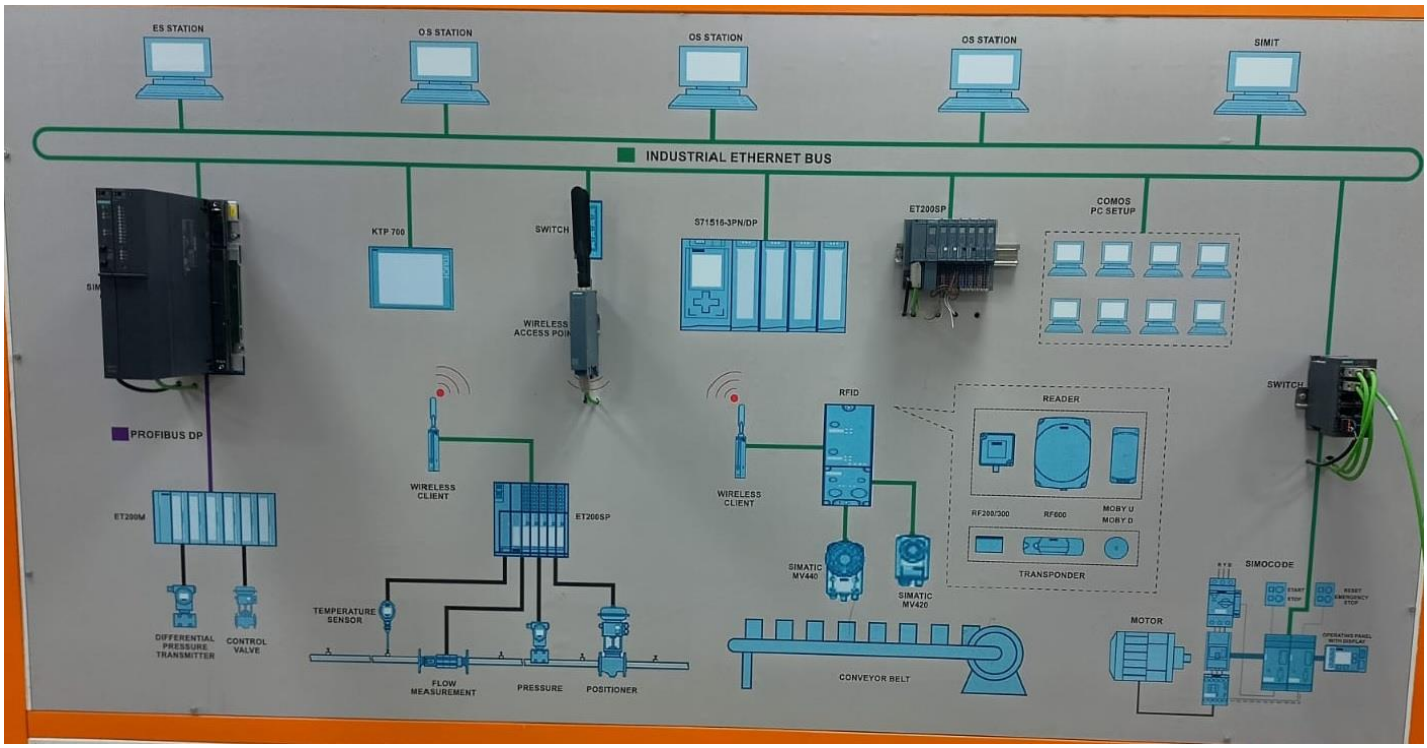
AVIT
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY

VINAYAKA MISSION'S RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

NAME OF THE RESEARCH CENTER :

SIEMENS DCS COMOS INTEGRATED ENGINEERING



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PREFACE

This Research center manual for Siemens DCS COMOS Integrated Engineering has been revised and updated in order to meet the Curriculum changes, laboratory equipment upgrading and the latest simulation.

Every effort has been made to correct all the known errors, but nobody is perfect, if you find any additional errors or anything else you think is an error, Please feel free to inform the HOD / EEE at eeedept@avit.ac.in

The Authors thanked all the staff members from the department for their valuable Suggestions and contributions.

The Authors
Department of EEE

DCS MANUAL

Siemens DCS System with safety I/O station

Modular systems AS 410-5H and AS 410E - Overview

With the rugged all-round AS 410 system, the SIMATIC PCS 7 process control system offers an exclusive automation system from the SIMATIC S7-400 series, which can be used in all domains due to its versatility.

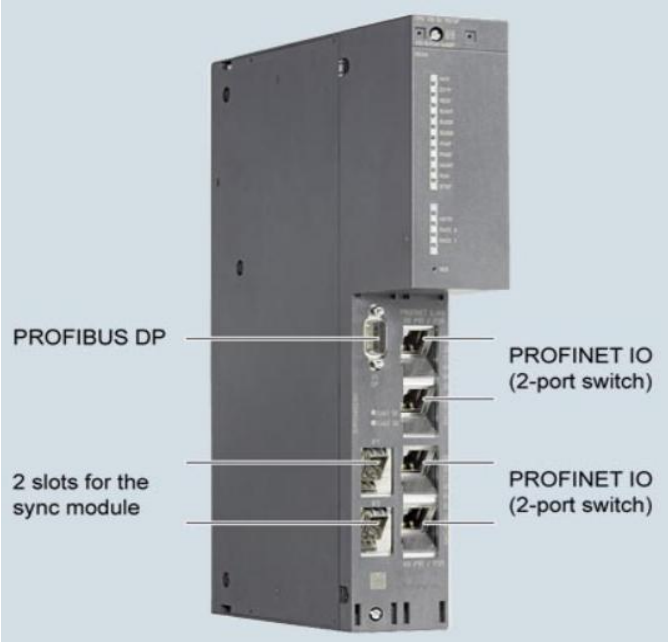
The rugged AS 410 is a modern, future-oriented, all-round system for the process industry. Its versatility means it can be used in all areas – as a standard AS 410S system, as a high-availability AS 410H or as safety-related AS 410F/FH. More and more innovative functions are being exclusively combined with this automation system, for example redundant PROFINET configurations and configuration changes during operation for PROFINET in singular and redundant applications

With its high-performance hardware and optimized firmware, the innovative CPU 410-5H Process Automation of the AS 410 covers the entire performance range of conventional AS 412 to AS 417 automation systems. Its automation performance can be scaled with system expansion cards based on the number of SIMATIC PCS 7 process objects (POs).

Flexible and scalable availability

A particular characteristic of the modular S7-400 systems is the flexible and scalable availability of various components. For a SIMATIC PCS 7 AS Single Station of the AS 410 type, you have the option of specifically increasing the availability by implementing a redundant configuration of the power supply or the Industrial Ethernet communications module, and combining these measures.

Even the AS Redundancy Station of the AS 410 type with its redundant CPUs offers significantly higher availability. It operates according to the 1oo2 principle, in which a switch is made from the active subsystem to the standby system in the event of a fault. Starting from here, you can double the power supply or the Industrial Ethernet communications module for each subsystem, and combine these measures.



As shown in the figure, CPU 410-5H Process Automation is equipped with two PROFINET IO interfaces (2-port switch in each case) for up to 250 I/O devices and a PROFIBUS DP interface for up to 96 PROFIBUS DP slaves. Two integrated slots allow the synchronization of two redundant subsystems via sync modules and sync cables (FOC).

Features:

- Integrated 48 MB load memory and 32 MB RAM each for program and data
- Cycle time up to 10 ms/9 process tasks
- Total number of I/Os (on PROFIBUS DP and PROFINET IO) approx. 7 500, 16 KB each for inputs and outputs
- Additional protection of the circuit board with coating (conformal coating)
- Expanded temperature range during operation up to 70 °C (as of product version 2)
- High-precision time stamping
- Recessed RESET button
- Preset hardware parameters (PCS 7 skinning)
- Changes in the type of module during operation (TCiR) in association with the SIMATIC PCS 7 Engineering System V8.1 and higher

ET 200iSP - Distributed I/O for hazardous areas

The SIMATIC ET 200iSP distributed I/O system is the economical solution for areas subject to explosion hazards. The intrinsically safe, modular I/O station is particularly flexible and requires minimum engineering, installation and cabling overhead.

Area of application

The SIMATIC ET 200iSP is typically used in production facilities of the process industry and offers optimum integration into PCS 7 and other control systems. The intrinsically safe I/O system is suited for direct installation in areas subject to gas or dust explosion hazards, i.e. in Zone 1 and 2 as well as in Zones 21 and 22; sensors and actuators may be located directly in Zones 0 and 20.

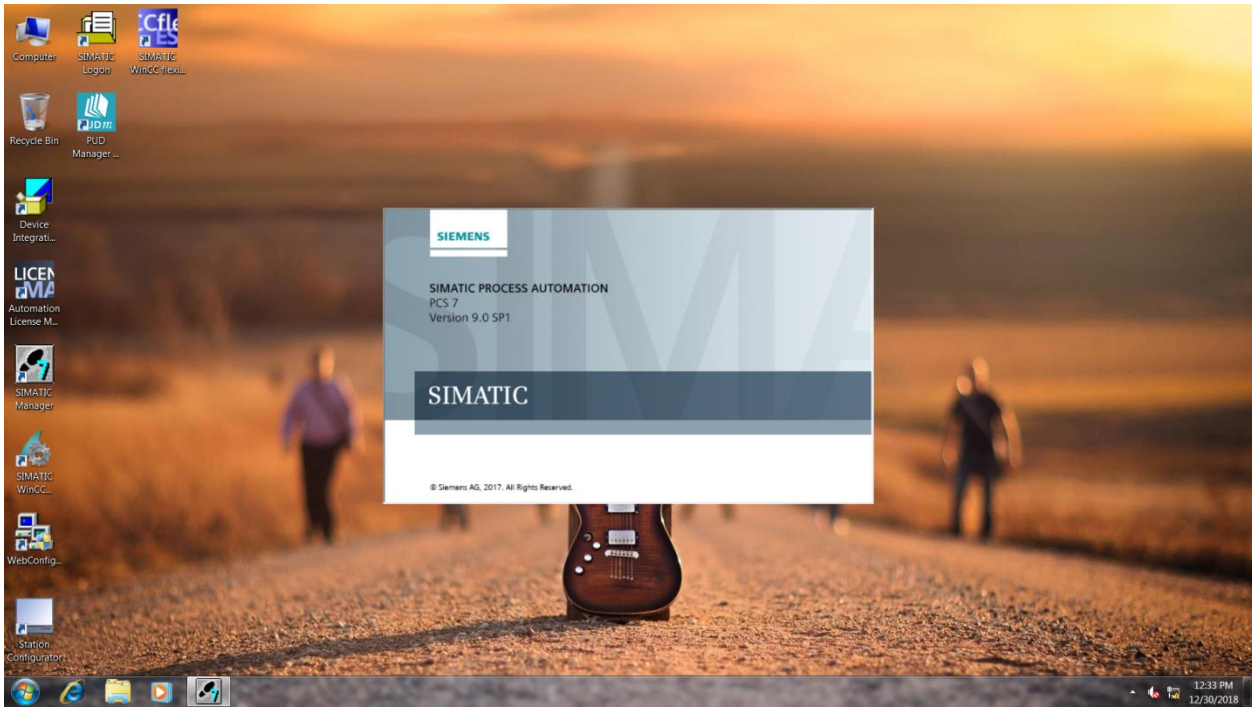
Benefits

- Individual configuration and flexible expansion thanks to modularity
- Module replacement during operation (hot swapping) and Configuration in Run possible
- Connection of signals to HART standard without any restrictions in functionality
- Comprehensive diagnostic options simplify commissioning and troubleshooting
- Condensation-resistant modules in a temperature range from -20° to +70°
- Full PROFIBUS and power supply redundancy

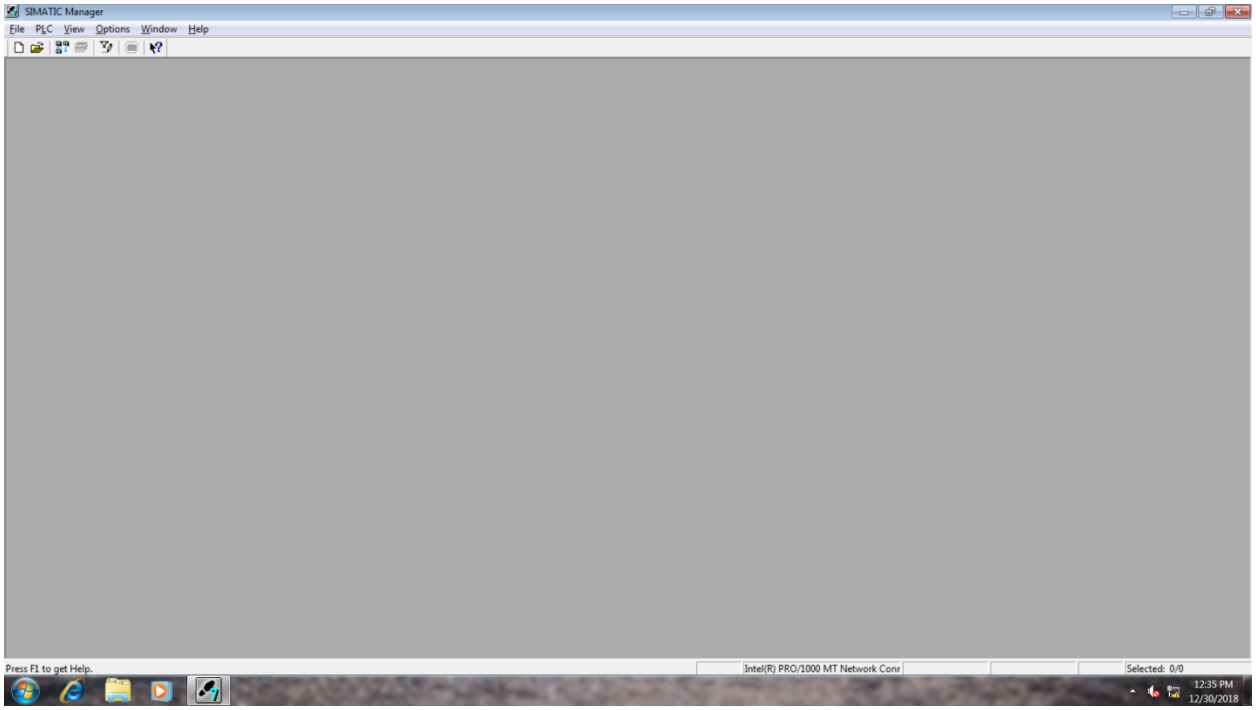
Working Procedure:

Double Click on **Simatic Manager** icon on the Desktop

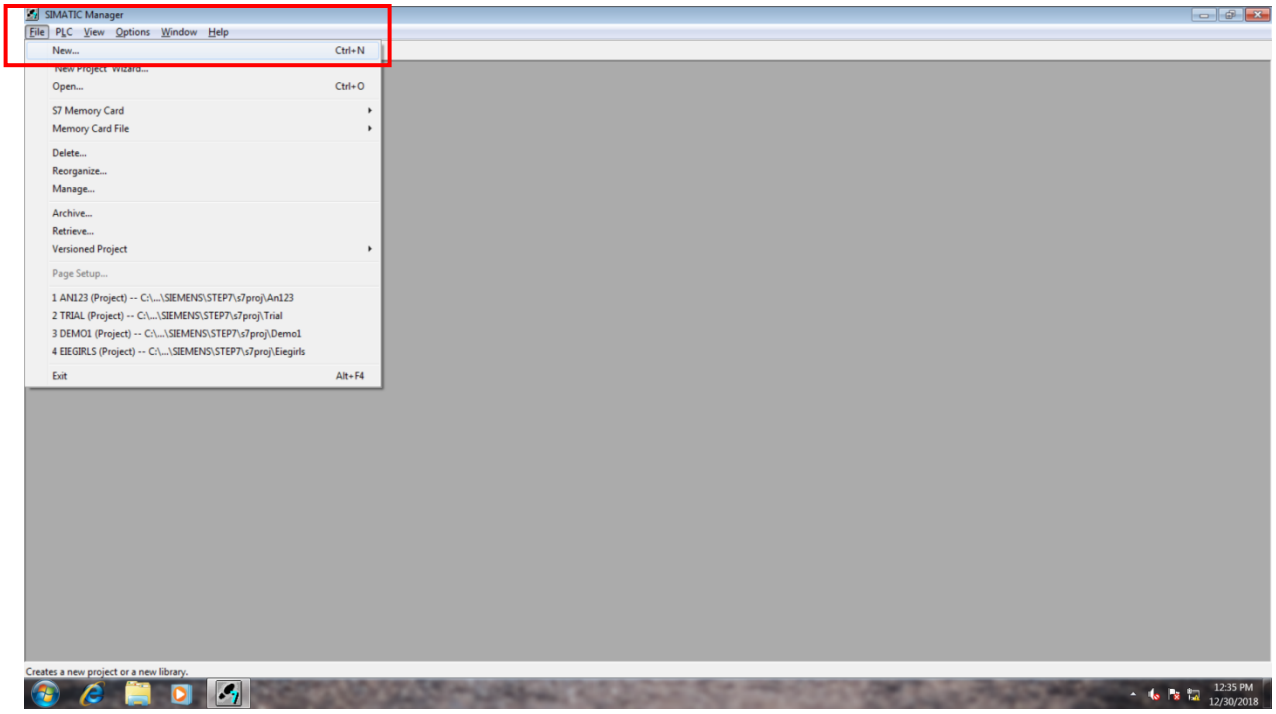
PCS7 v9.0 Sp1 Software will open



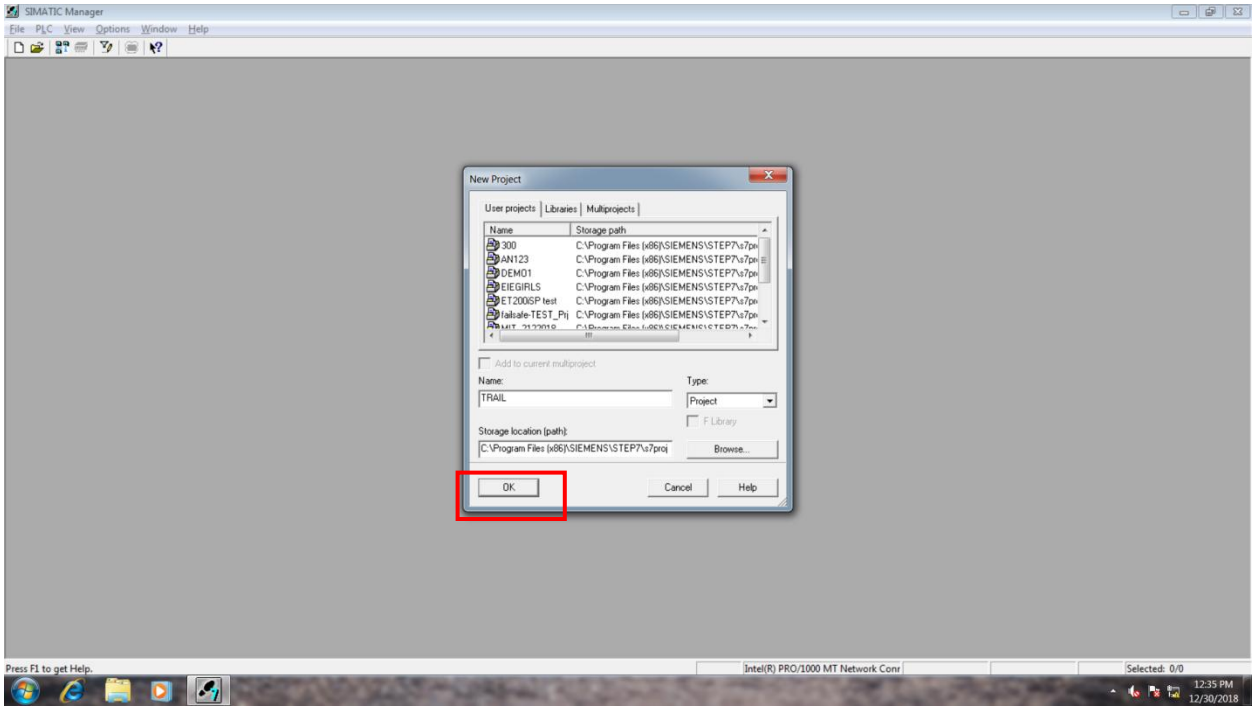
The Main Page **Simatic window** will open



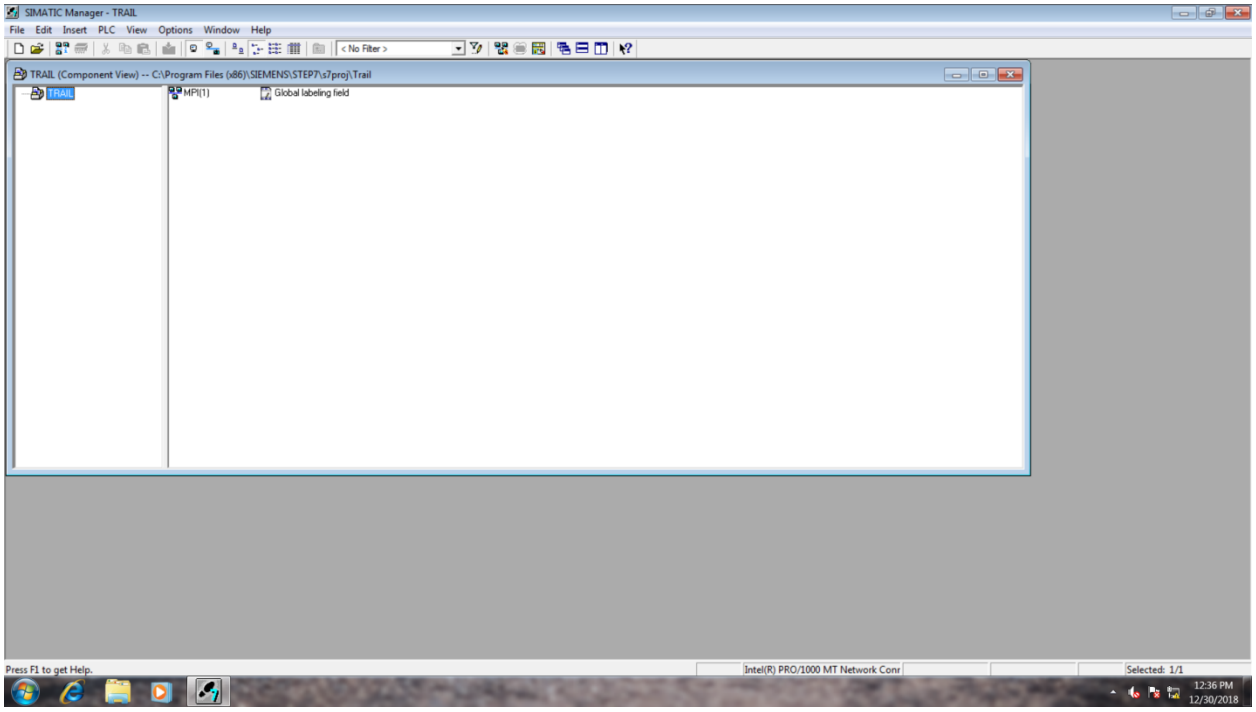
To create a Project go to **File** → Click **New**



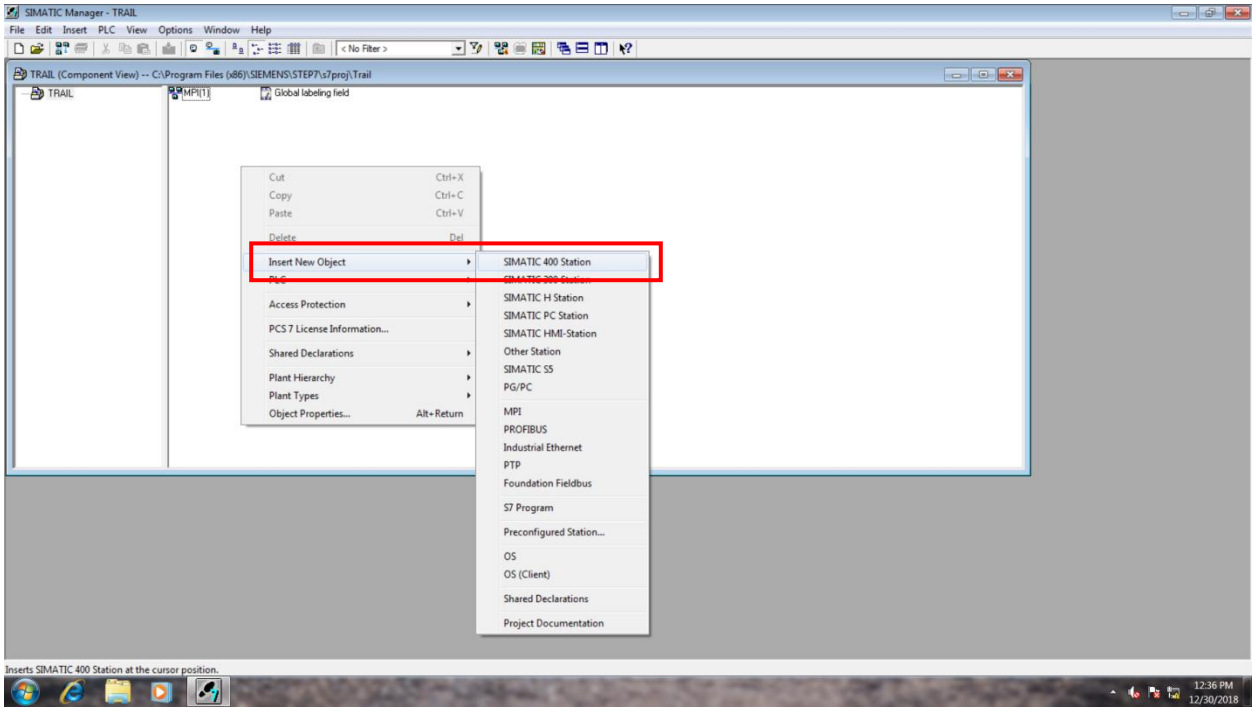
Now Create a **Name** for the Project and Click **OK**



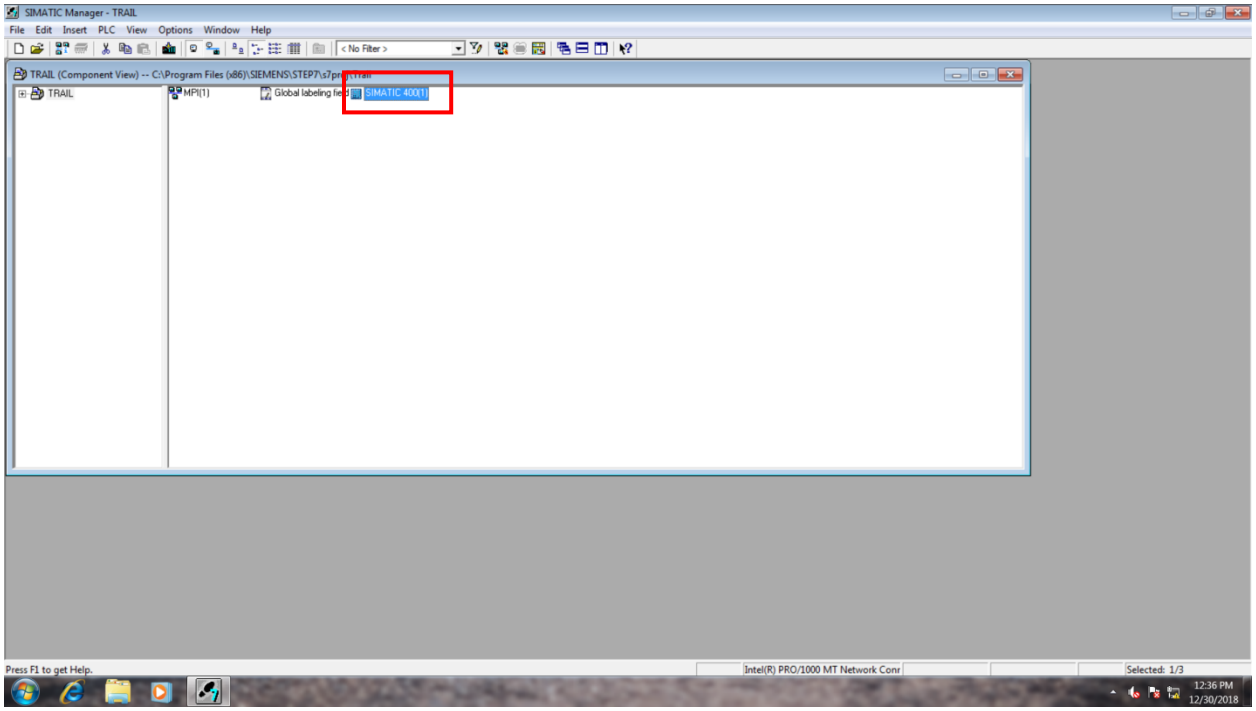
Now a Empty Project will be created



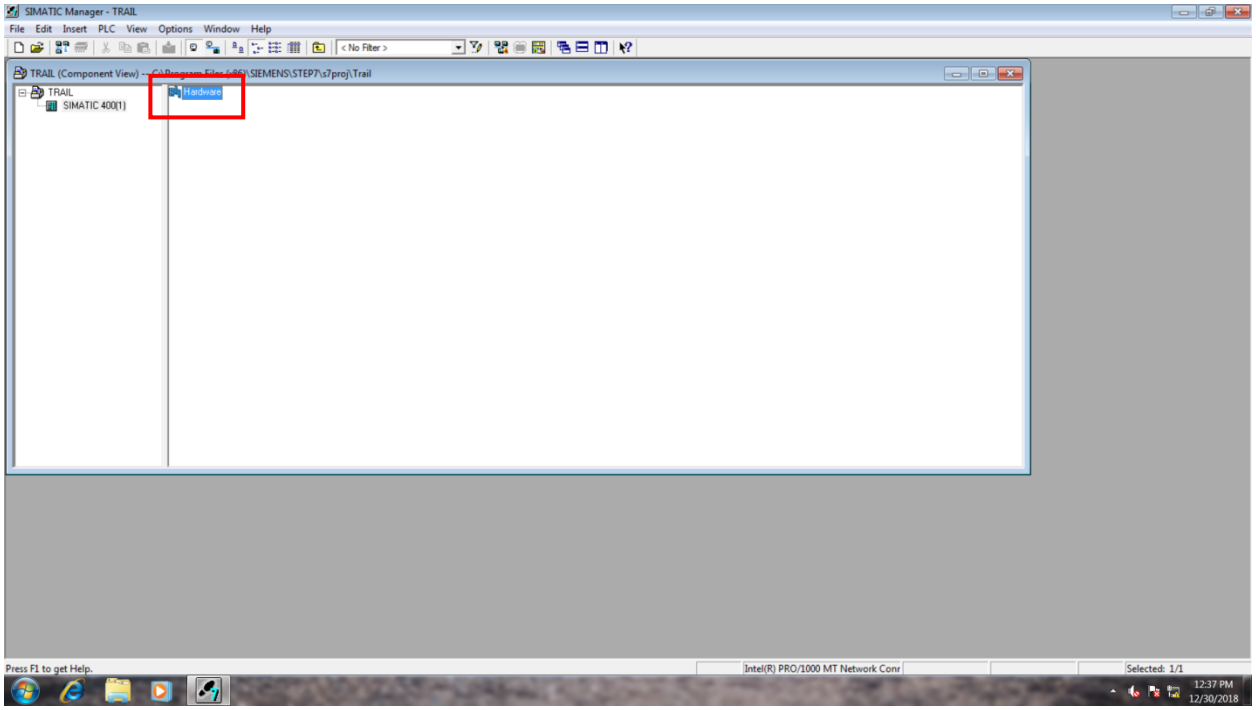
To insert your Controller, right click on work area and select **insert new Object**" → **Simatic 400 Station**.



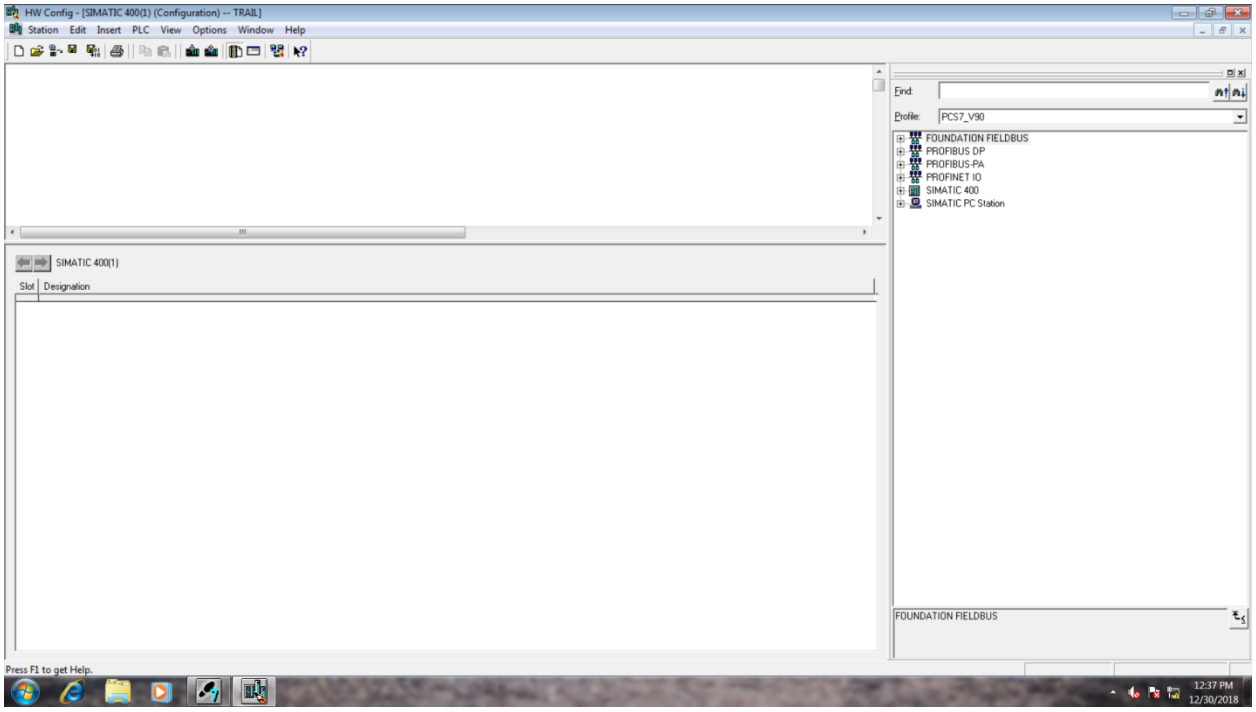
Now a **Simatic 400** icon will be created and now double click that icon.



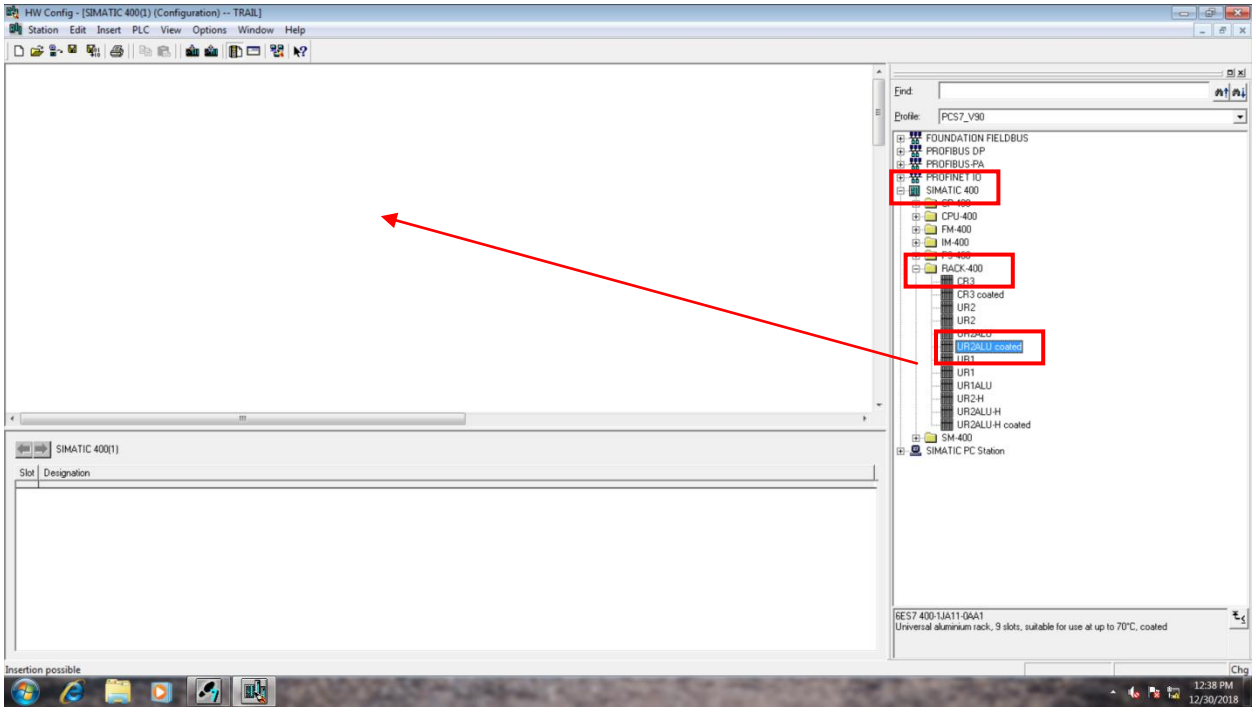
Now click on **Hardware** icon to go to hardware configuration window



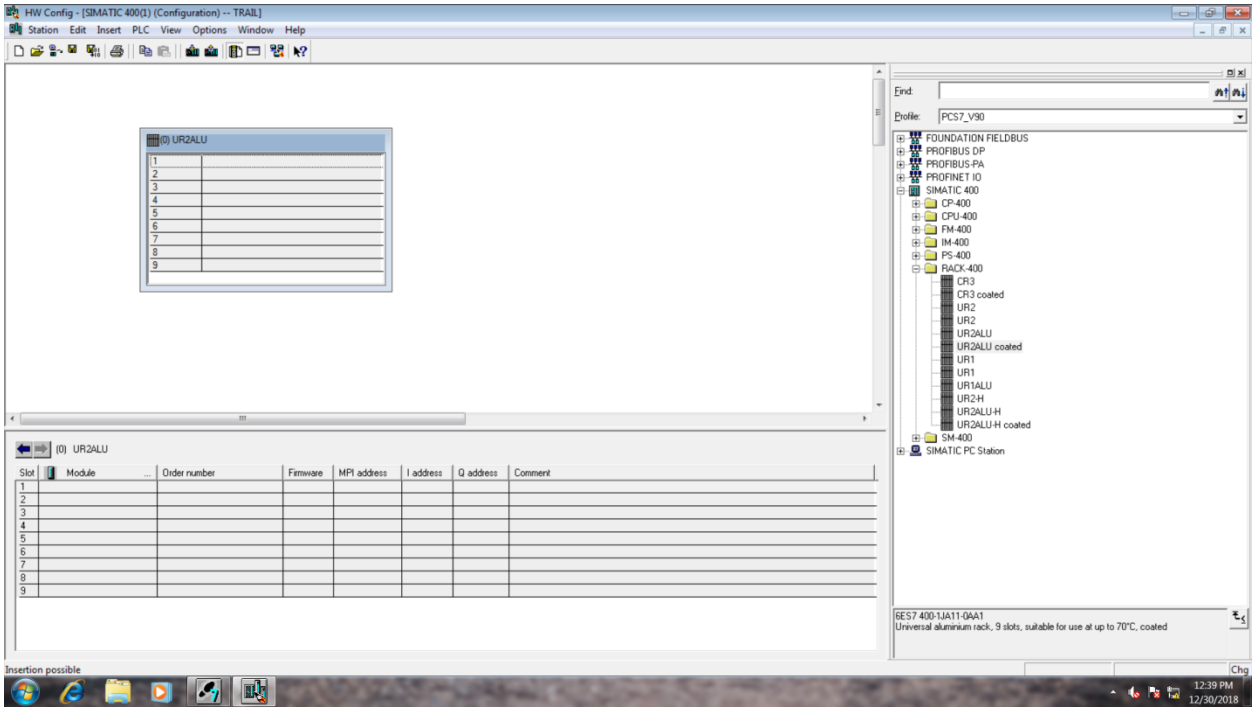
Now a separate window "**HW Config**" will be open



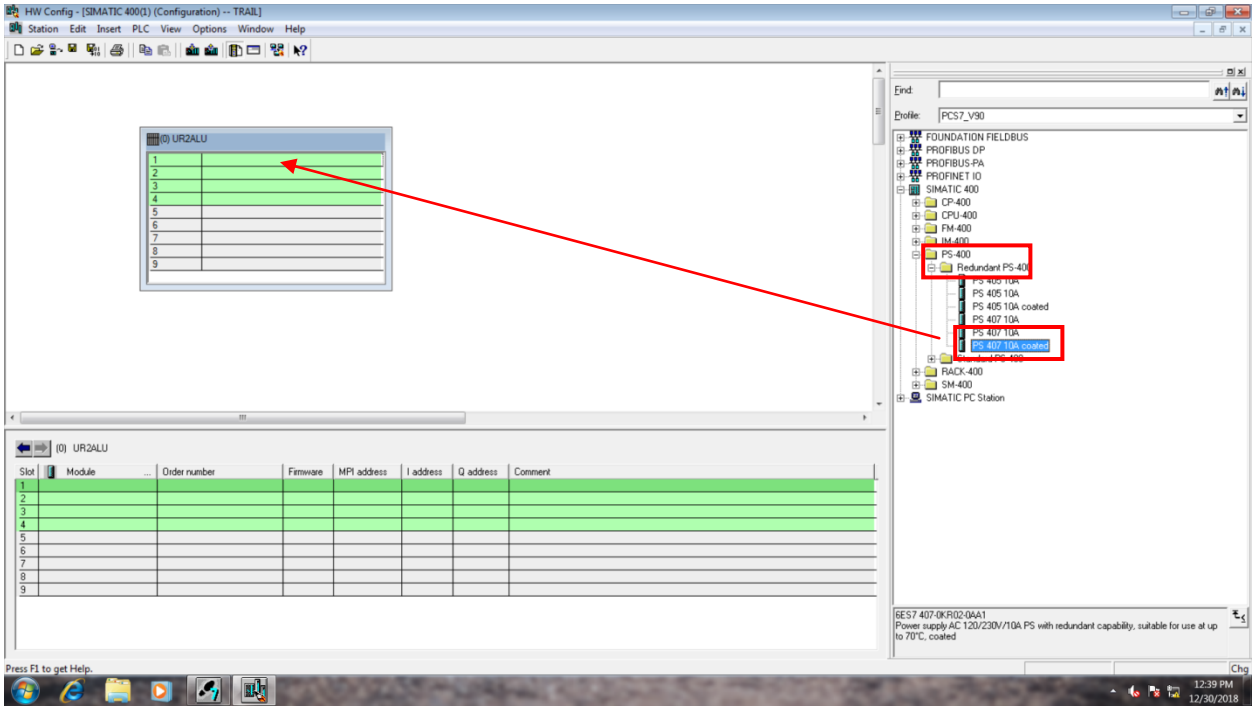
Now to configure your controlled module, Go to **Simatic 400** folder on Catalog tab. Select **Rack 400** → Drag and drop **UR2ALU** coated module.



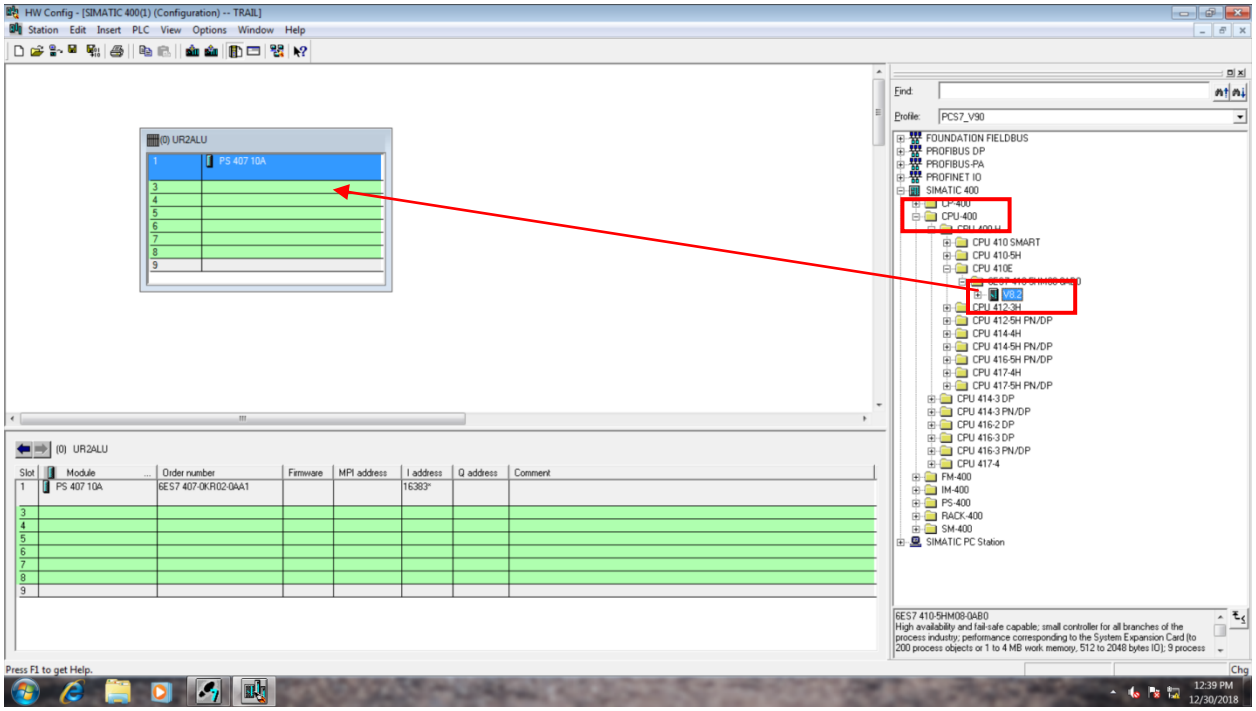
Now a 9 slot rack will be on the work area with the name **(0)**



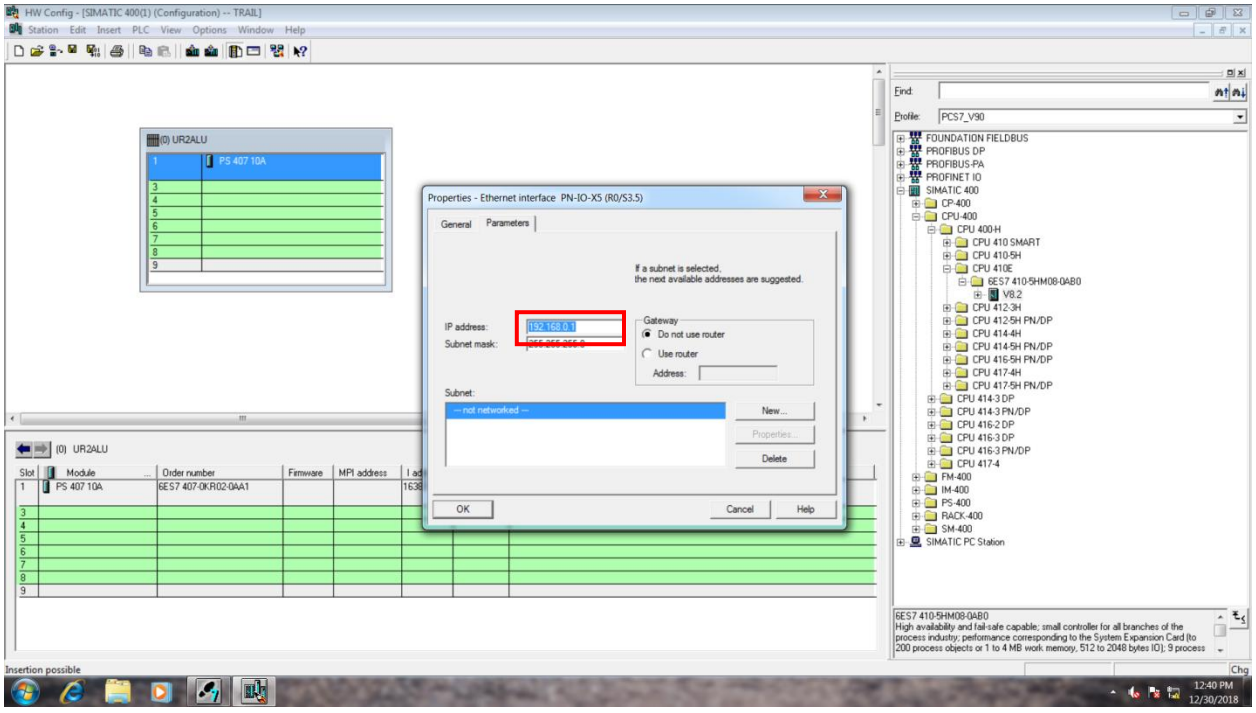
Select the Power module **PS 407 10A Coated** in the slot 1.



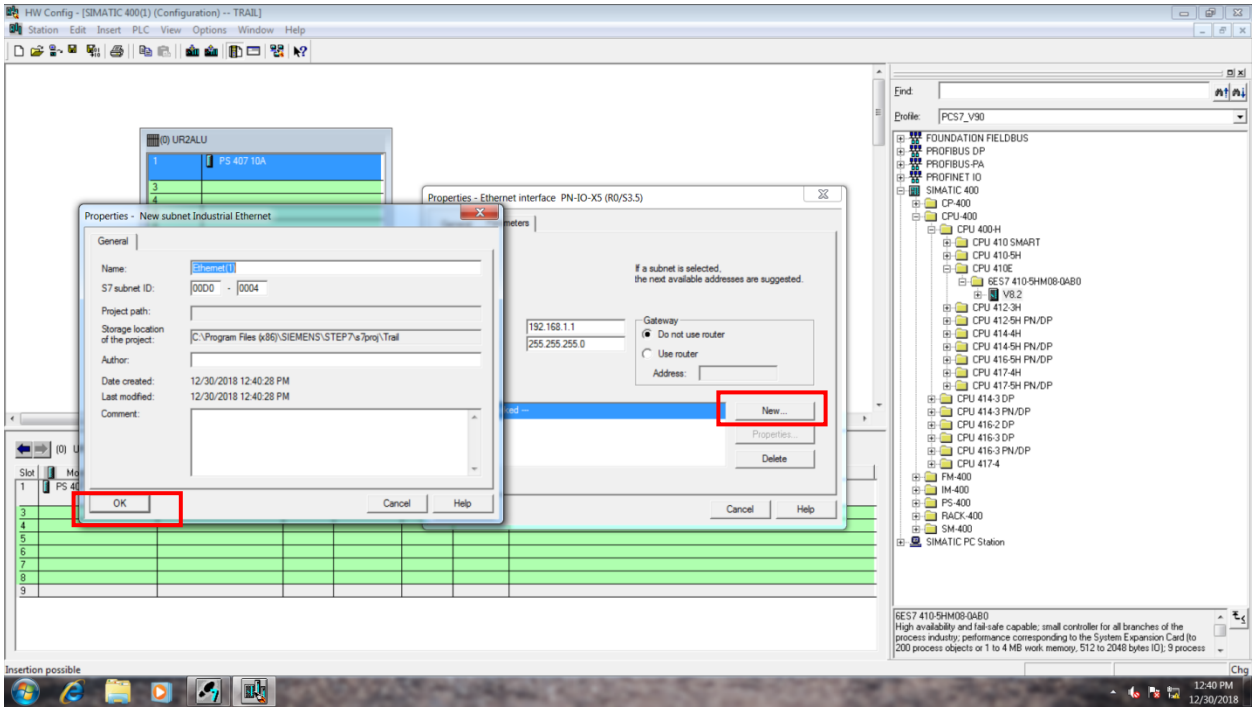
Now select **CPU 410E v8.2** from the folder CPU-400



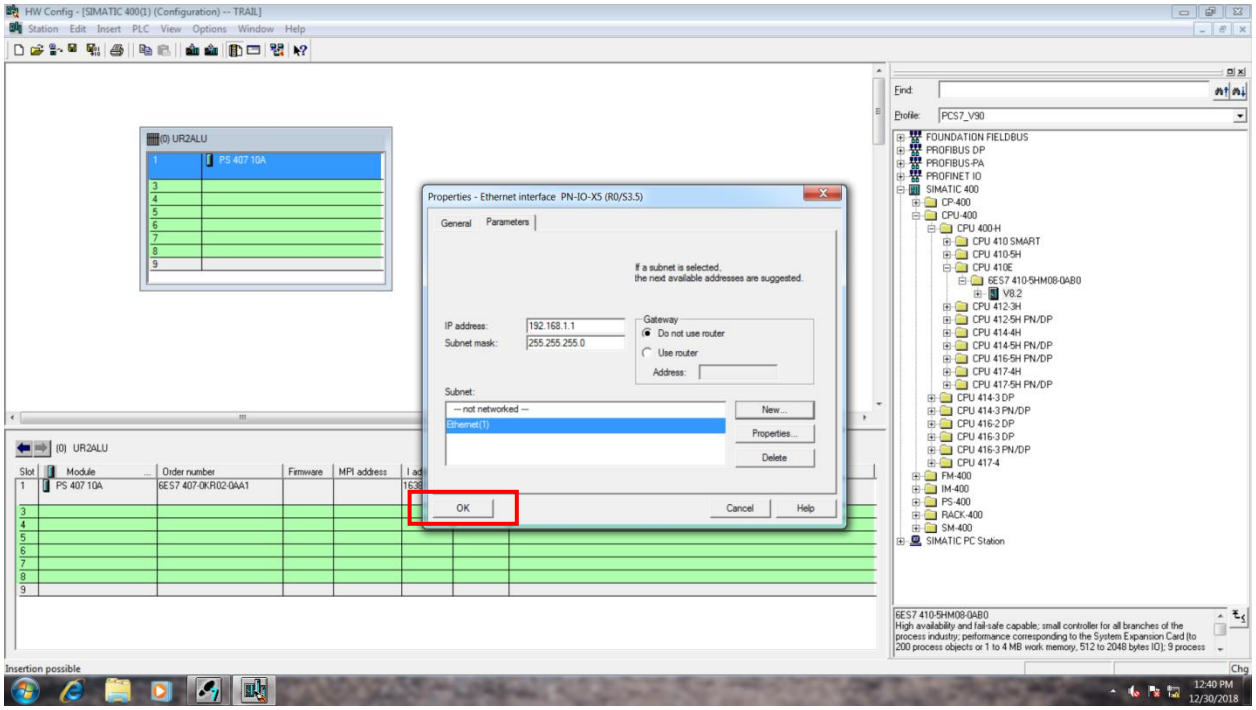
Once you drag and drop the CPU, it will ask for the Interface address **X5**. Set the IP Address as **192.168.1.1** and click on **New**.



