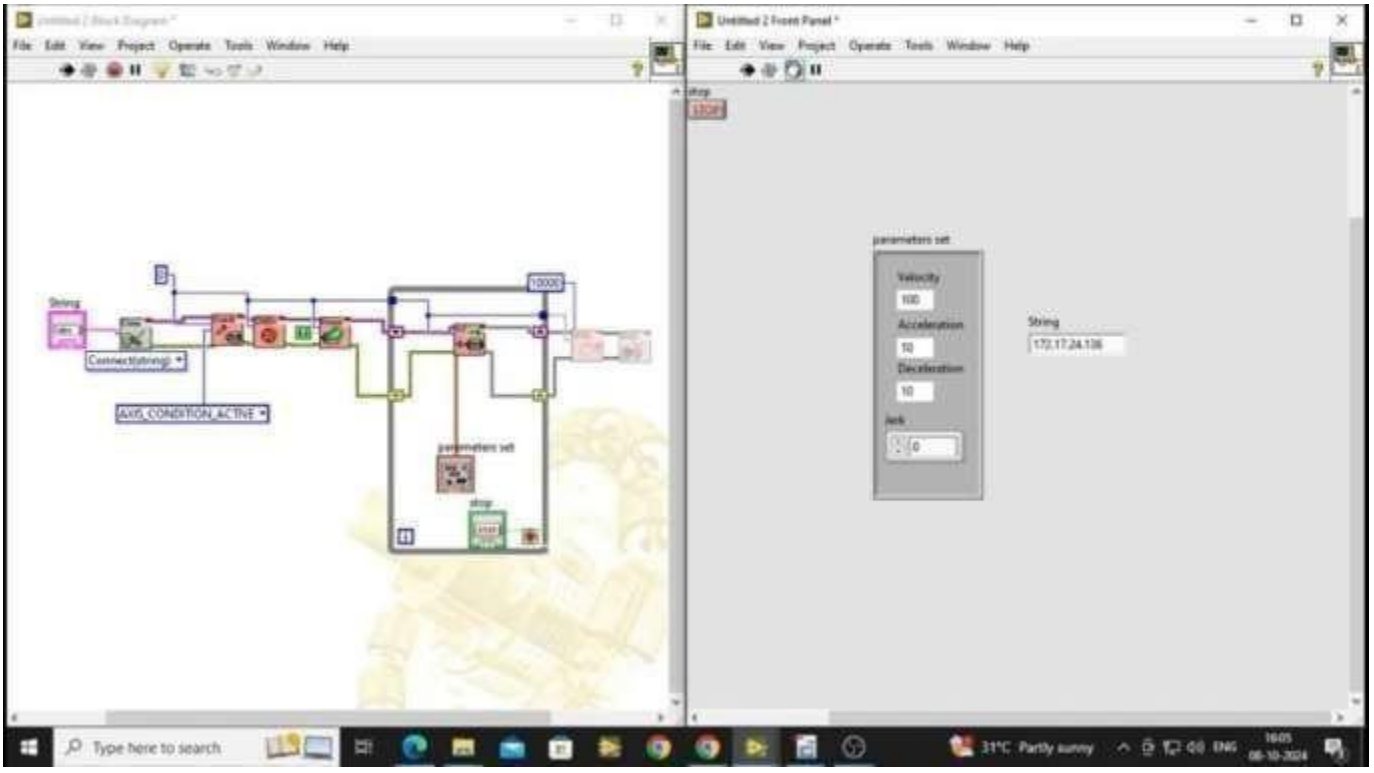
Apparatus Required:

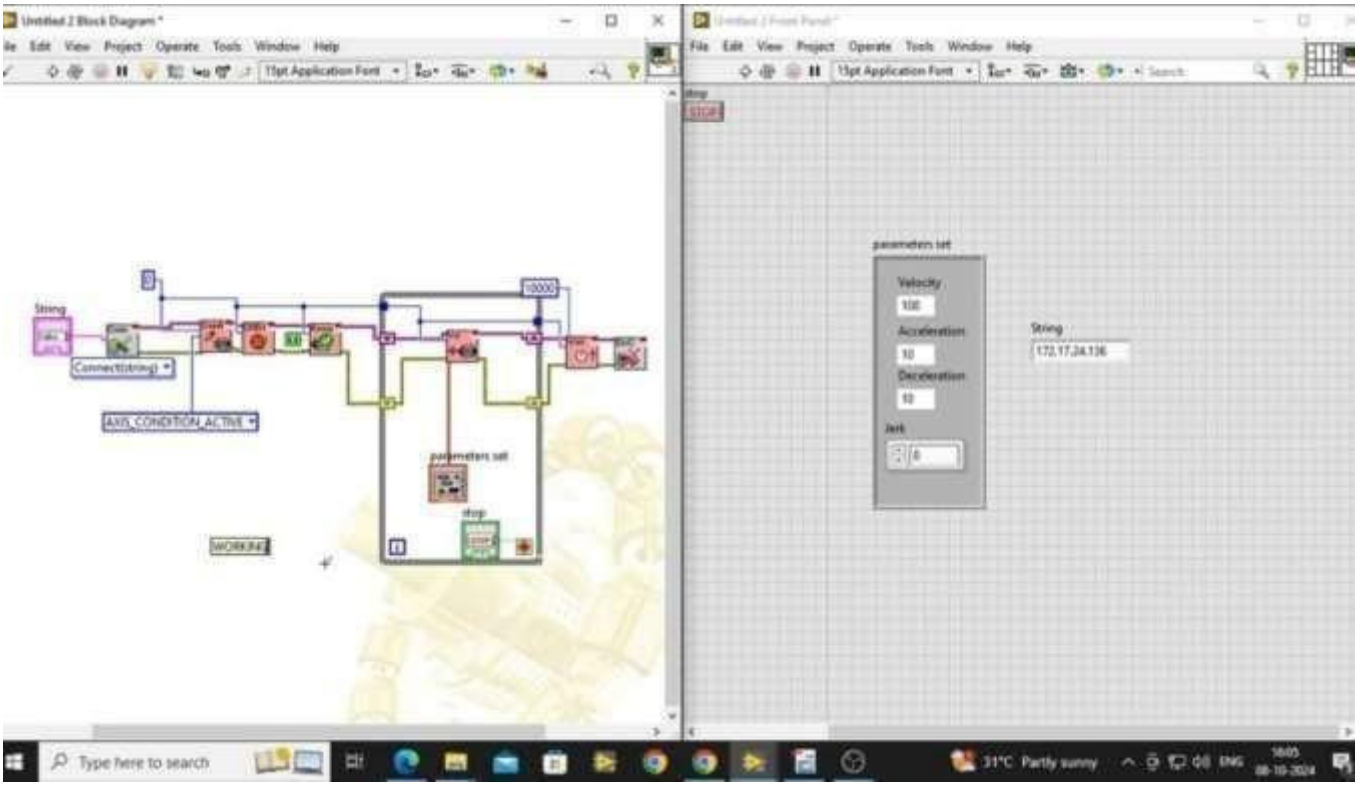
- Bosch Rexroth and Indraworks XLC-L25 PLC
- LABVIEW with required addons
- Indraworks software

Procedure:

1. Open LabVIEW and create a new VI.
2. Navigate to the Block Diagram and open the functions palette.
3. Select "eal4LabVIEW" from the "Addons" section.
4. Access the "Motion LIB" to access motion control functions.
5. Place a While Loop on the Block Diagram and place the Move Velocity function inside.
6. Create necessary control for velocity by right-clicking on the input terminal of Move Velocity.
7. Place Acknowledgement and Disconnect elements from the same motion library.
8. Wire their input and output terminals and use the wire tool to connect data flow.
9. Set parameters for velocity, acceleration, and deceleration.
10. Add necessary constants for conditions like loop control or enabling/disabling features.
11. Use controls to set motion parameters based on application needs.
12. Execute the program and observe outputs.

Circuit Diagram:





Inference:

1. This experiment sets up velocity-based motion control in LabVIEW using the EAL addon, focusing on precise control of movement parameters like velocity, acceleration, and deceleration.

2. It involves configuring hardware communication via IP and verifying real-time outputs to ensure proper integration and function of the motion system.

Result:

Thus, the communication between Bosch Rexroth PLC controls using LABVIEW is executed and verified.