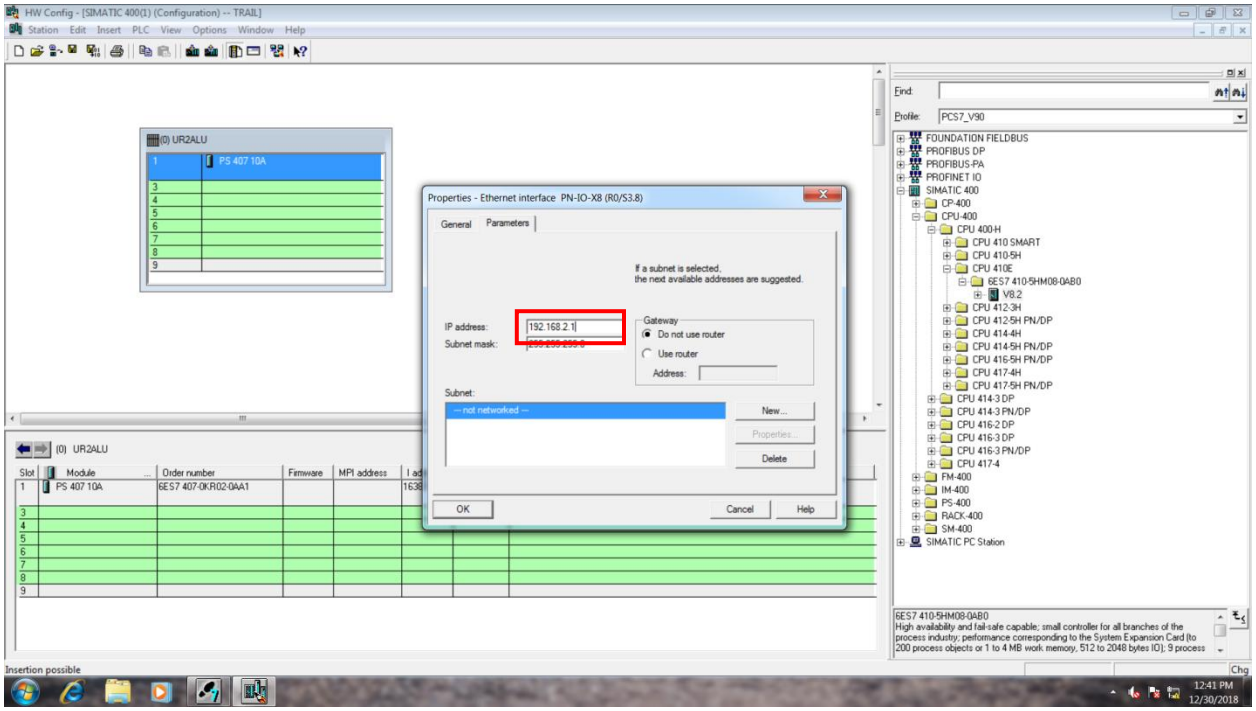
Now a new **subnet** will created and click **ok**



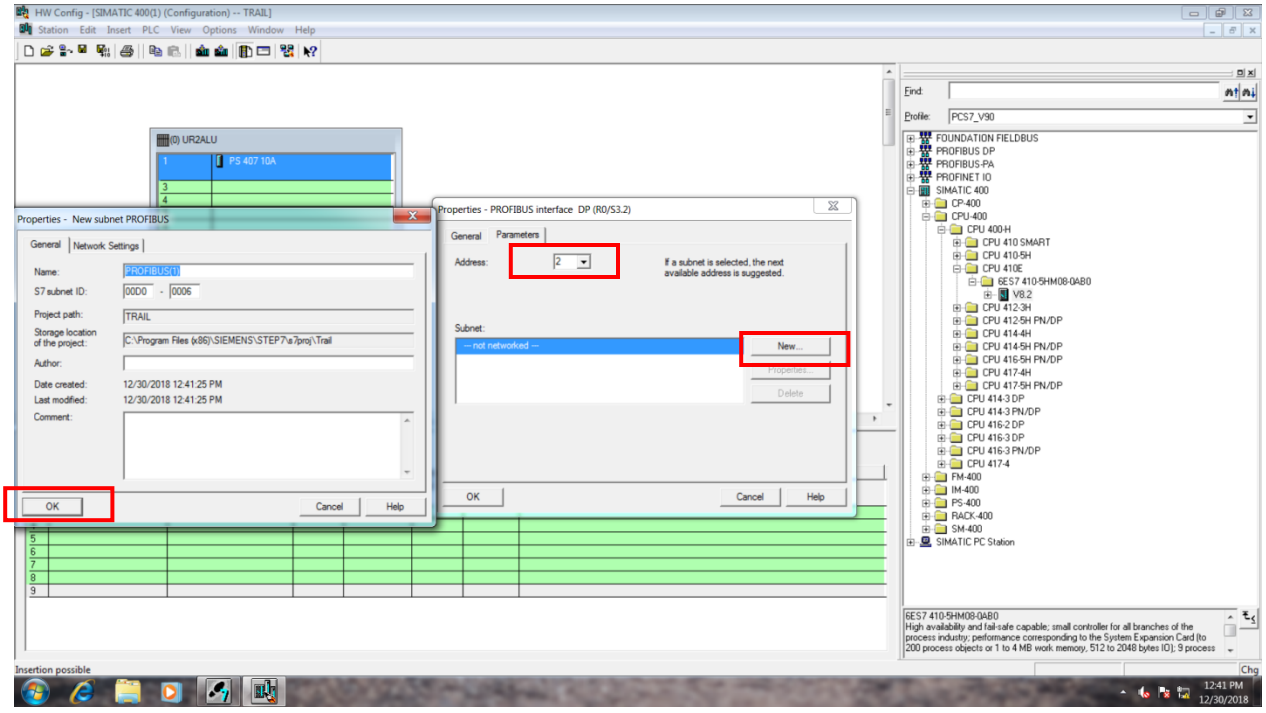
Click **OK**



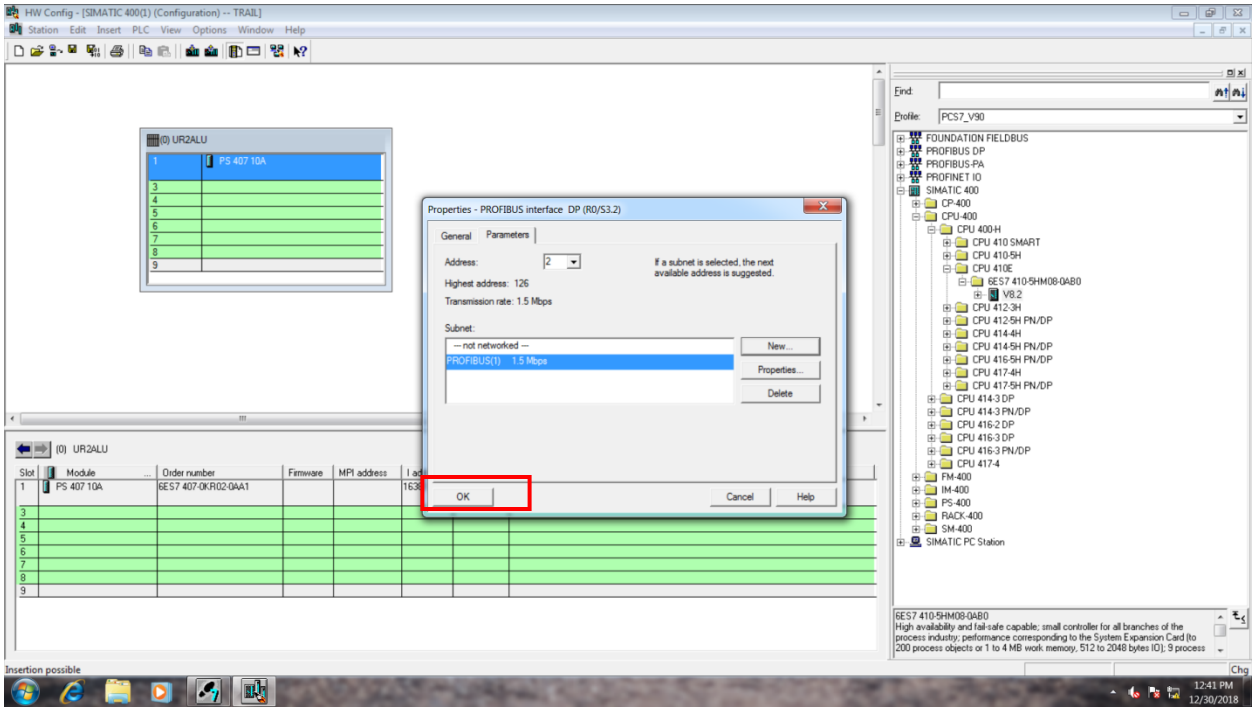
Now set IP address for **X8** as **192.168.2.1** and click **OK**



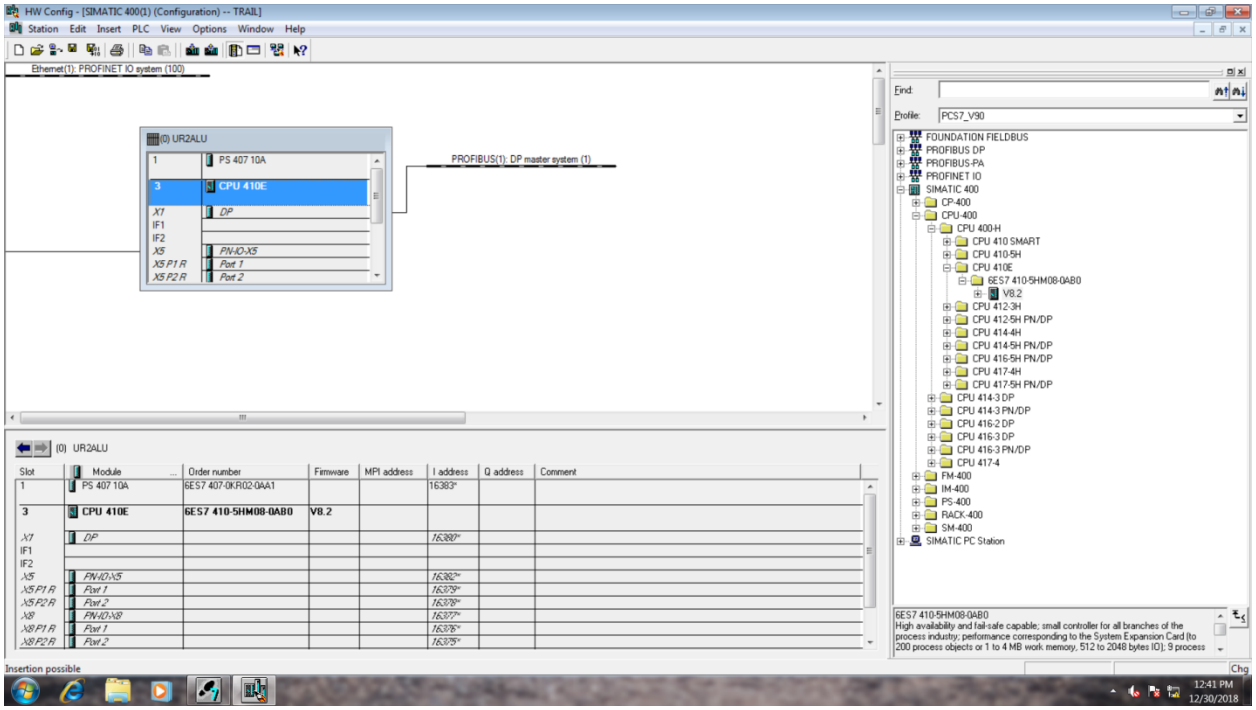
Now it will ask for interface **X1** and set **Profibus** address as **2** and click **new** to create a new subnet. Click **ok** to conform.



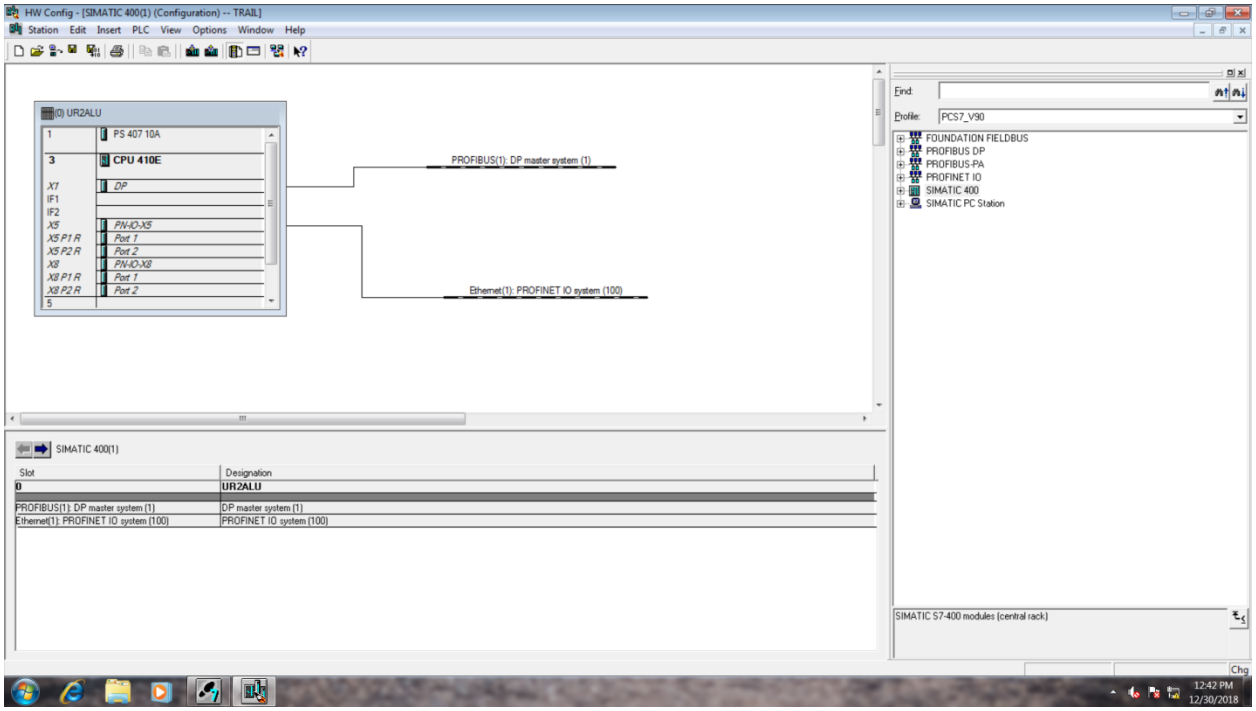
Click **ok**



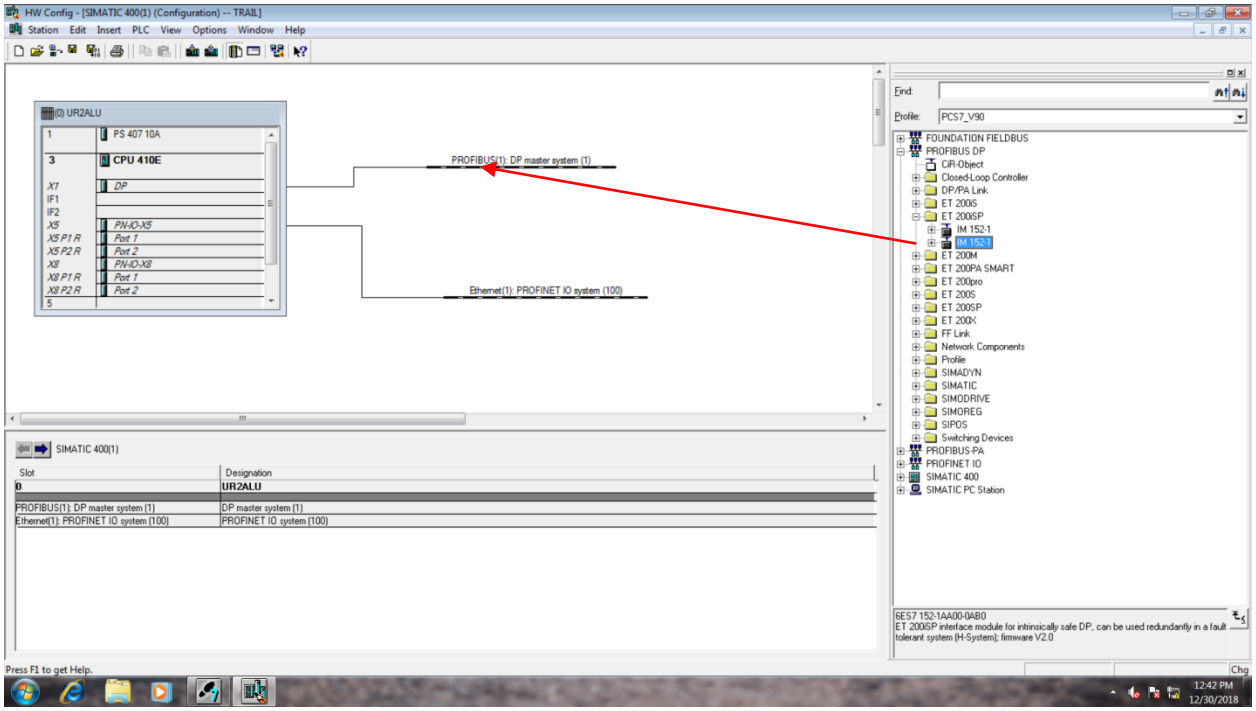
Now two networks will be created.



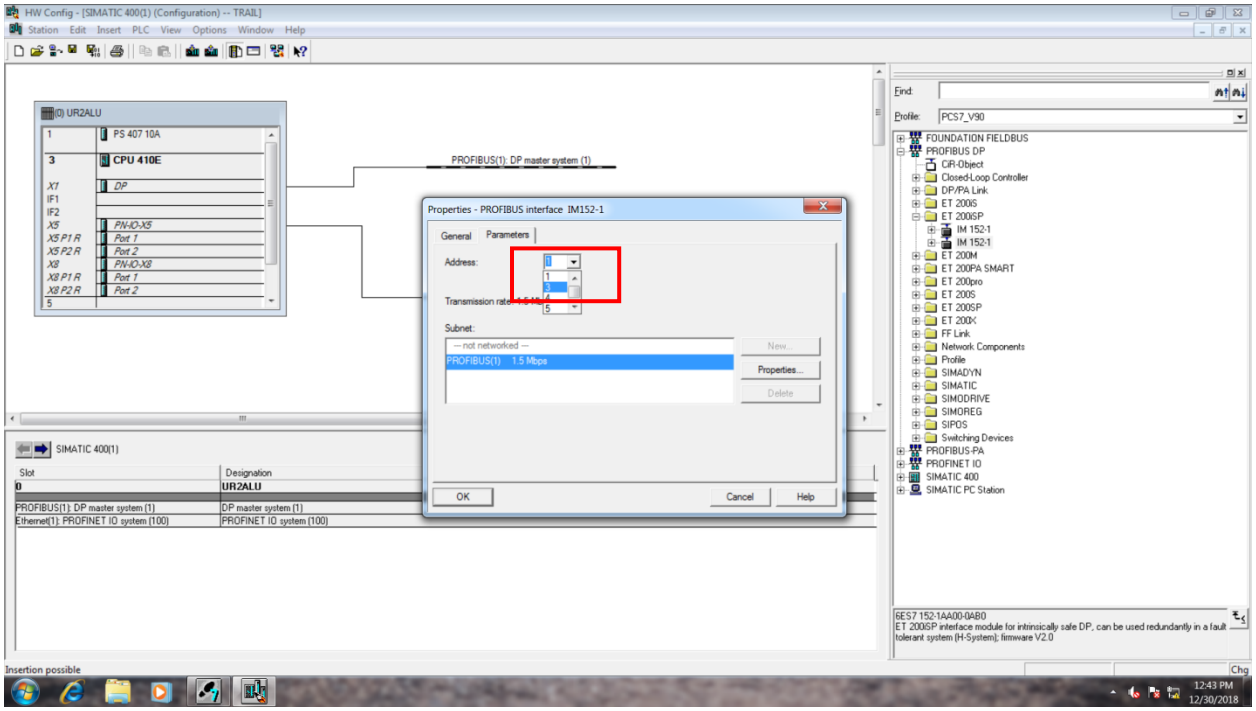
Rearrange the two networks.



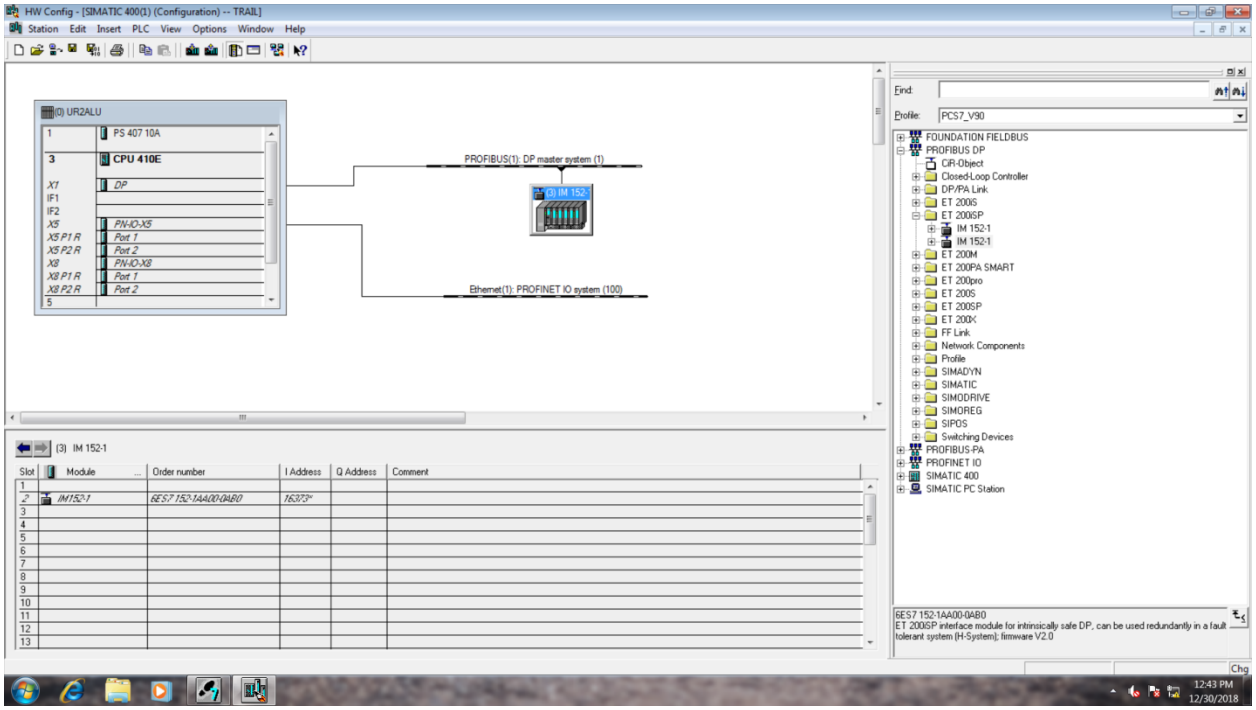
To select the Remote I/O station, go to **Profibus DP → ET200iSP → IM152-1** (second one) and drag and drop to the Profibus network.



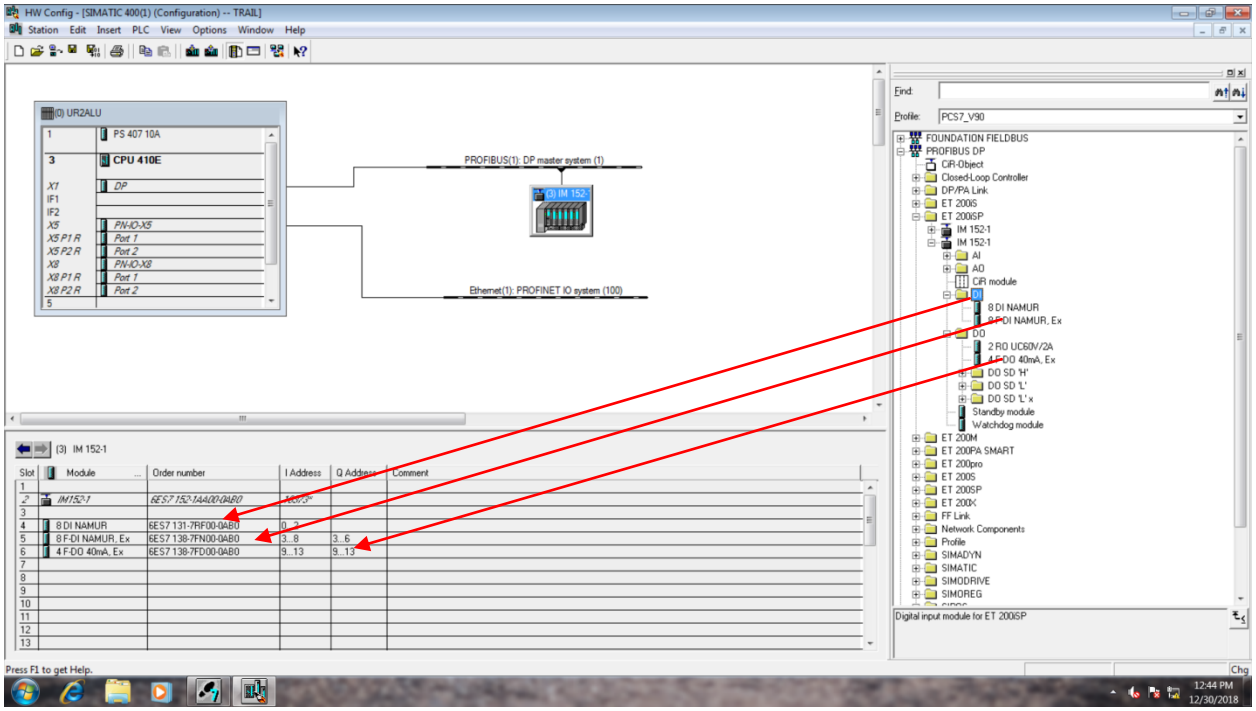
Now select profibus address as **3** (same as in Hardware dip switch)



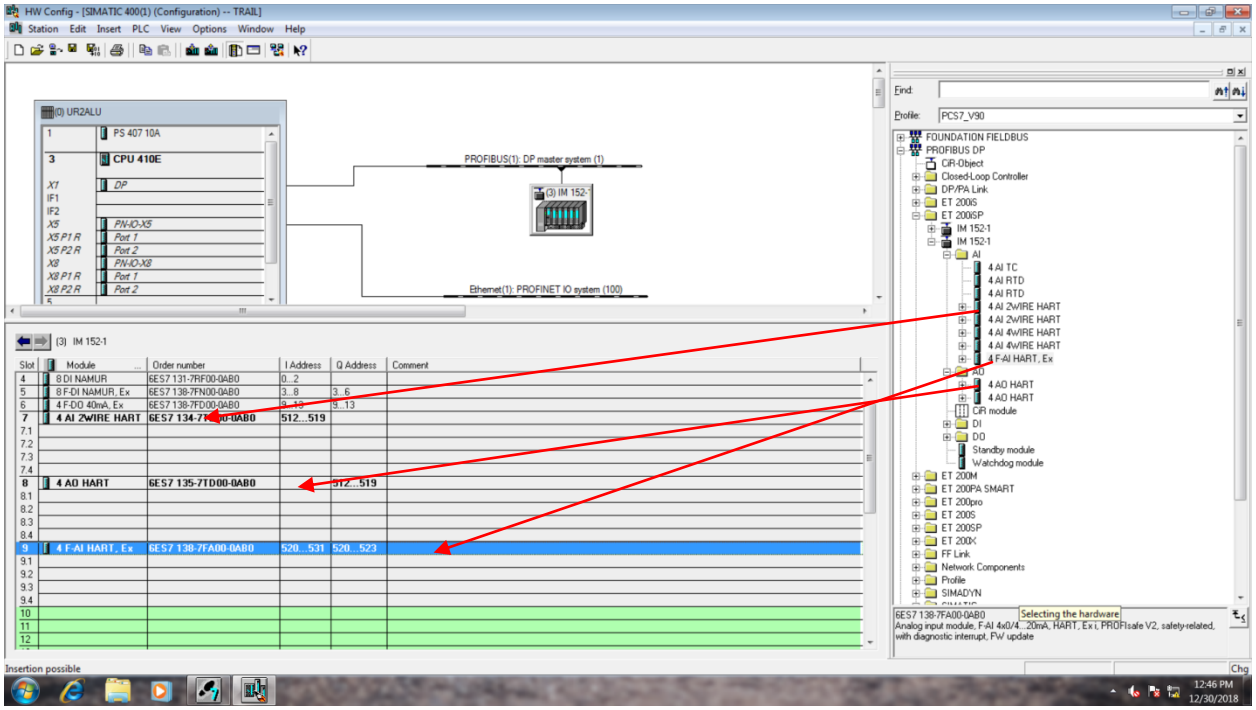
Now select the other signal modules as in hardware.



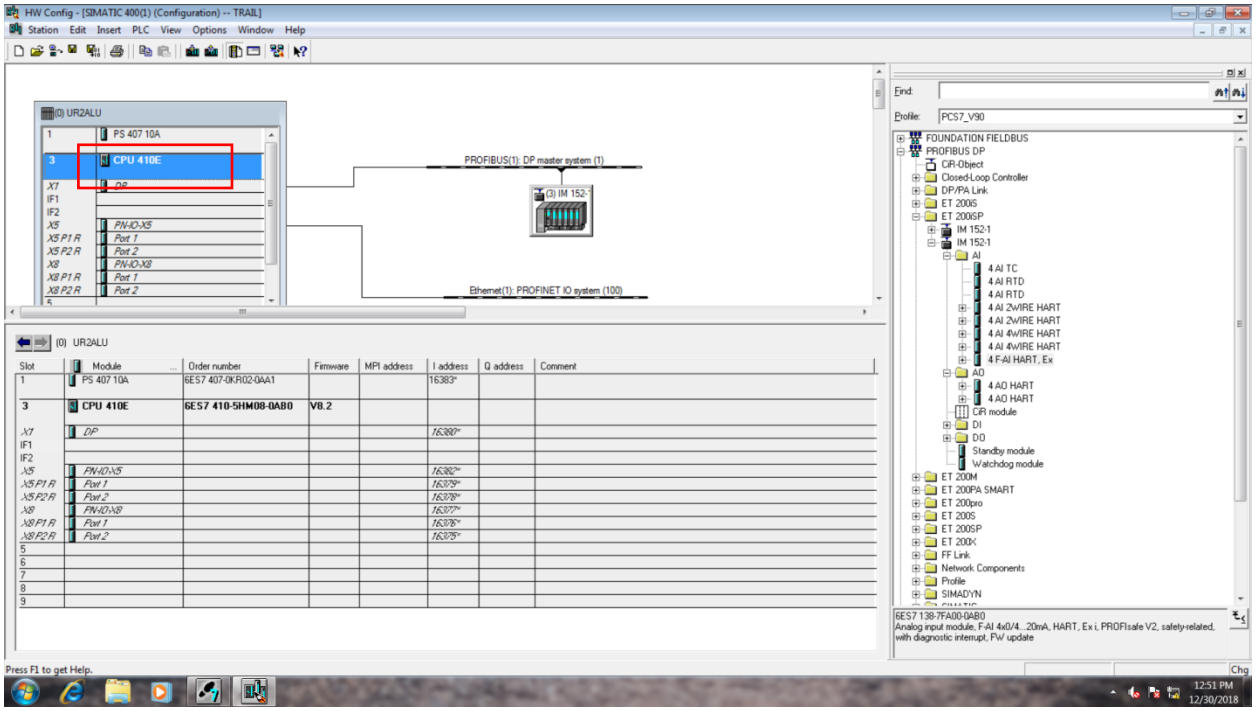
Select the Digital module in the same folder of the IM152-1.



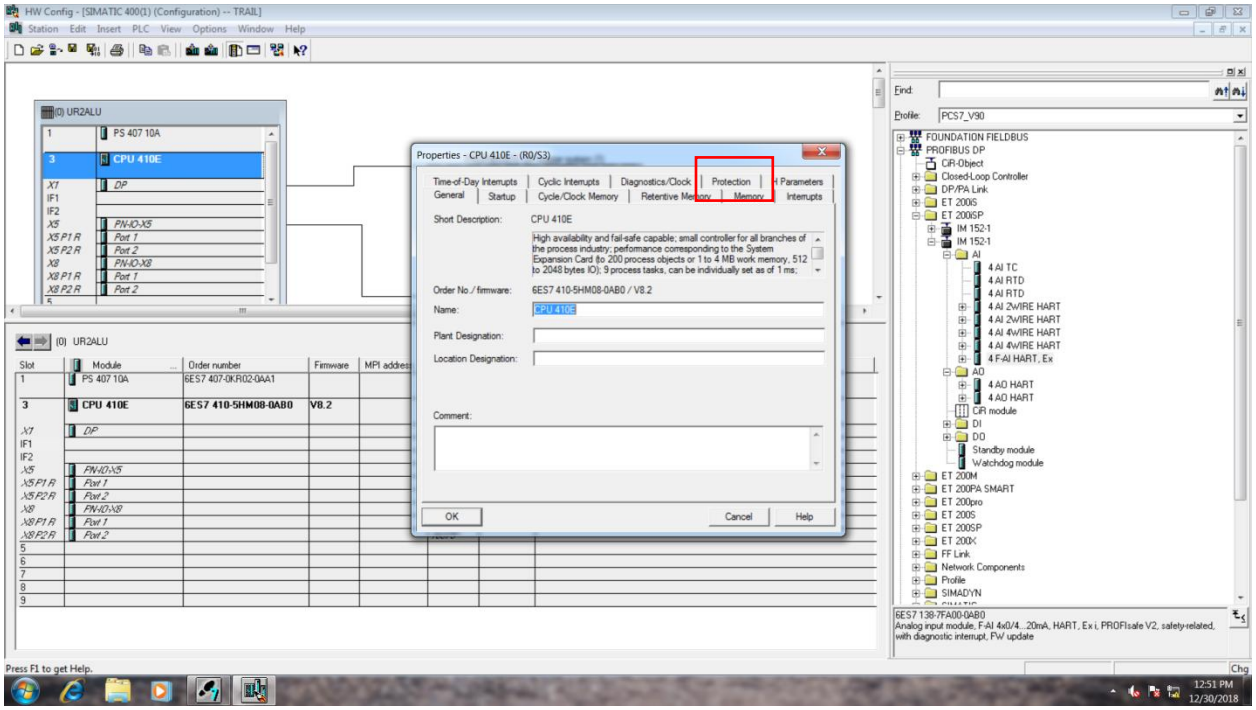
Select the Analog module in the same folder of the IM152-1.



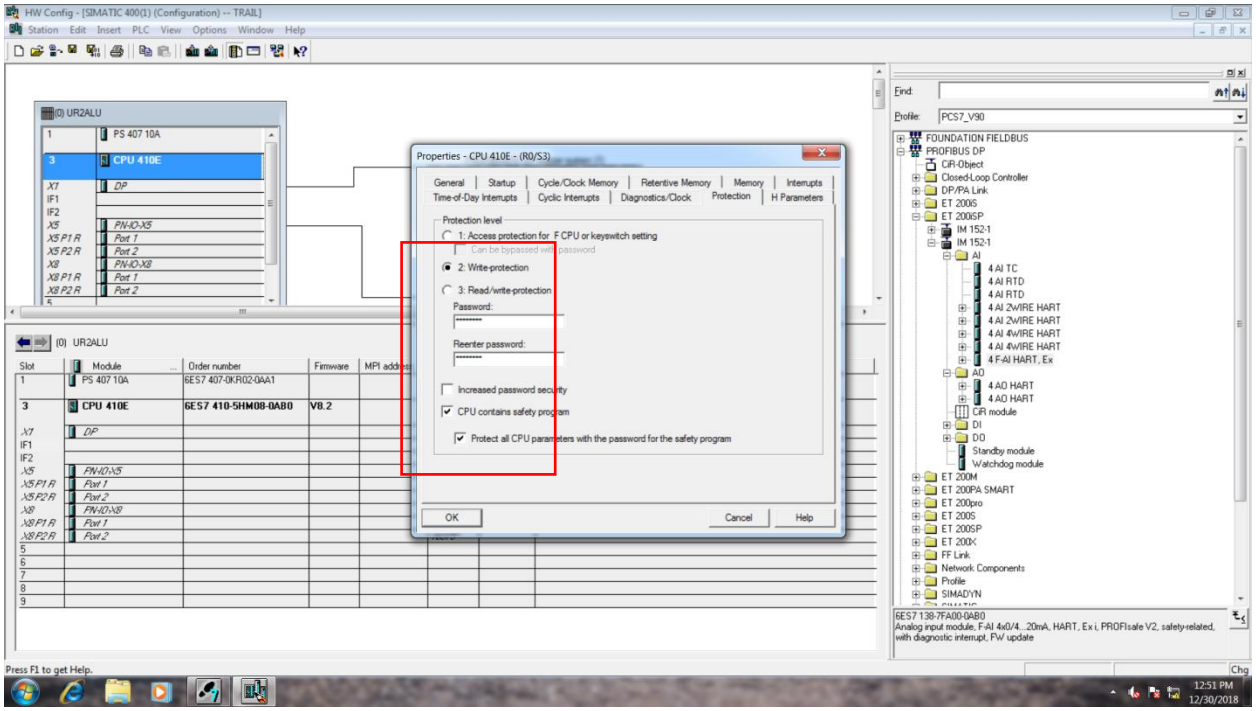
After selecting the module go to **main rack** and double click the **CPU410E**.



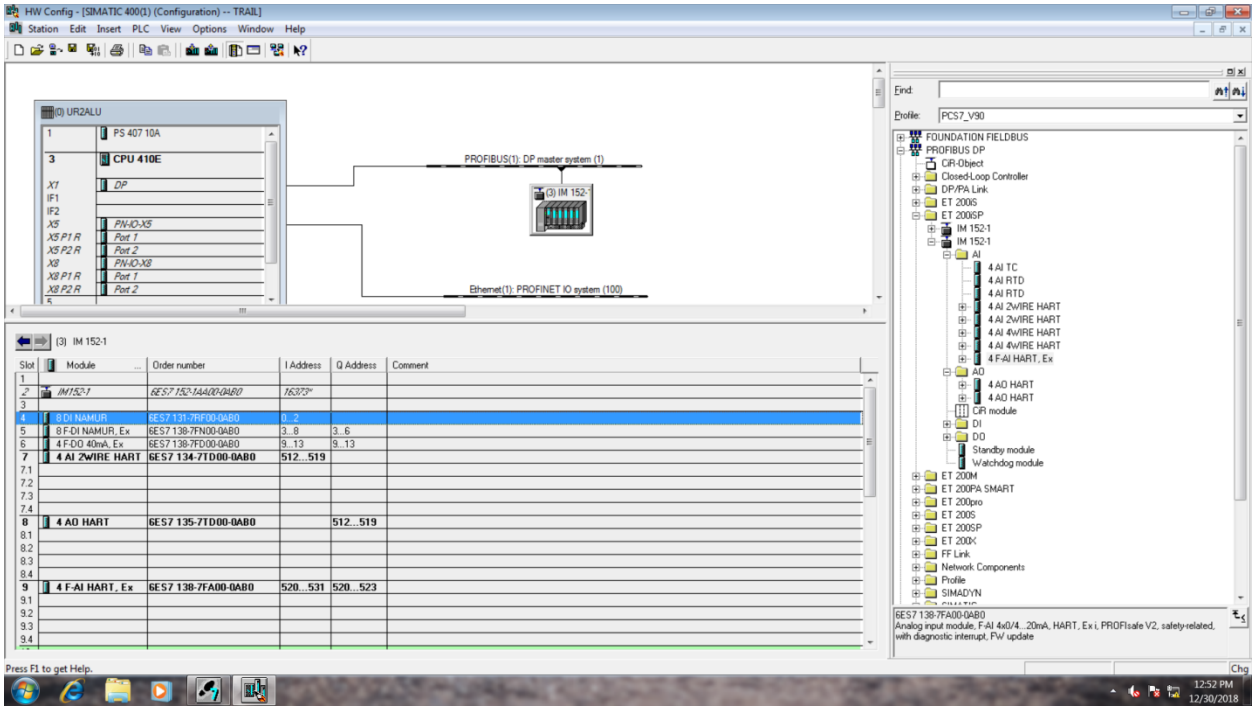
Go to **Protection** Tab.



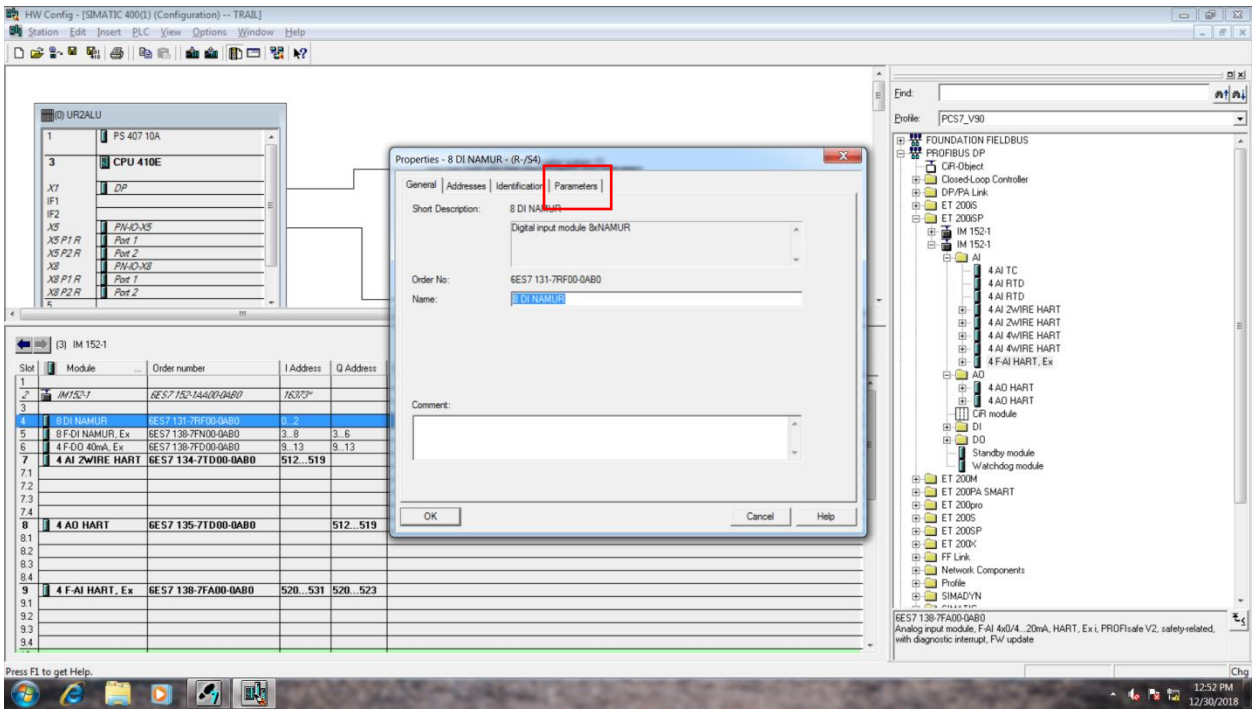
Click on Write Protection and set Password as “MIT@1234”



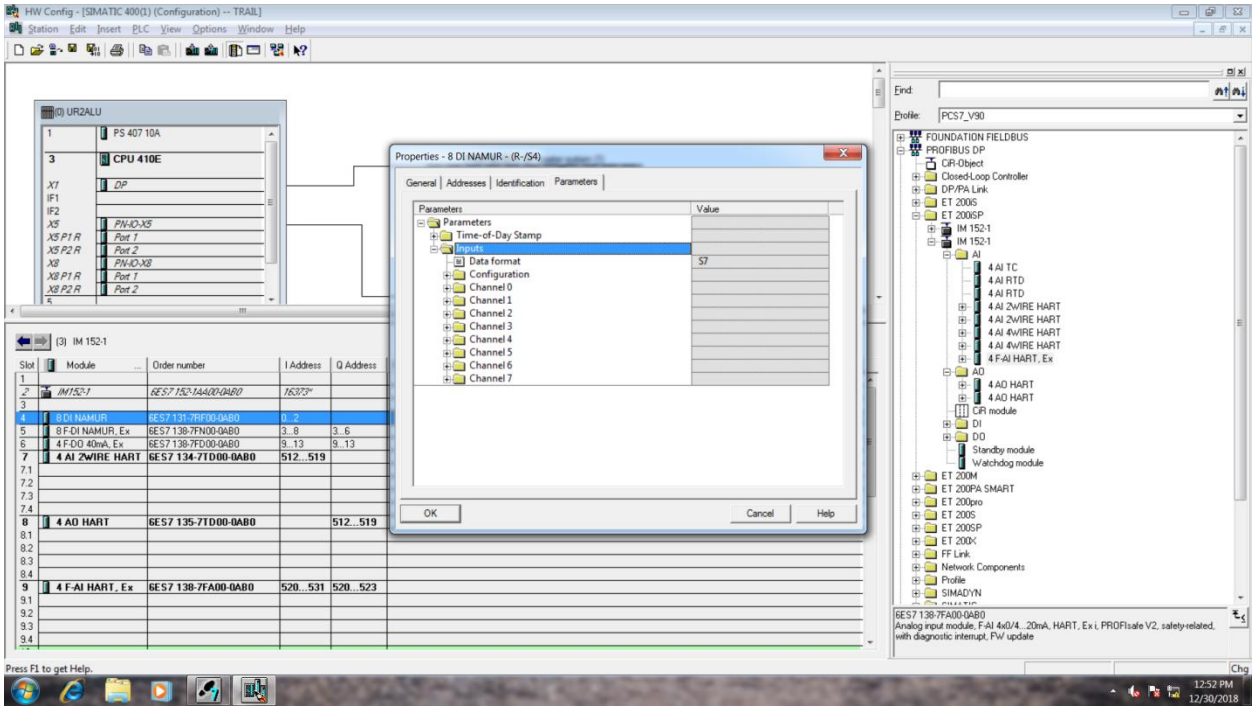
For the configuration of Module, select **DI** module.



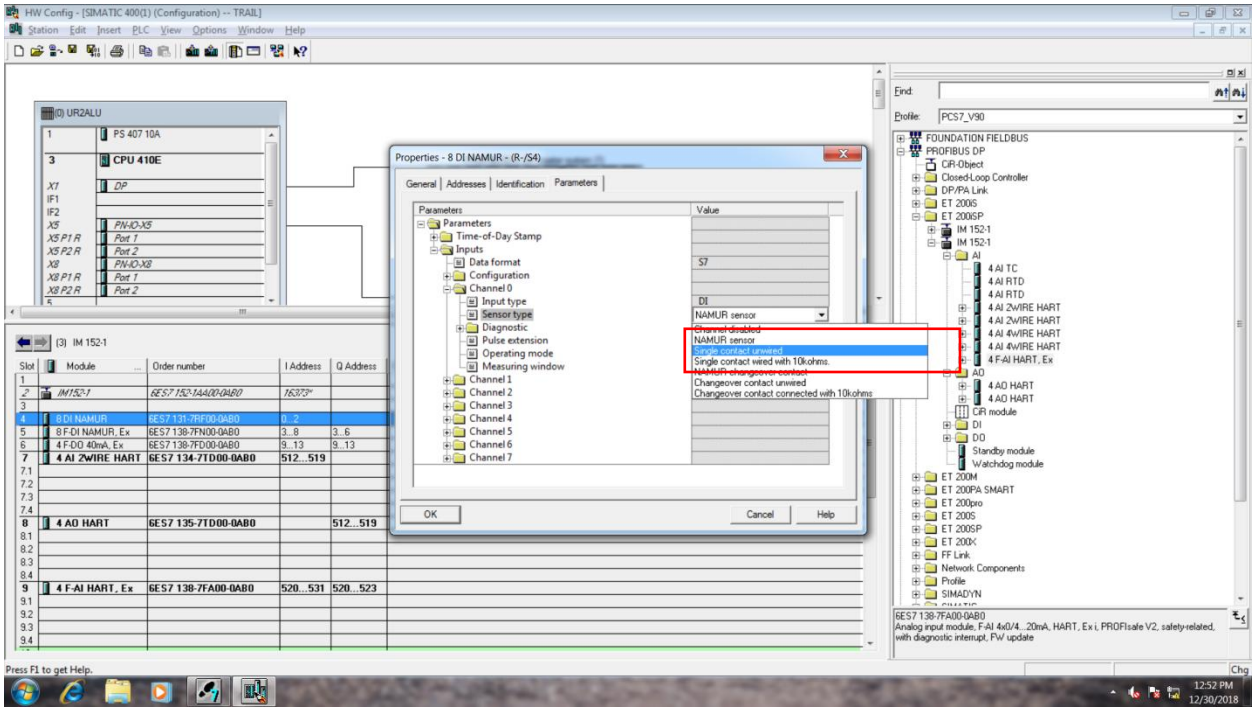
Once you double click on DI module, go to **parameter** tab



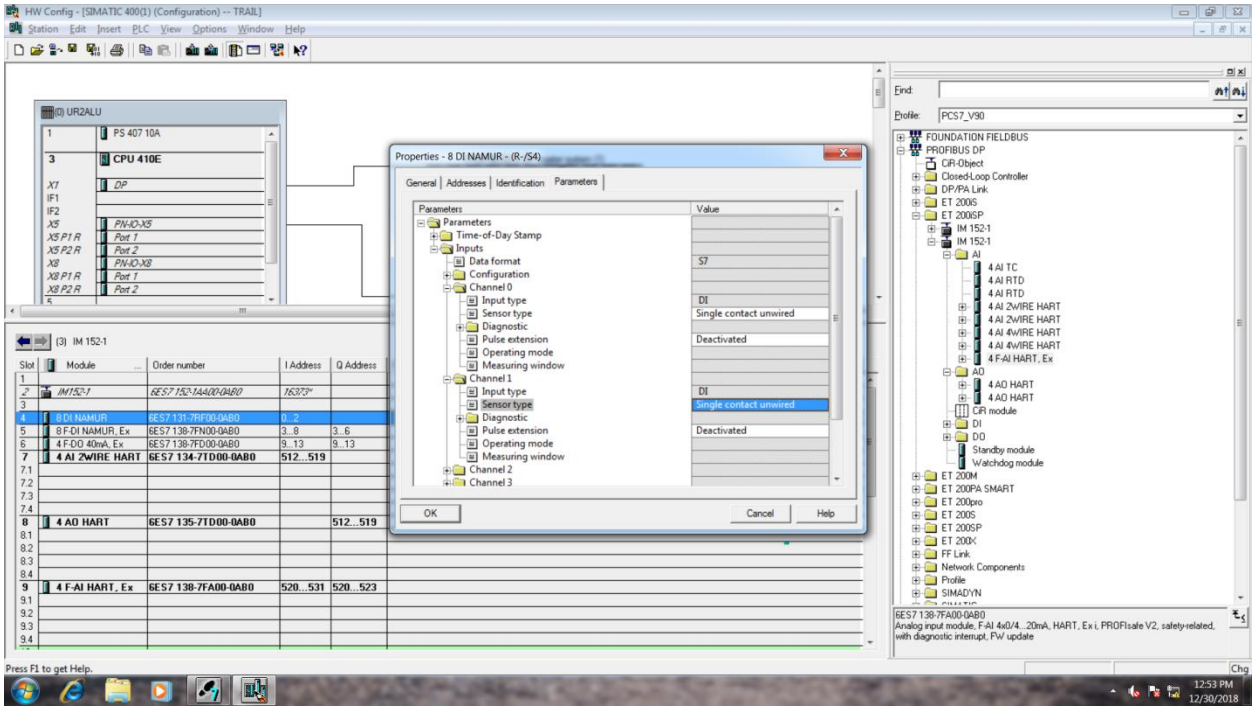
Select **input → Channel 0**



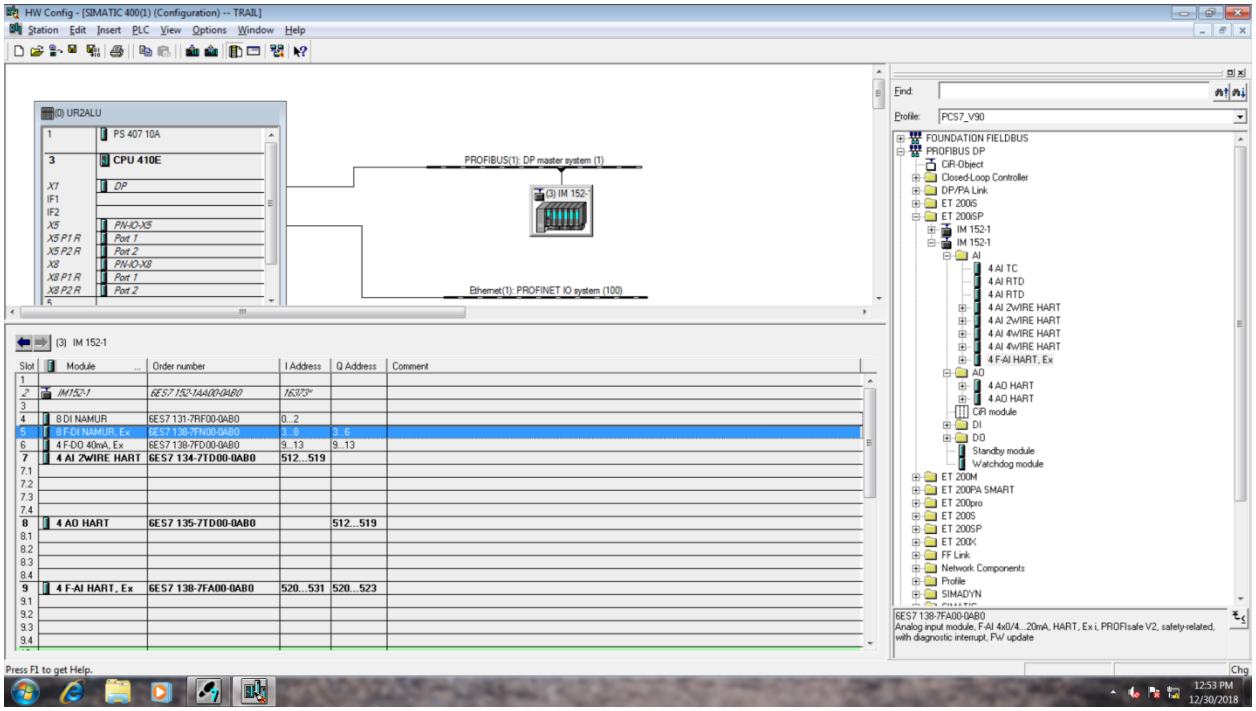
Select Sensor Type as **Single contact unwired**



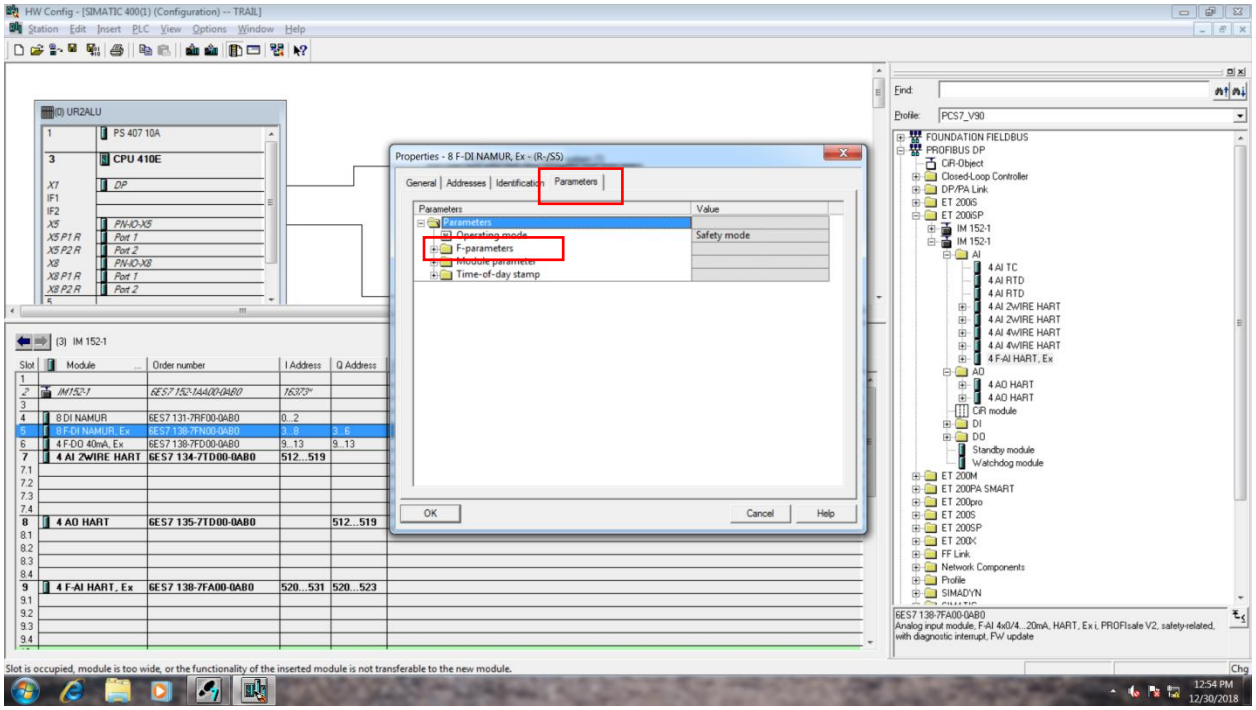
Repeat the same for all Channels as we wired the Input as switches



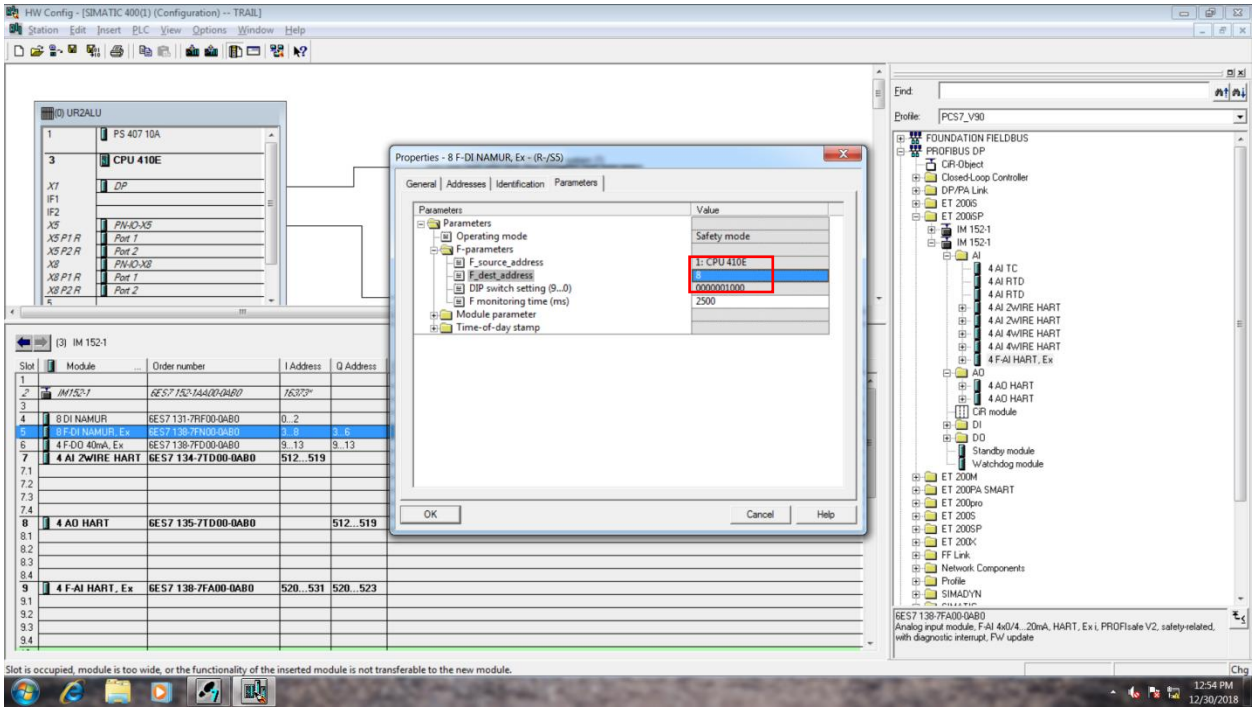
Next Double click on **F DI** module



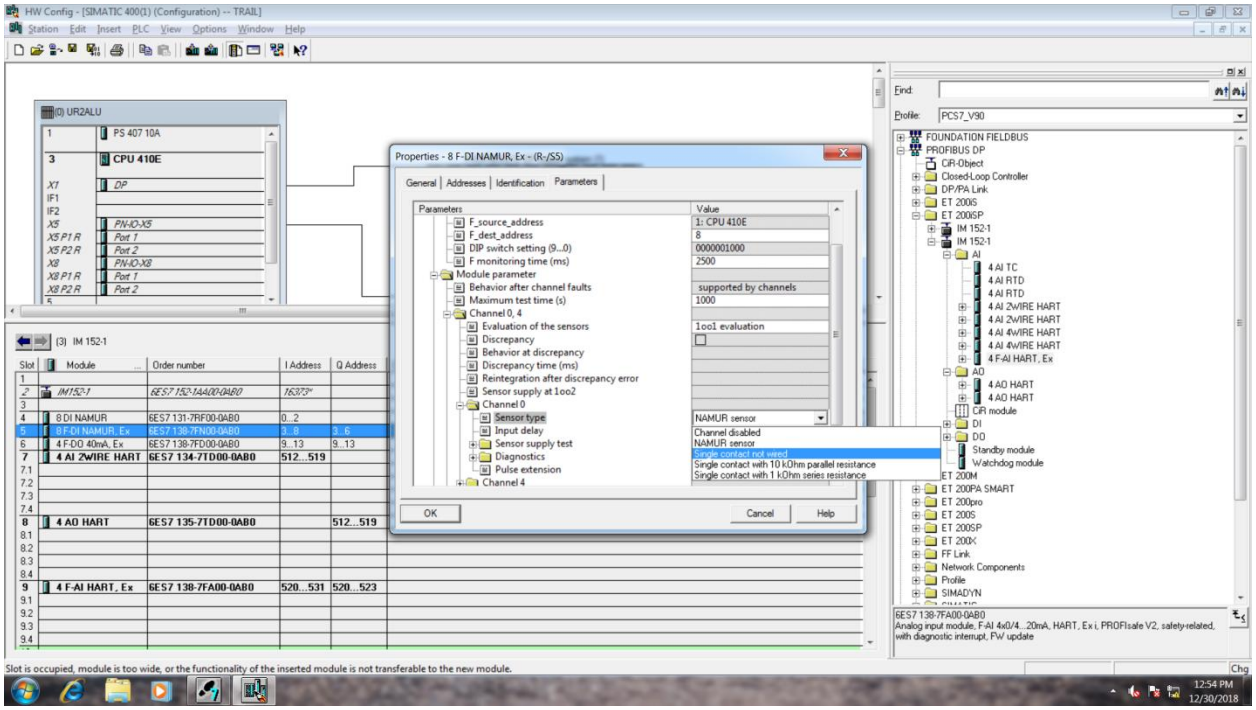
Go to **Parameter→ F-parameter**



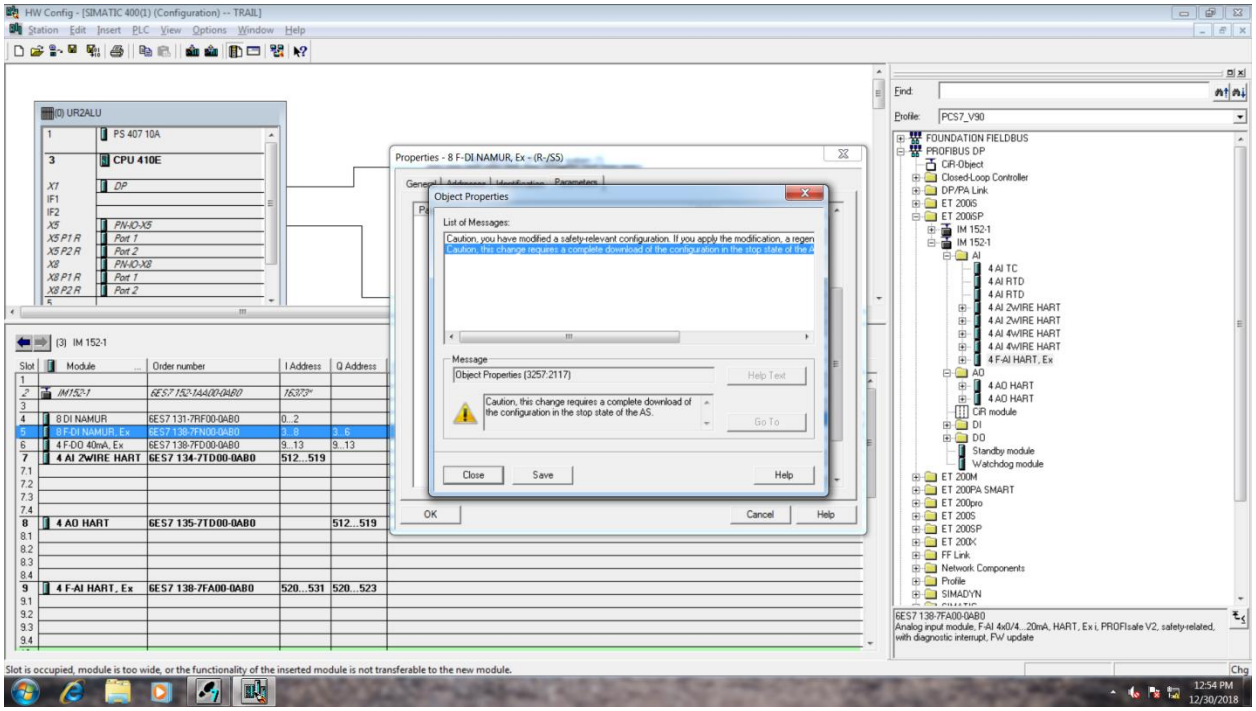
Set the **F_dest Address** as **8**



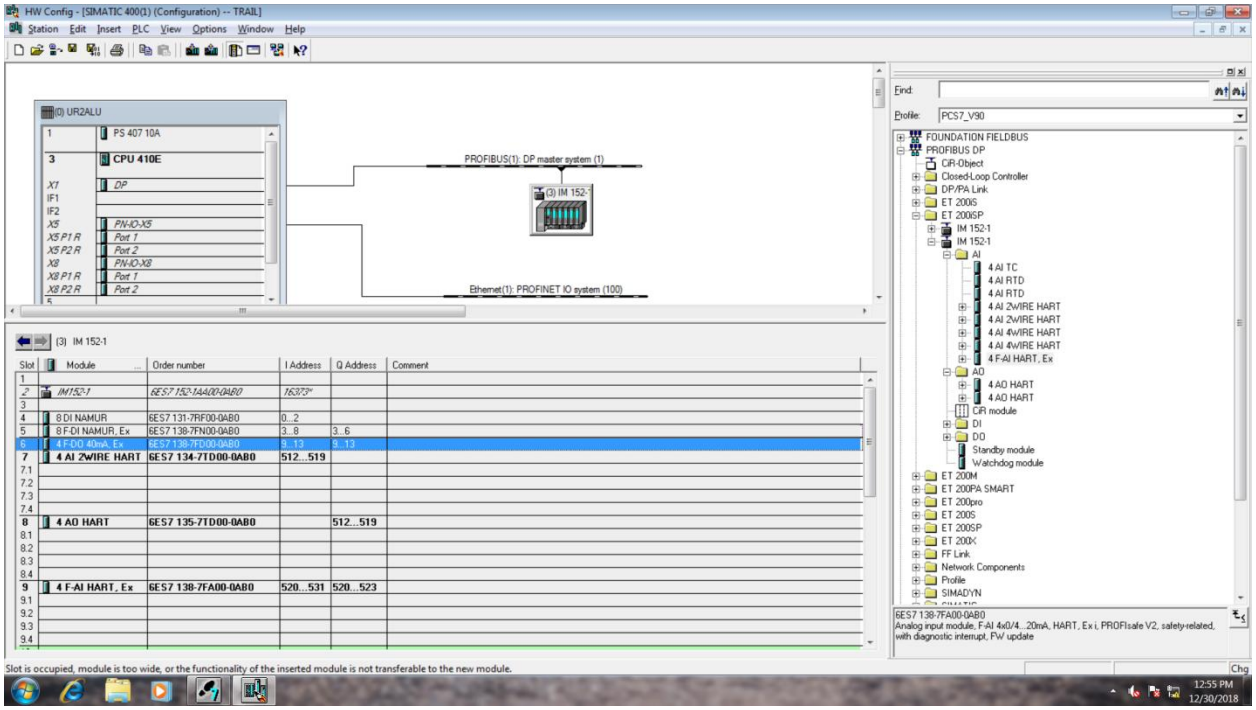
Go to **Module Parameter → Channel 0 →** Sensor Type as **Single contact unwired**



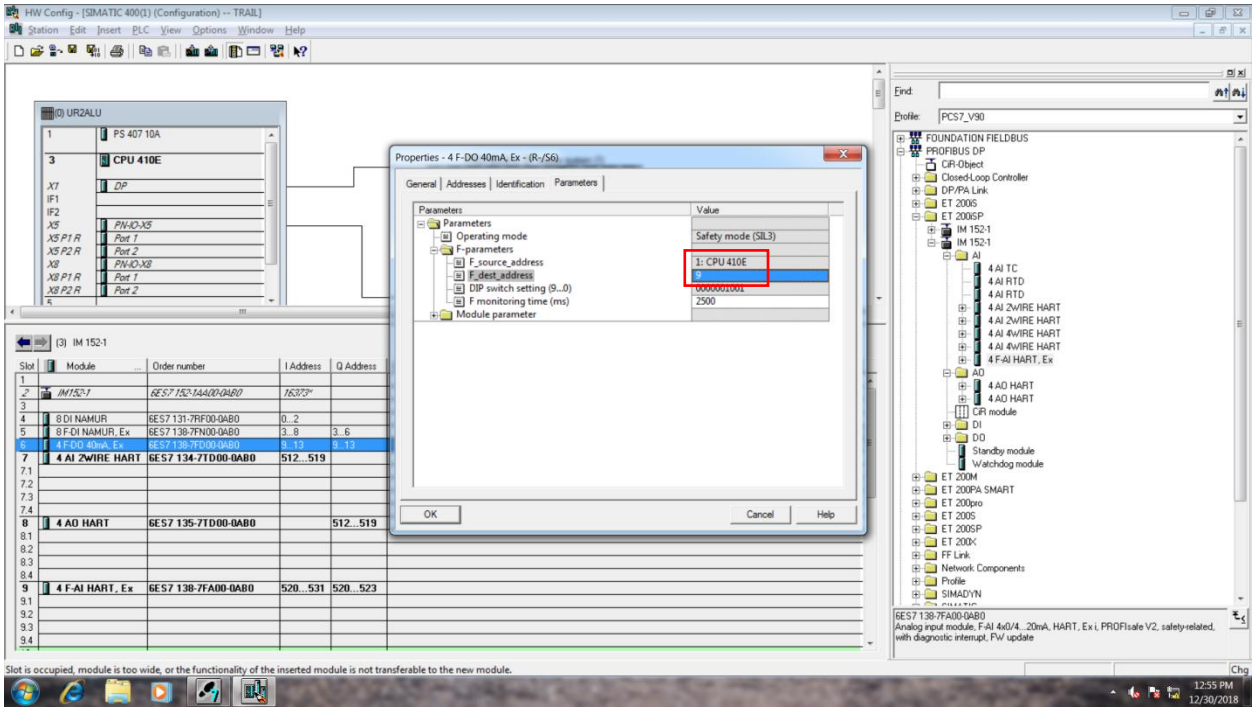
Repeat the steps for all the channel and select ok. Click **close**



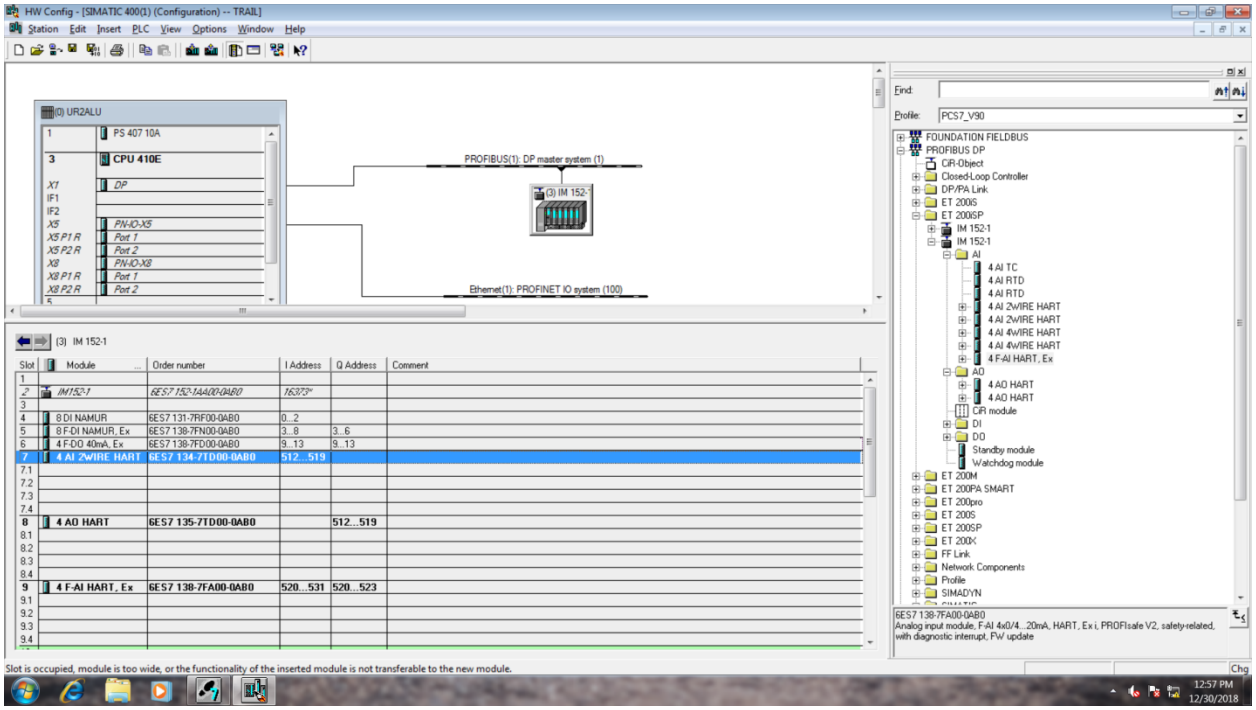
Now select **F_DO** module and double click



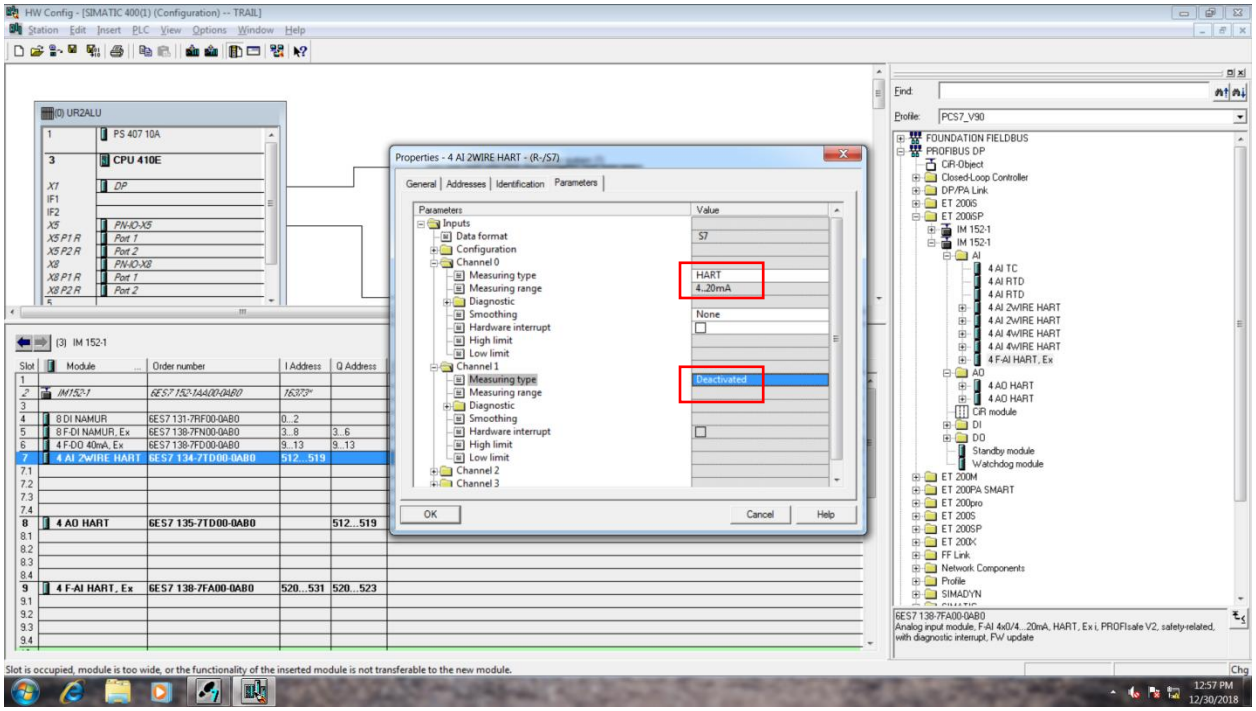
Set the **F_ dest address** as **9** and click **ok**



Double click **AI** module

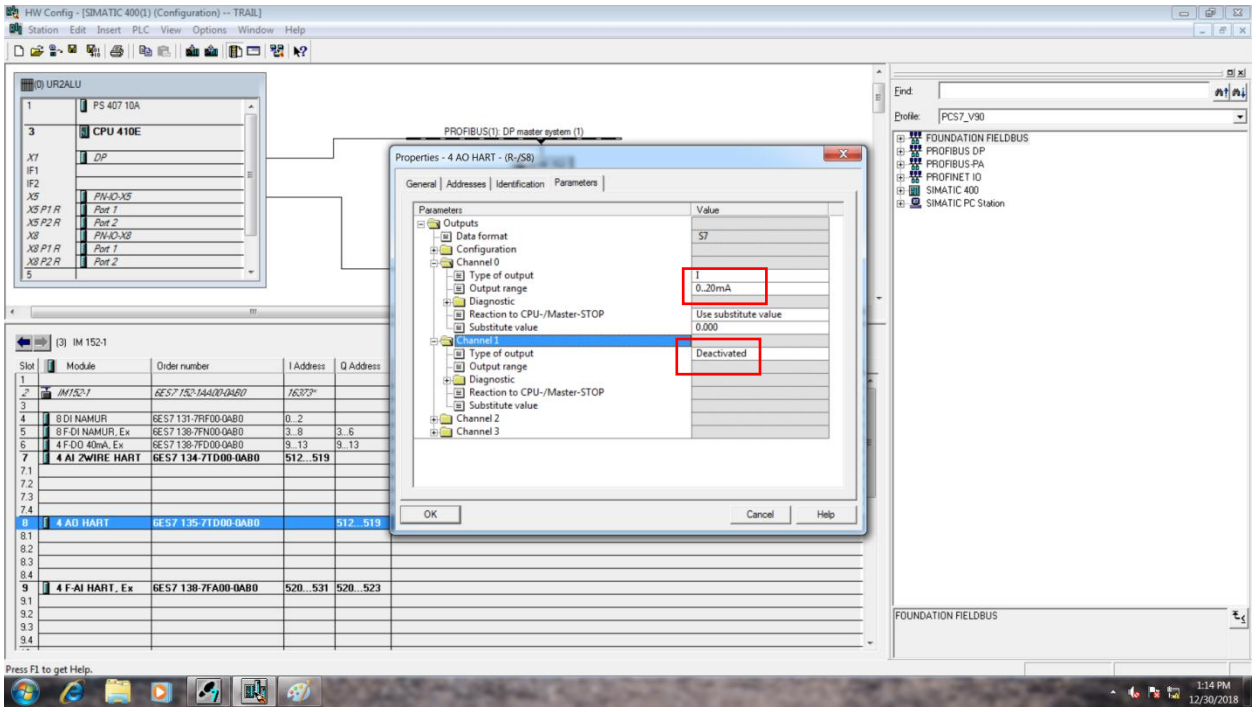


Go to **Parameter → channel 0 →** select measuring type as **Hart**. Select Remaining Channel as **Deactivated**.

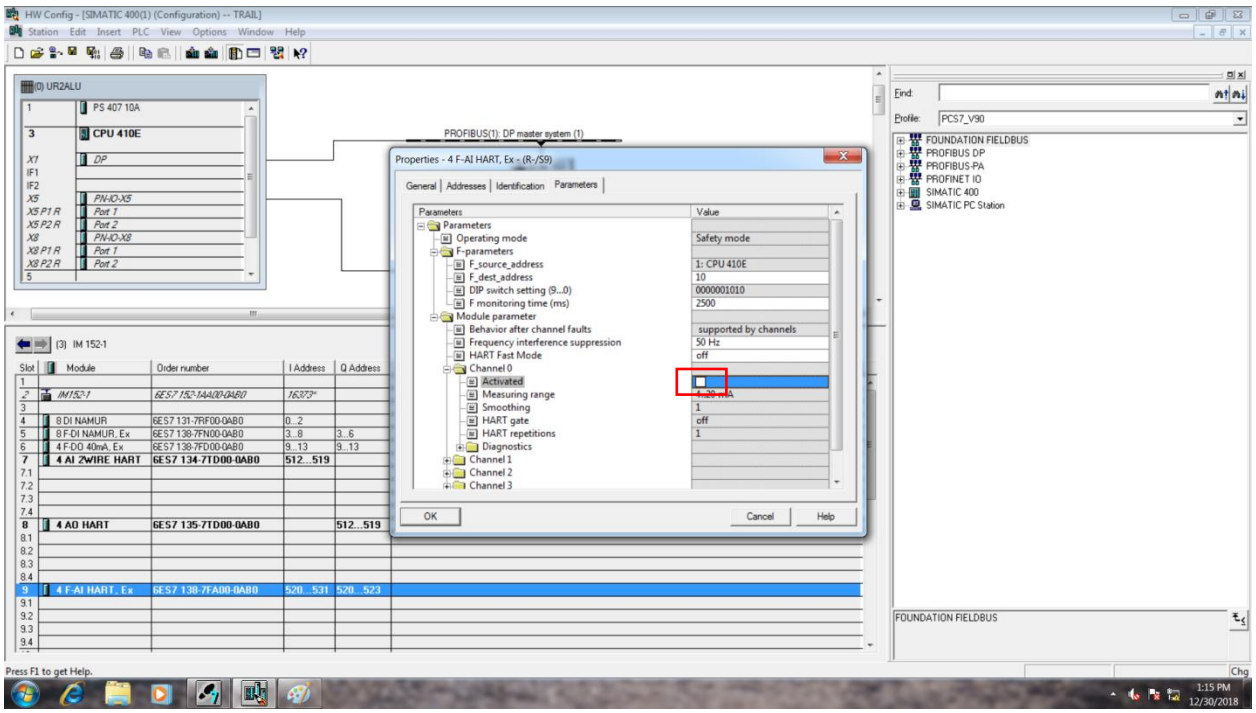


Now select **AO** module and select the Output type as **I** and select **0 .. 20mA** for **Channel 0**.

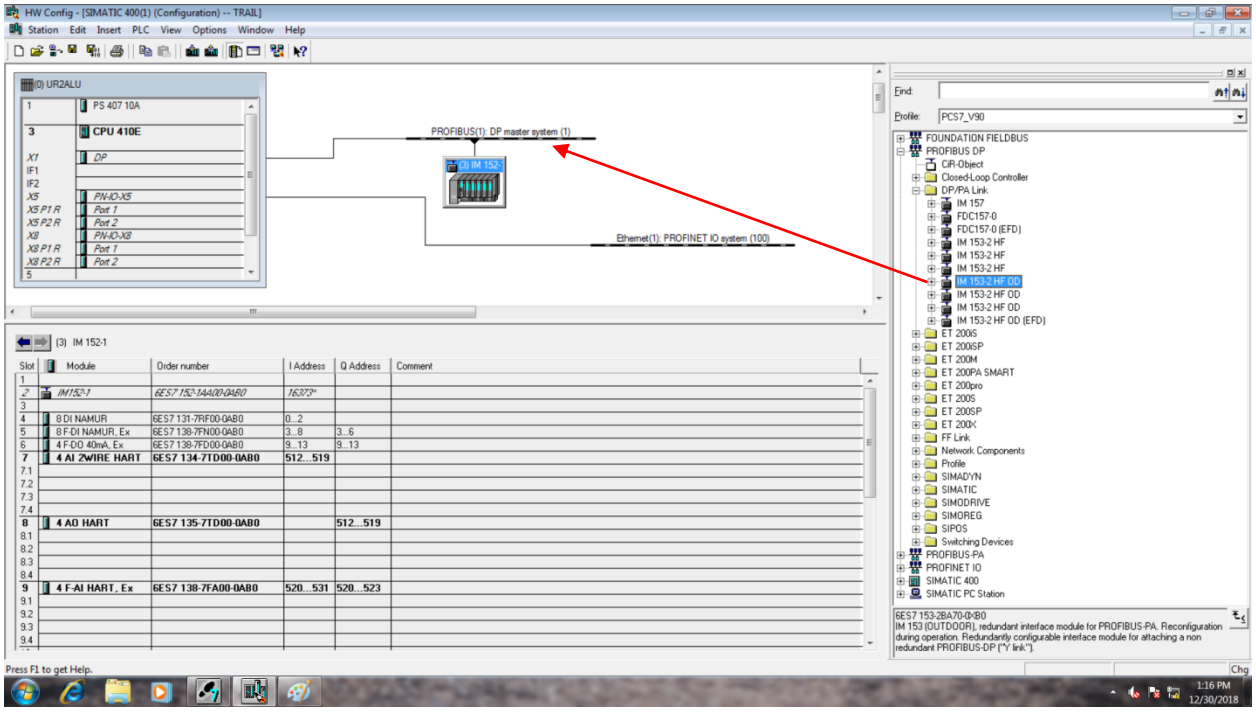
Deactivate the other channel.



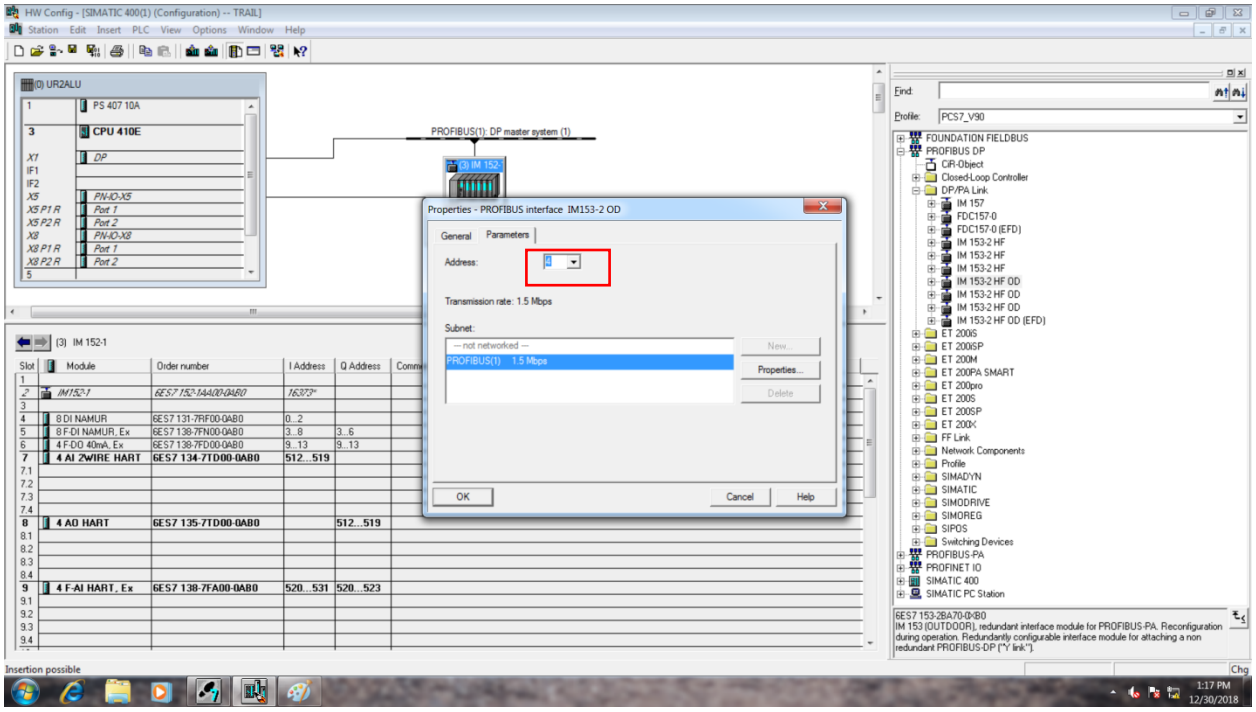
Now select **F_AI** module and **uncheck** all the channel.



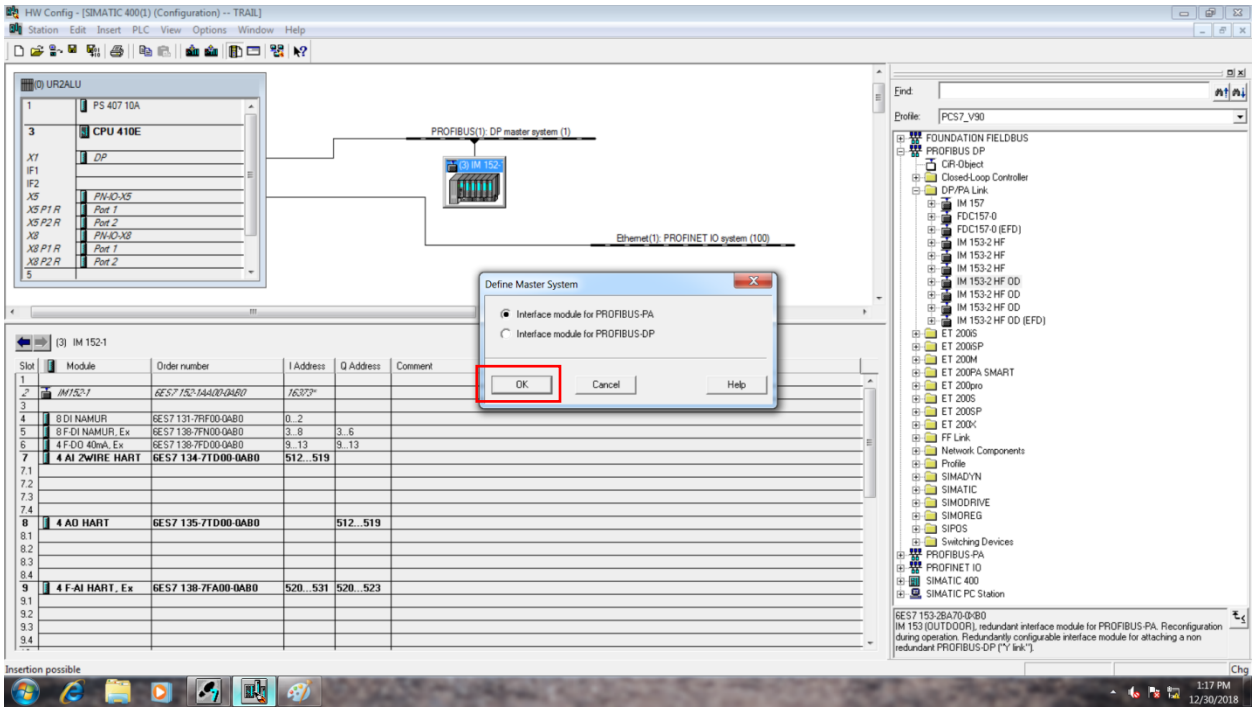
After finished the Remote I/O configuration, Go to **Profibus DP → DP/PA Link → IM 153-2 HF OD** (6ES7-153-2BA70-0XB0). Drag and drop to Profibus network.



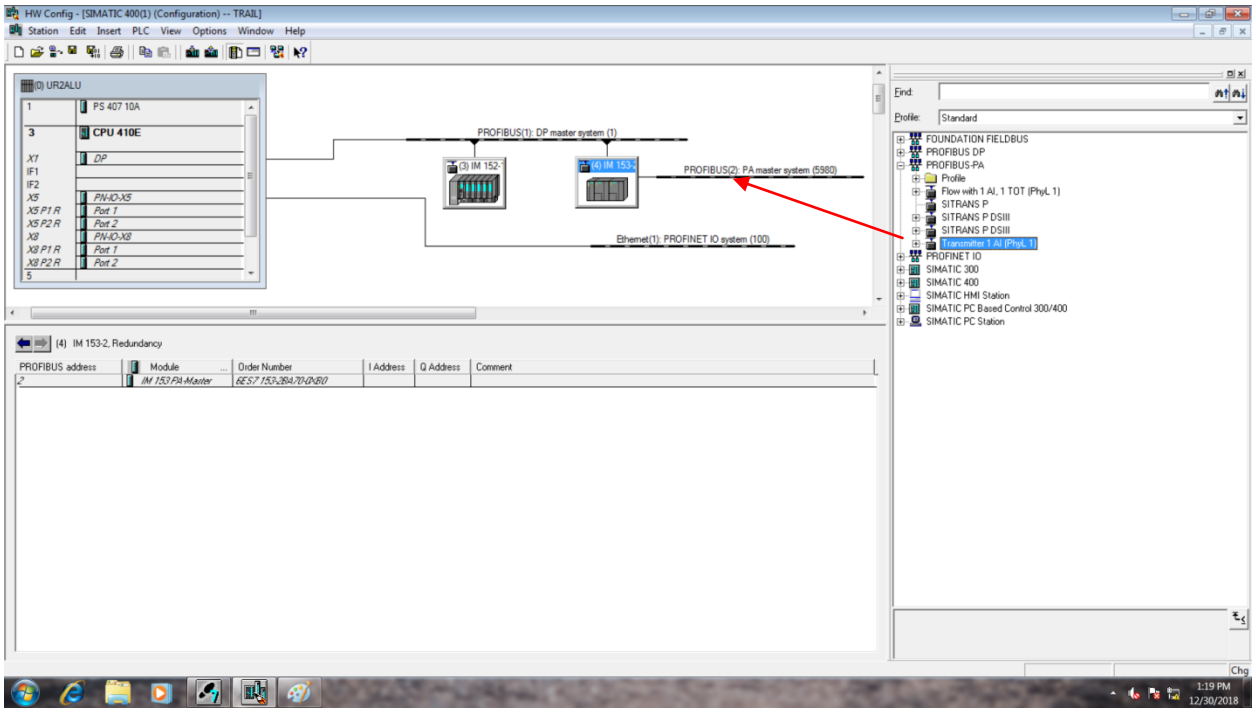
Set address as **4**



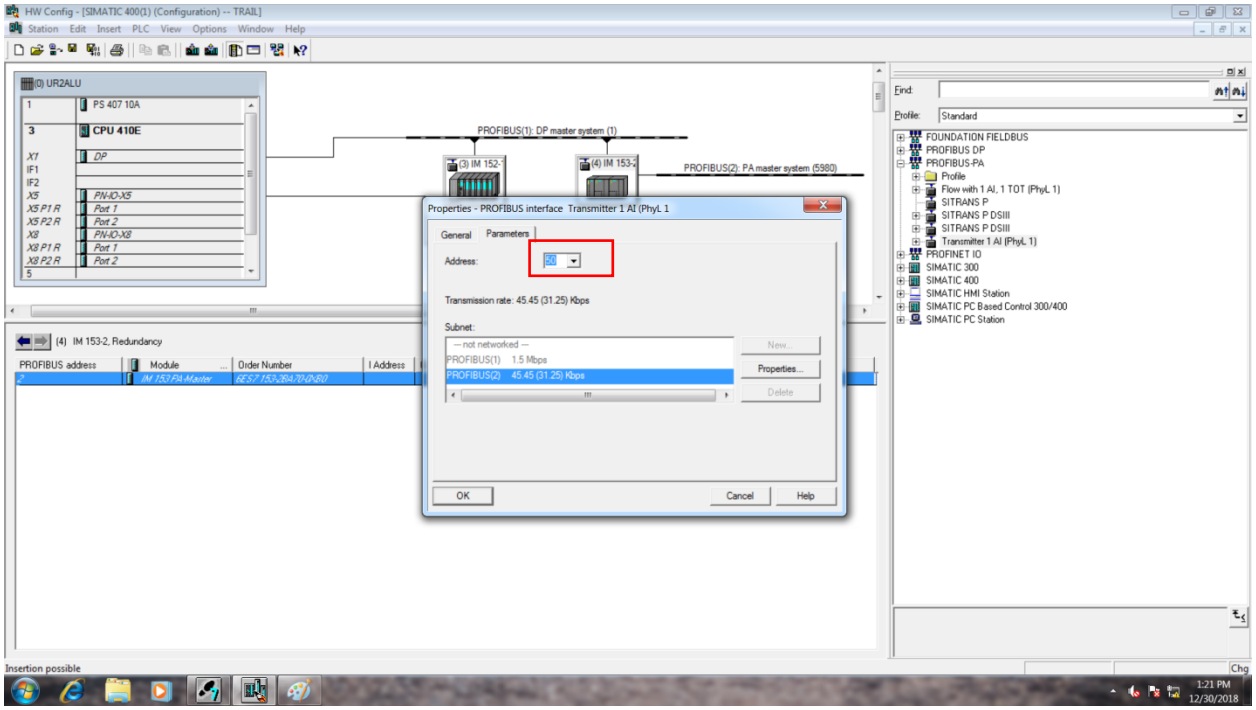
Select Interface module for **Profibus-PA**



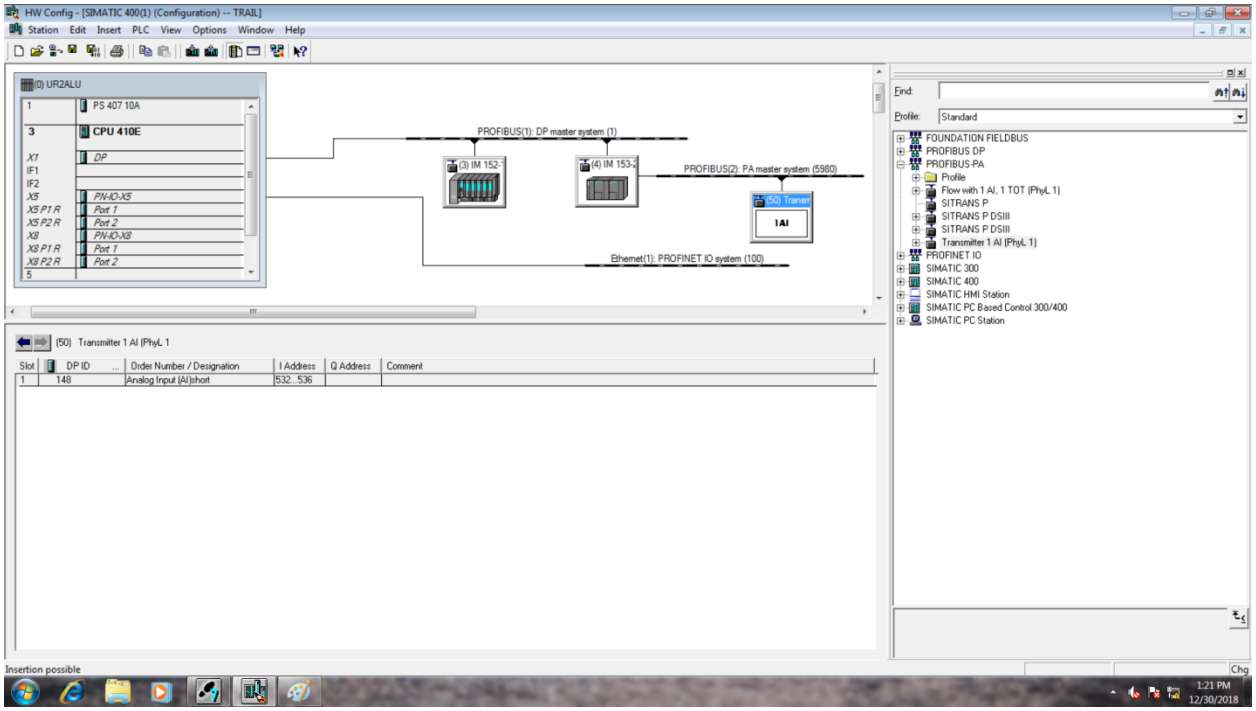
To Select the DPT Transmitter, go to **Profibus PA → Transmitter 1 AI**. drag and drop to Profibus PA network.



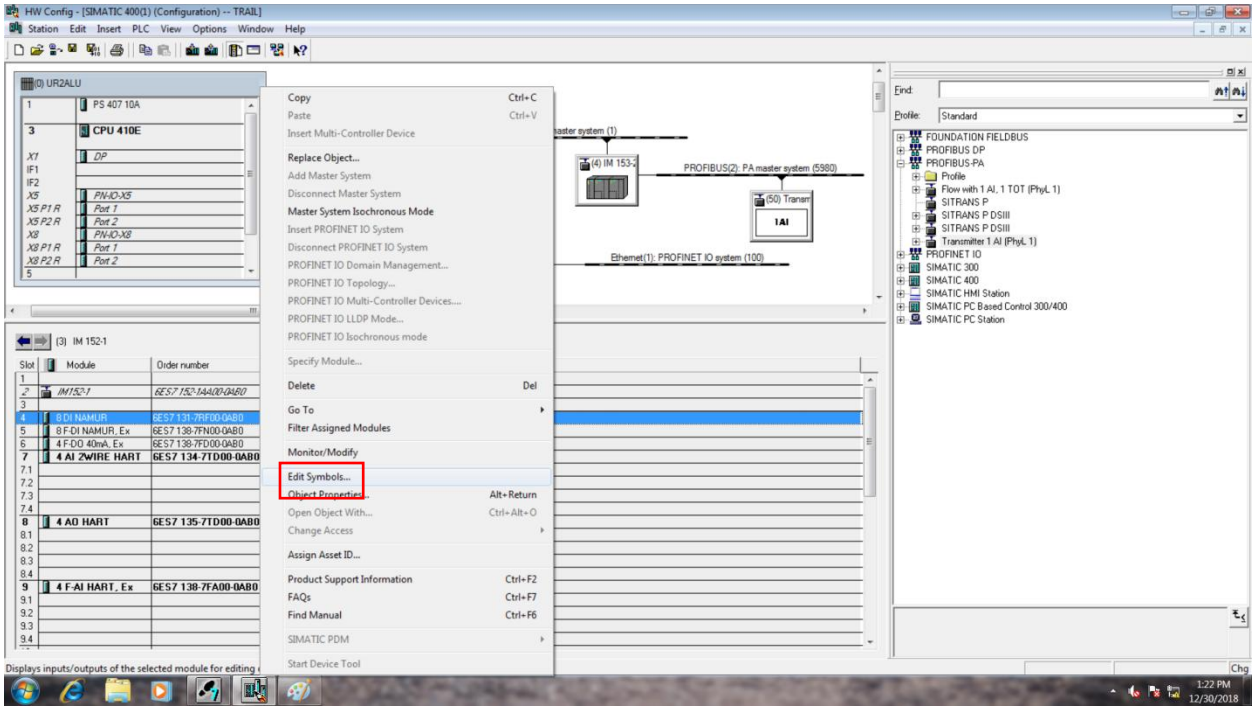
Set the address as **50** and click **ok**



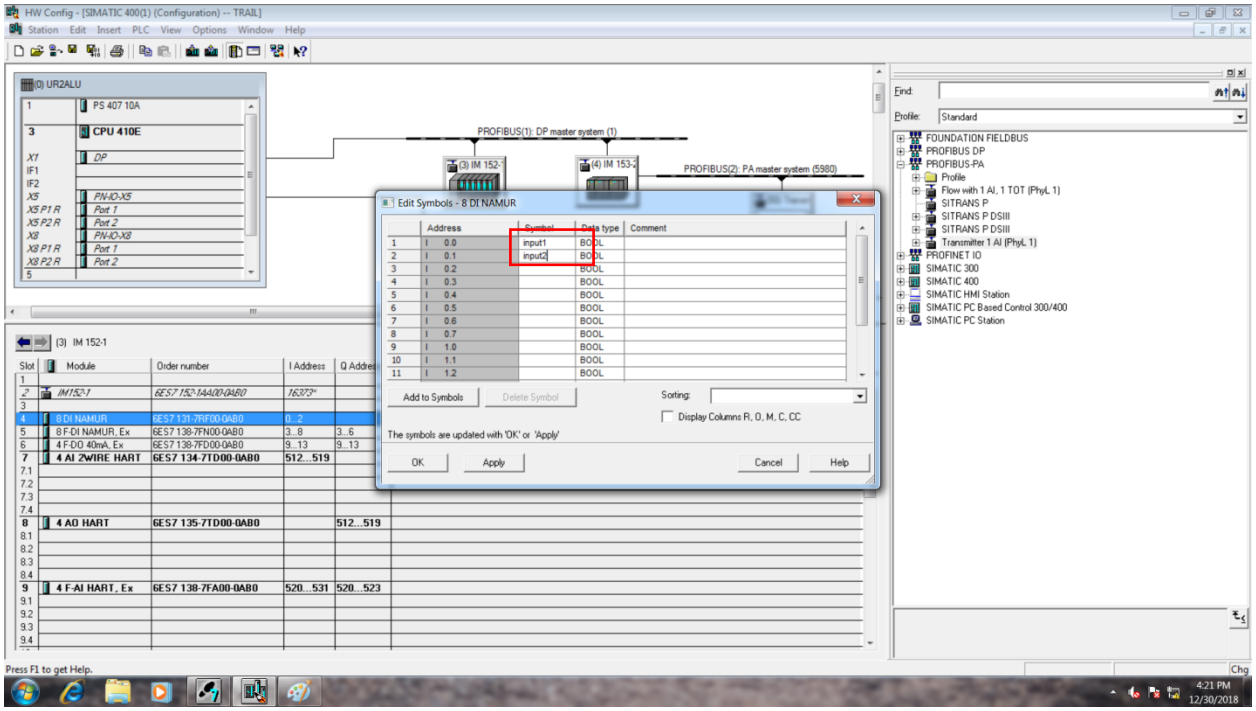
Now configuration hardware is finished.



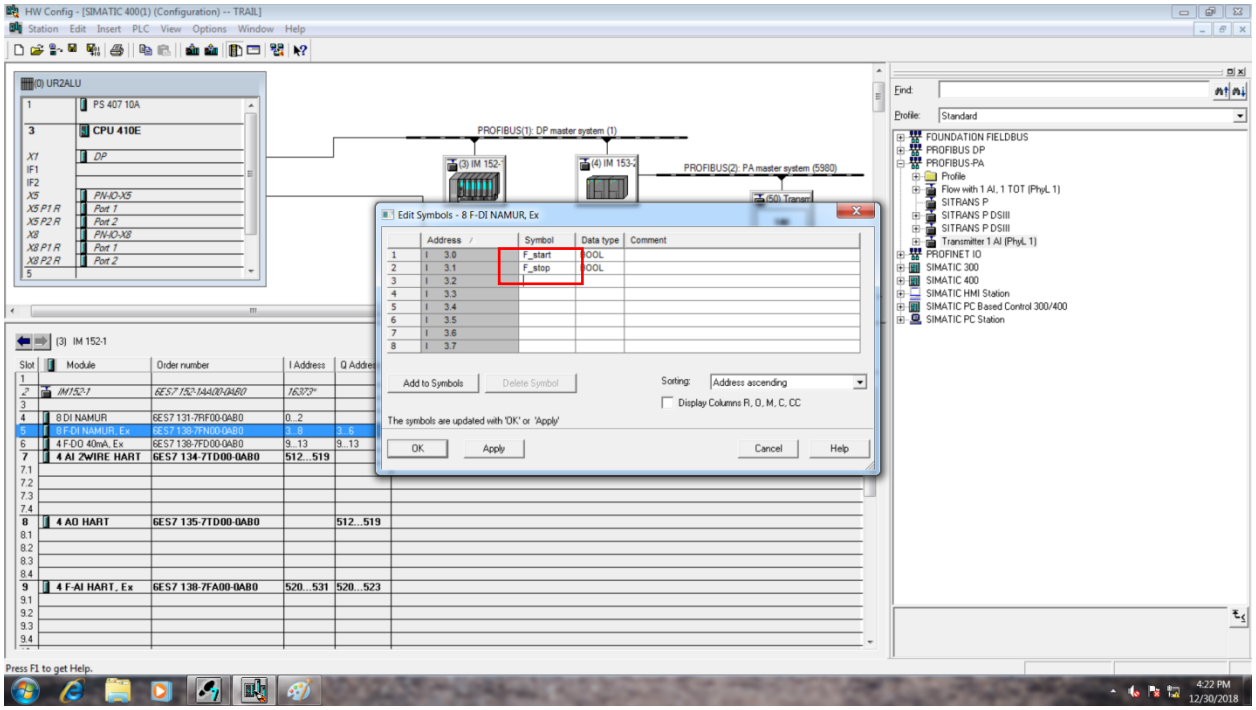
To create a symbolic names for input and outputs. Right the **DI** module and select **Edit symbol**.

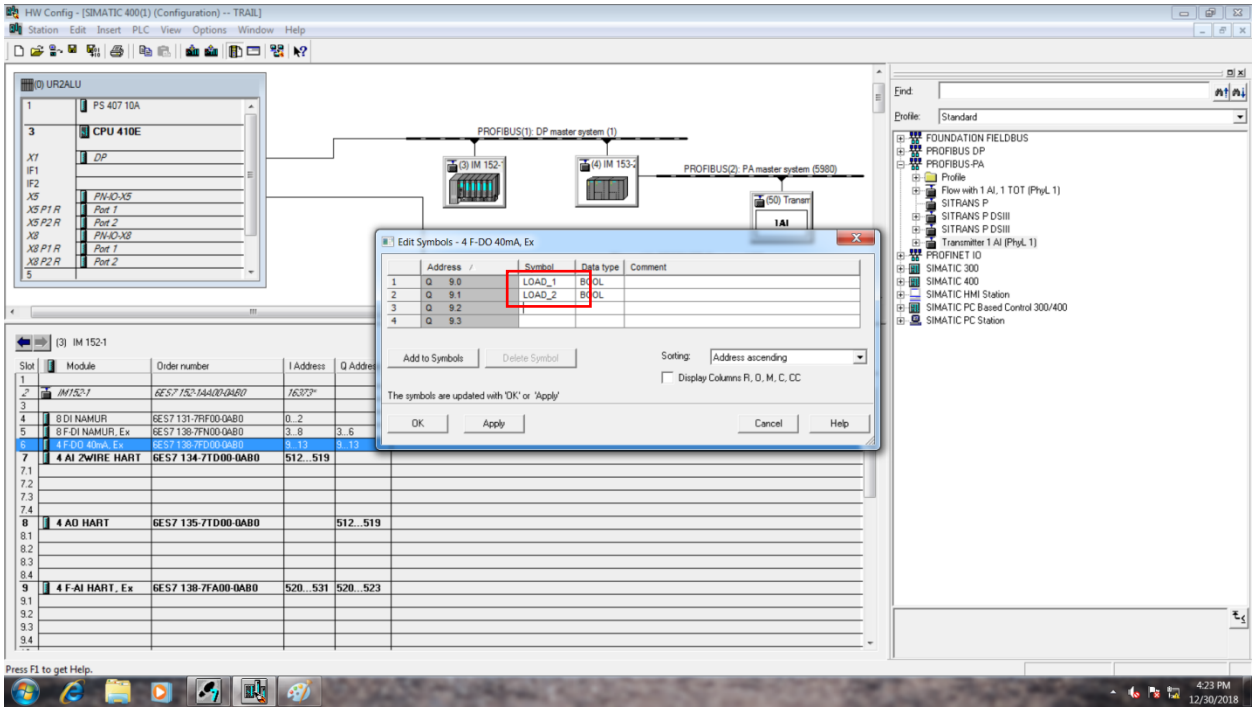


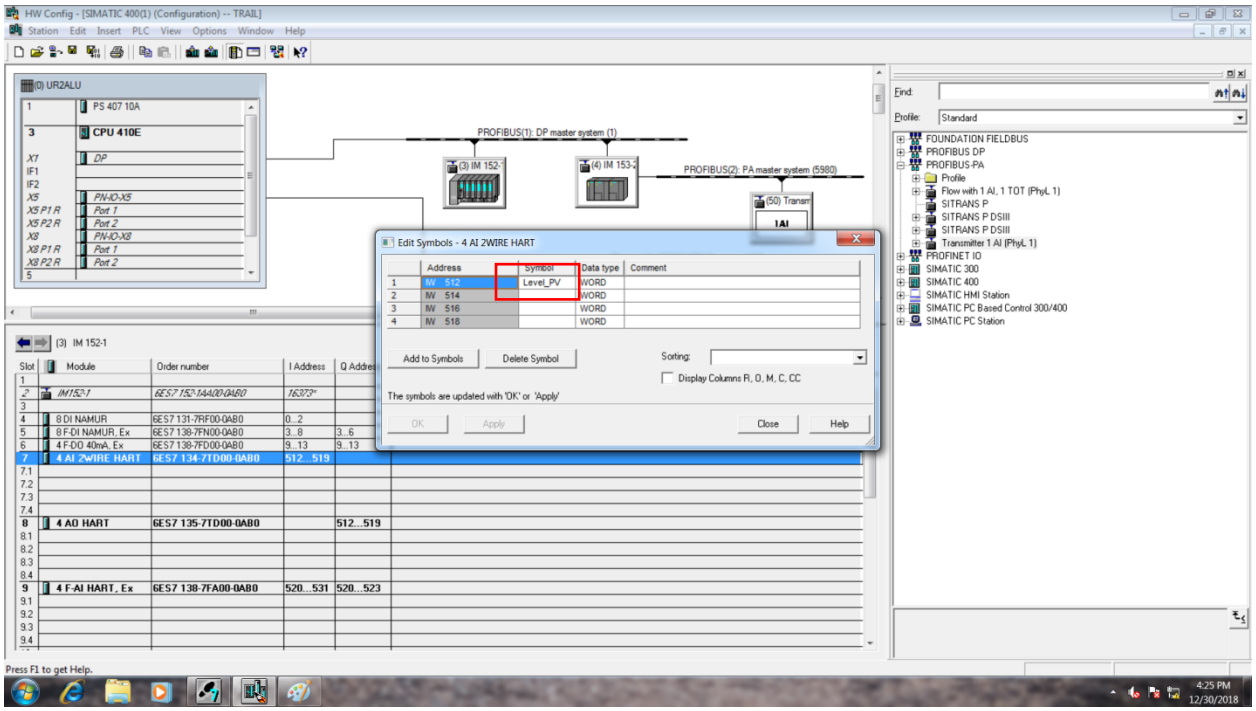
Create a name for inputs you are going to use in the program and click **ok**.

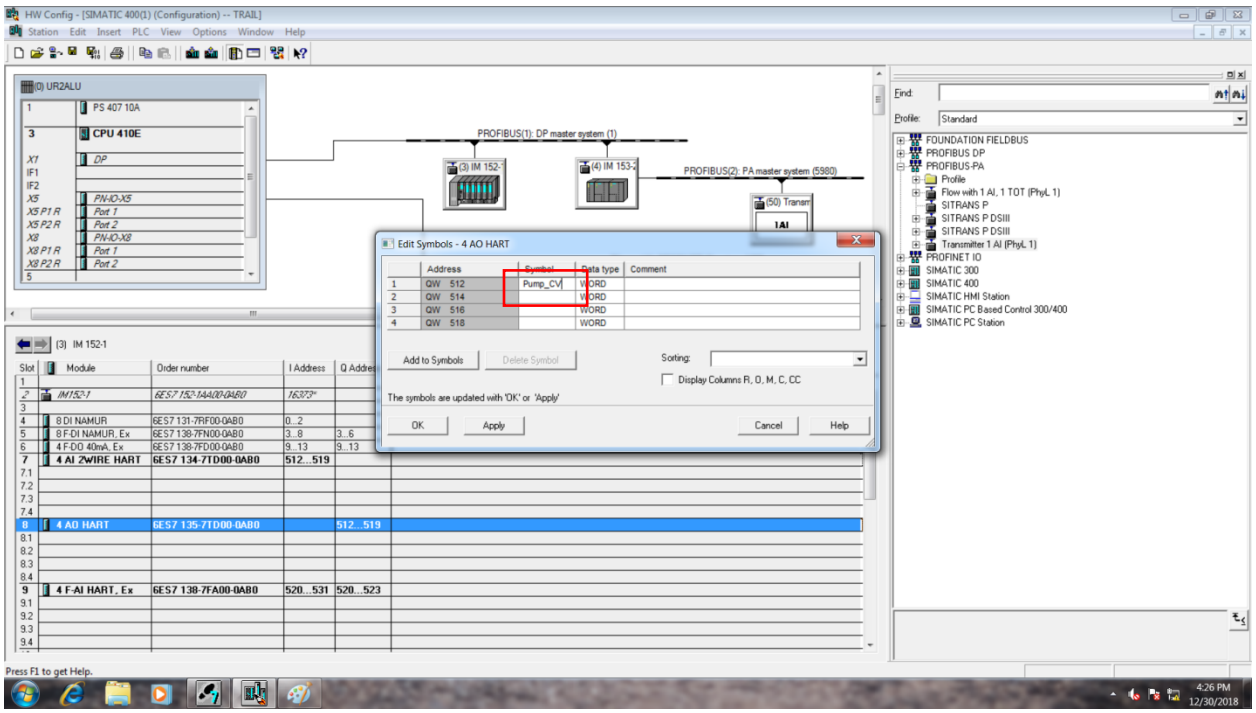


Repeat for all the module.

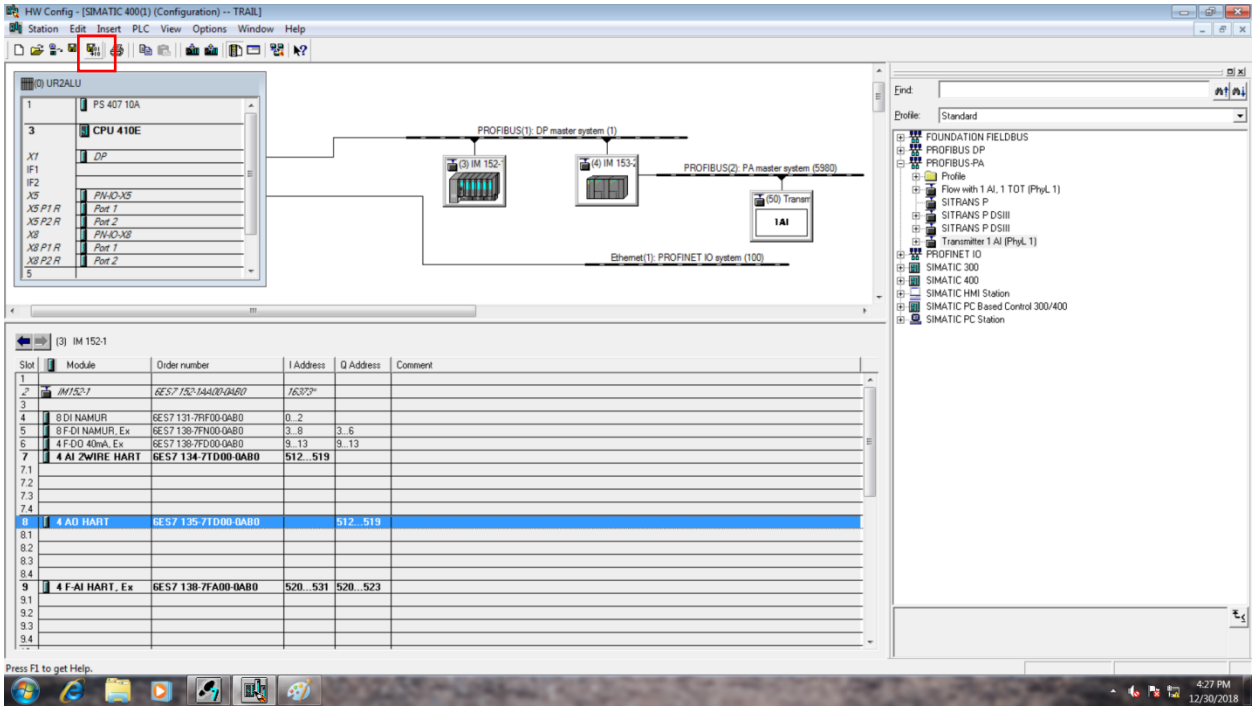




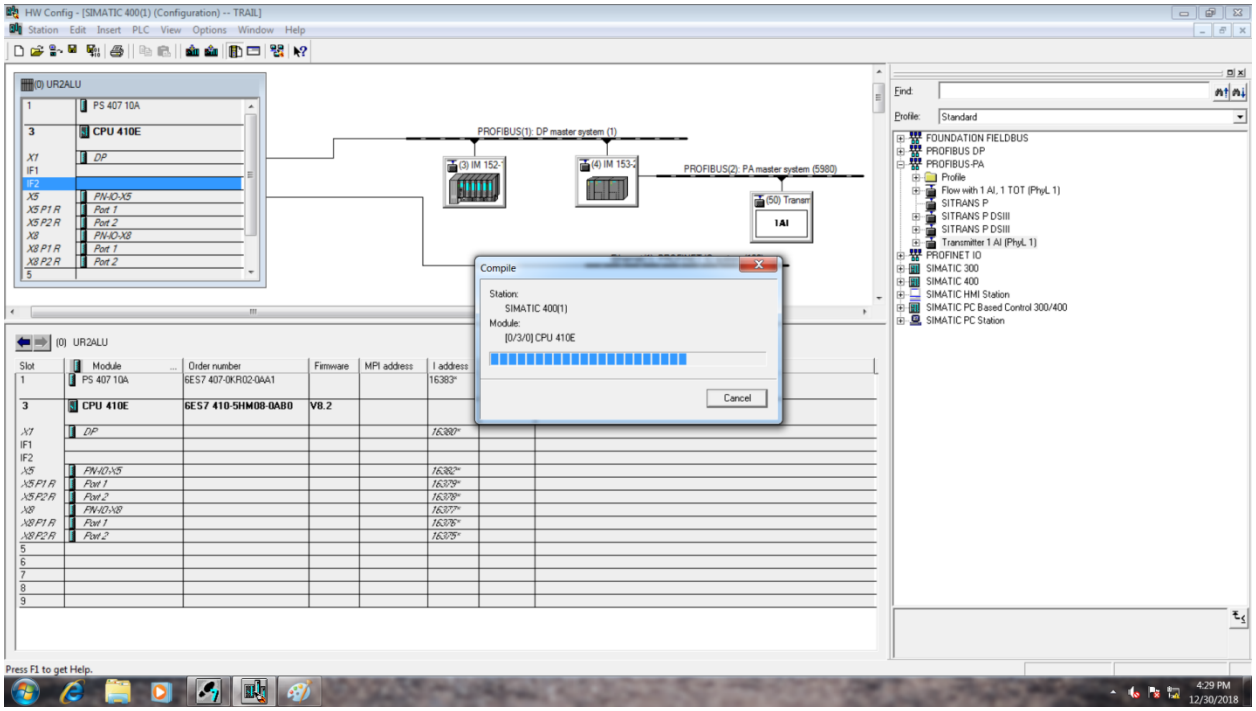

HW Config - [SIMATIC 400(1) (Configuration) -- TRAIL]
Edit Symbols - 4 AI 2WIRE HART
Address
Symbol
Data type
Comment
IW 512
Level_PV
WORD
Add to Symbols
Delete Symbol
Sorting:
Display Columns R, O, M, C, CC
The symbols are updated with 'OK' or 'Apply'
OK
Apply
Close
Help
PROFIBUS(1): DP master system (1)
PROFIBUS(2): PA master system (5980)
4 AI 2WIRE HART
6ES7 134-7TD00-0AB0
4 AO HART
6ES7 135-7TD00-0AB0
4 F-AI HART, Ex
6ES7 138-7FA00-0AB0


HW Config - [SIMATIC 400(1) (Configuration) -- TRAIL]
Edit Symbols - 4 AO HART
Address
Symbol
Data type
Comment
QW 512
Pump_CV
WORD
Add to Symbols
Delete Symbol
Sorting:
Display Columns R, O, M, C, CC
The symbols are updated with 'OK' or 'Apply'
OK
Apply
Cancel
Help
PROFIBUS(1): DP master system (1)
PROFIBUS(2): PA master system (5980)
4 AI 2WIRE HART
6ES7 134-7TD00-0AB0
4 AO HART
6ES7 135-7TD00-0AB0
4 F-AI HART, Ex
6ES7 138-7FA00-0AB0

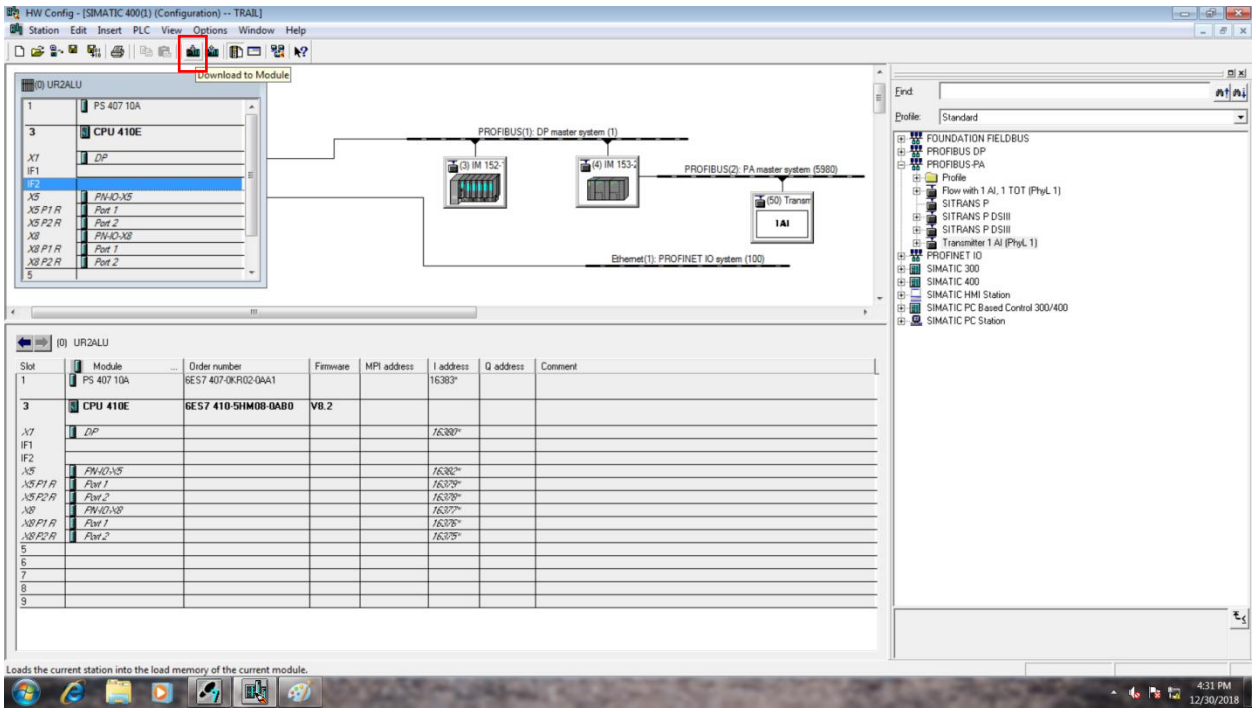
After finished the Process, Click **Save and compile**.



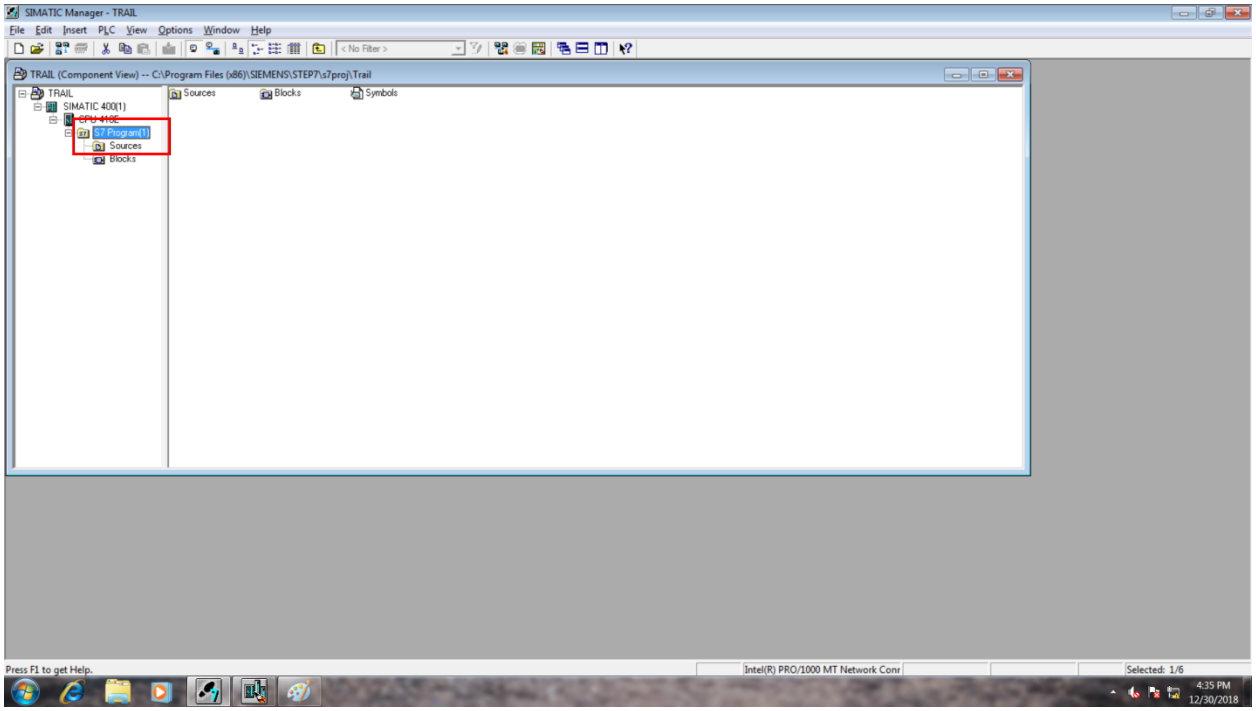
Compile will proceed.



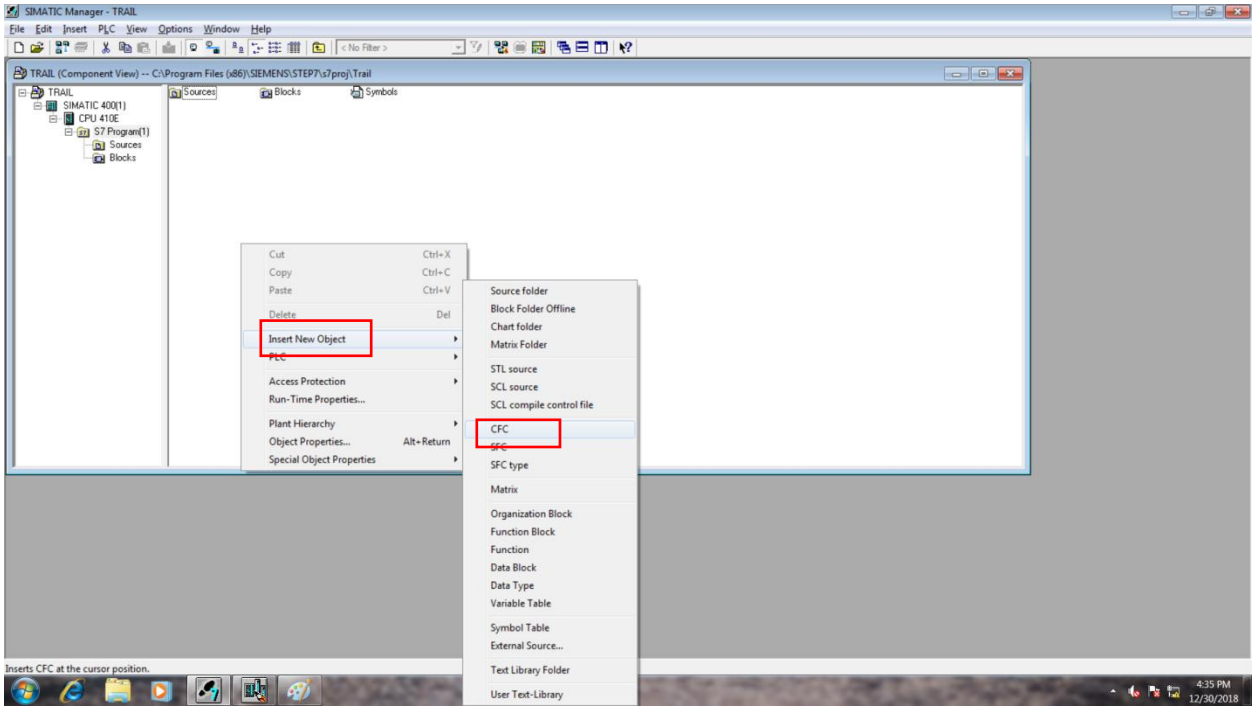
Click **Download**.



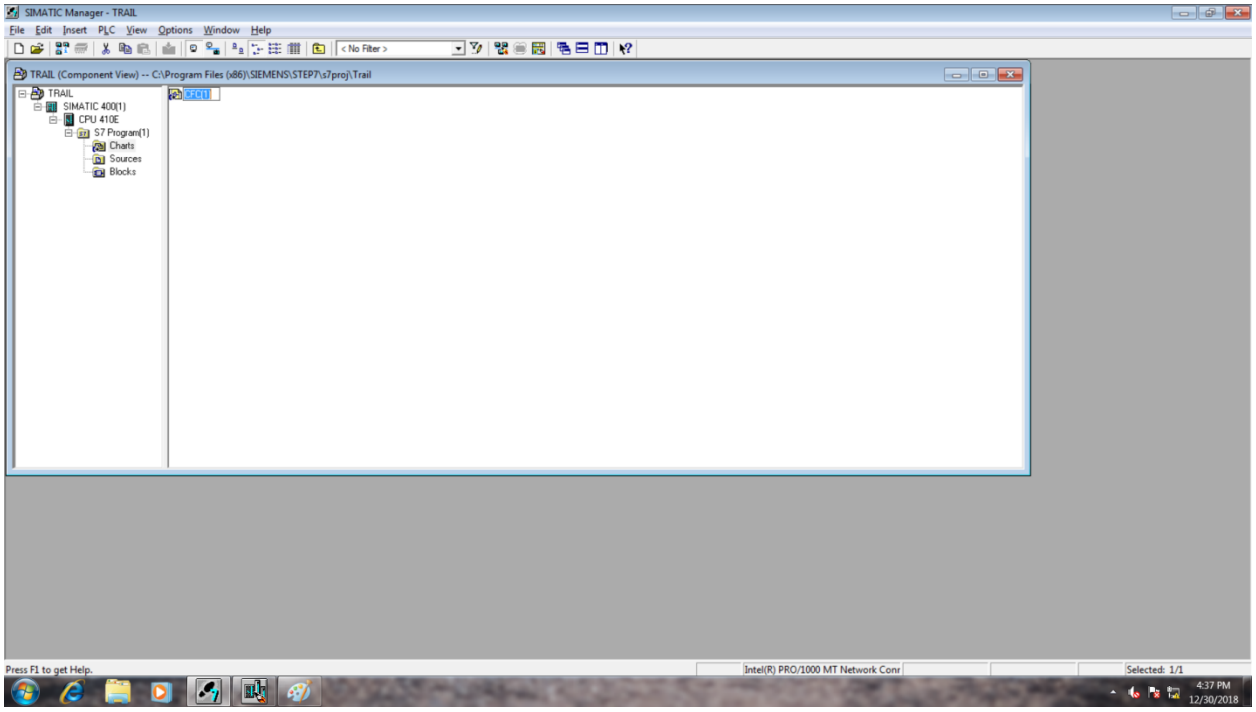
After finishing the Hardware configuration, go to Simatic manager window. Click on **S7 Program**.



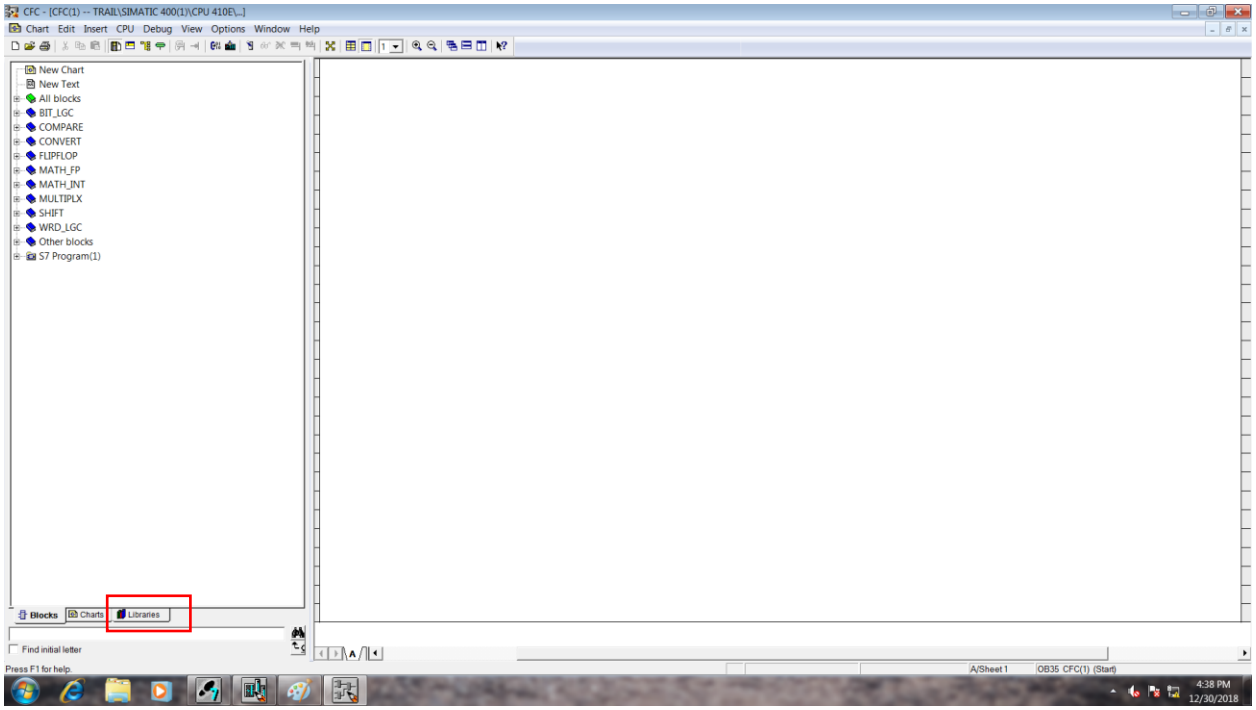
Right Click on Work area and click **Insert New Object → CFC**.



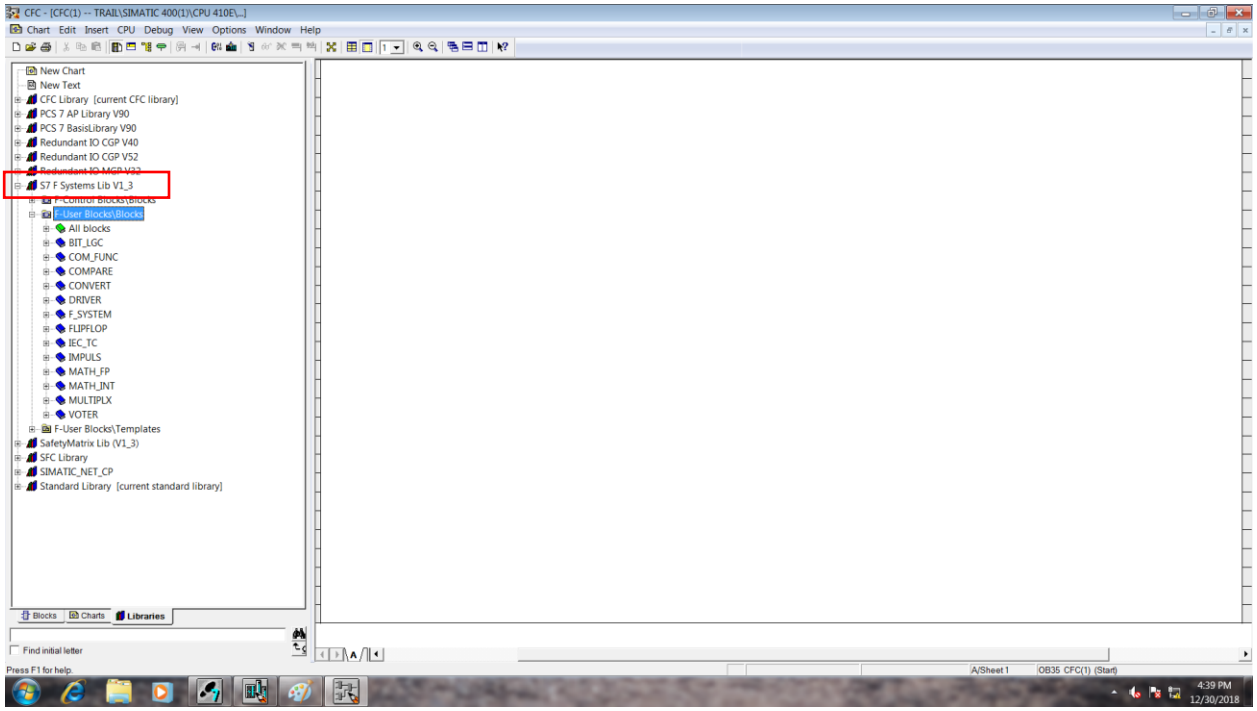
A new CFC Will is created under the **Chart** Folder. Click to Open the **CFC**.



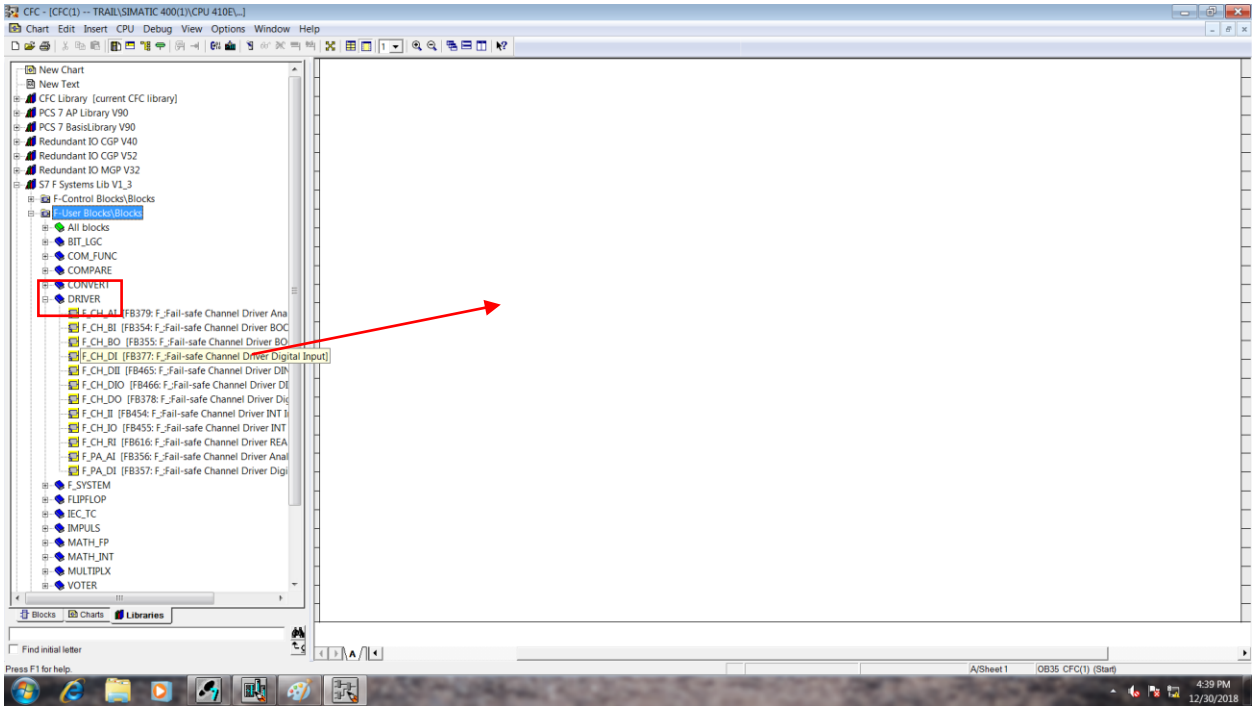
To start the Program, Go to **Library** tab.



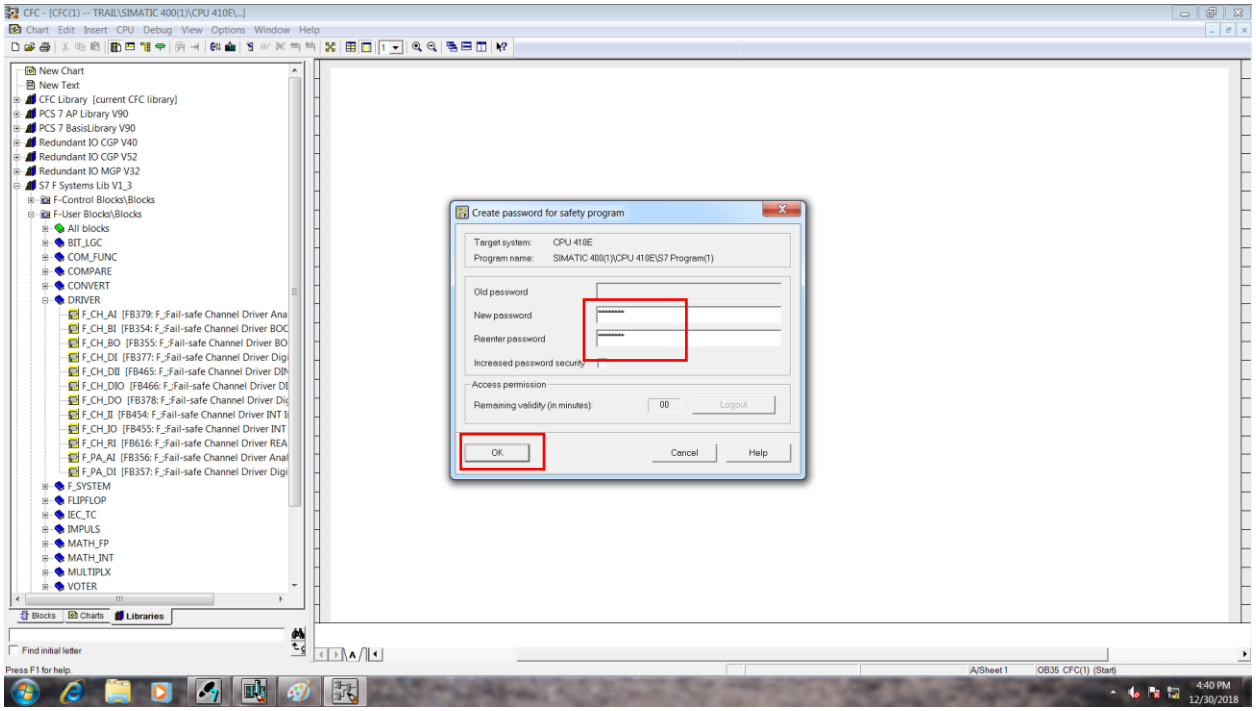
To use safety I/O's, Open the Folder "**S7 F System Lib V1.3**" and go to **F- User Blocks\Blocks**



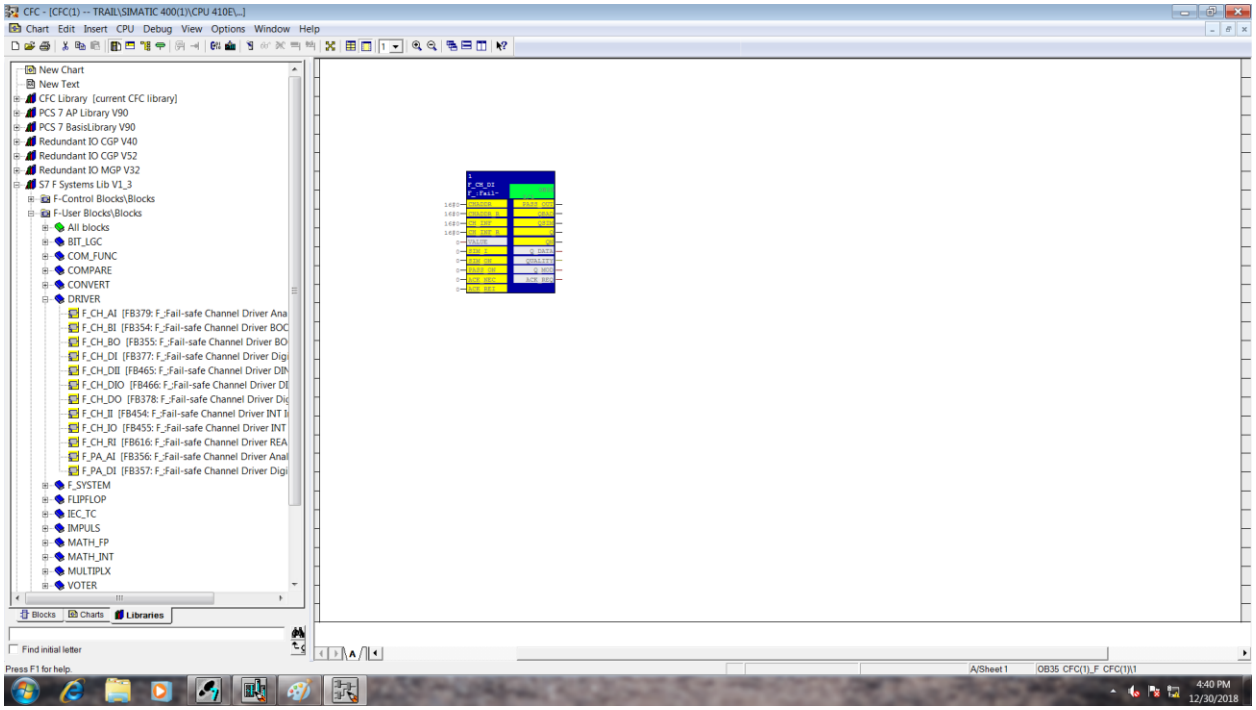
To add a Digital Input, Select **Channel Driver Digital Input** from **Driver** folder.



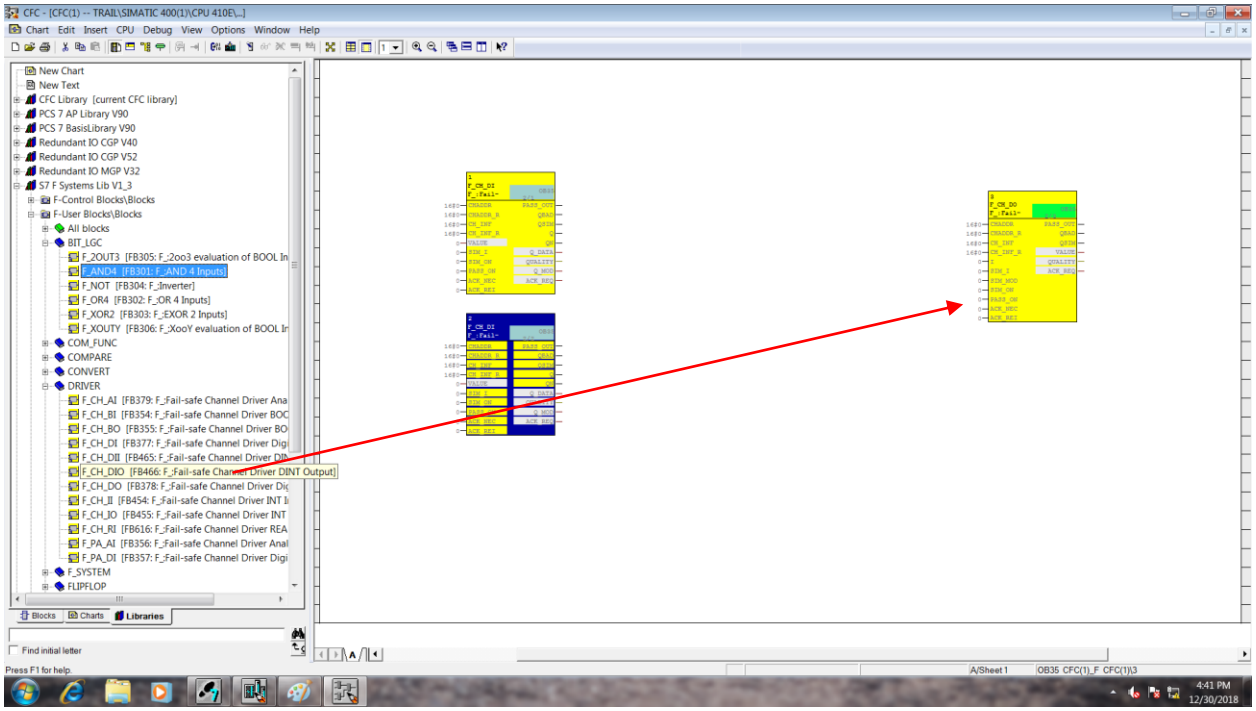
When you drag and drop the Block into the chart, it shows a popup to create a password. It is Compulsory to create a password to program for a safety input and outputs



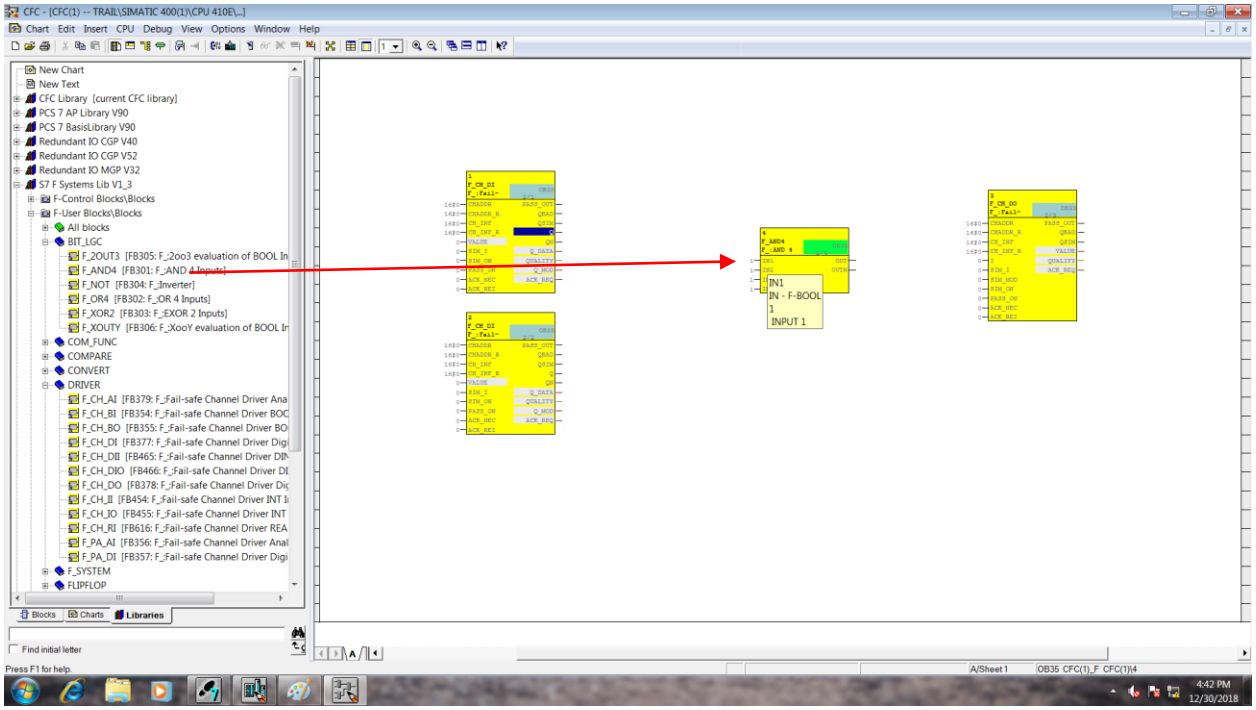
Once you created a Password, Block will be generated.



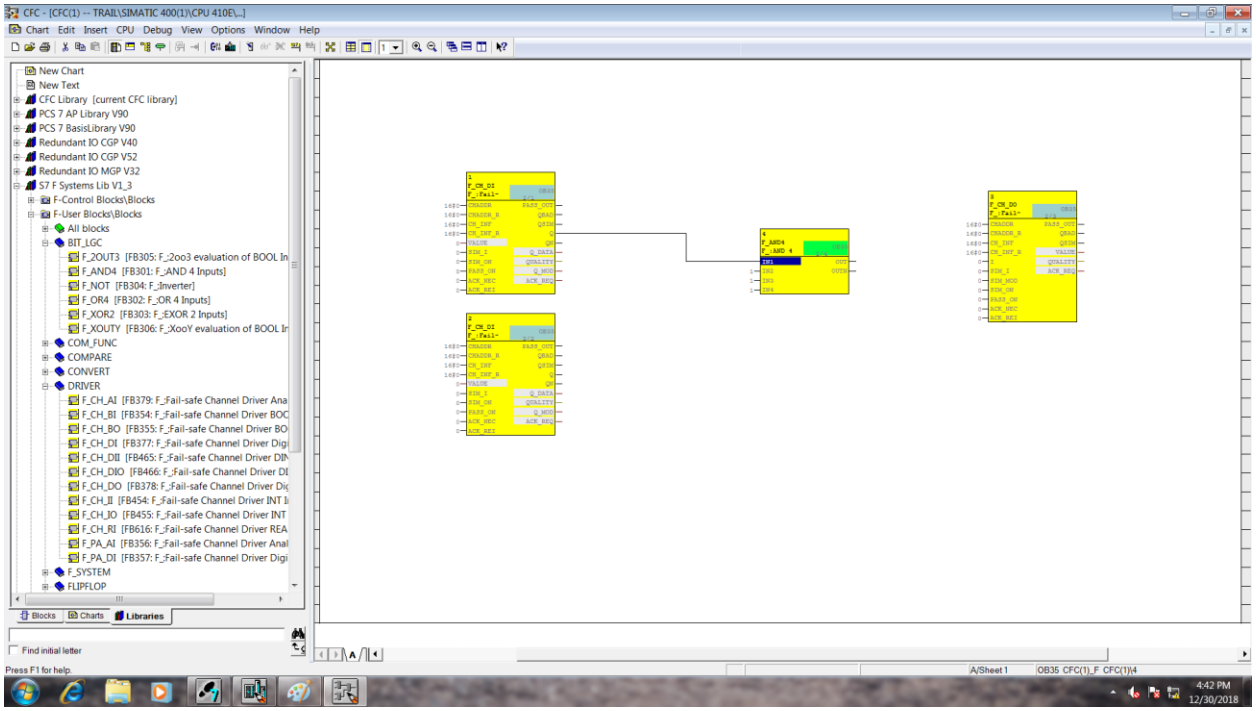
To make a ADD gate logic, Make Two Input Blocks and one Output blocks from the Driver folder.



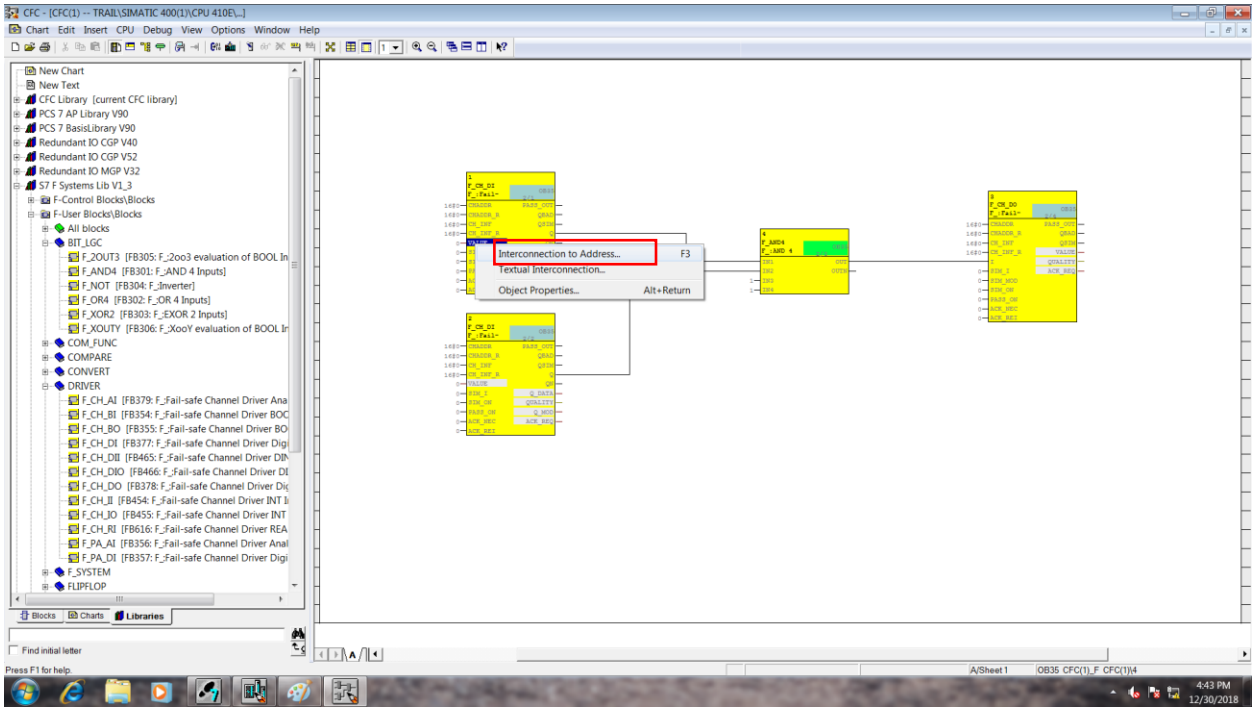
For ADD GATE, Go to **BIT_LGC → F_AND4** and Drag and drop the block.



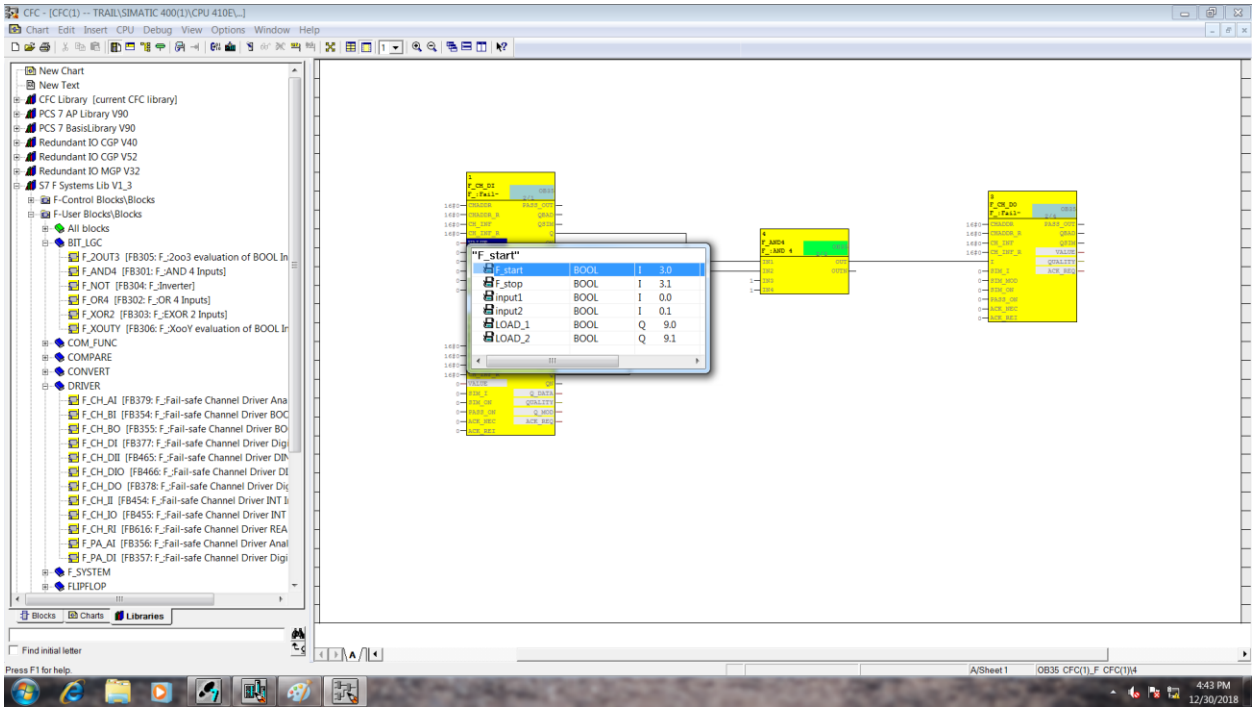
Click on respective input and output terminals for interconnections as shown in the image.



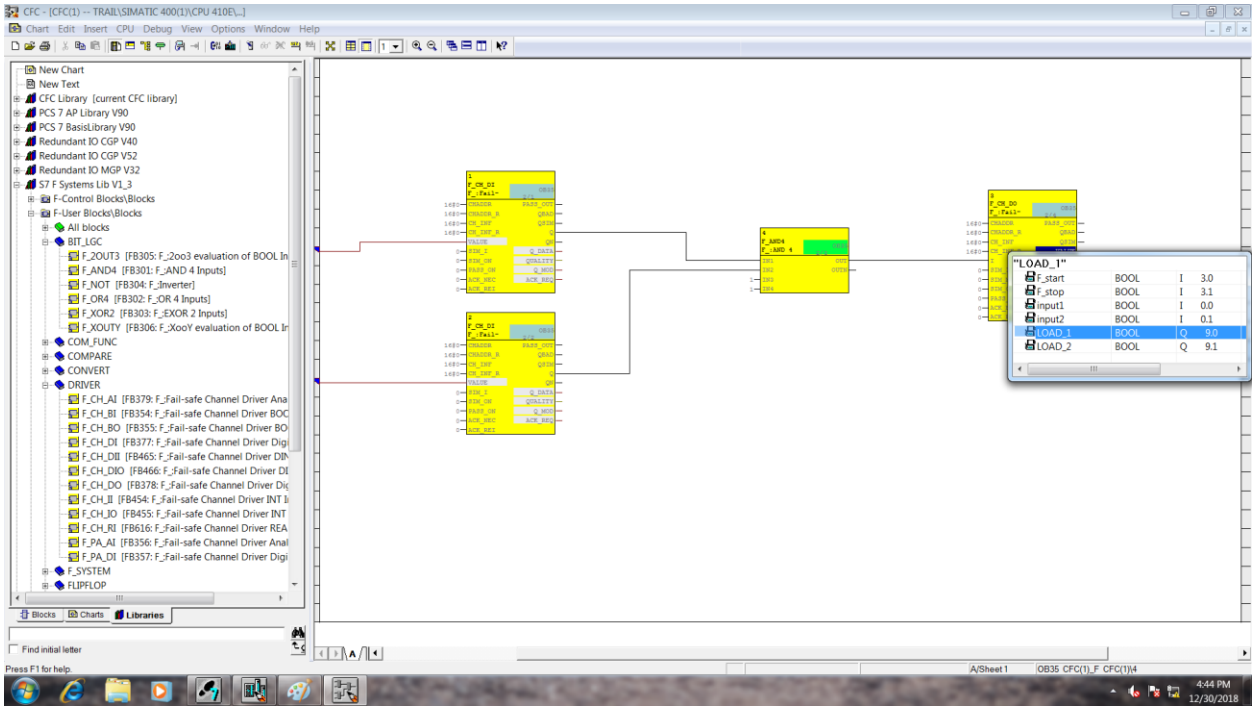
To connect Inputs, right click on Value in Input driver block and select **interconnection to Address**.



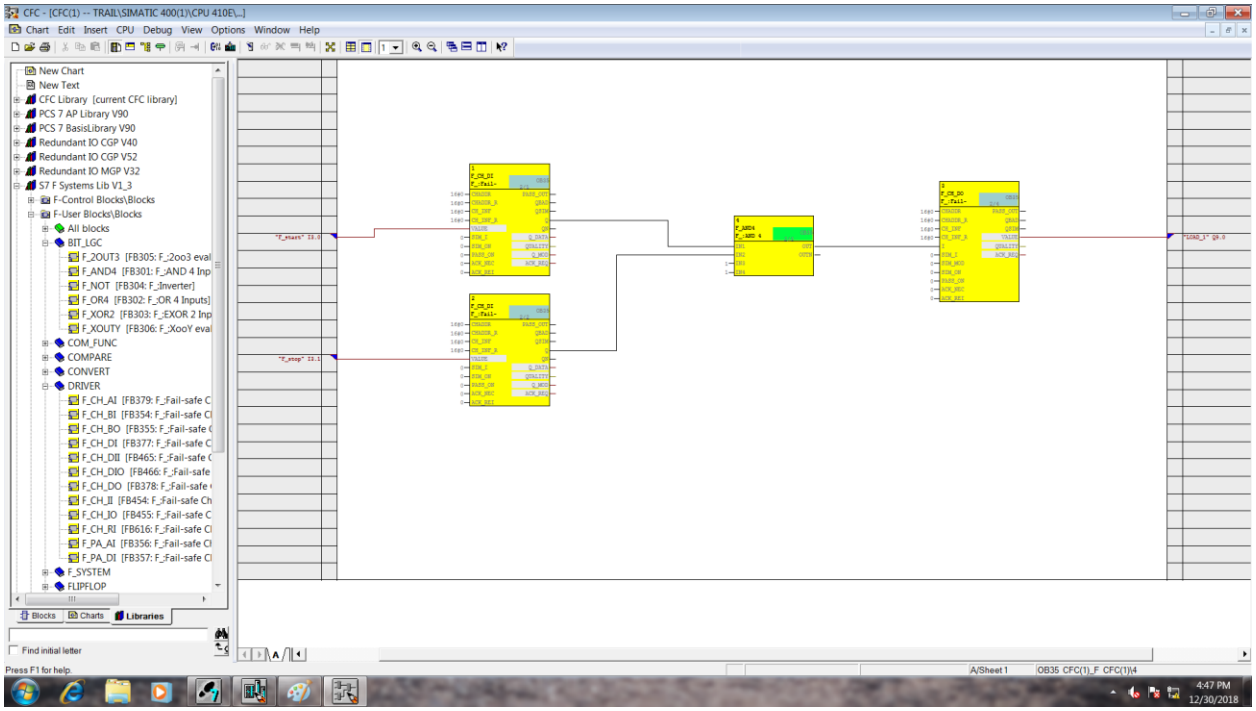
It will show the I/O List. Select **F_start**.



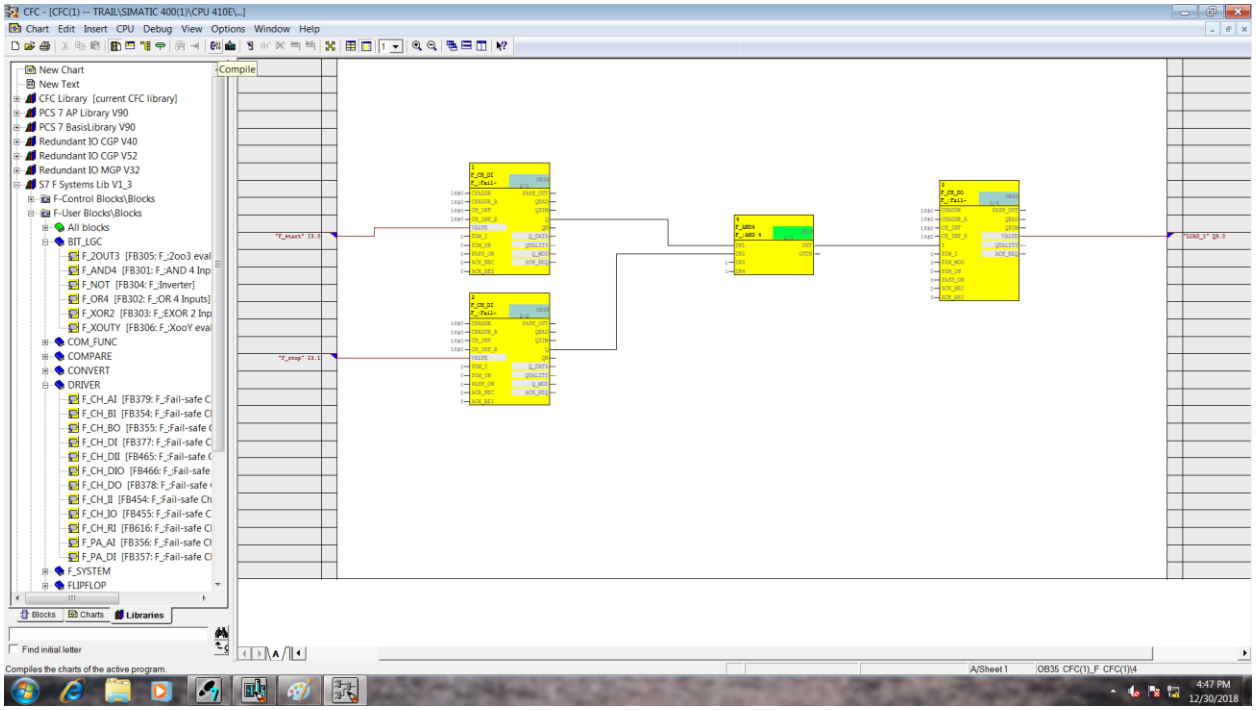
Proceed the Same for both inputs and outputs



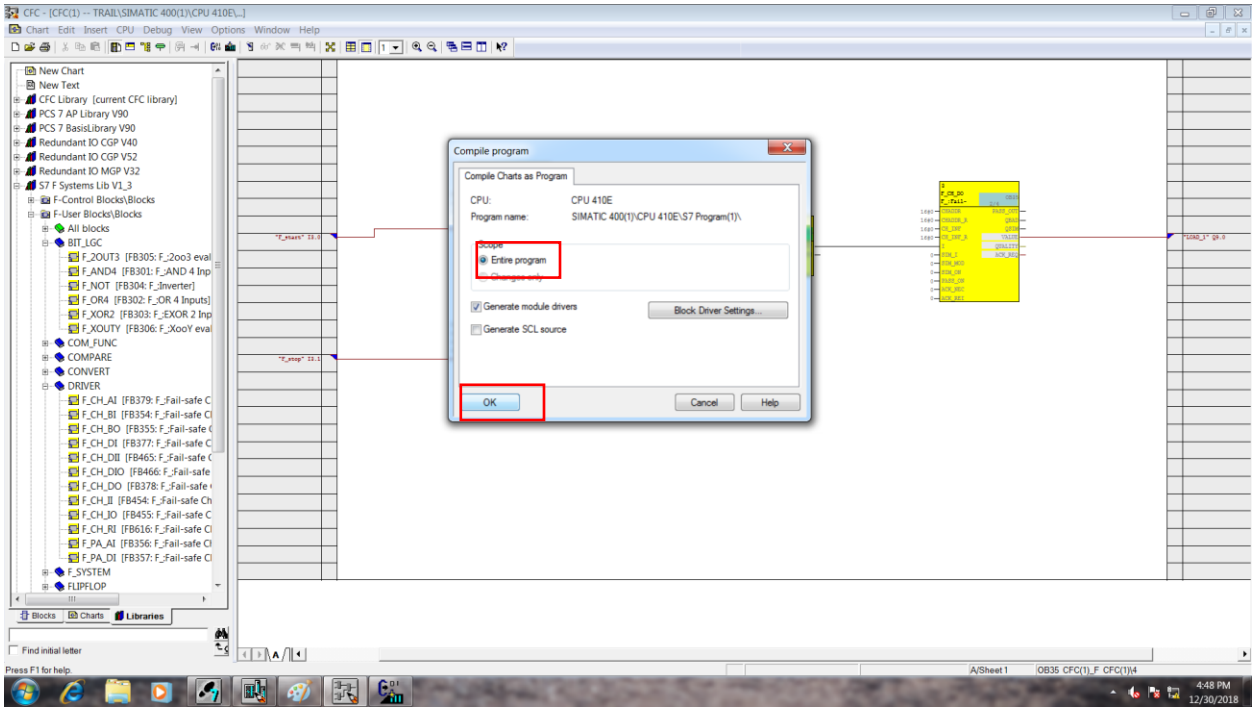
Check whether you had made all the connection.



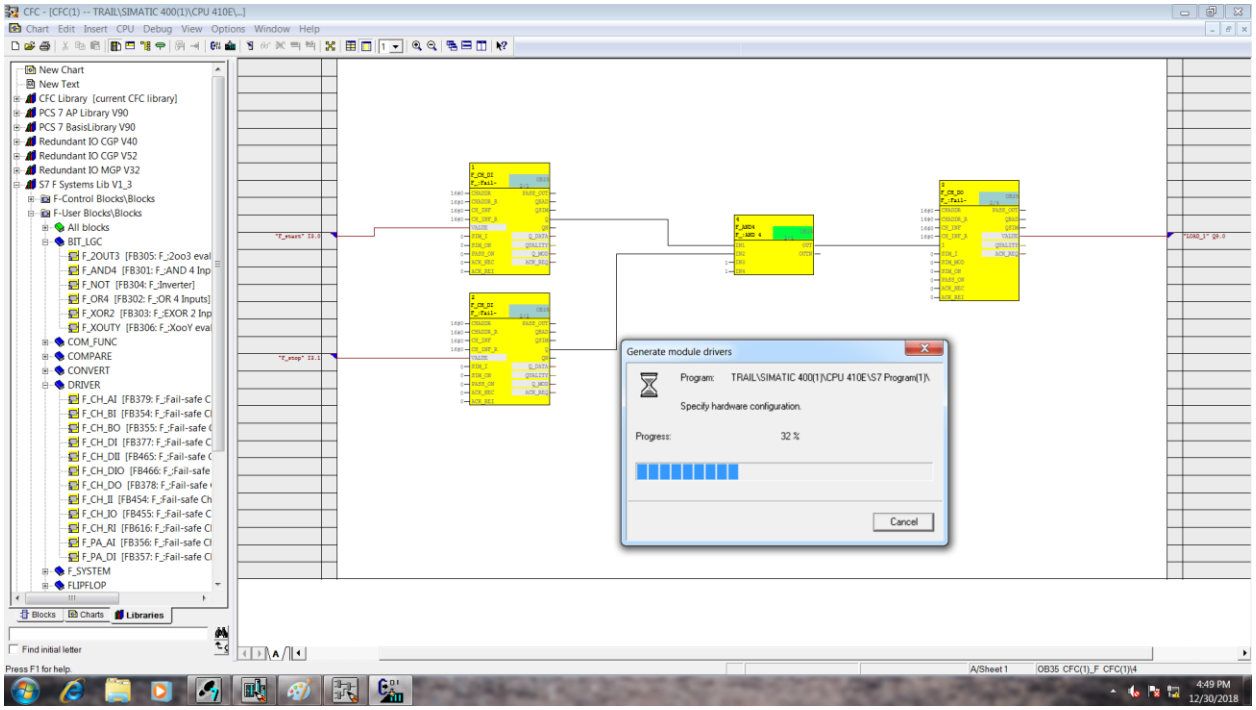
Next Select "**compile**" on the Tool Bar



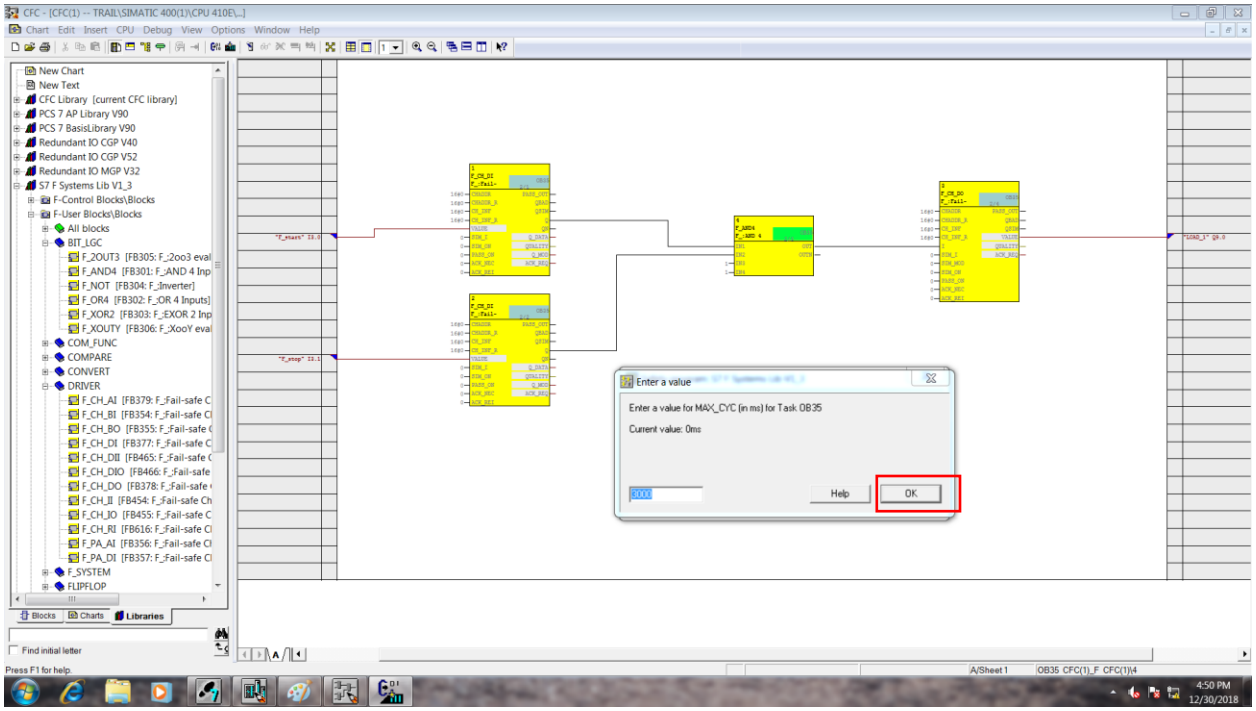
Select **Entire Program** and click **OK**



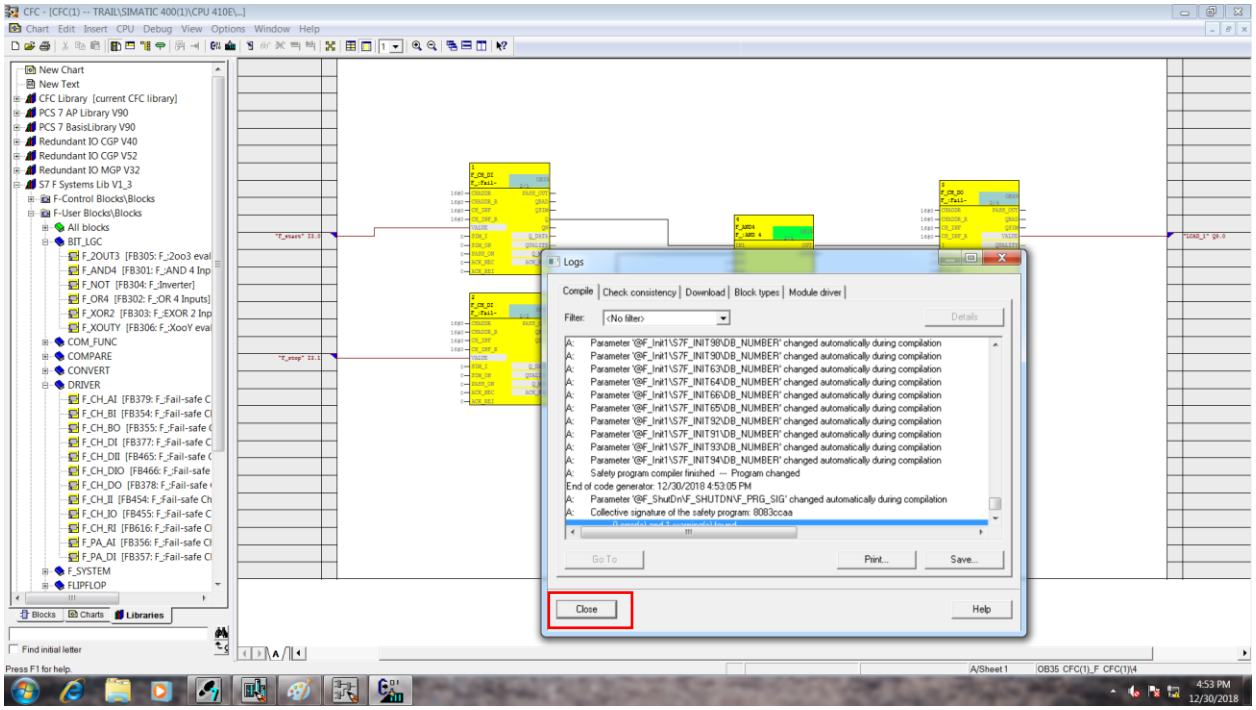
Compilation will proceed and it takes Few minutes to complete.



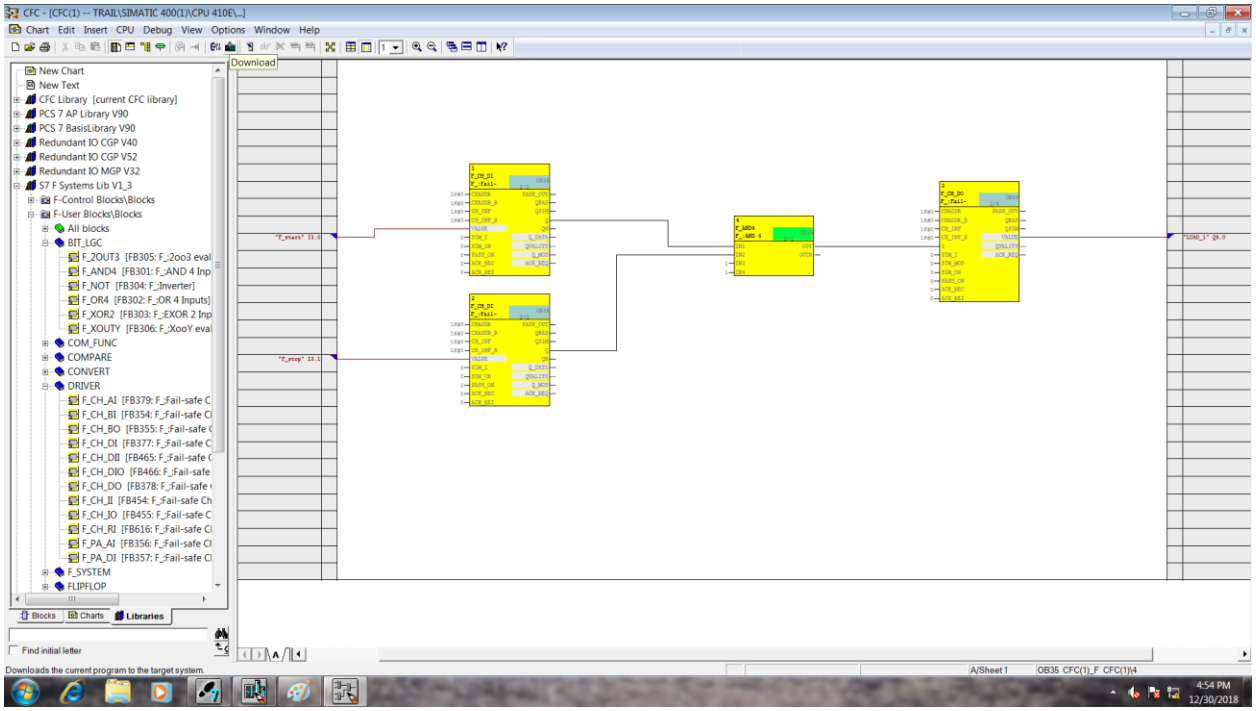
Click **OK**.



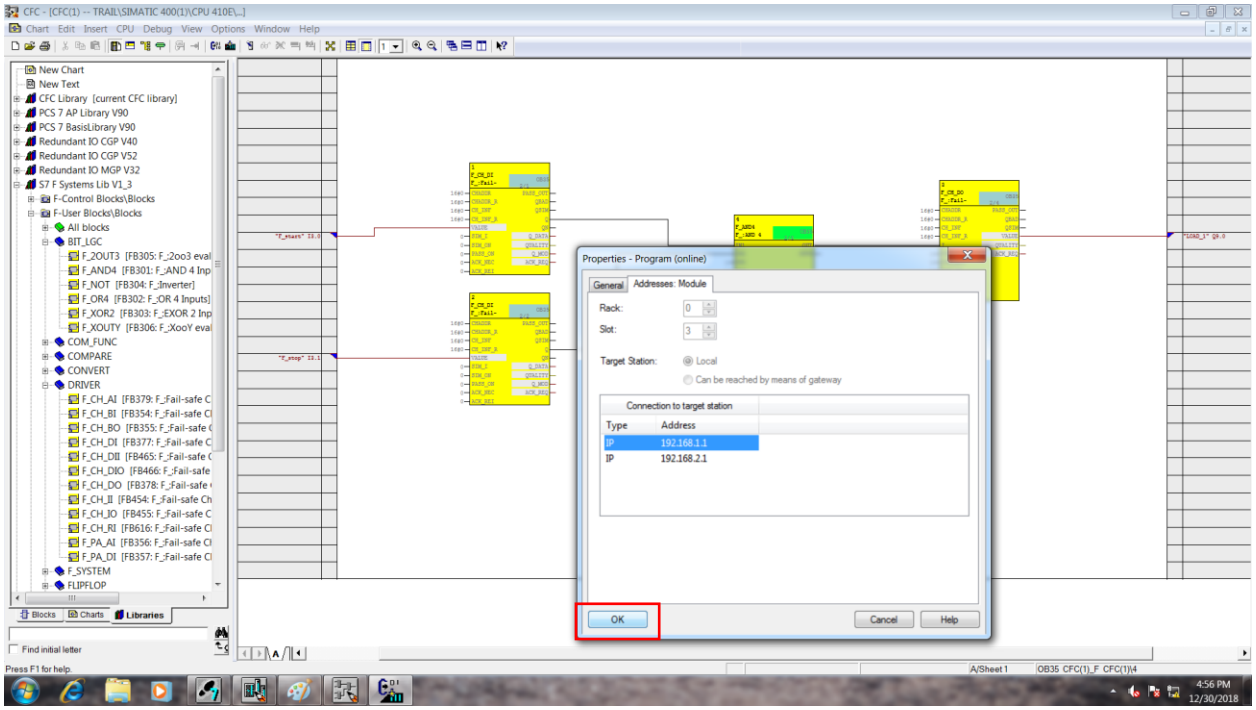
Click **Close**.



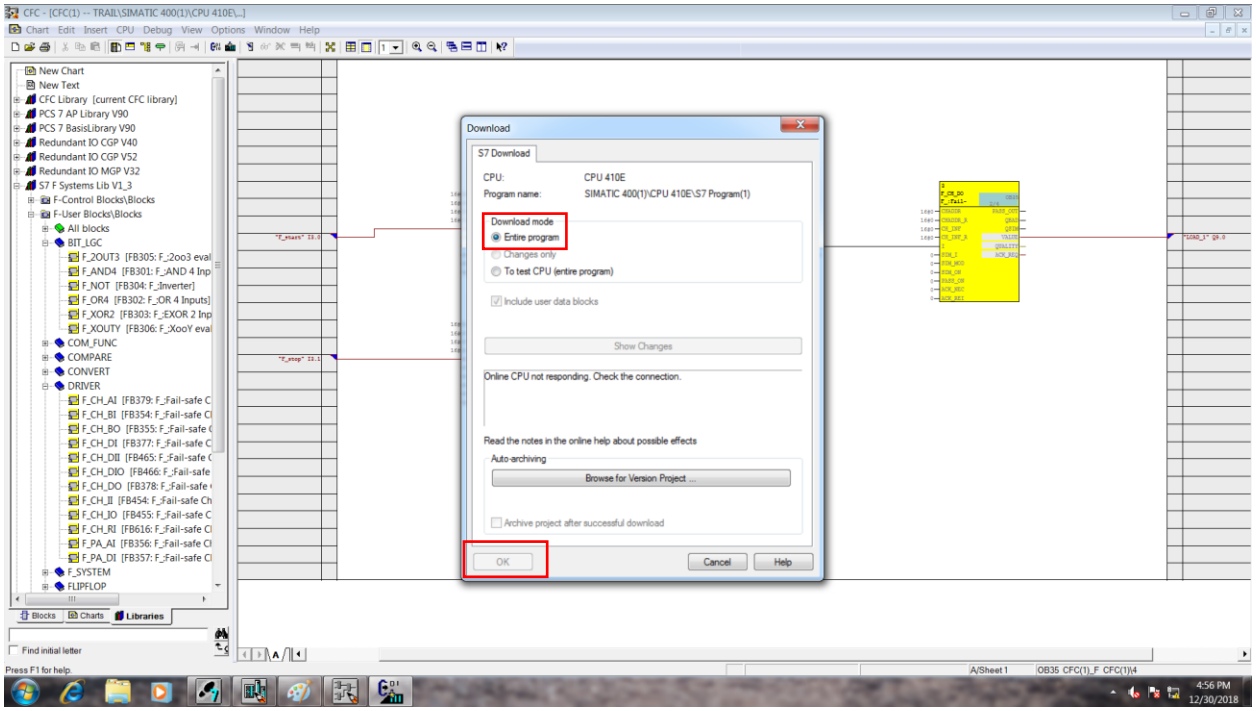
Next click **Download**.



Select **192.168.1.1** and click **OK**

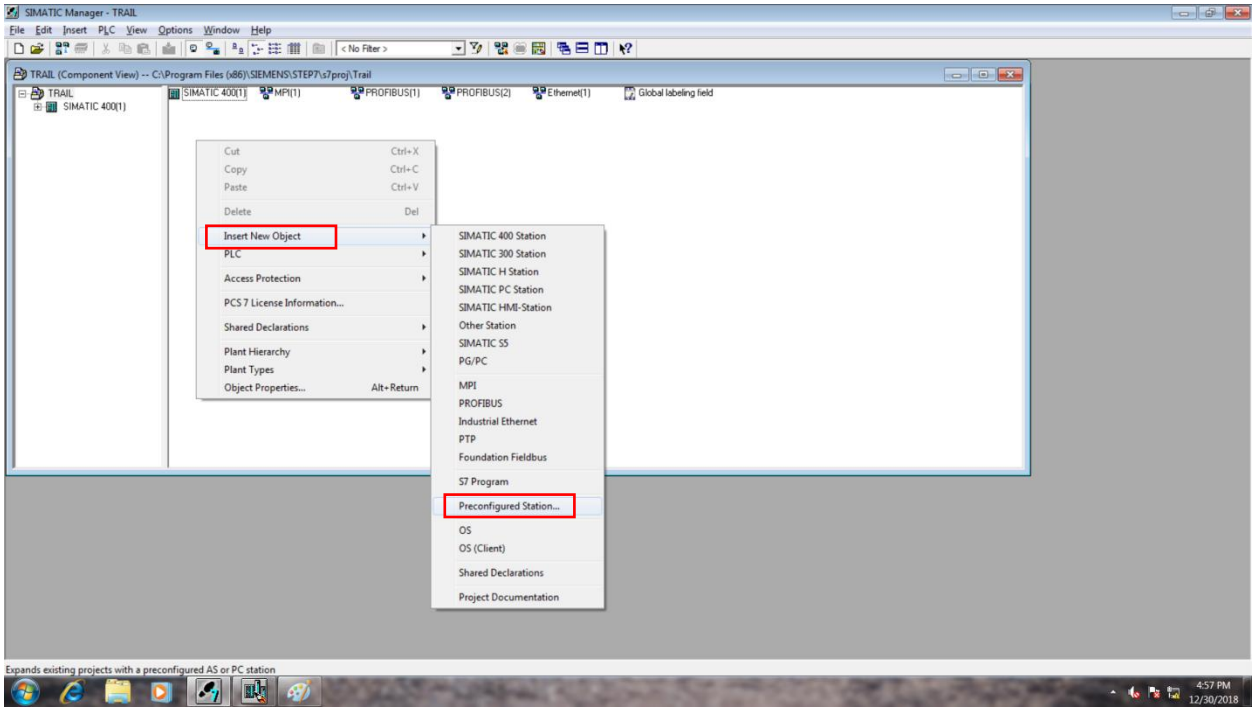


Click **Entire Program** and click **OK**

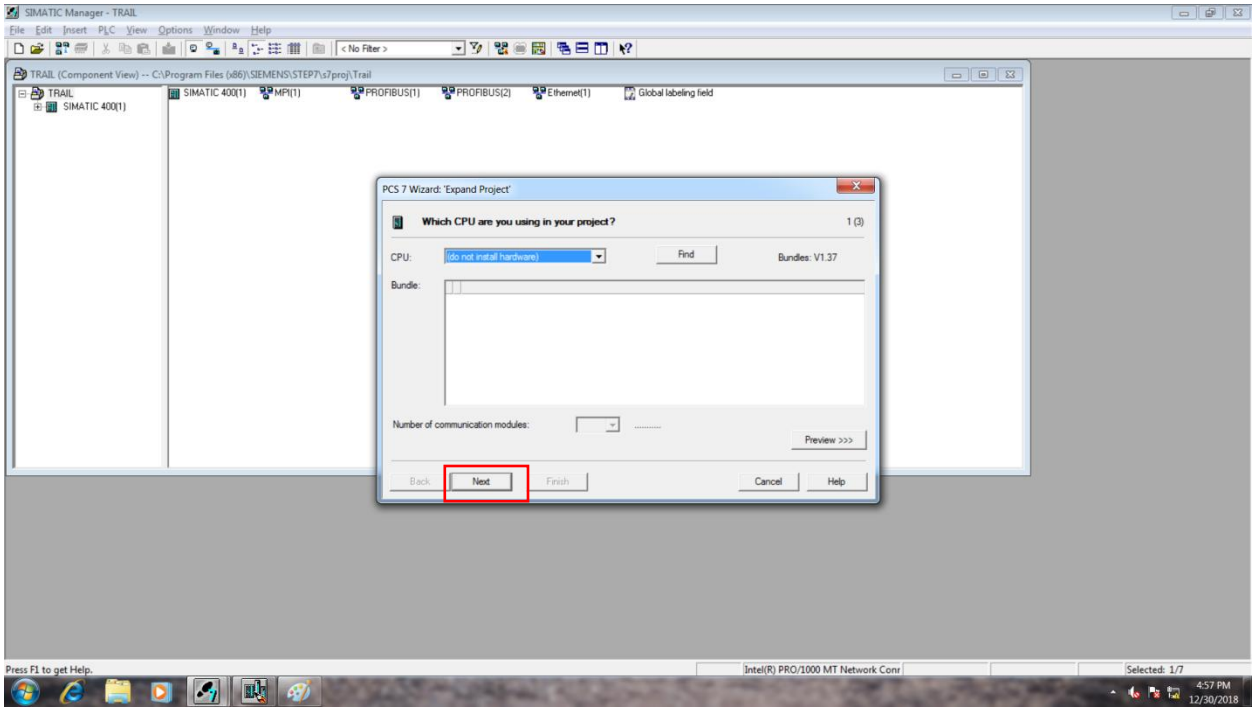


Now the Program has been completed and you can check it on the field by activating the two input switch and verify the output through the LED.

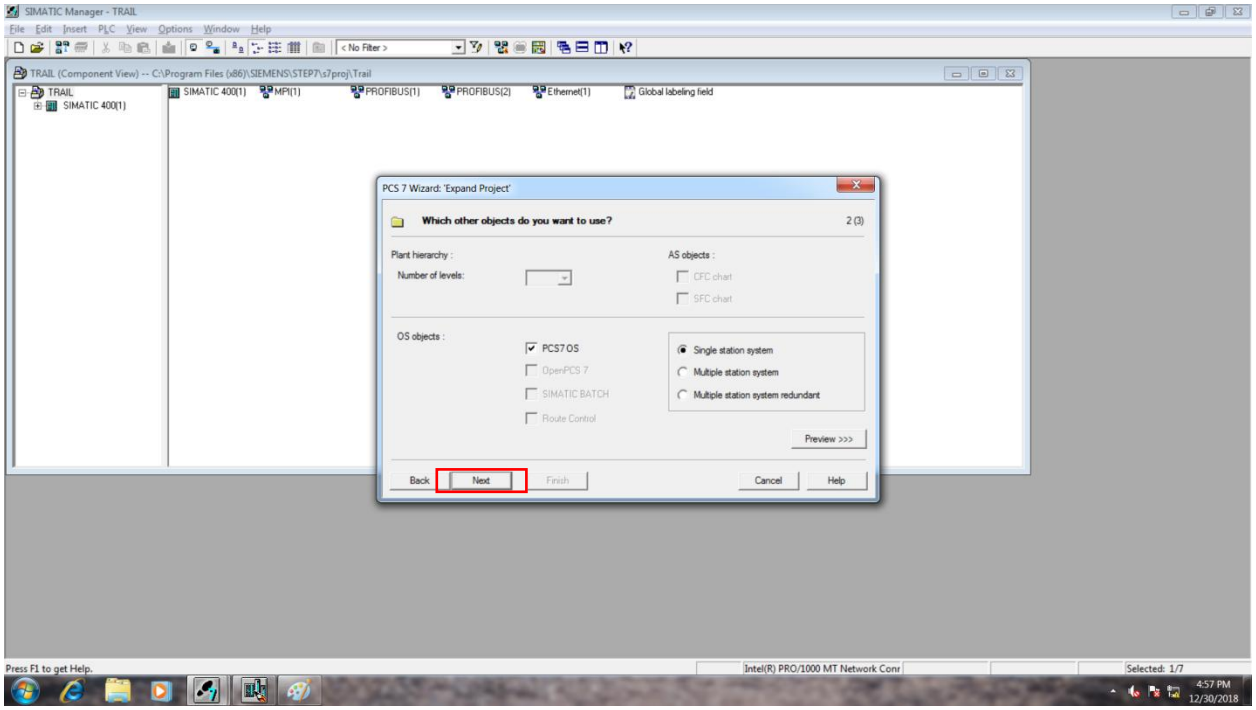
To create a **OS station**, go to **Simatic** window → click on Project name → in work area right click → **Insert new Object → Preconfigured Station**.



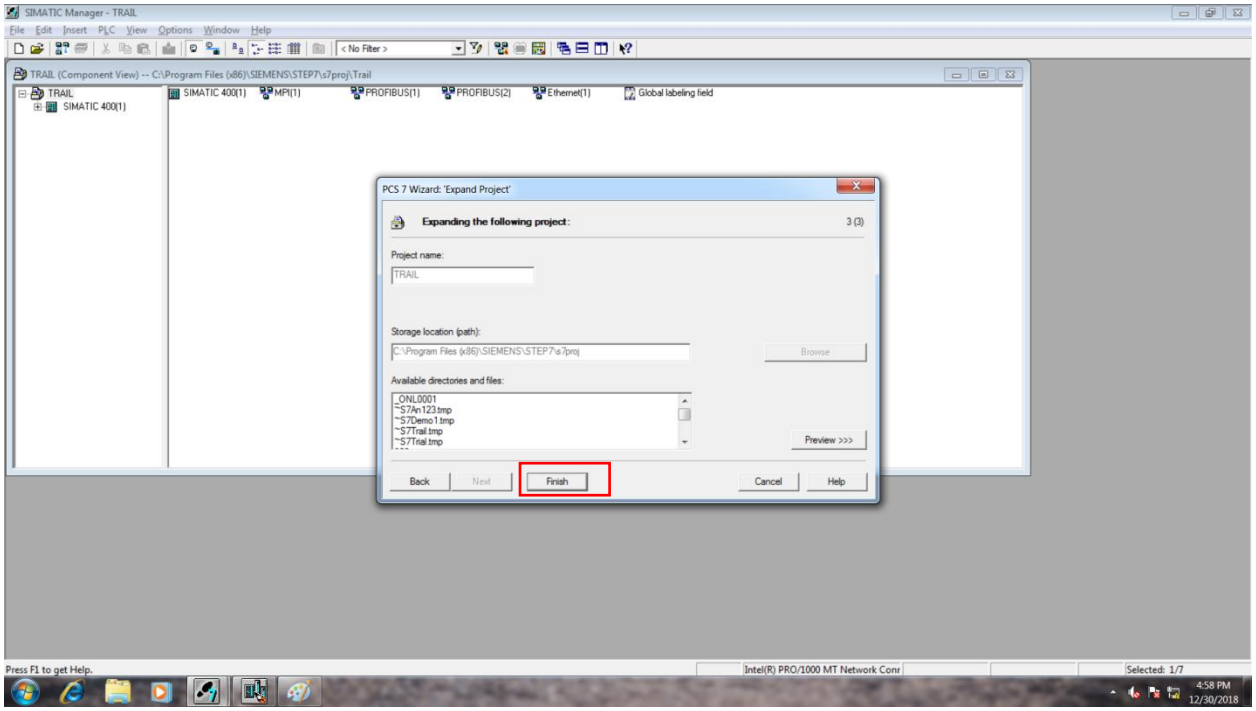
Click **Next**.



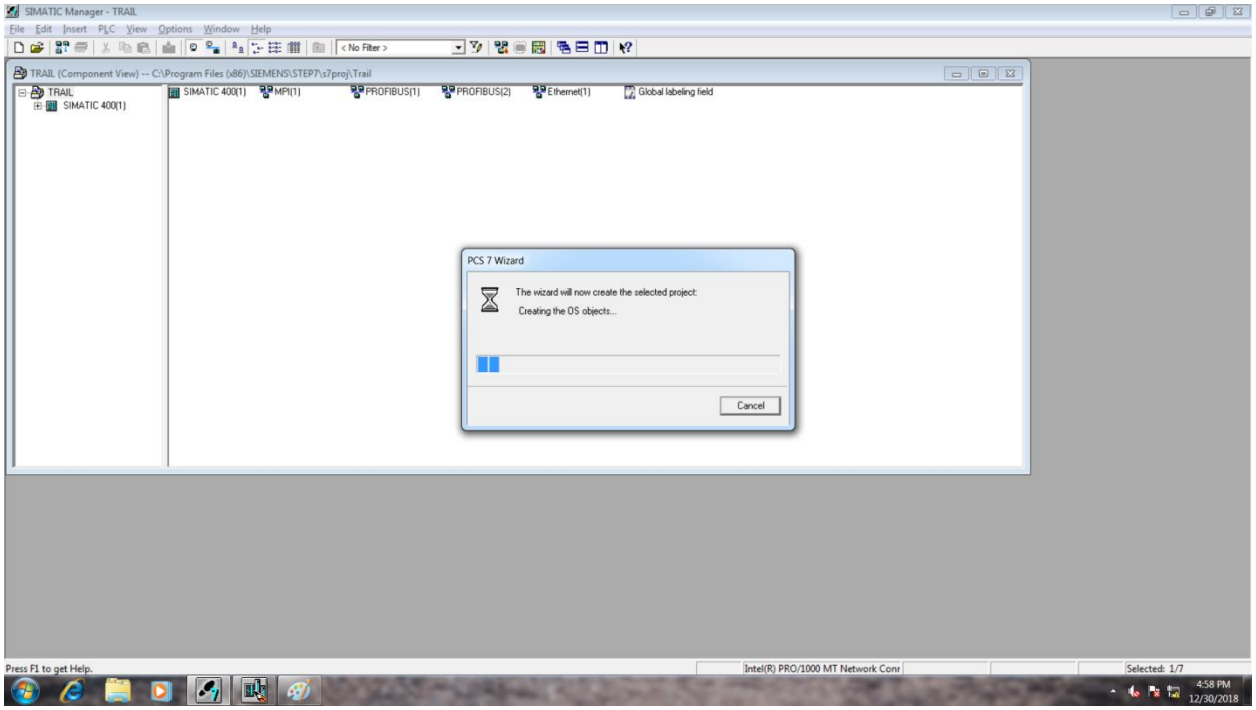
Click **PCS7 OS → Next**.



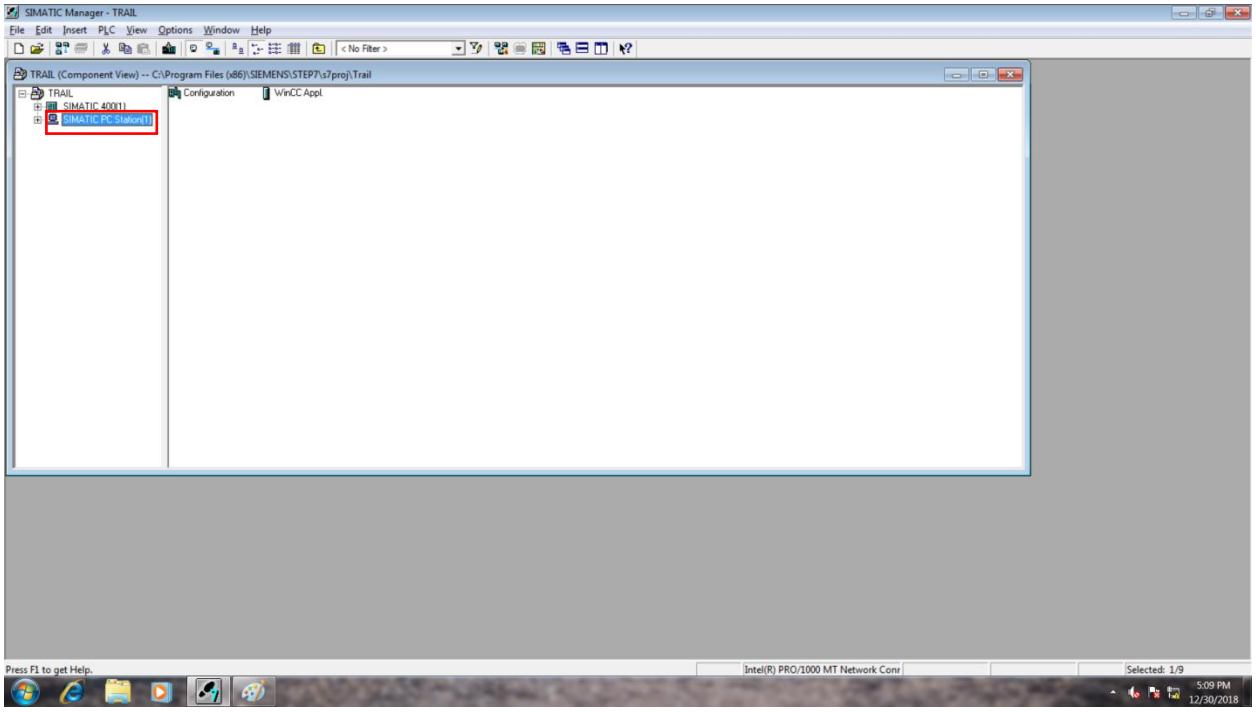
Click **Finish**

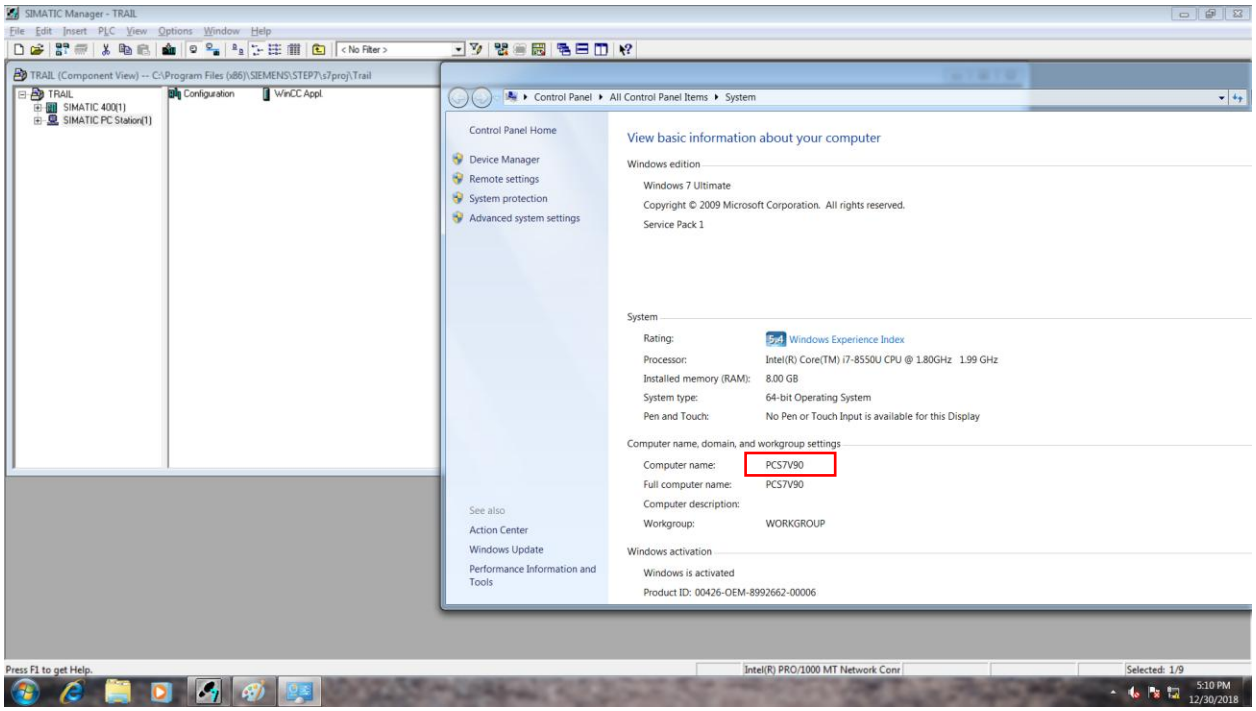


Now OS will start to Create. It takes few minutes.

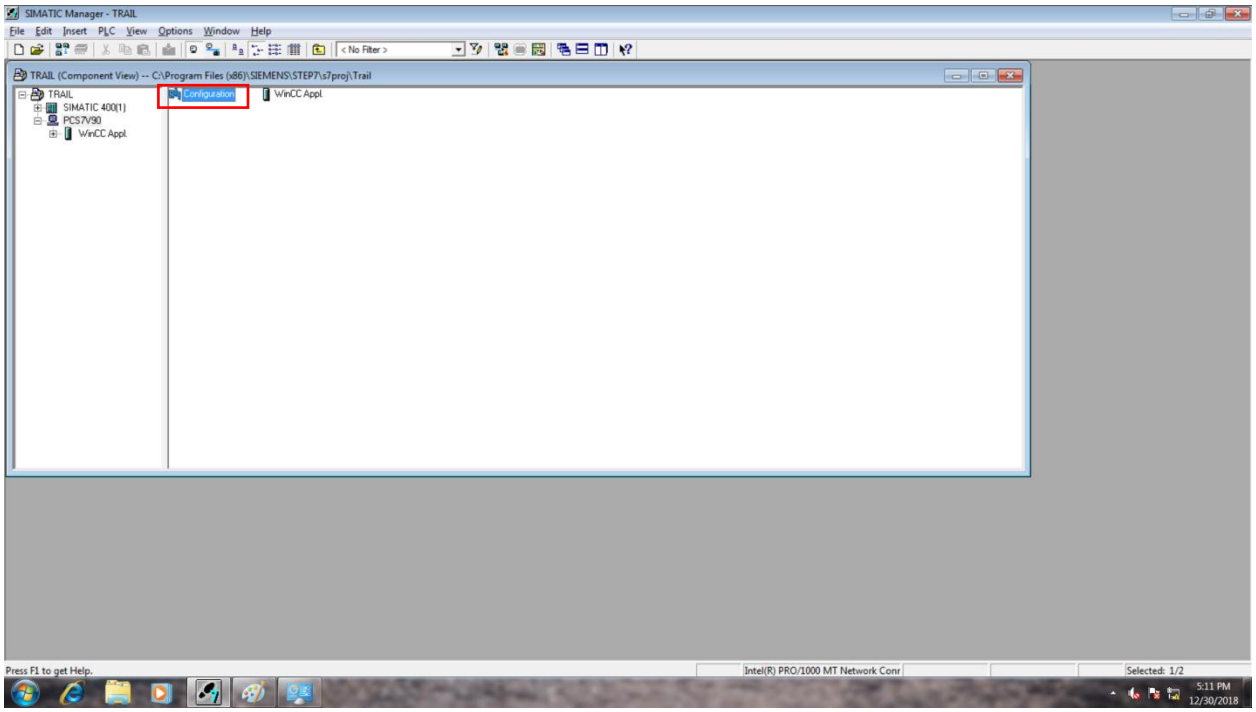


After PC station created, Rename it to your **PC name**.

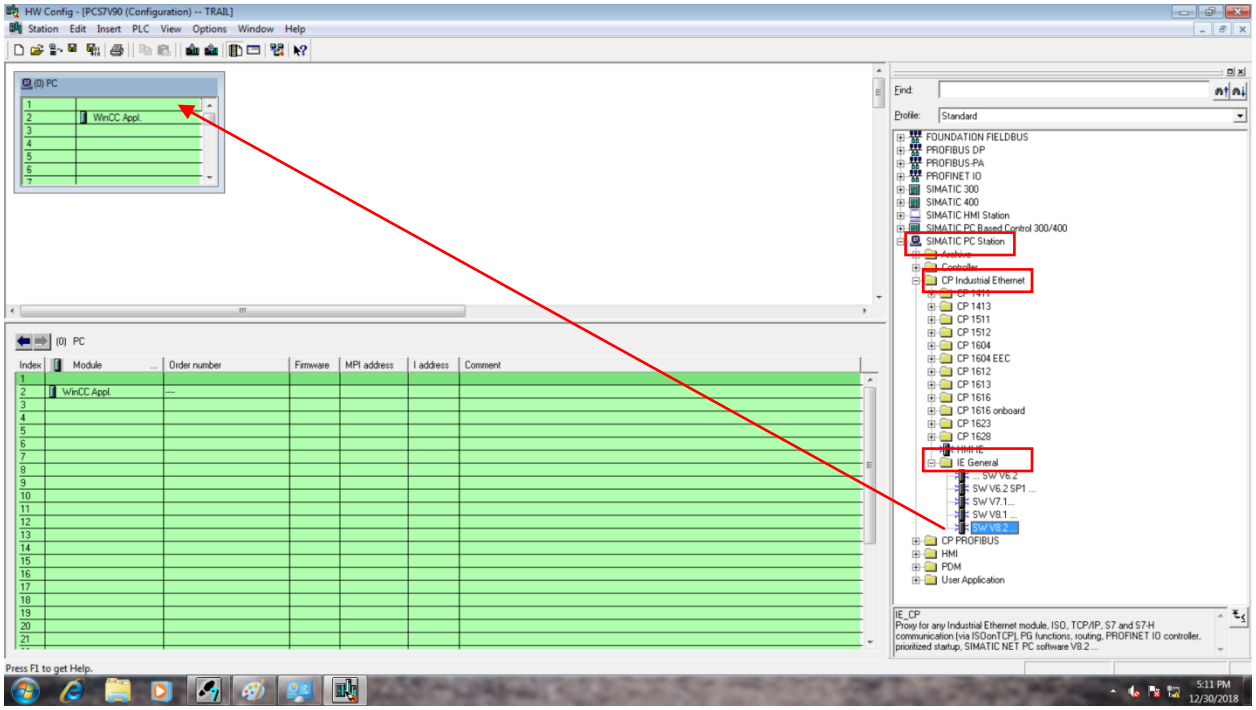




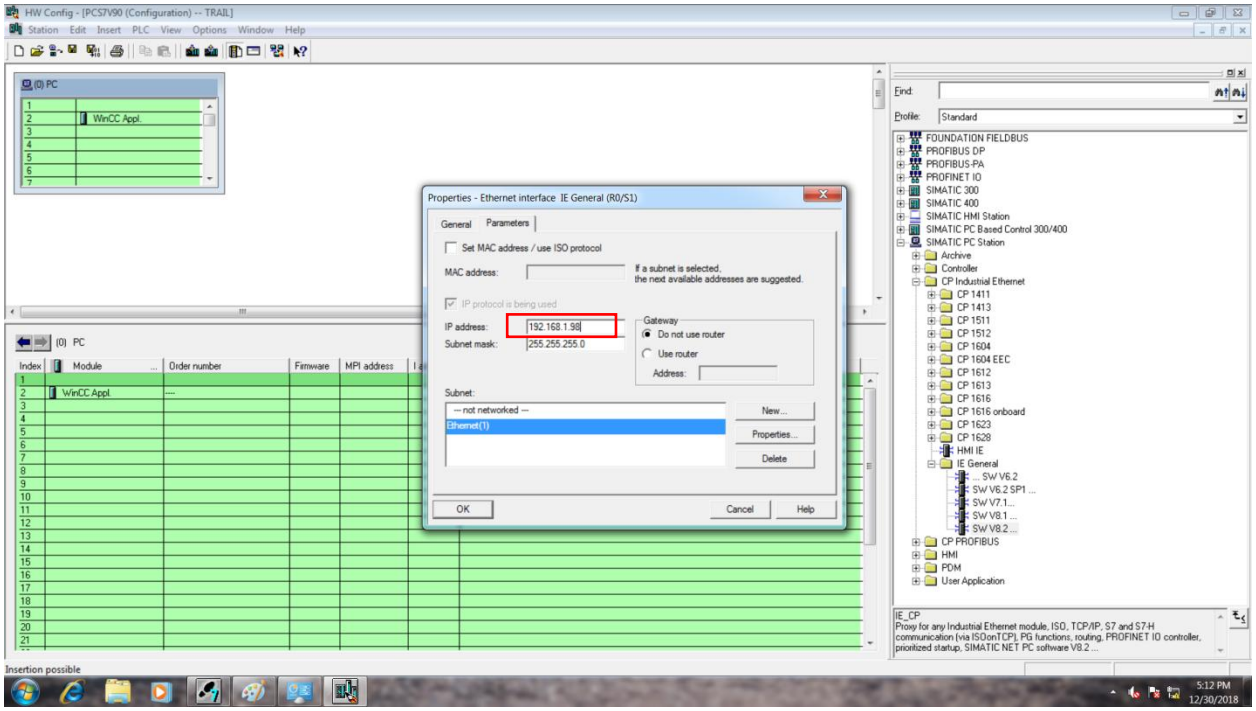
Next click **Configuration**



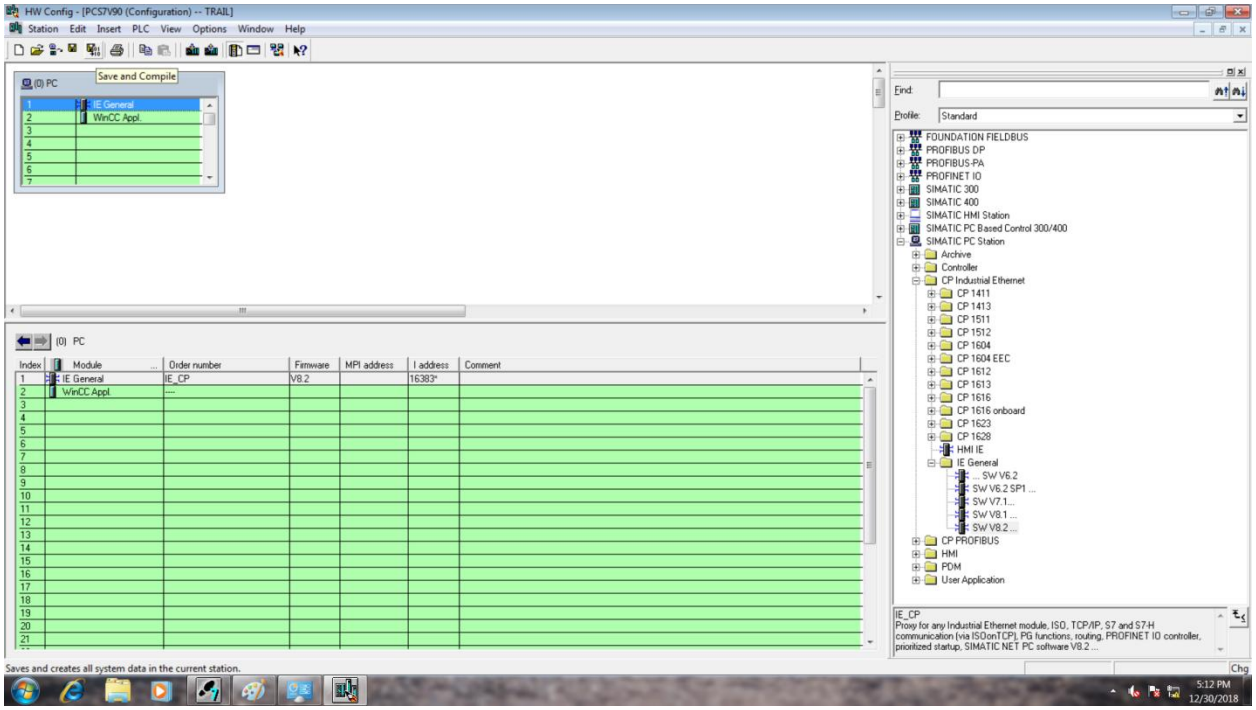
Now drag and drop the **IE general** to the first slot.



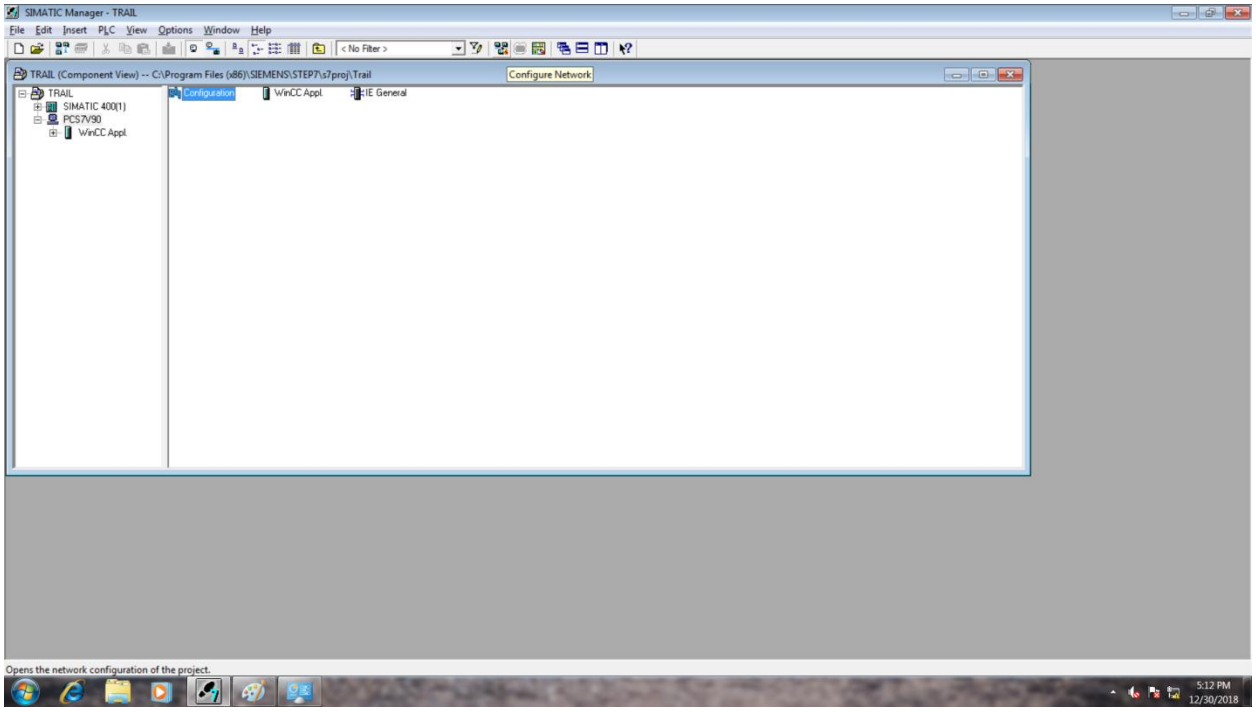
Set the IP address of the PC to IE general as **192.168.1.98**



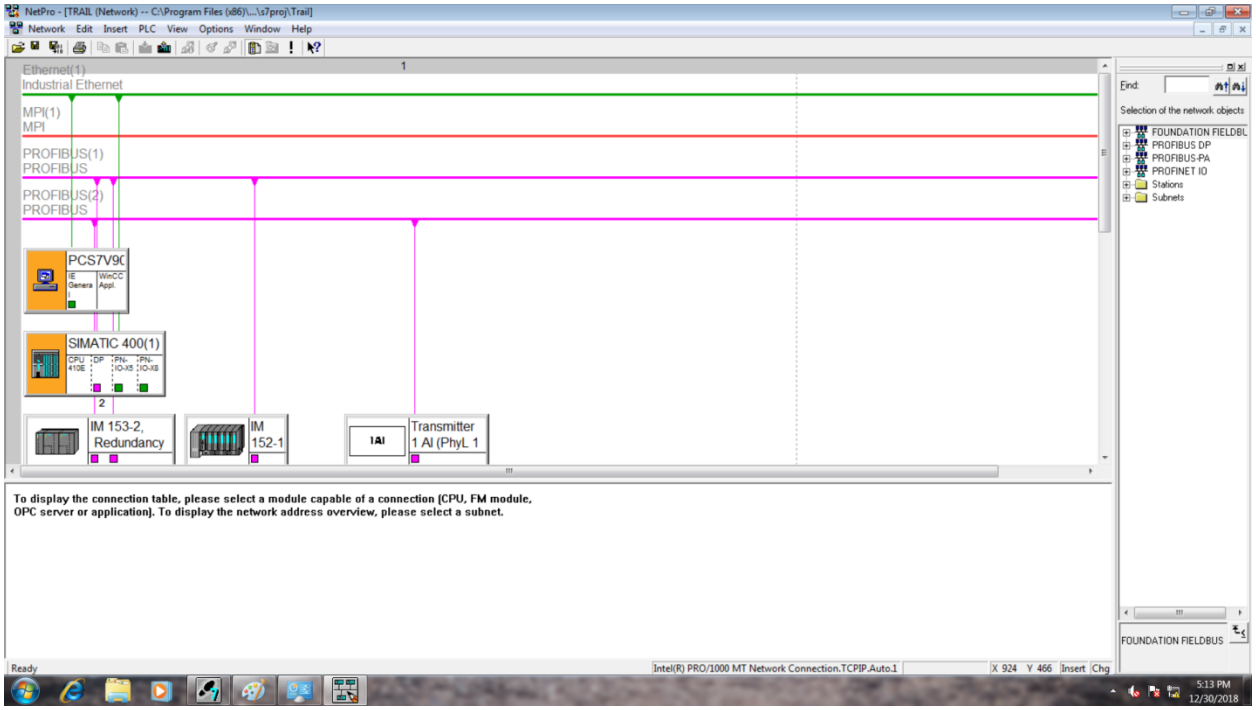
Click **Save and Compile**. Close the window after finished.



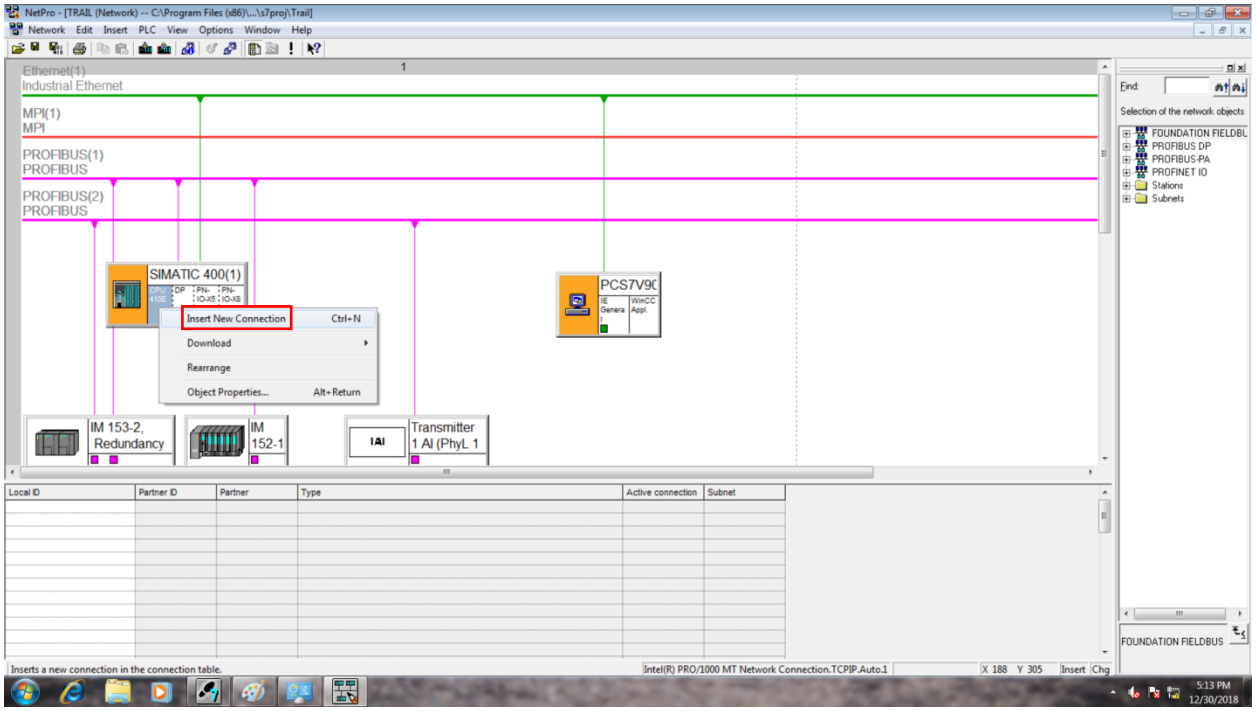
Click on **Configure Network** in toolbar



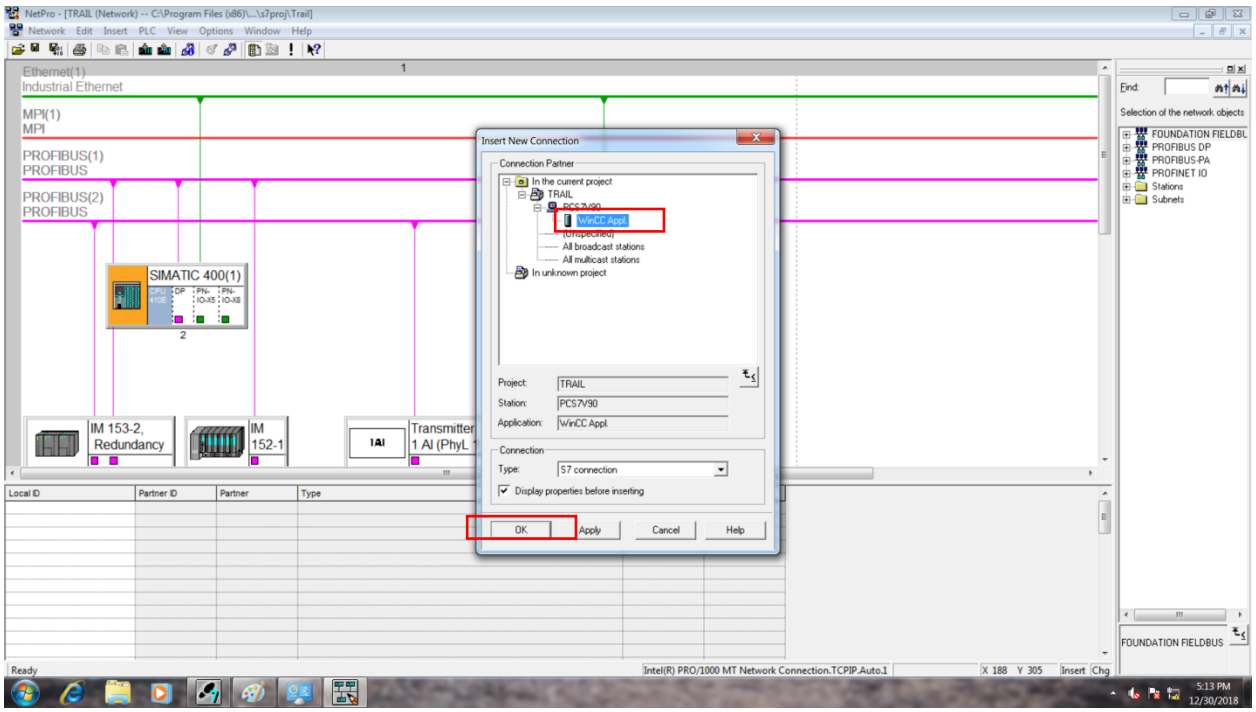
Now Available Station are shown on the screen and rearrange them by drag and drop.



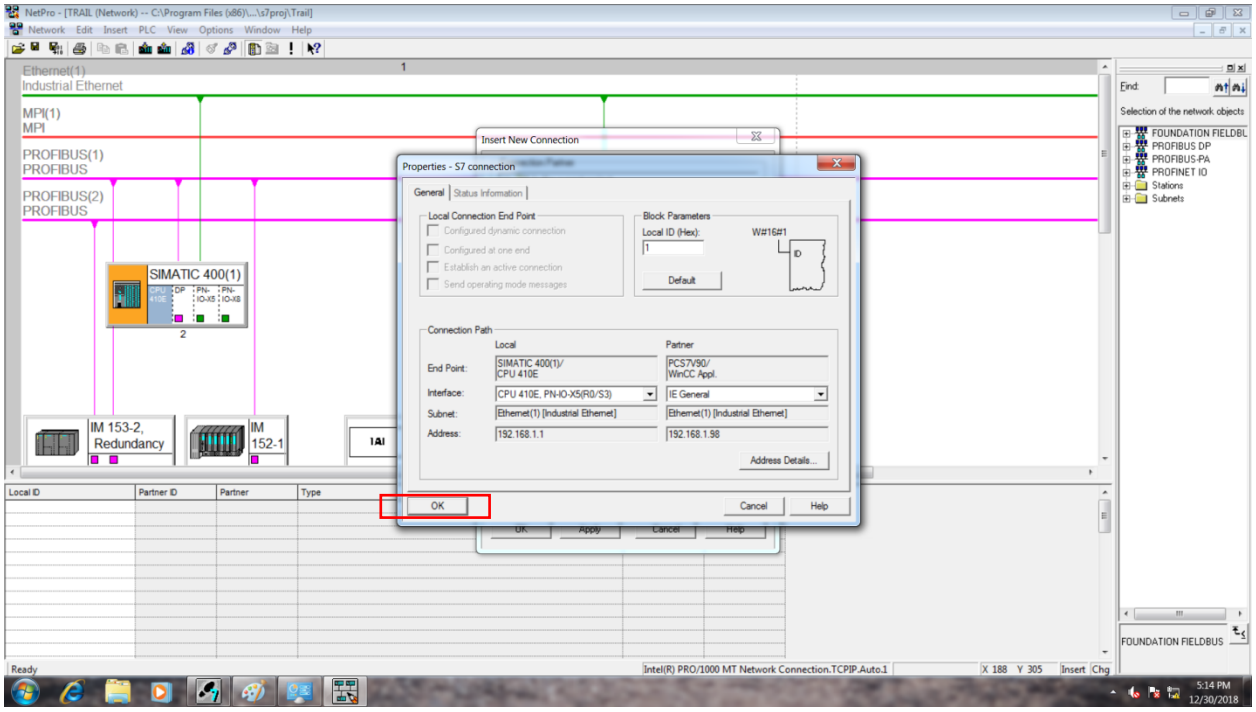
Right click on **CPU 410E** and select **Insert New Connection**.



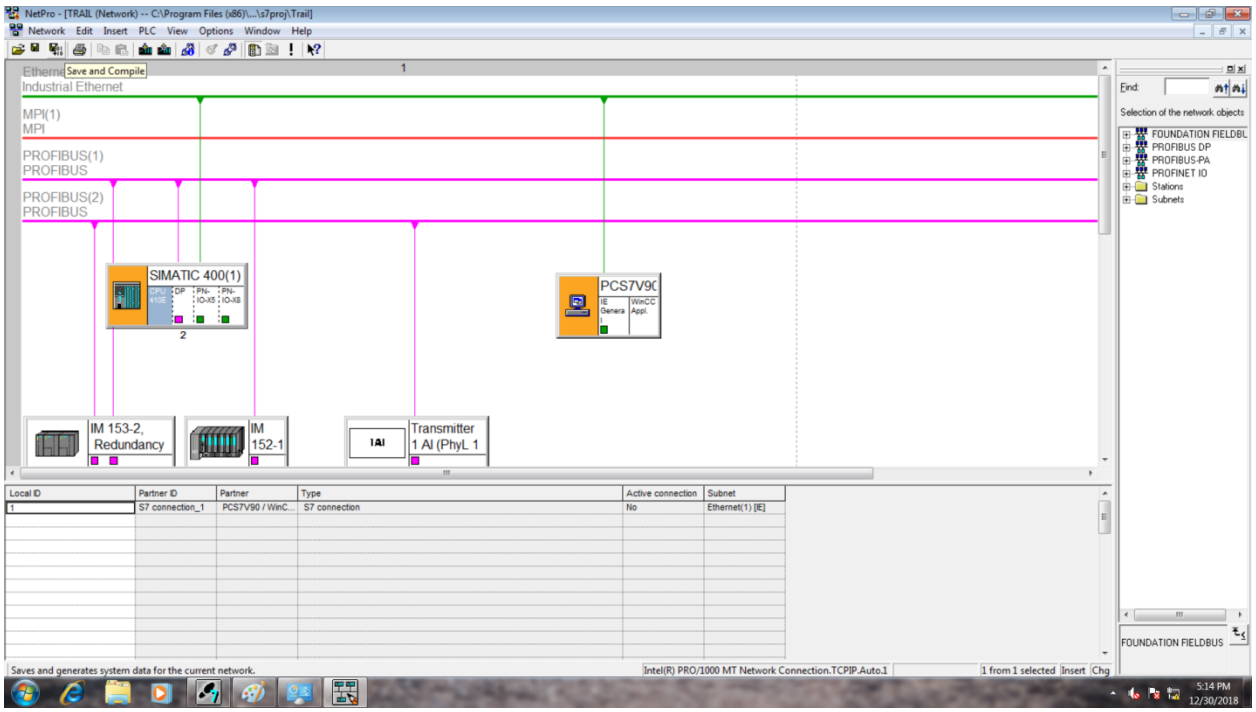
Select **WinCC Appl** and click **OK**.



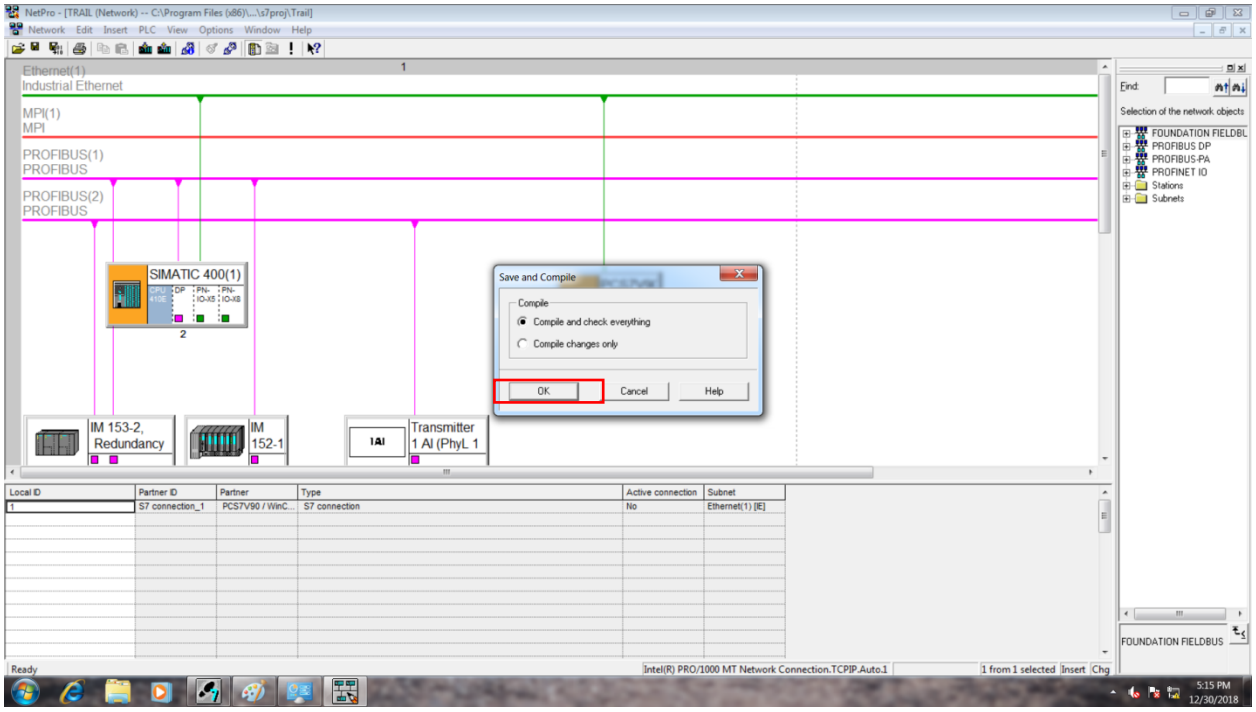
Click **OK**



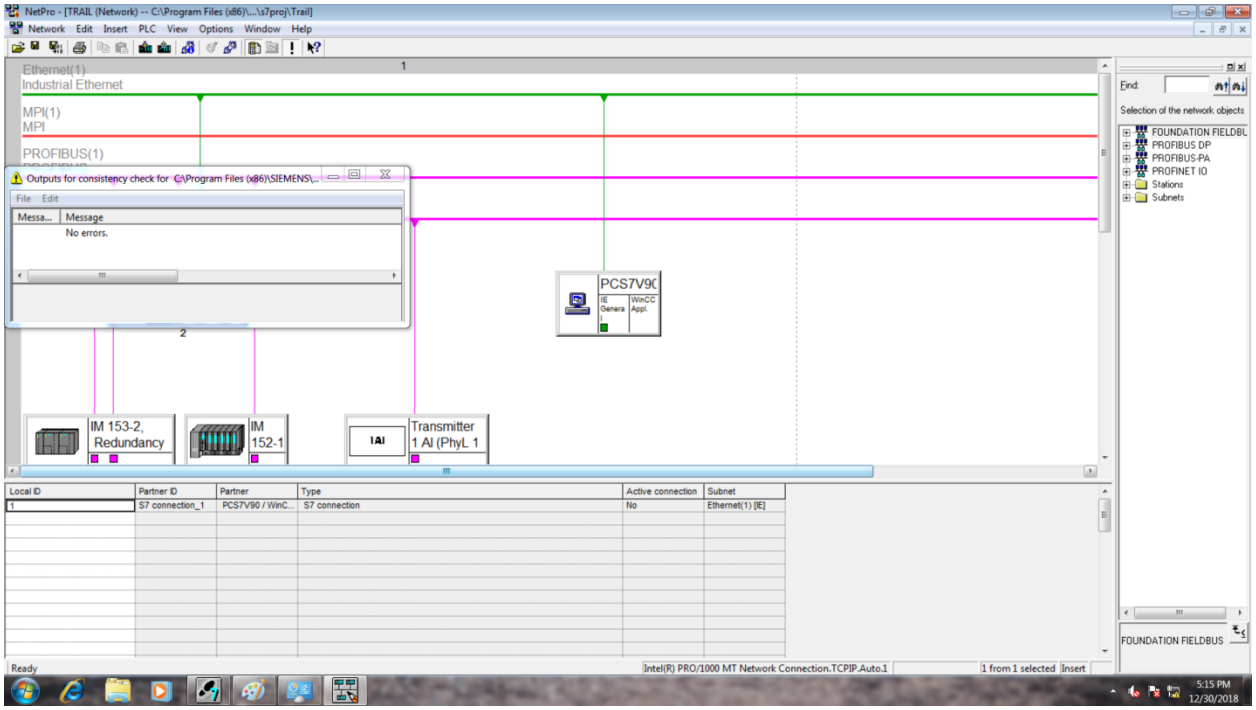
Click **Save and Compile**.



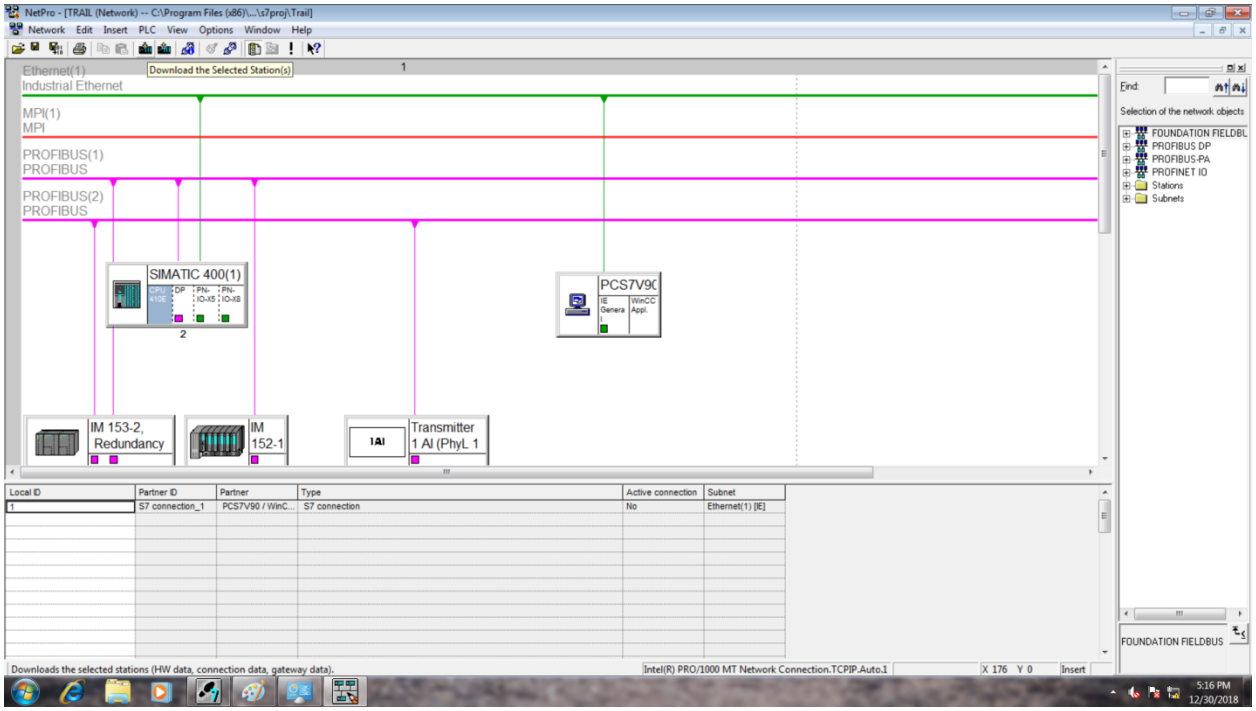
Click **OK**



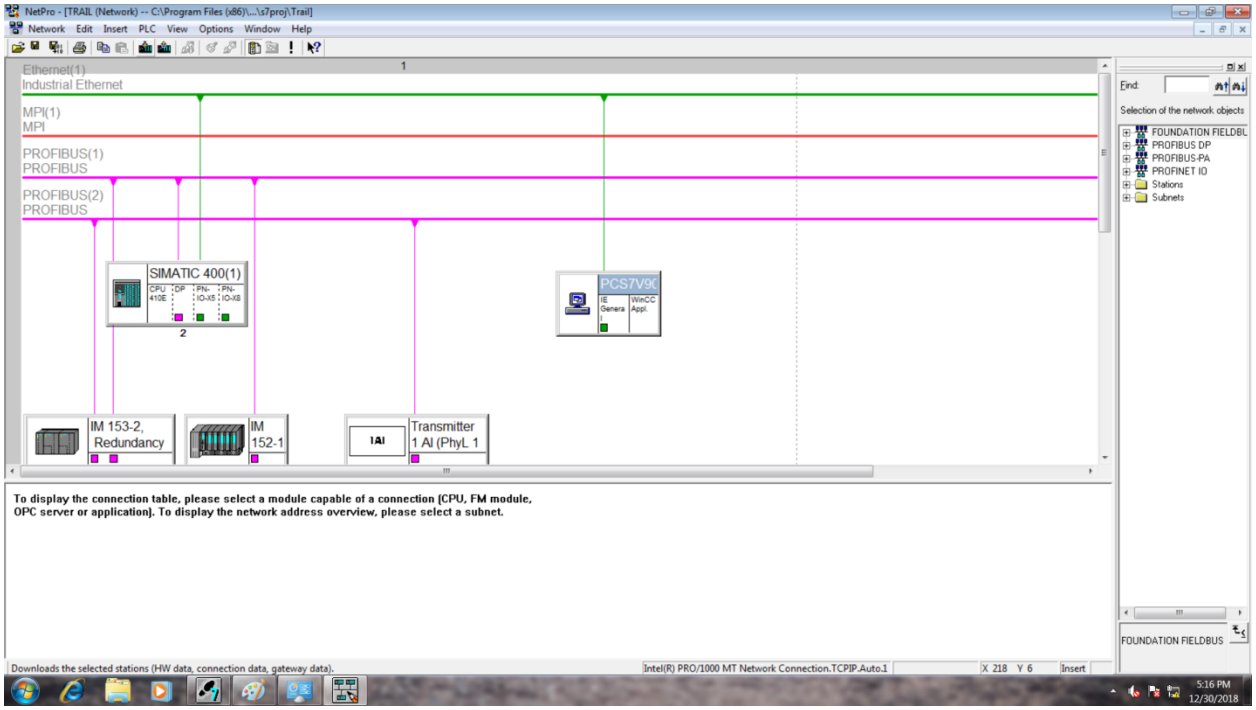
Check if any error comes or close the LOG.



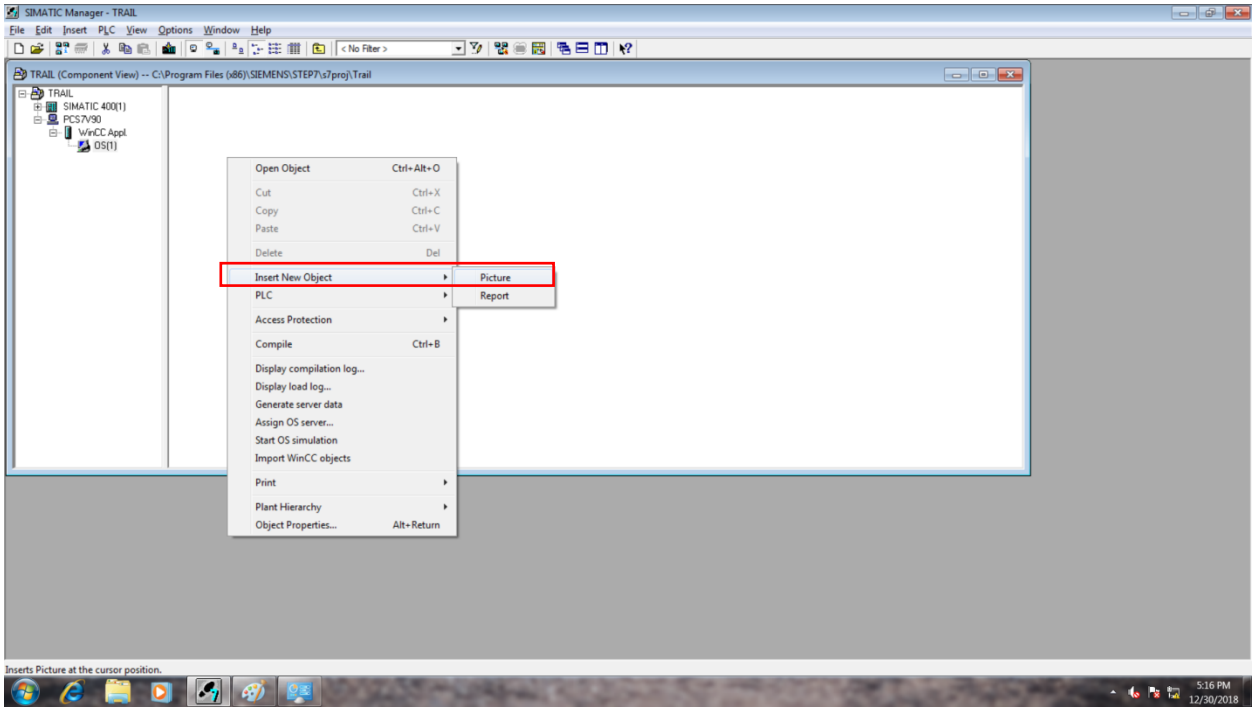
Click **CPU** and **Download**



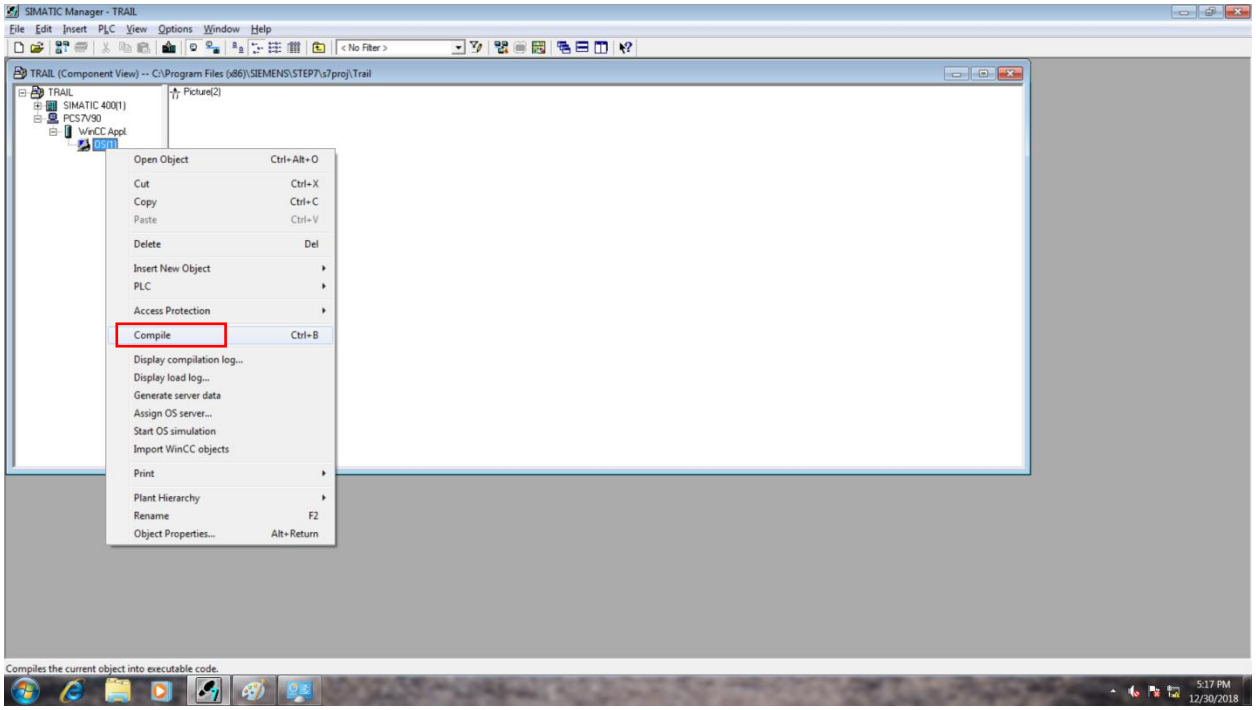
Click PC station and **Download**. Close the Window once you finish the download.



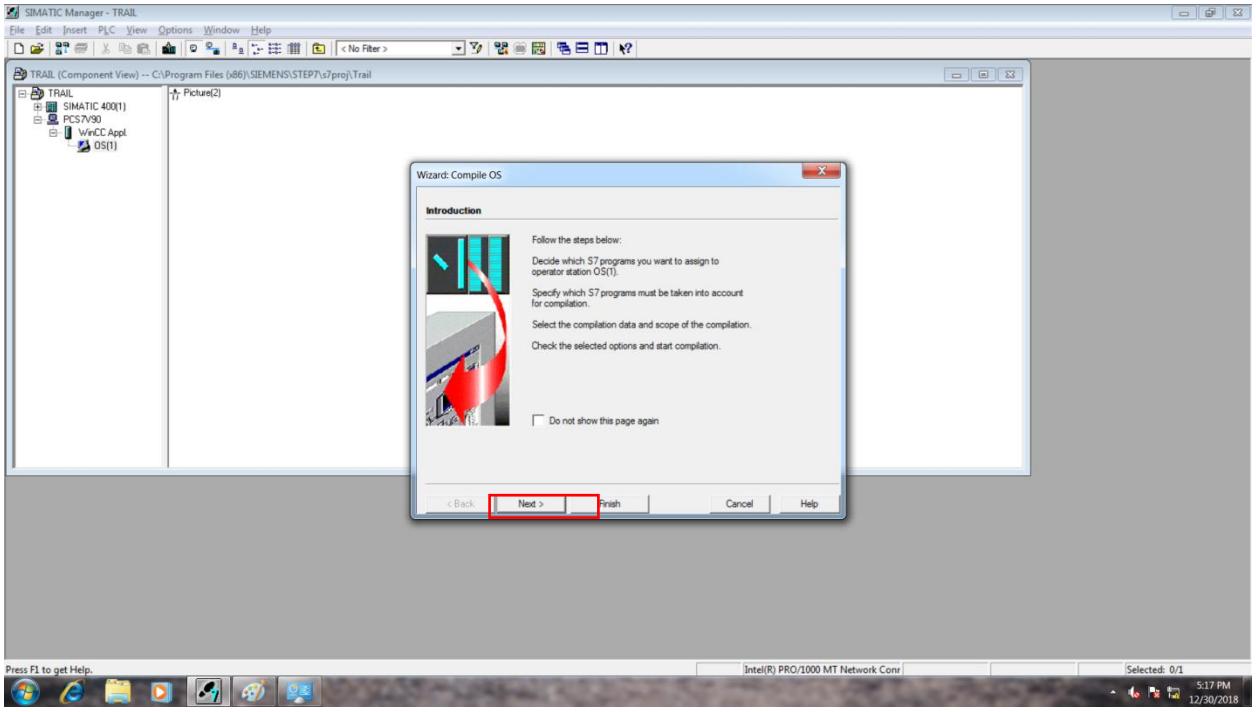
Now click on **OS(1)** and Right click on work area → **Insert New Object** → **Picture**.



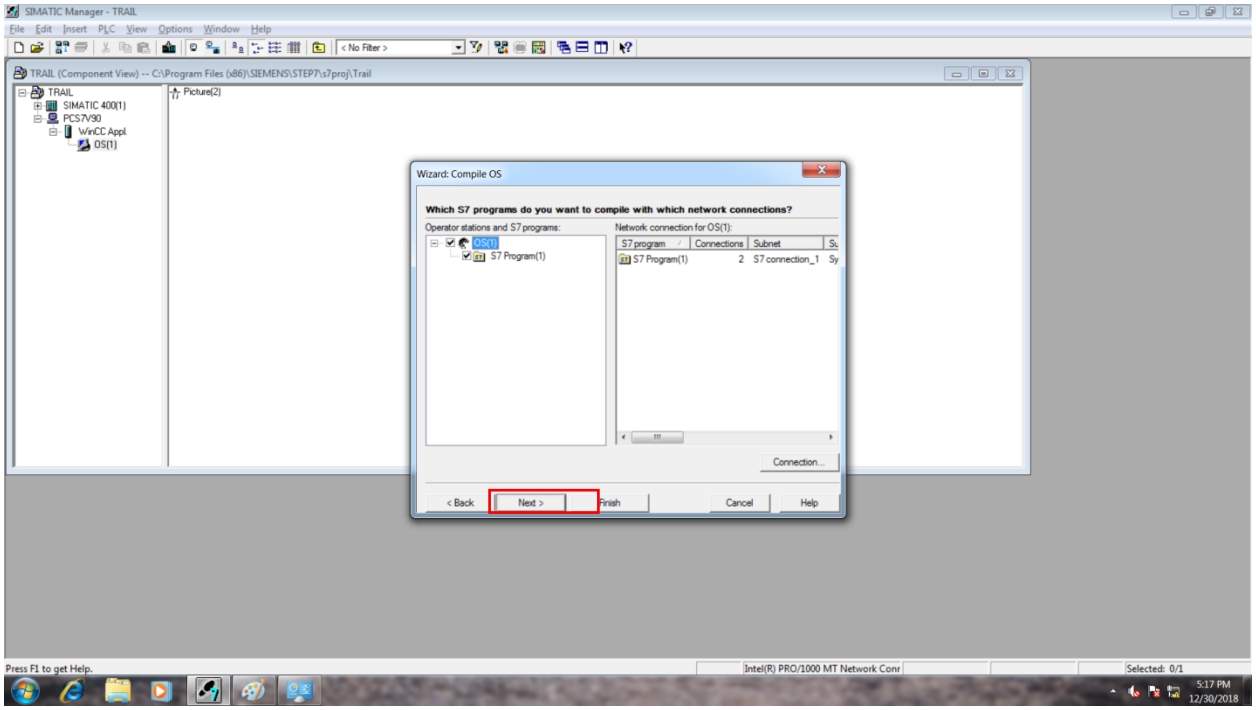
After creating the Picture, Right on OS(1) and Select **Compile**



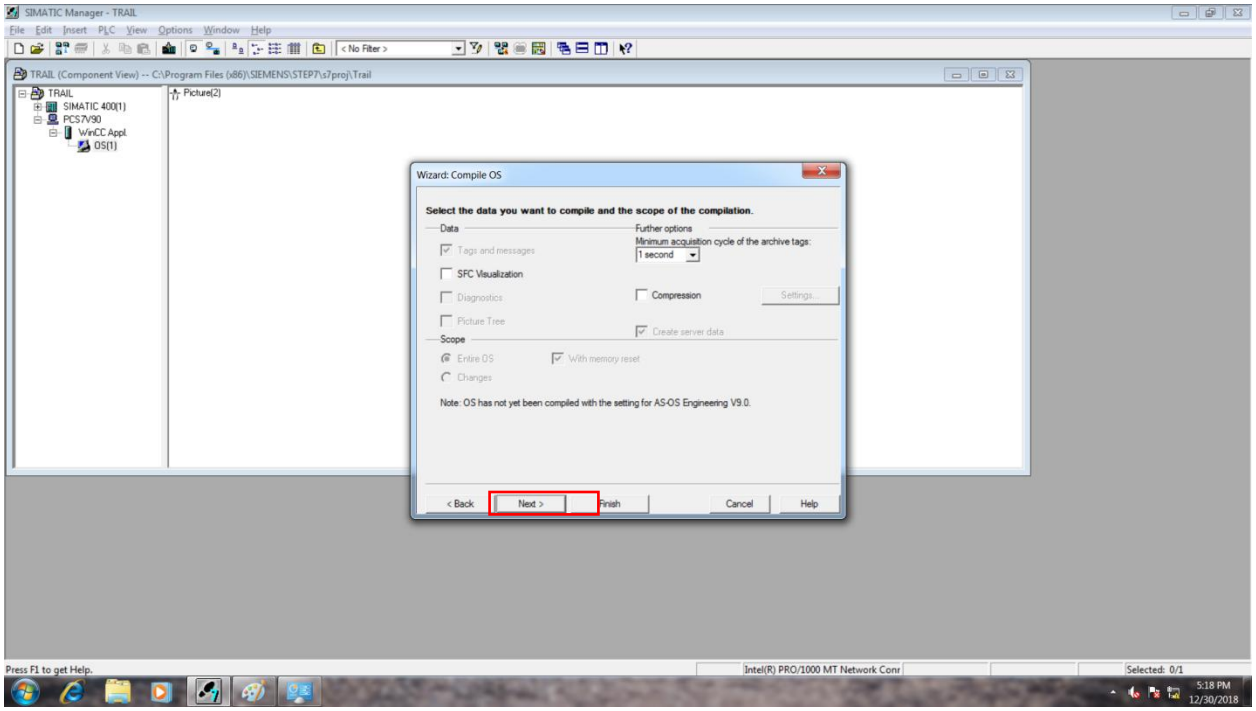
Click **Next**.



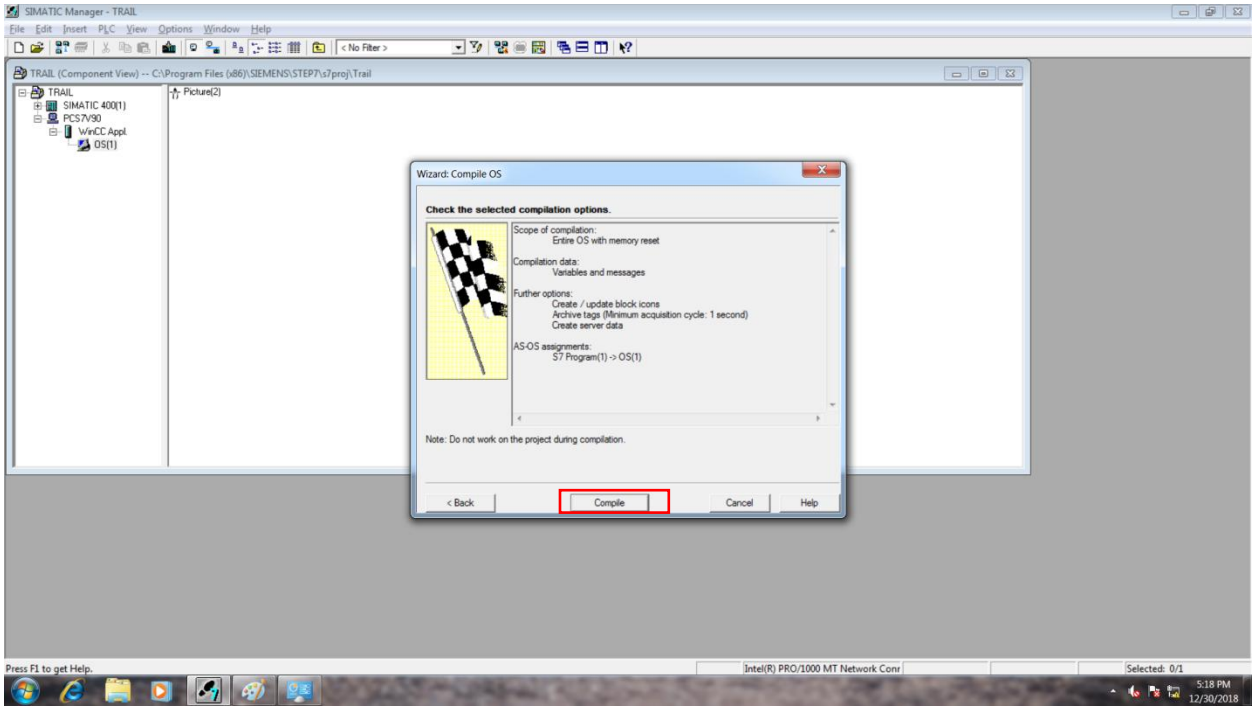
Click **Next**.



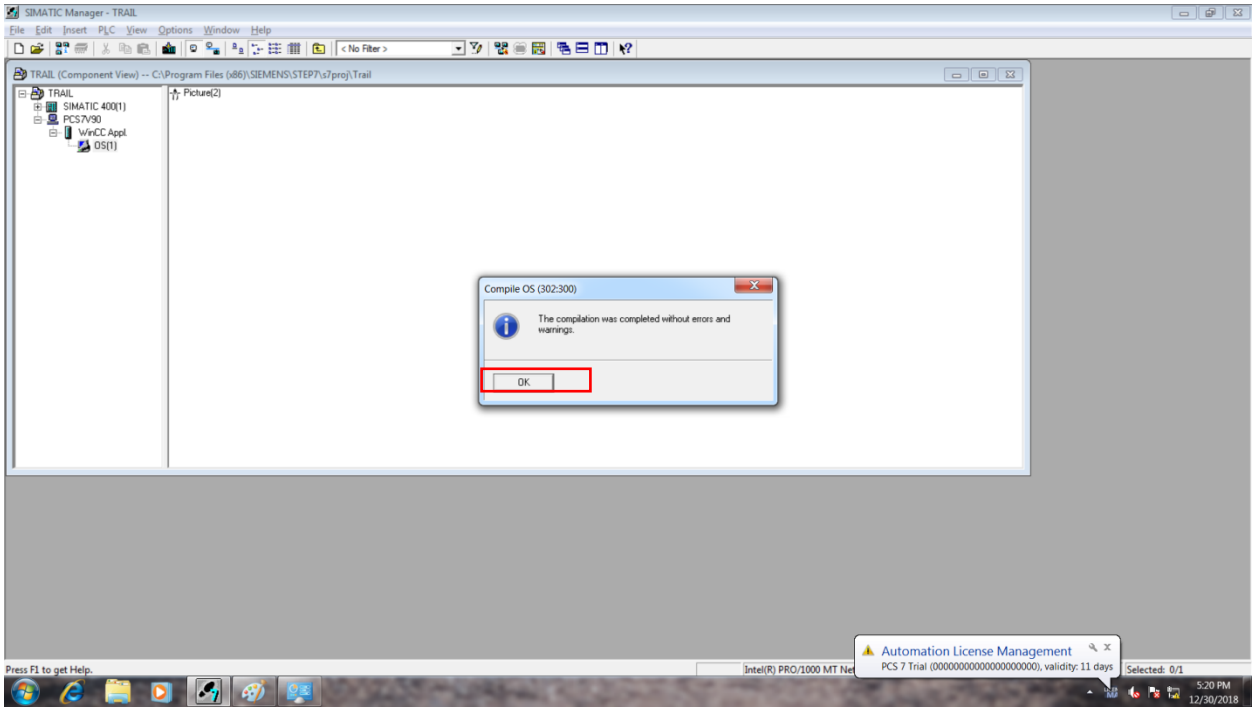
Click **Next**.



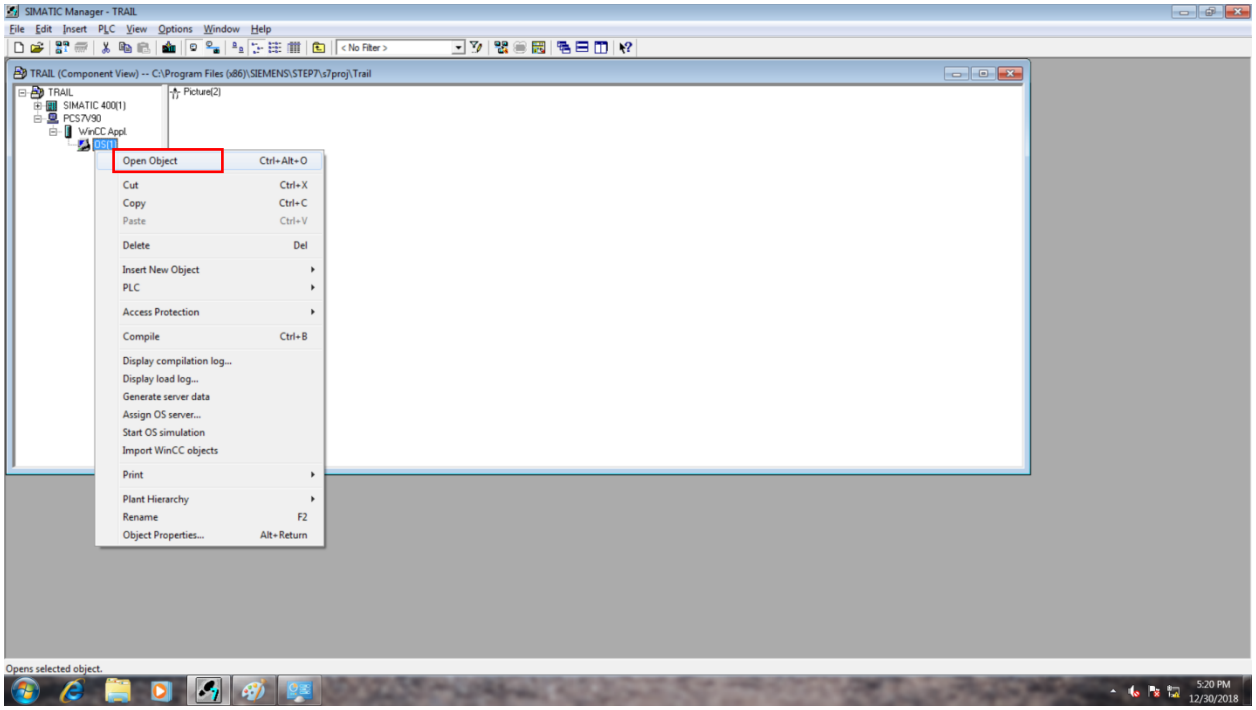
Click **Compile**. It will take few minutes.



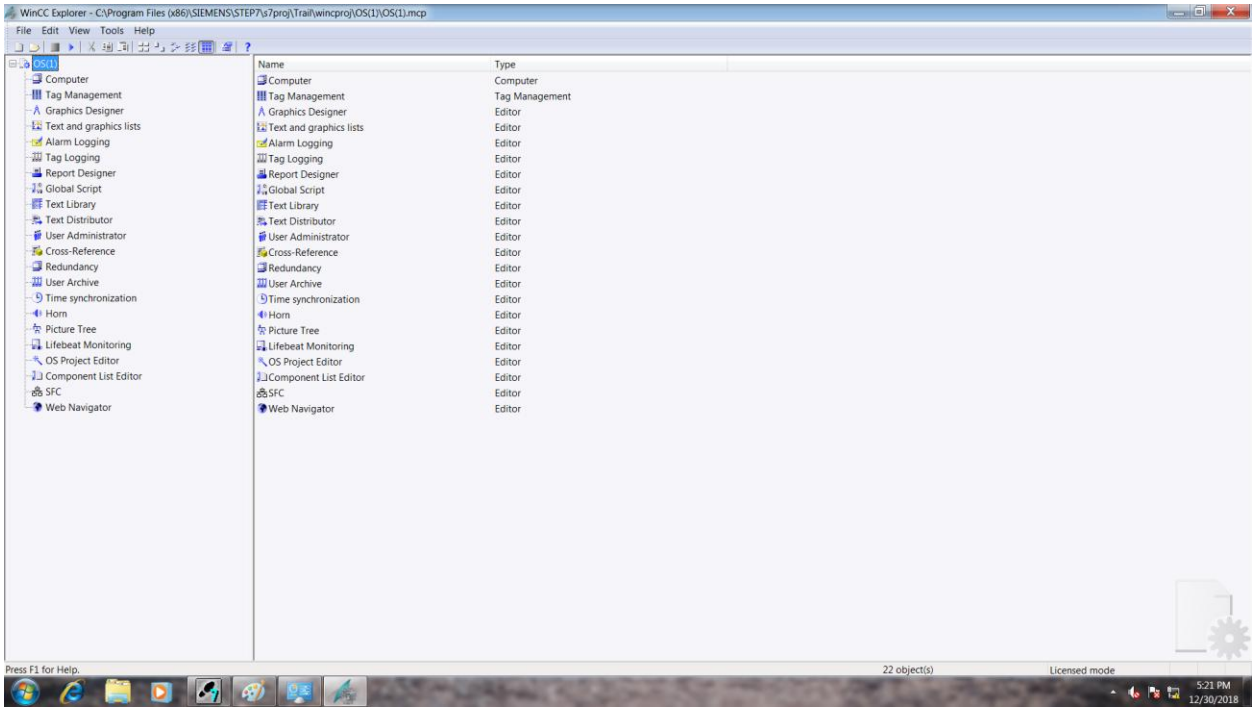
After successful compilation, it will show the popup that no error and warning. Click OK.



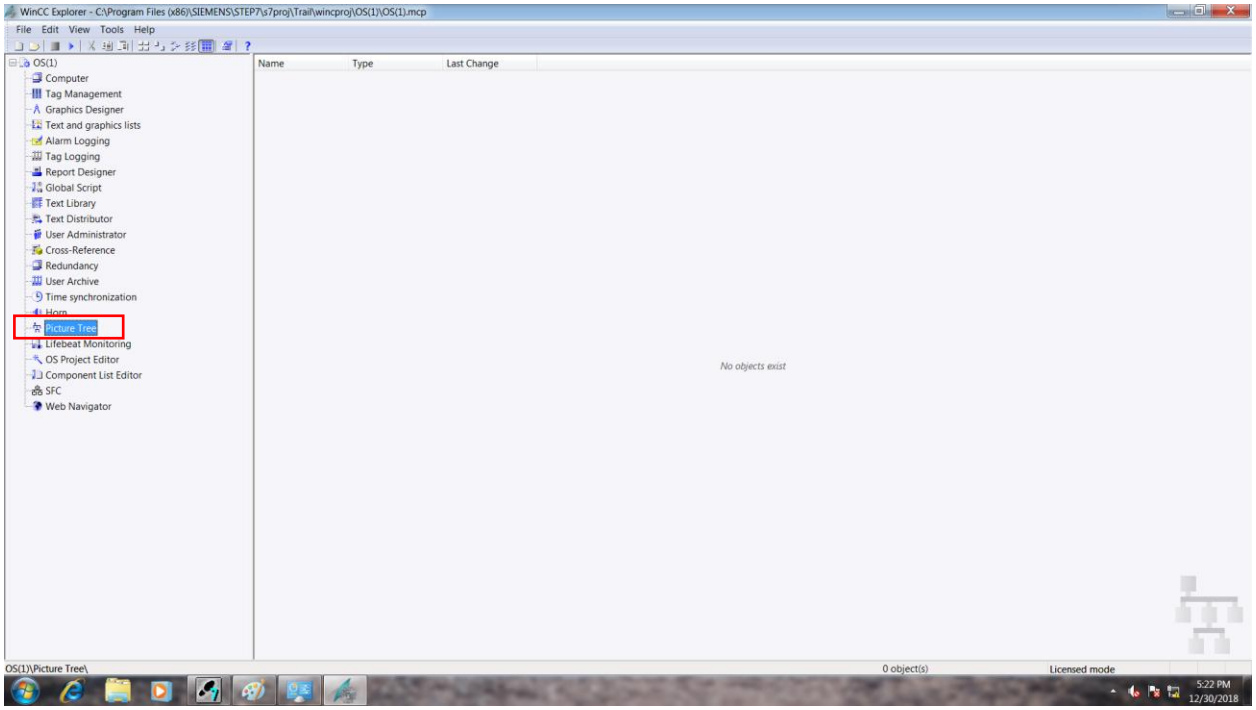
Now right the OS(1) and click **Open Object**



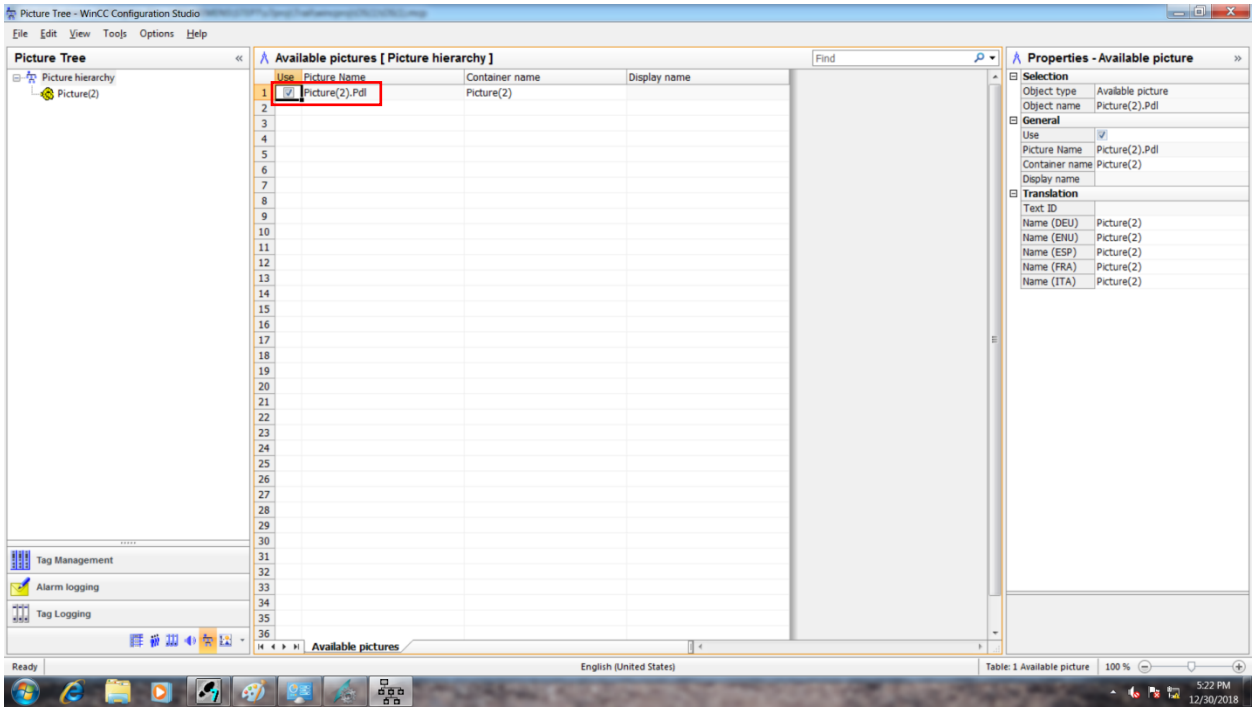
Now WinCC Explorer window will open.



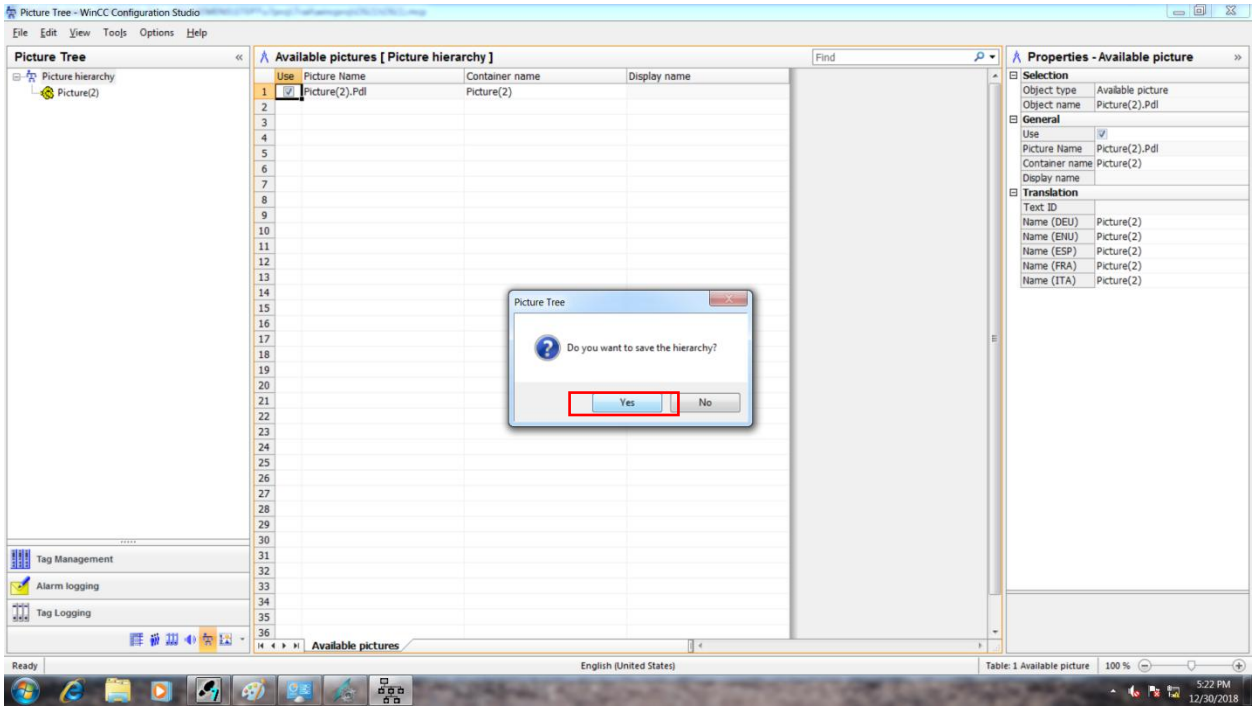
Double Click on **Picture Tree** option .



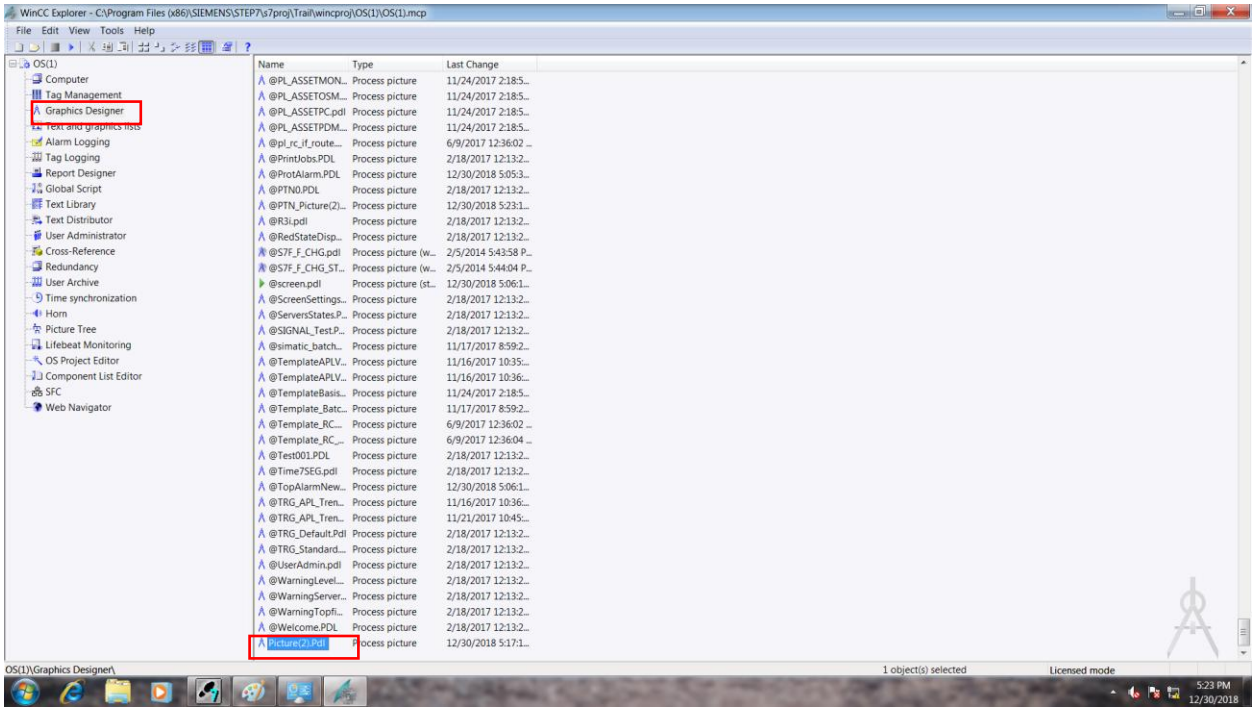
Select **Picture(2)** and close the window.



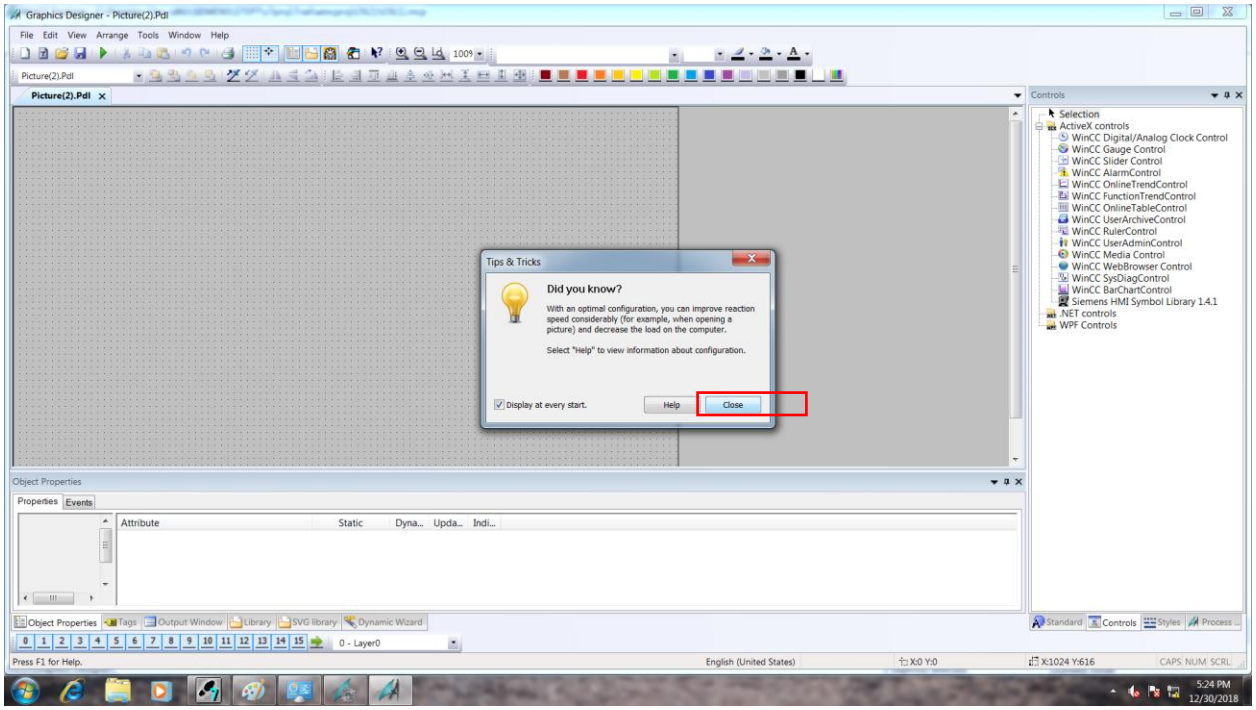
Click **Yes**.



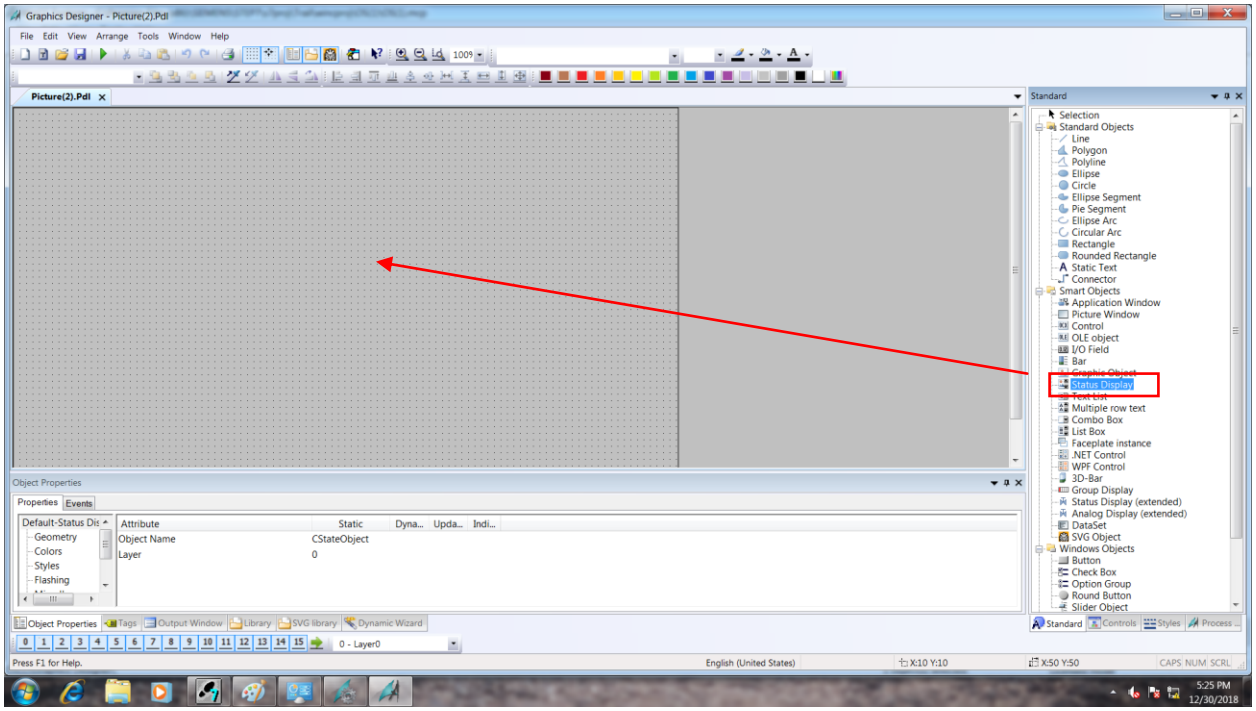
Select **Graphics designer** → Double click **Picture(2).Pdl**.



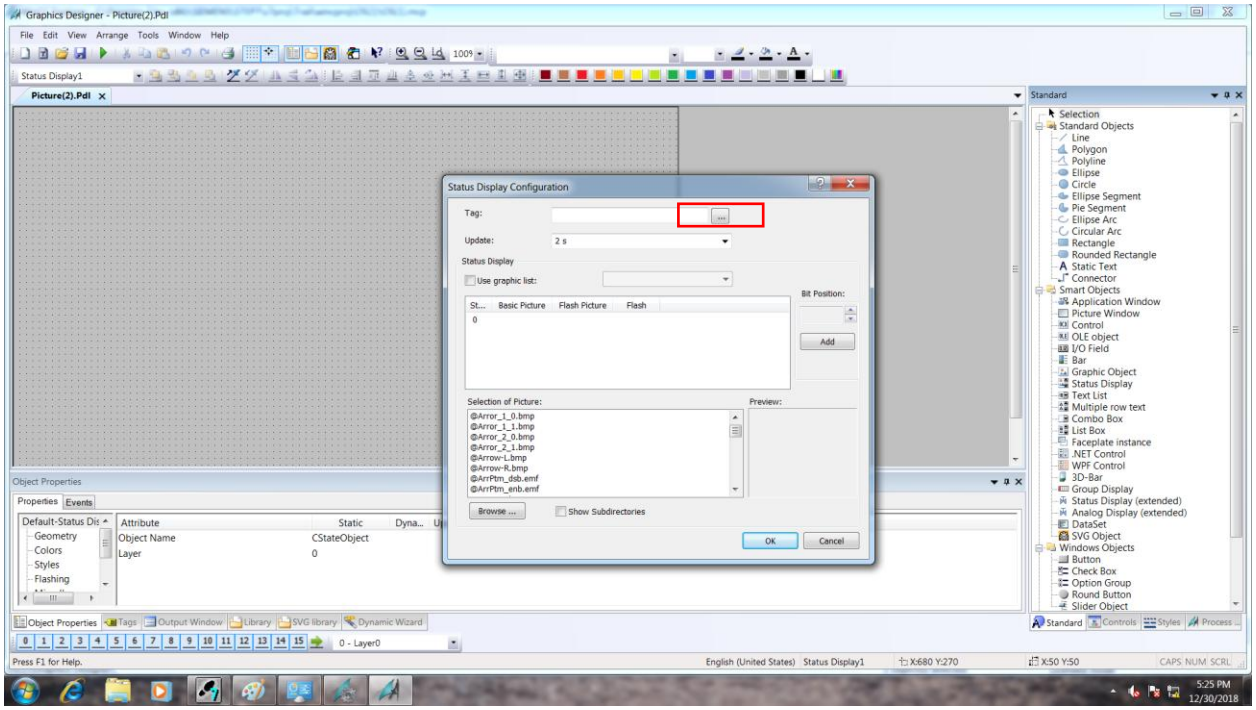
Click **close**.



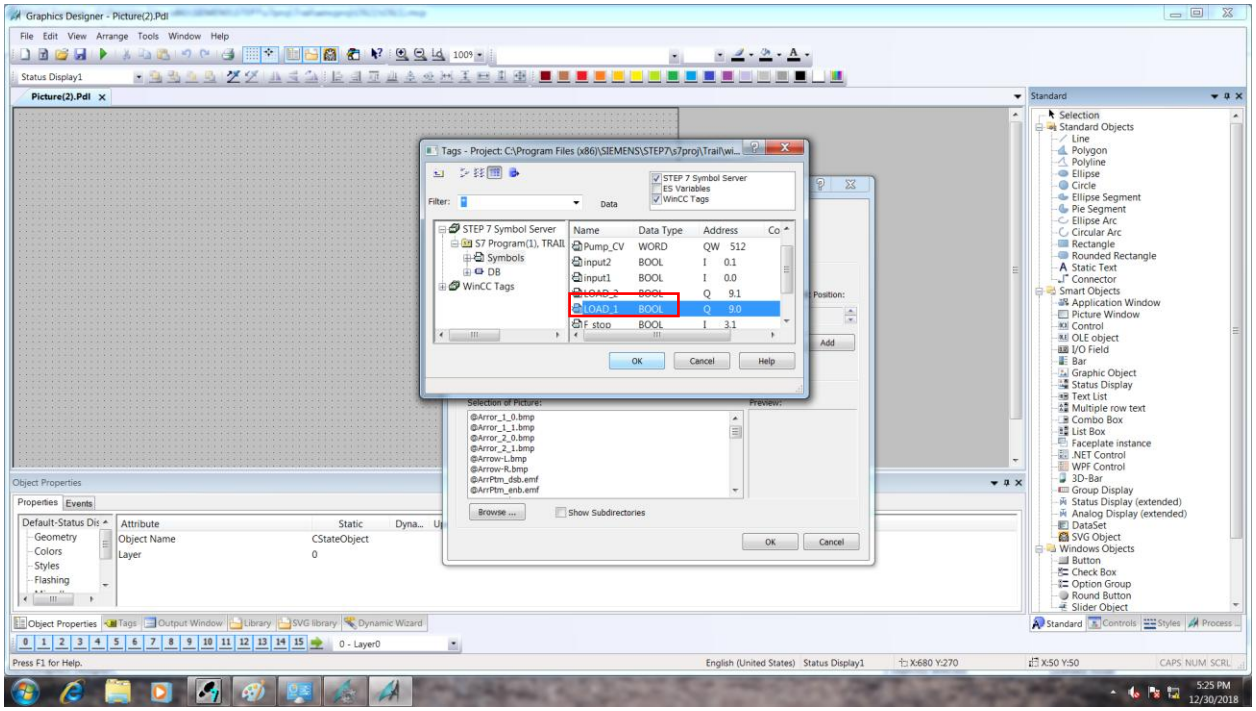
Drag and drop the **Status display** in the screen.



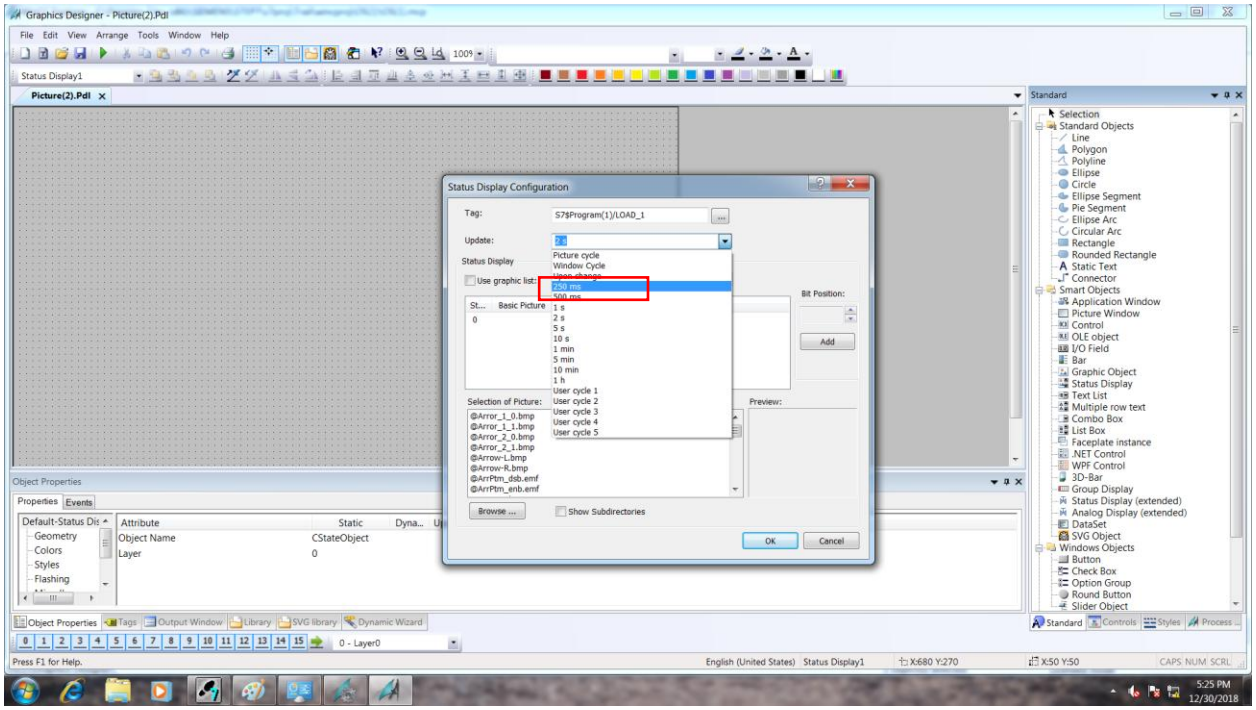
Click on **…** tab in Tag column.



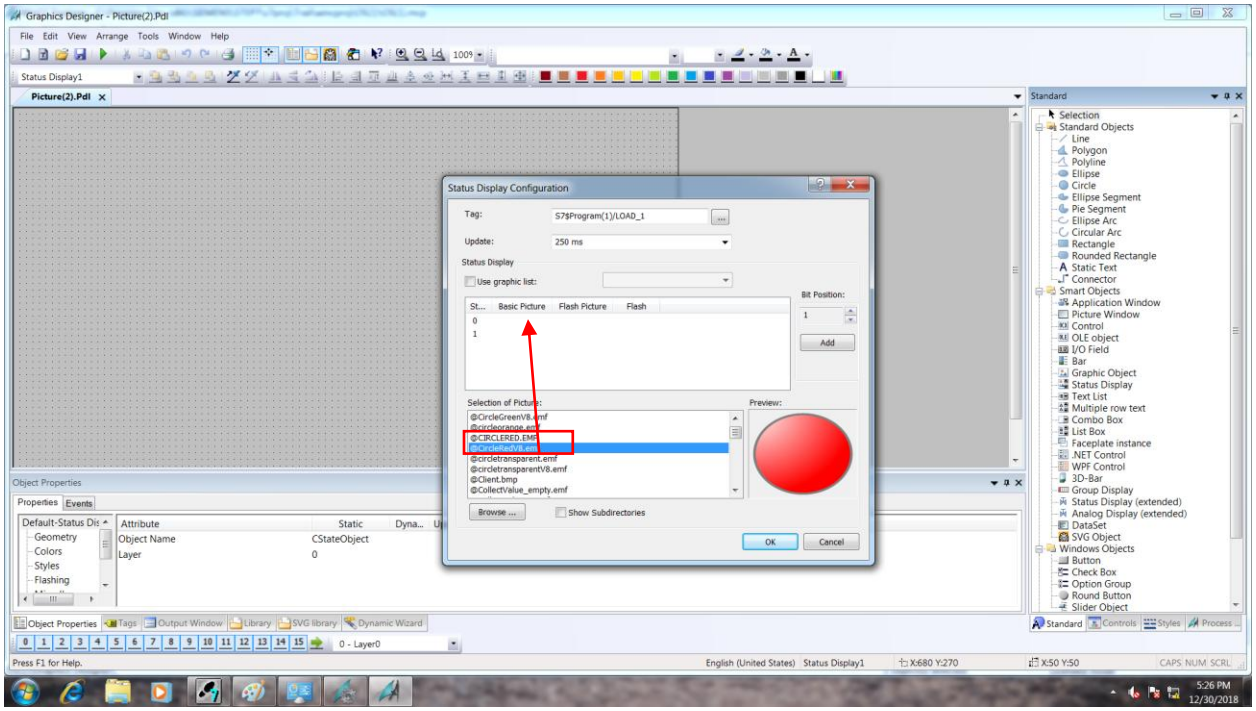
Select Output Tag as **Load 1**.



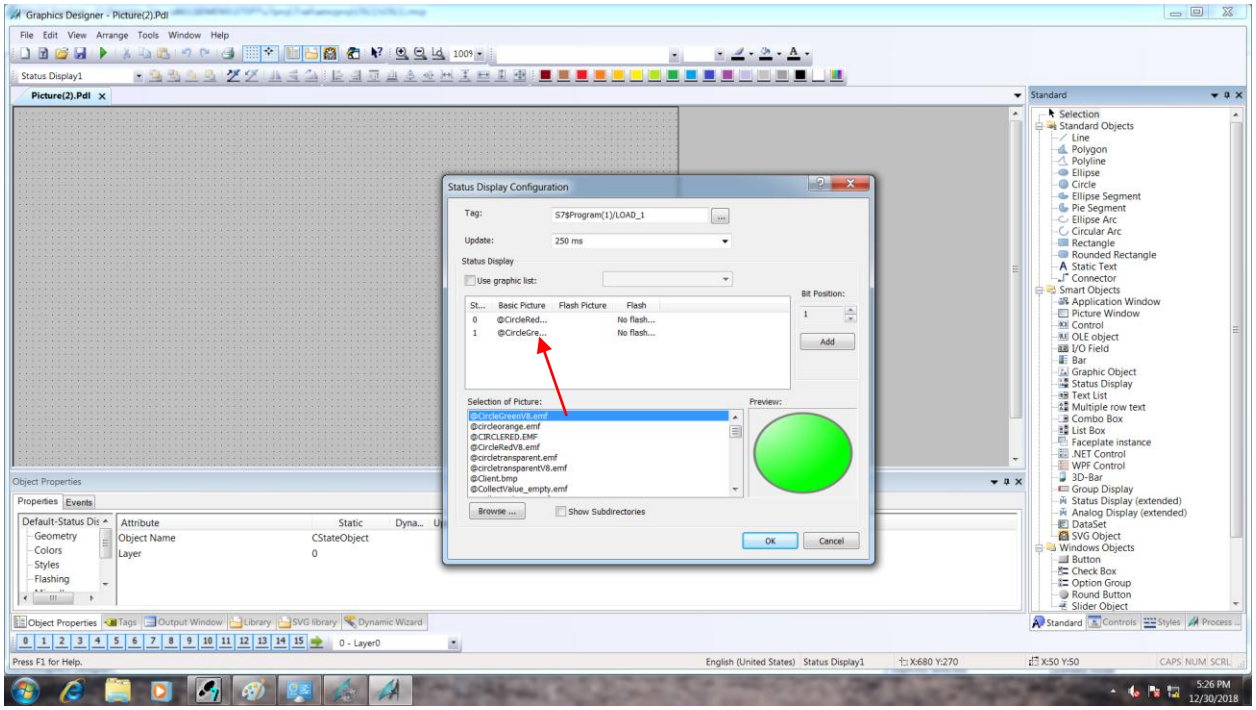
Select Update as **250ms**



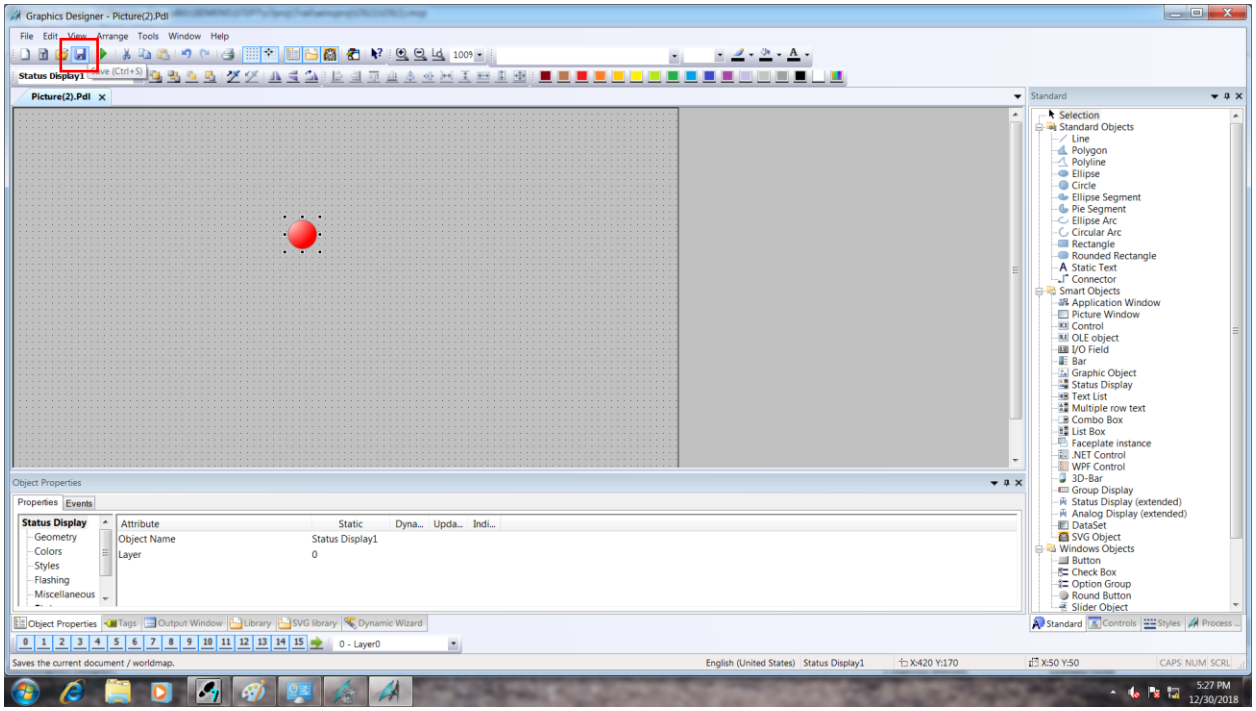
Select Pictures from the below tab for the 0 Status and 1 status as a **Basic Picture**.



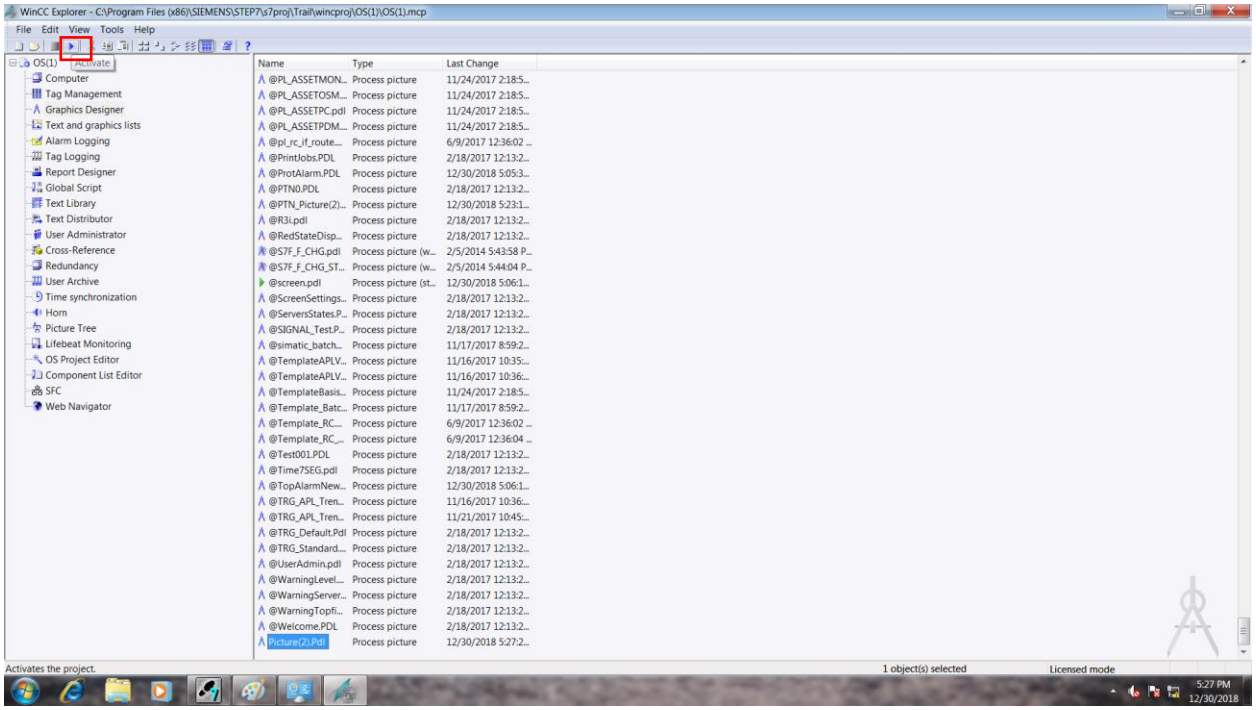
Drag and drop it.



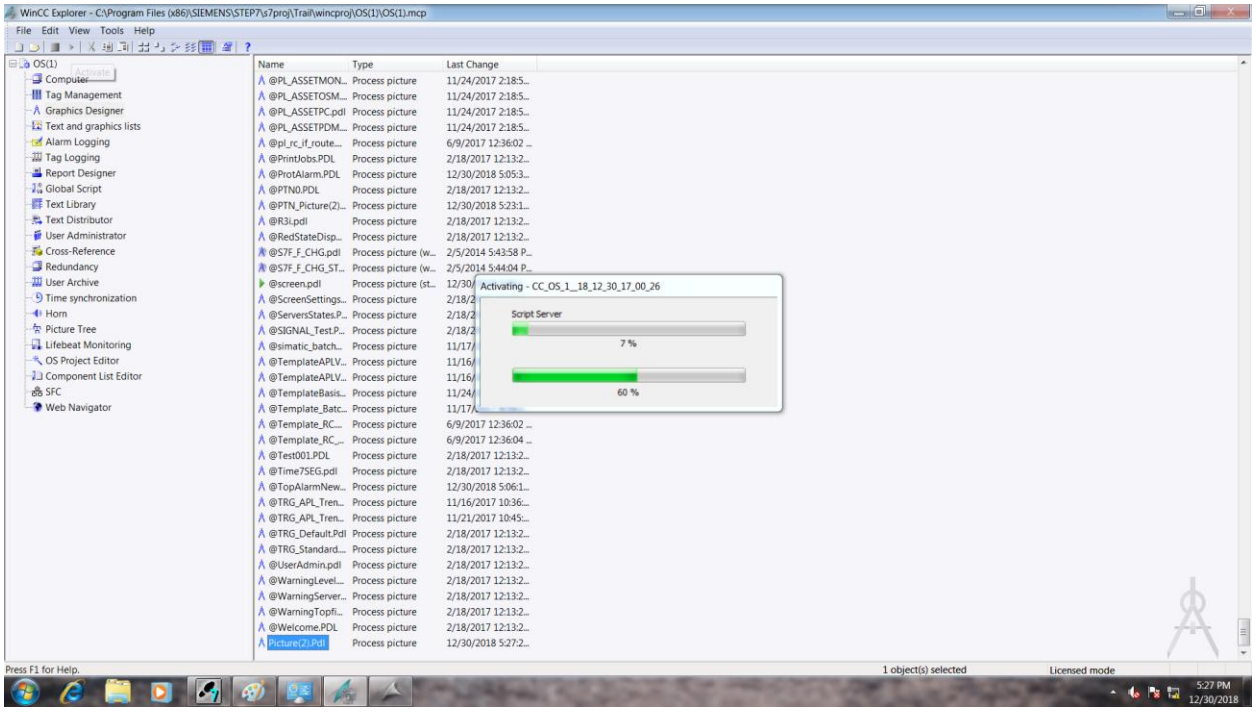
After finishing the Status display tagging, **save** the picture.

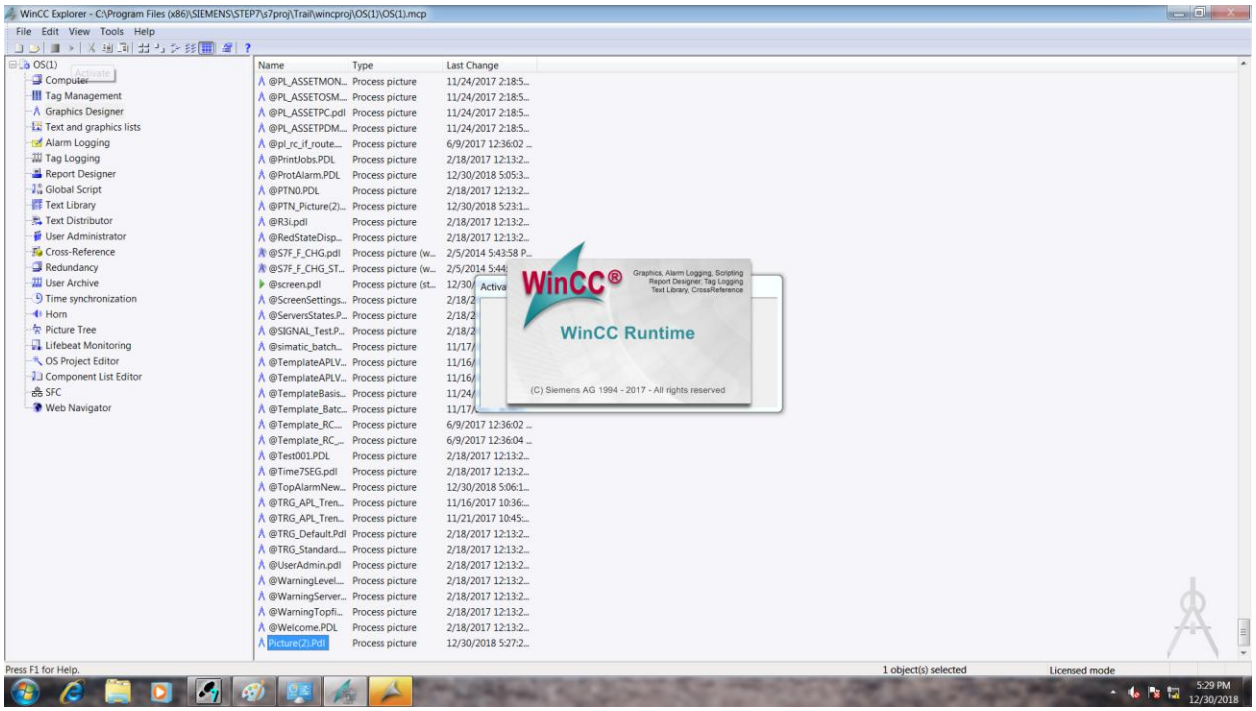


Now click **Activate** in WinCC Explorer window.



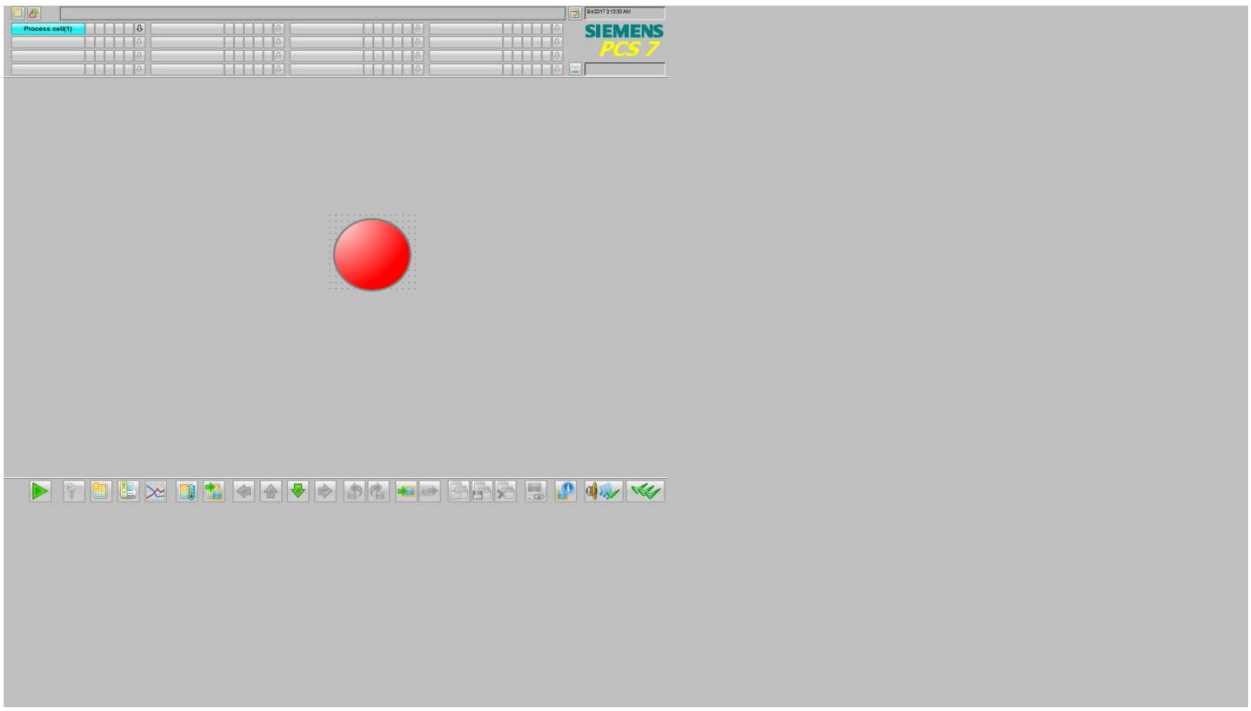
Now the Runtime window will Load



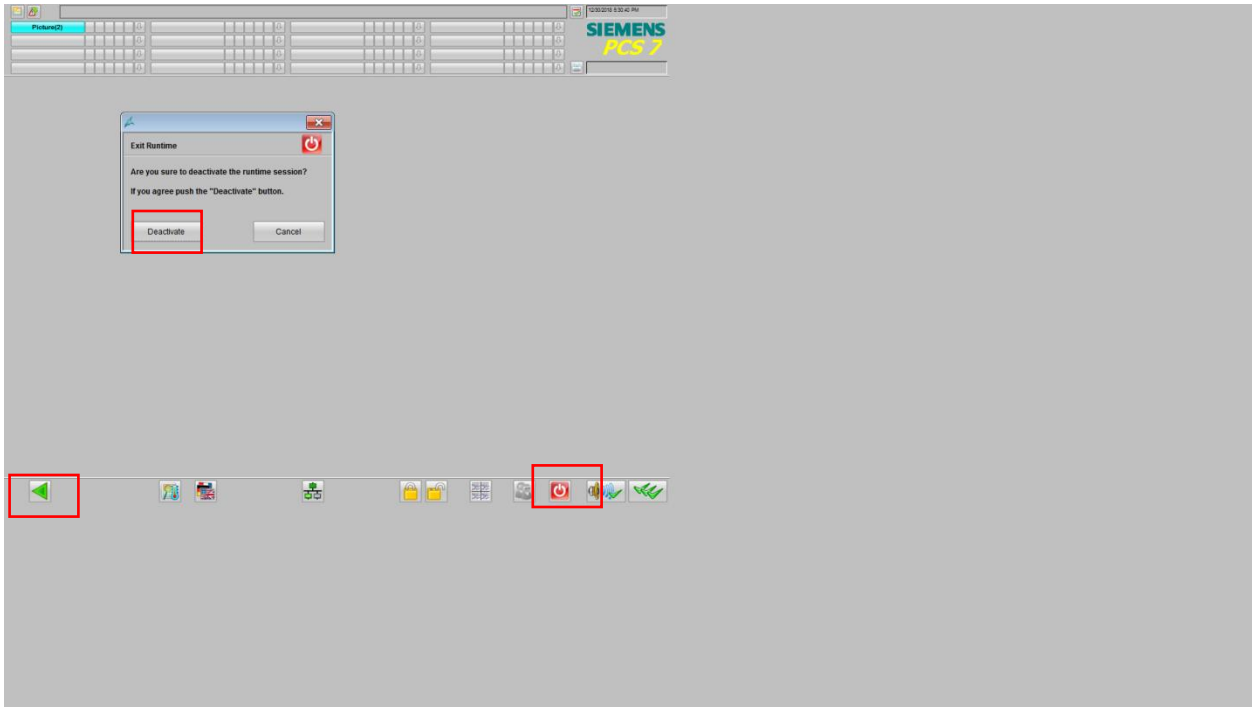


Click on Picture in The Tab on the Home Screen of runtime.

Now you see the Status of the Output.

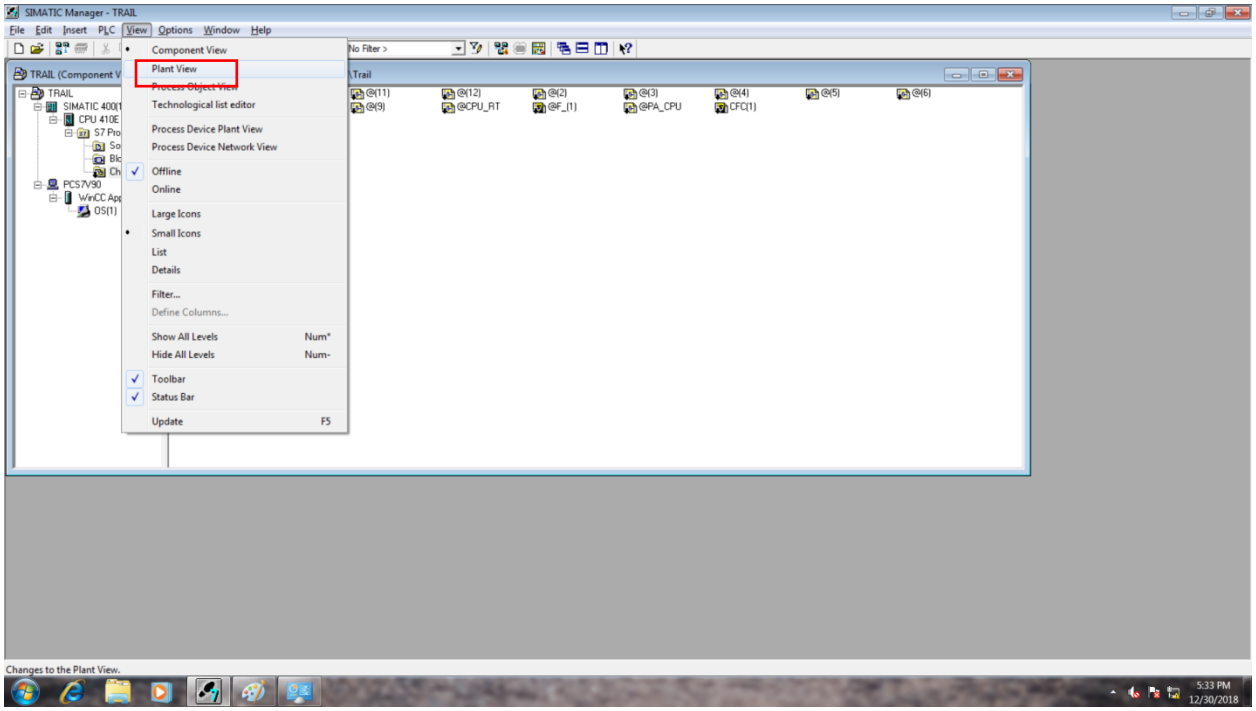


To deactivate click Exit runtime.

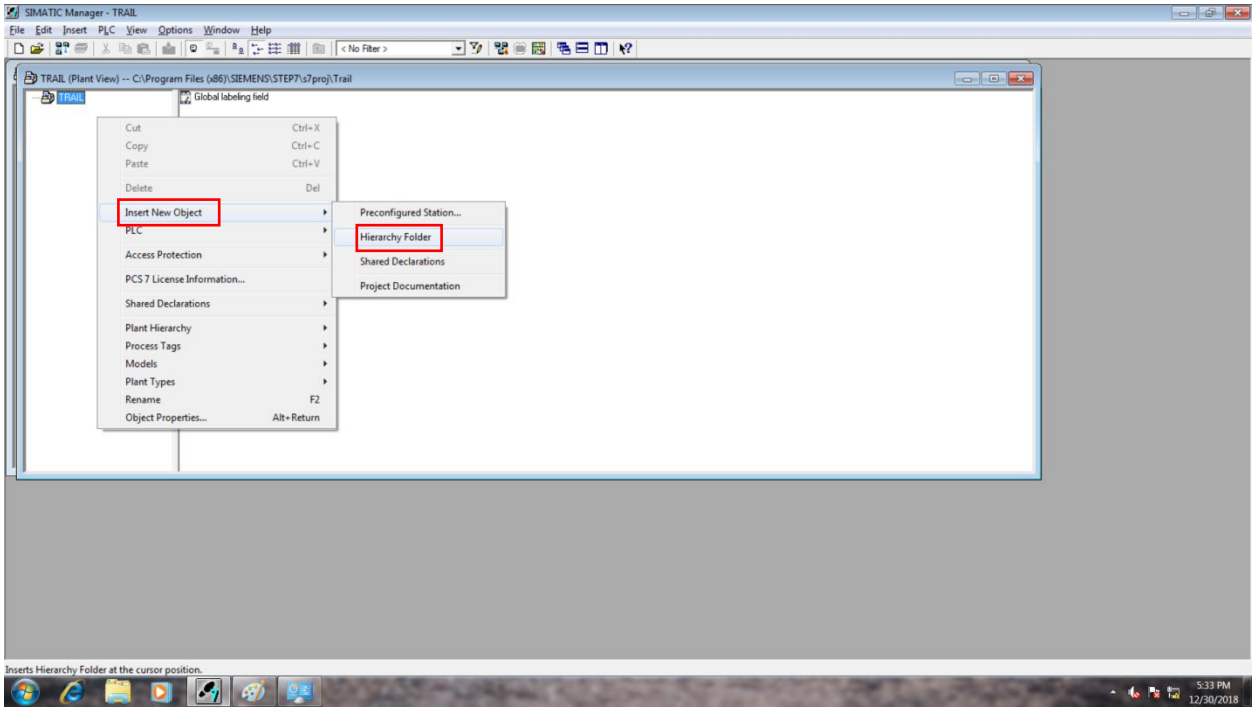


To Create a PID Function,

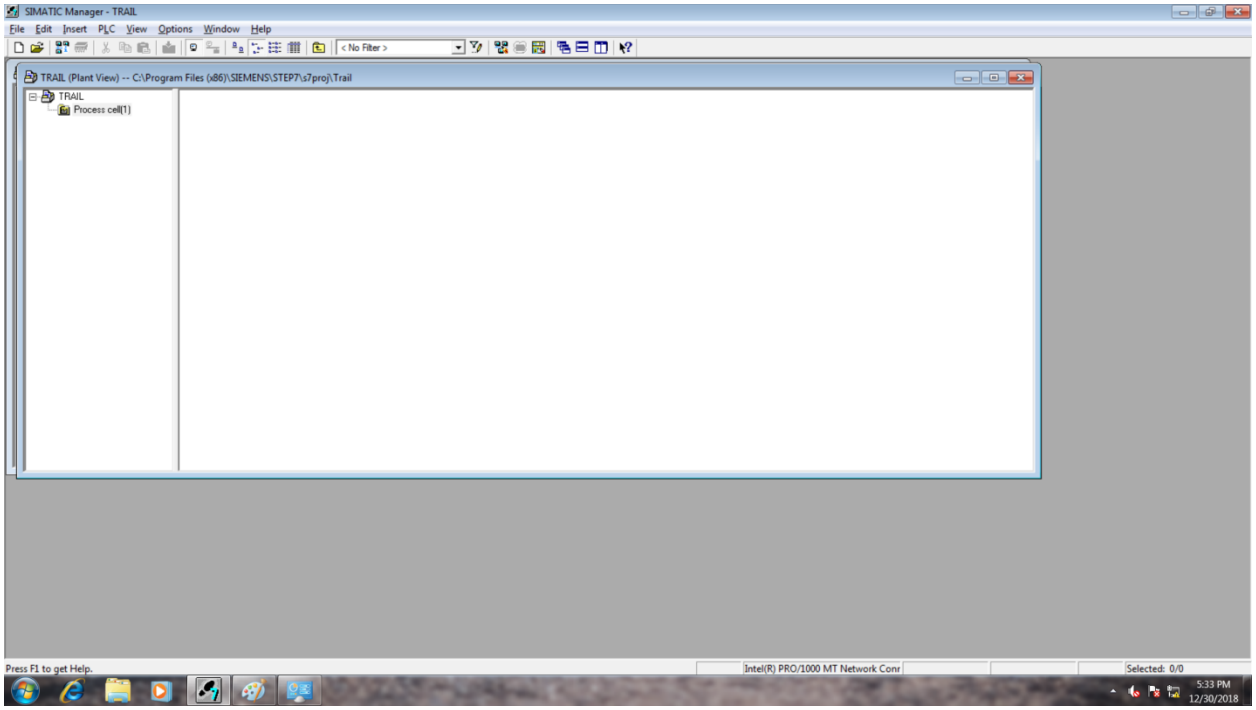
Go to **Plant View** in Simatic Manager.



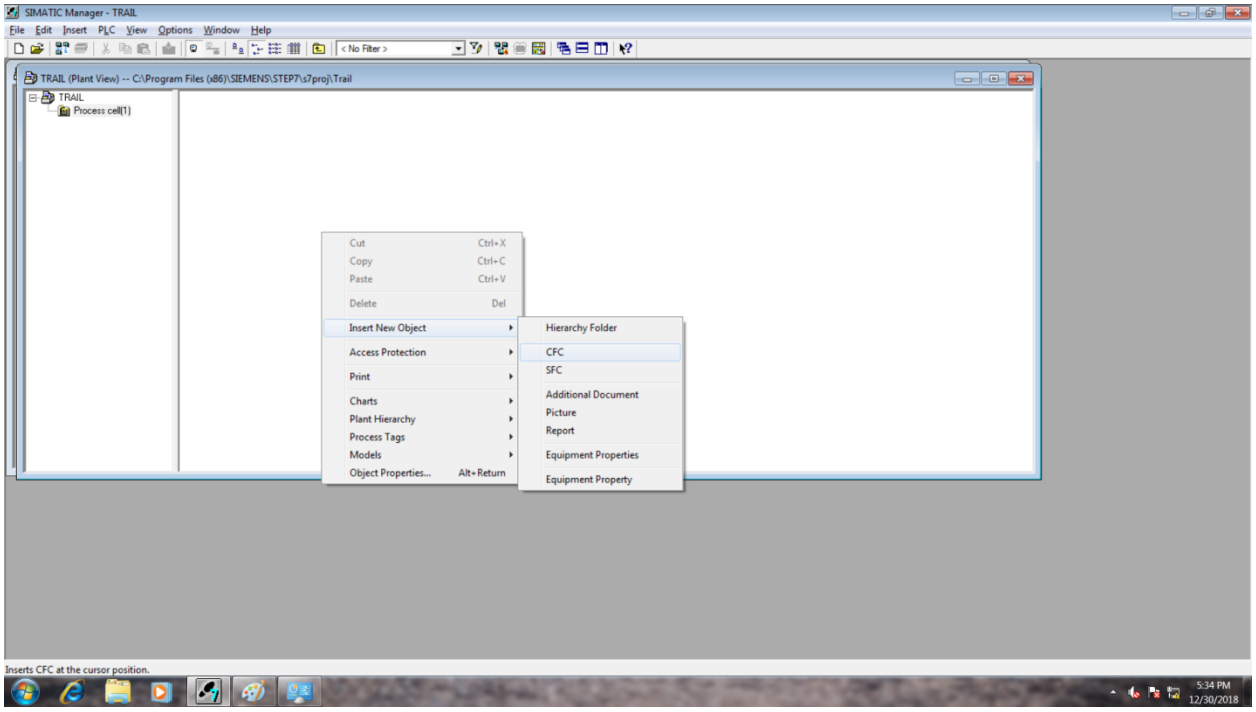
Create **Hierarchy Folder** by below Procedure.



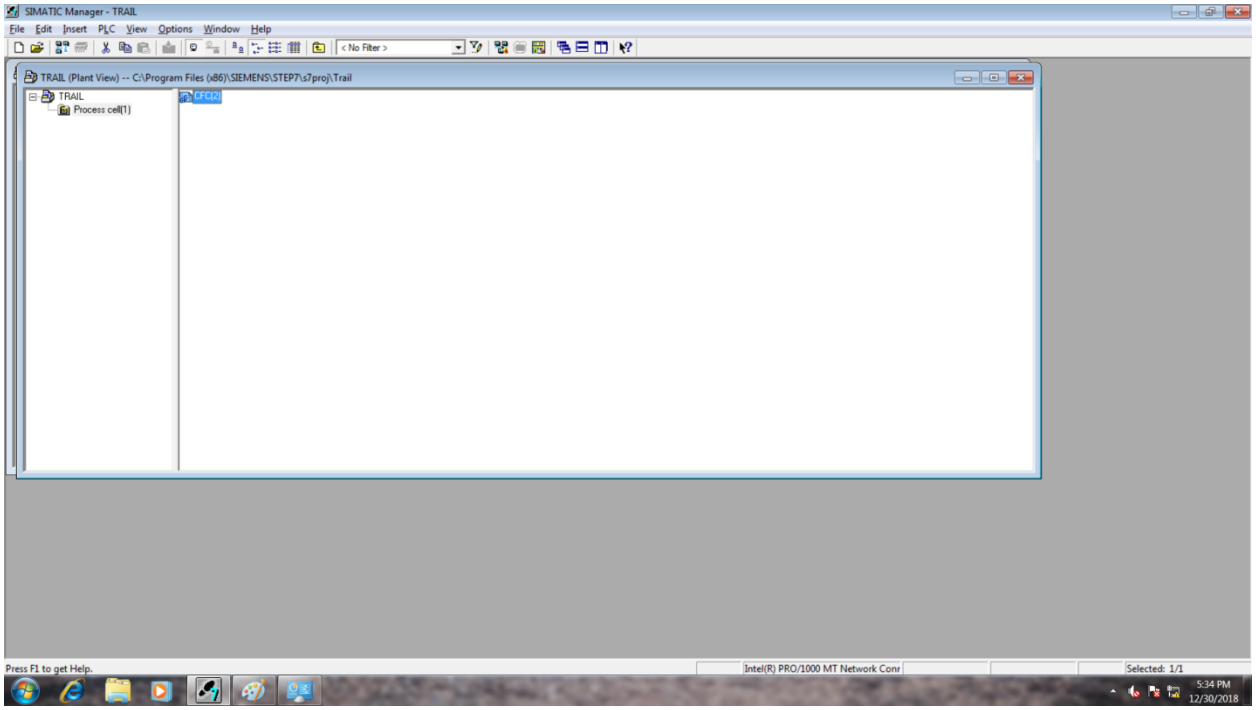
A **Process cell** folder will be created.



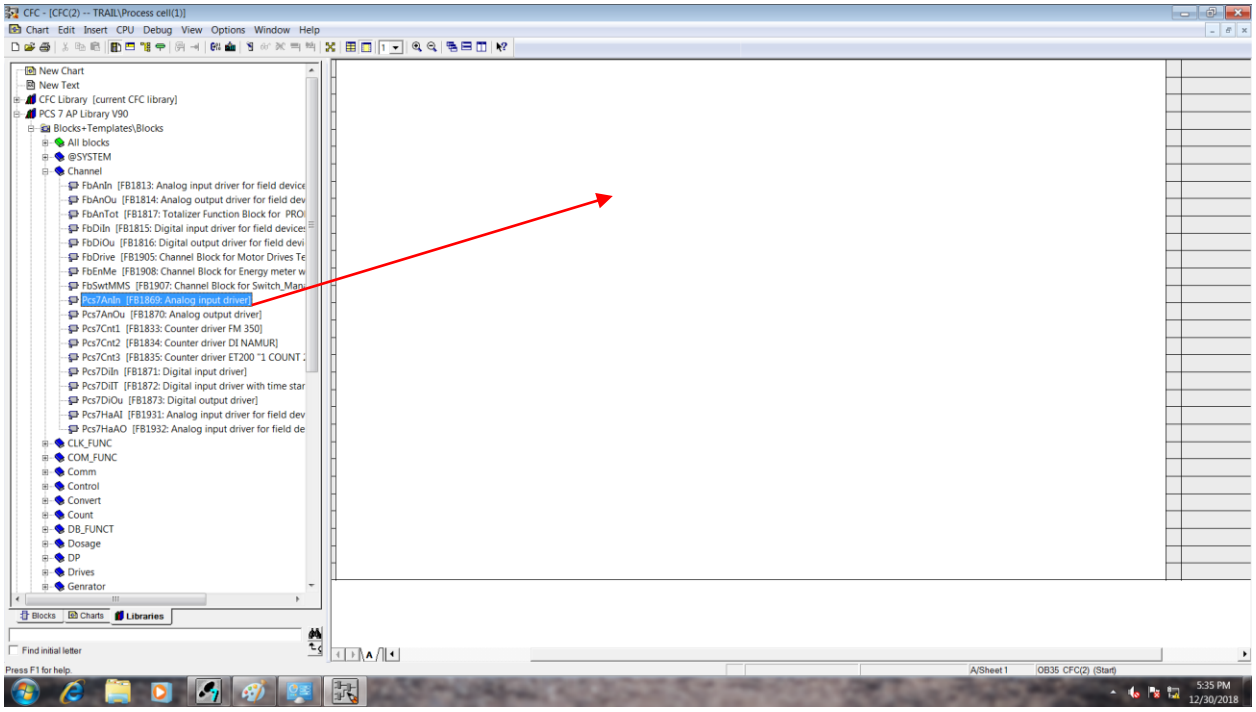
Create a new **CFC** under the Folder.



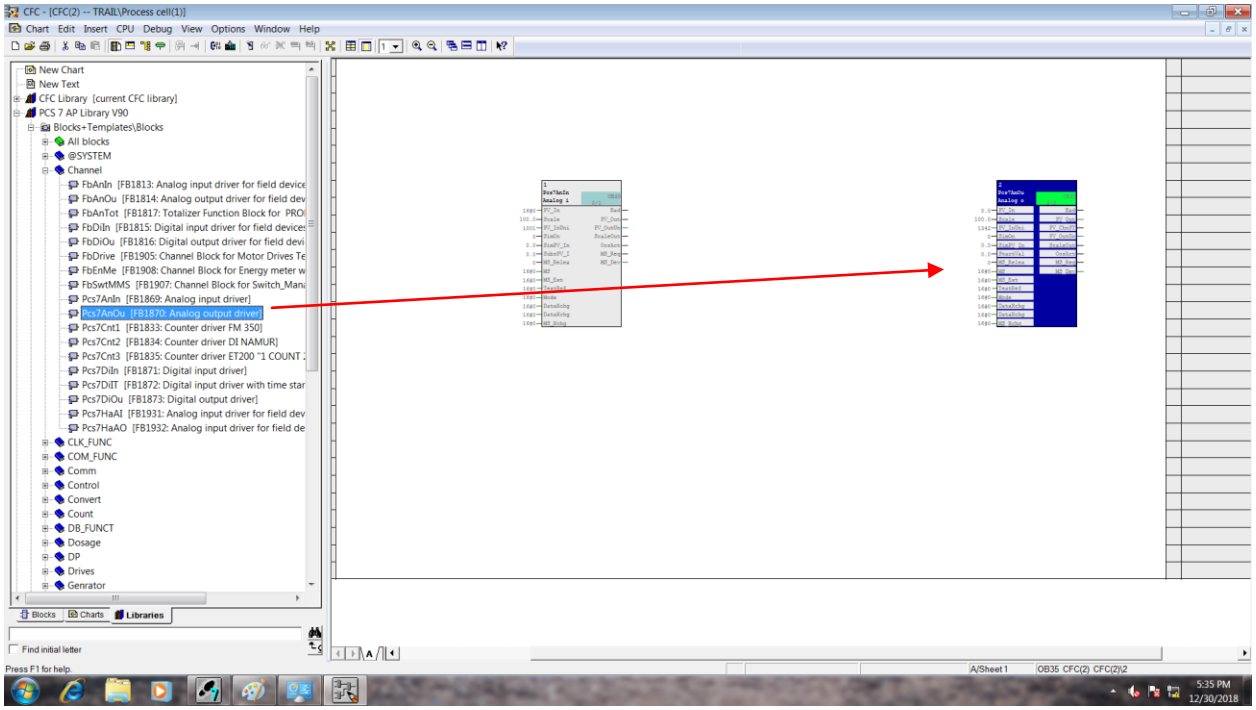
Double click to open the CFC.



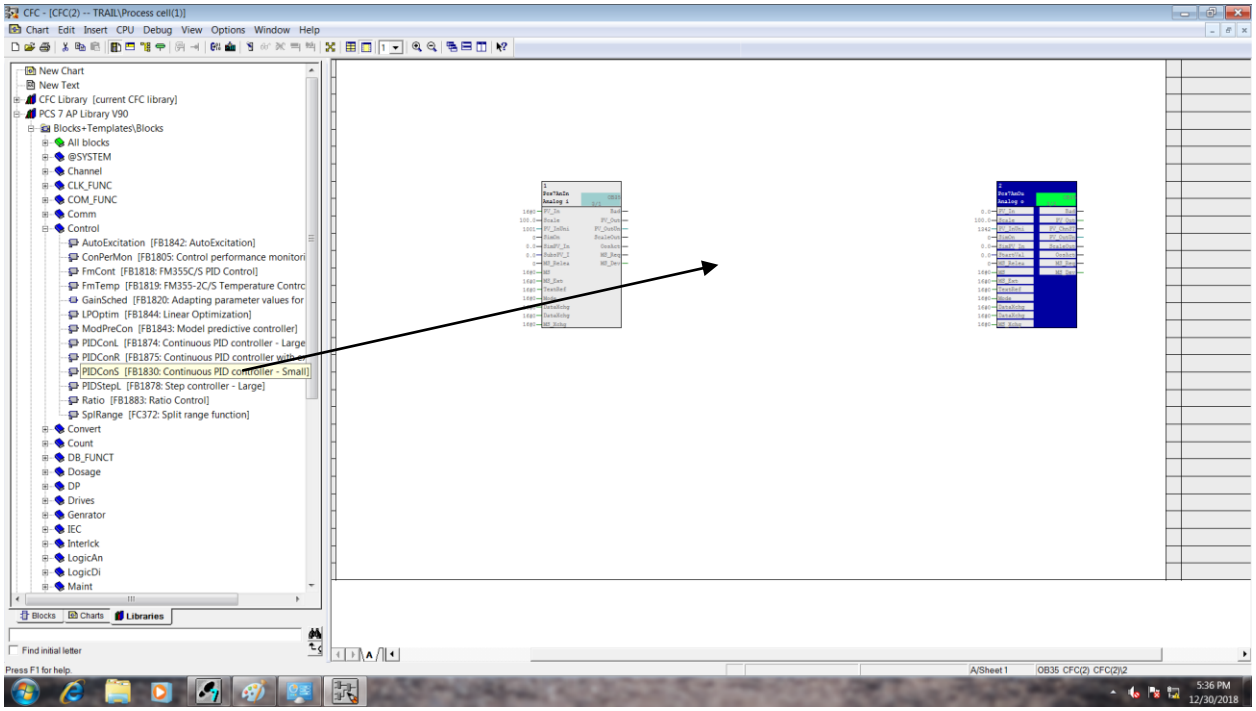
For PID, Drag and Drop **Analog Input driver** block.

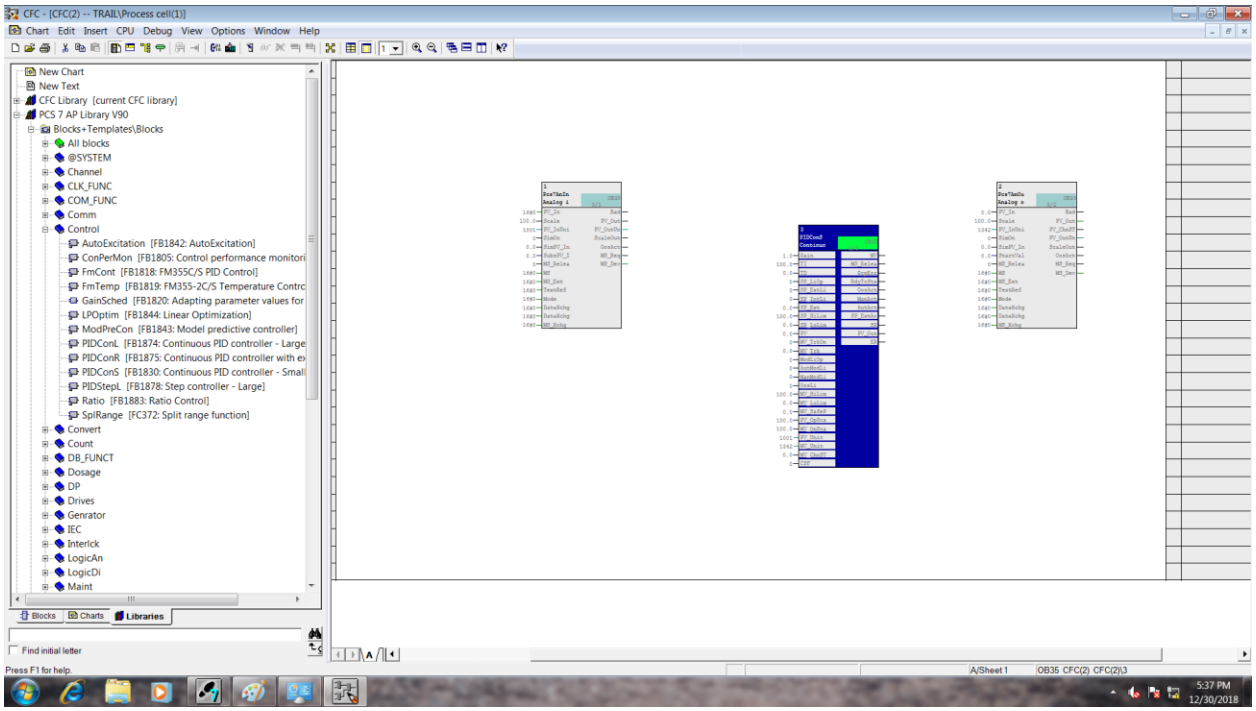


Drag and Drop **Analog Output driver** block.

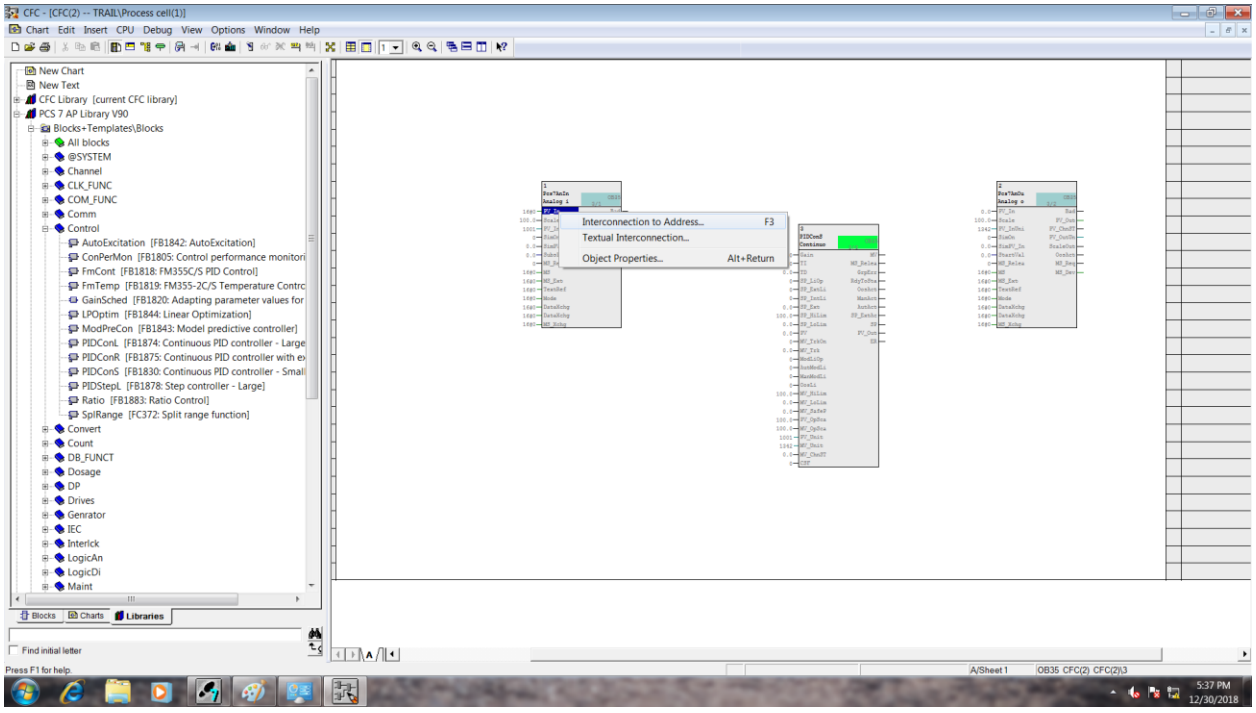


Drag and Drop **Continuous PID controller – Small** block.

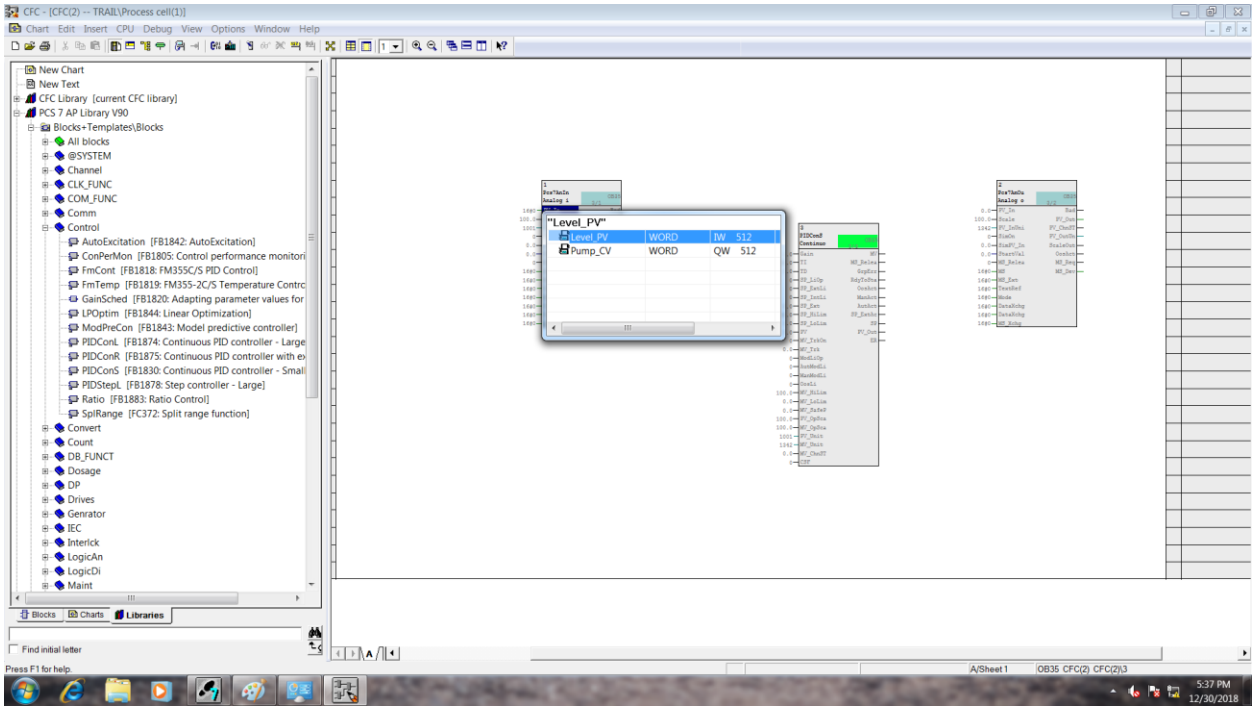




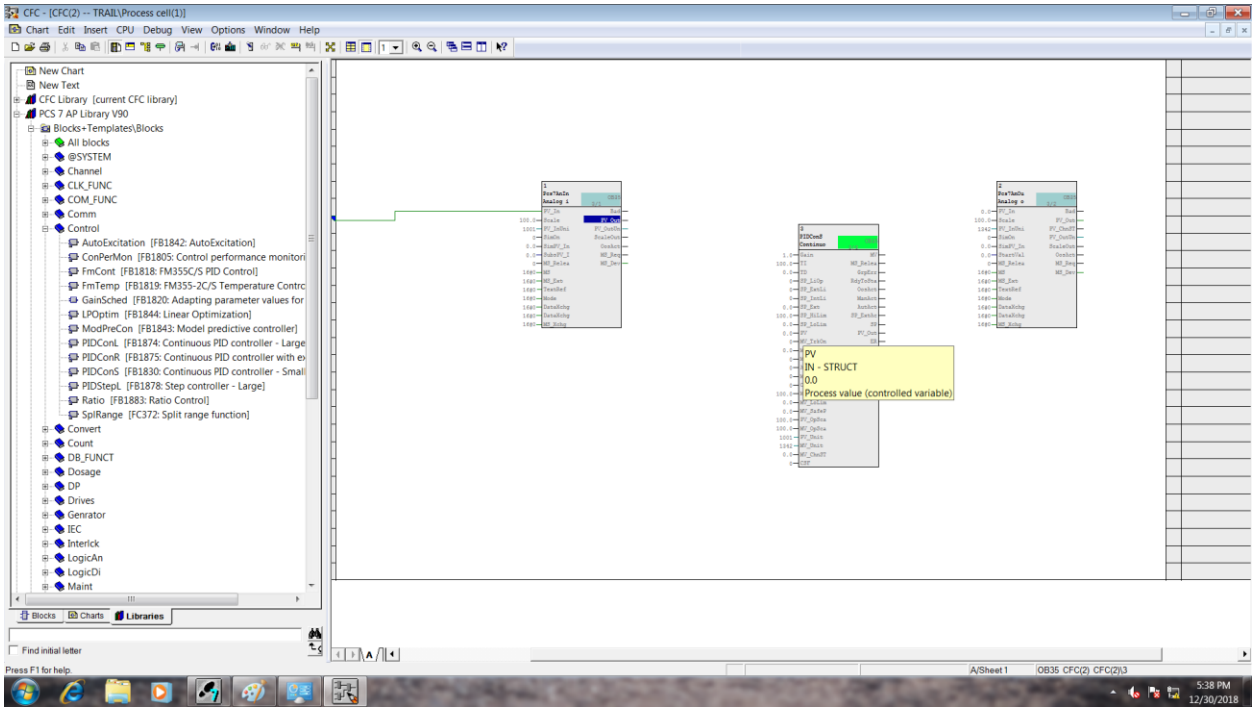
Now Connect the **PV In** Address by right click on it



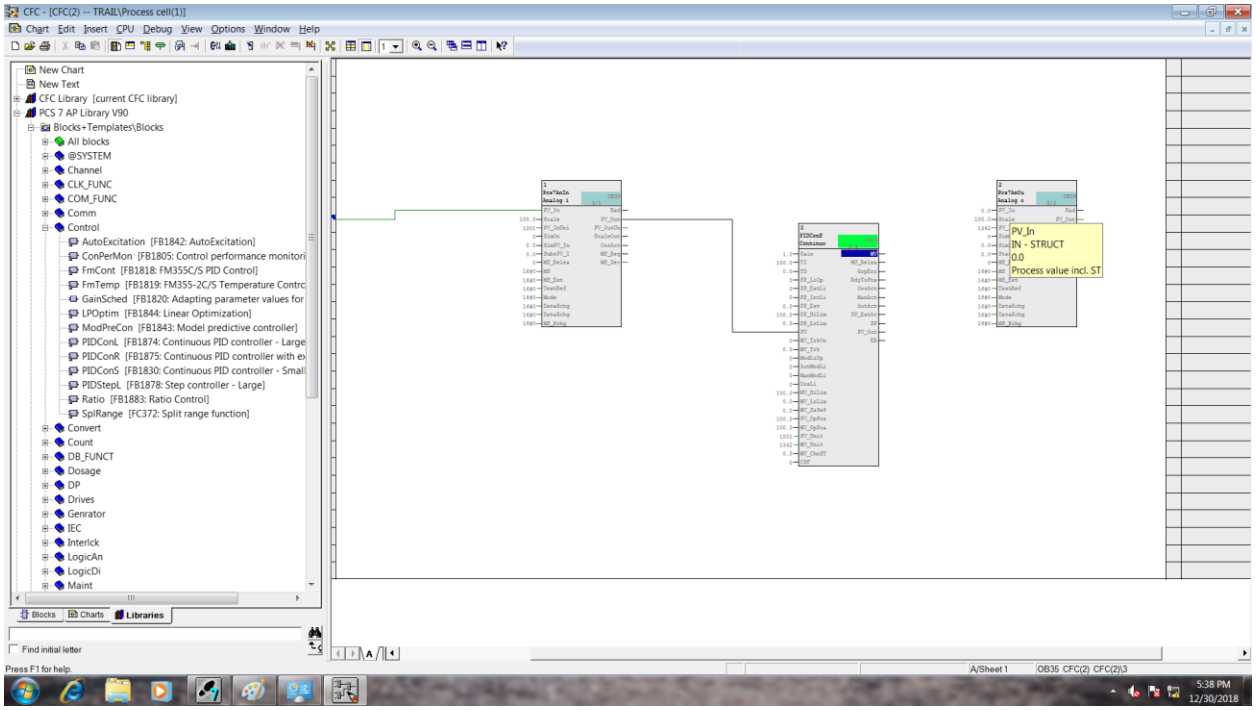
Select as **LEVEL_PV**



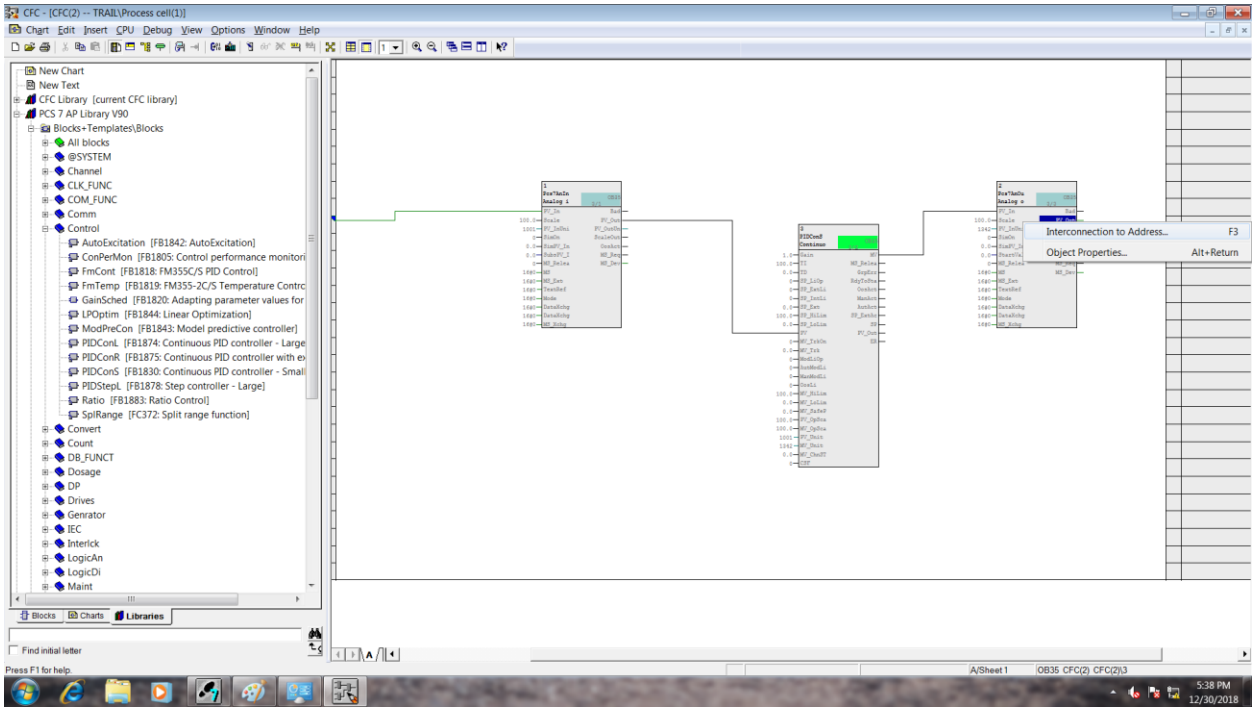
Interconnect **PV out** to **PV** of PID Block.



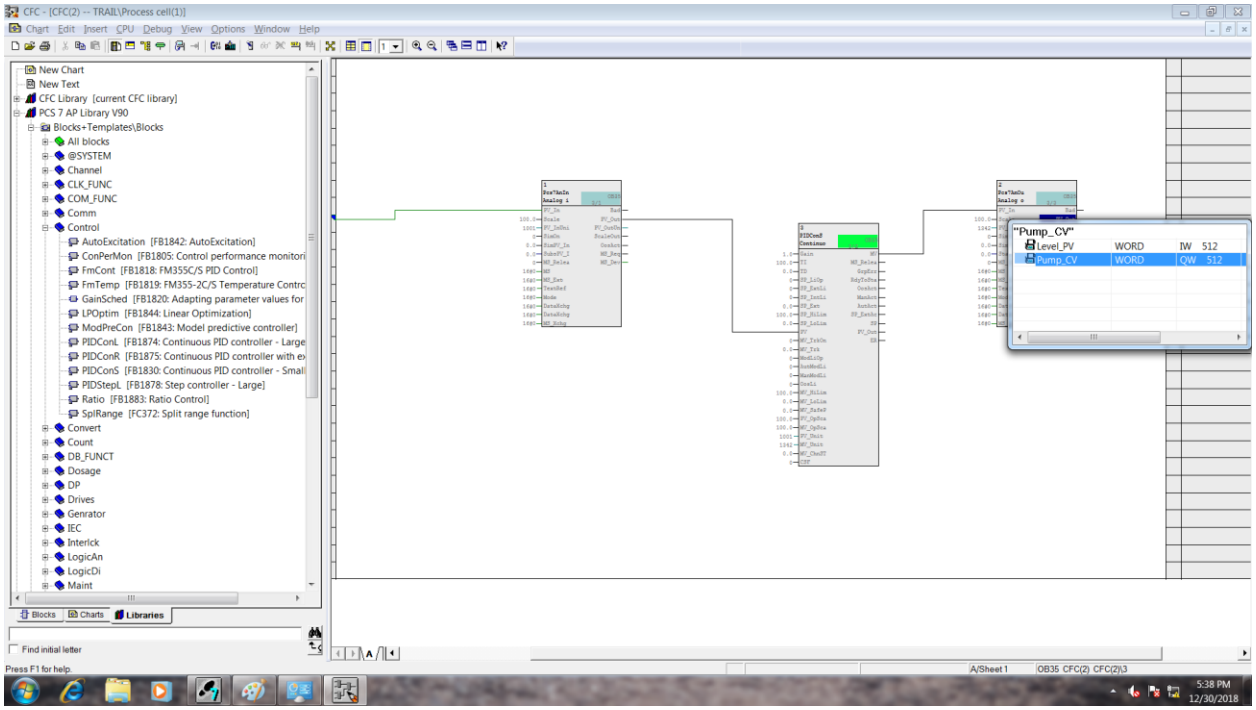
Interconnect **MV** to **PV In** in Output block.



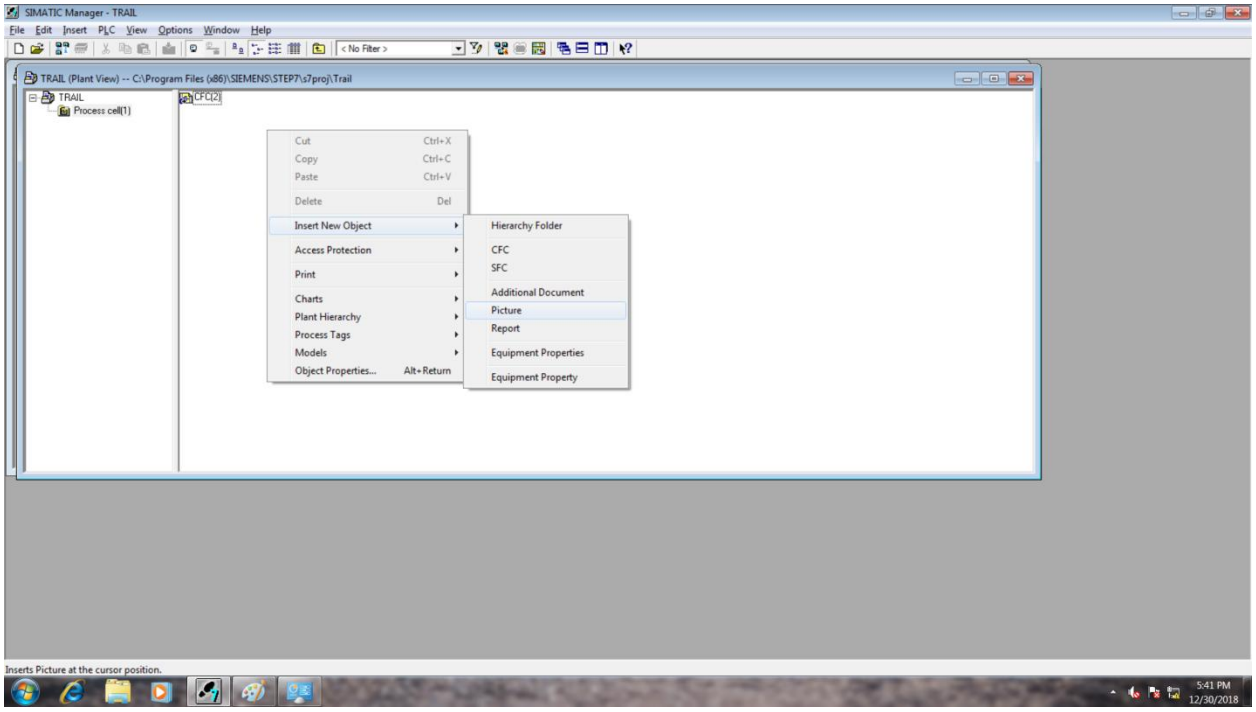
Now Connect the **PV Out** Address by right click on it



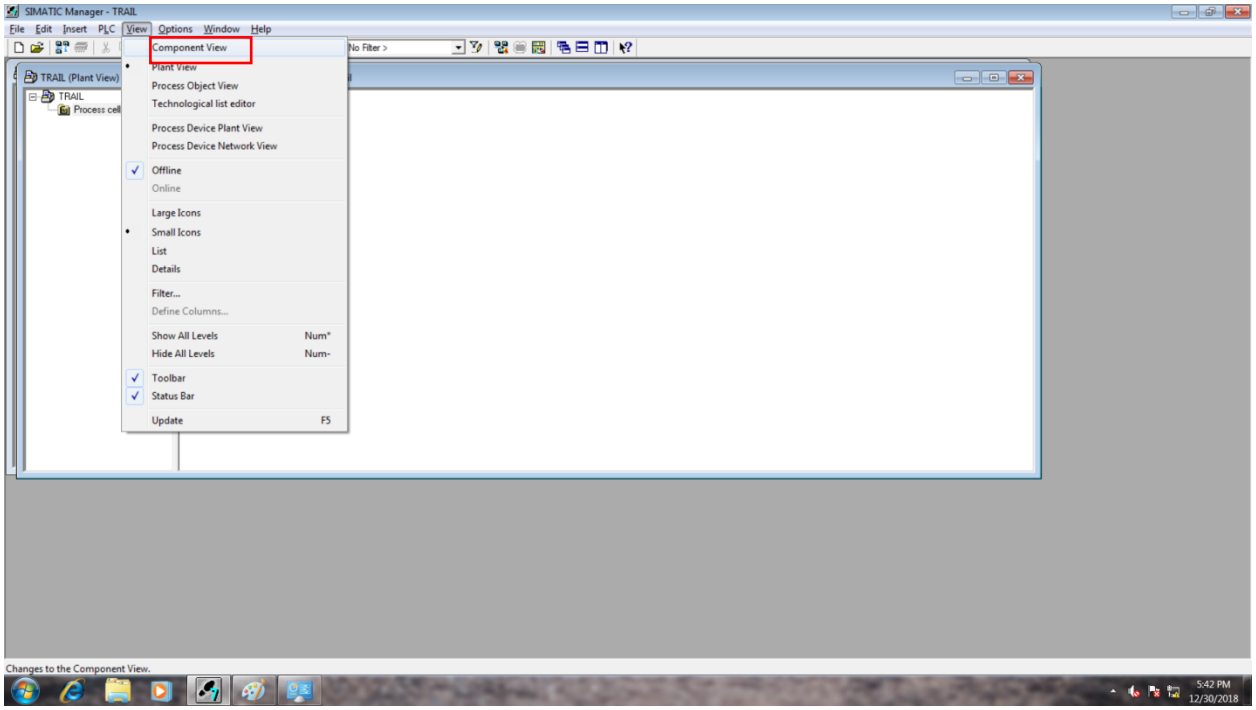
Select **PUMP_CV**.



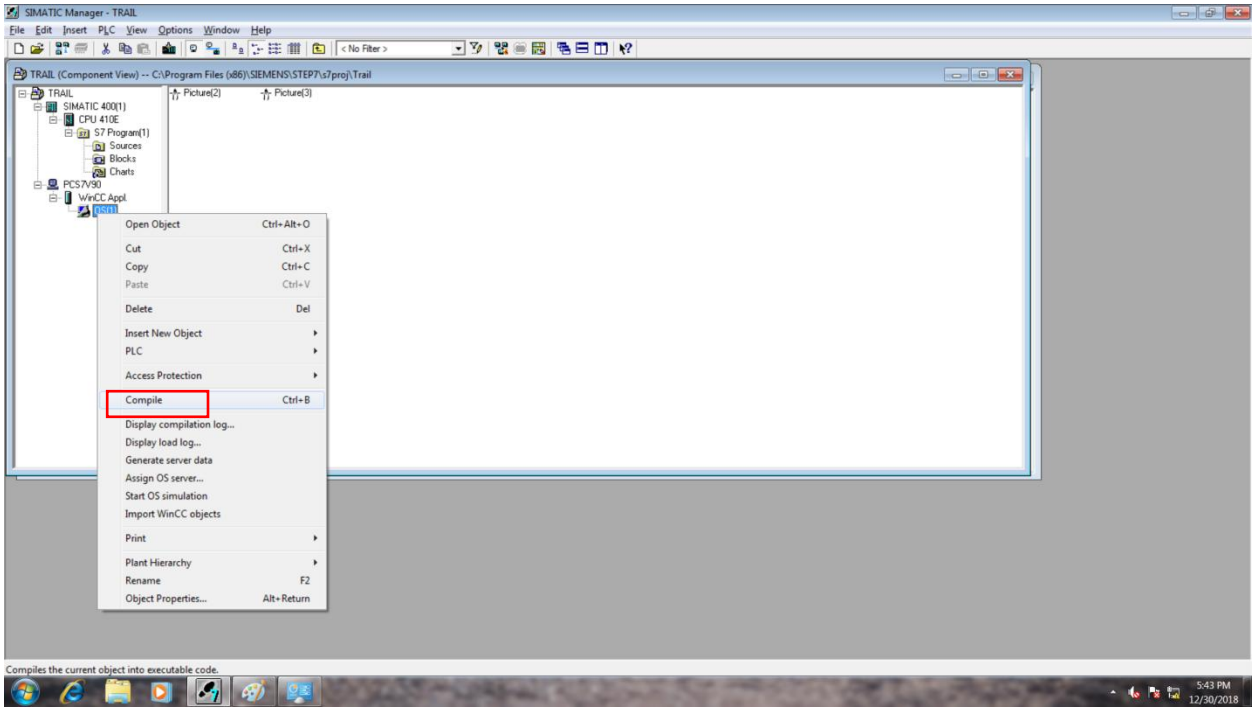
Now go to simatic window and create a **Picture** in Plant view in **Process Cell** Folder.



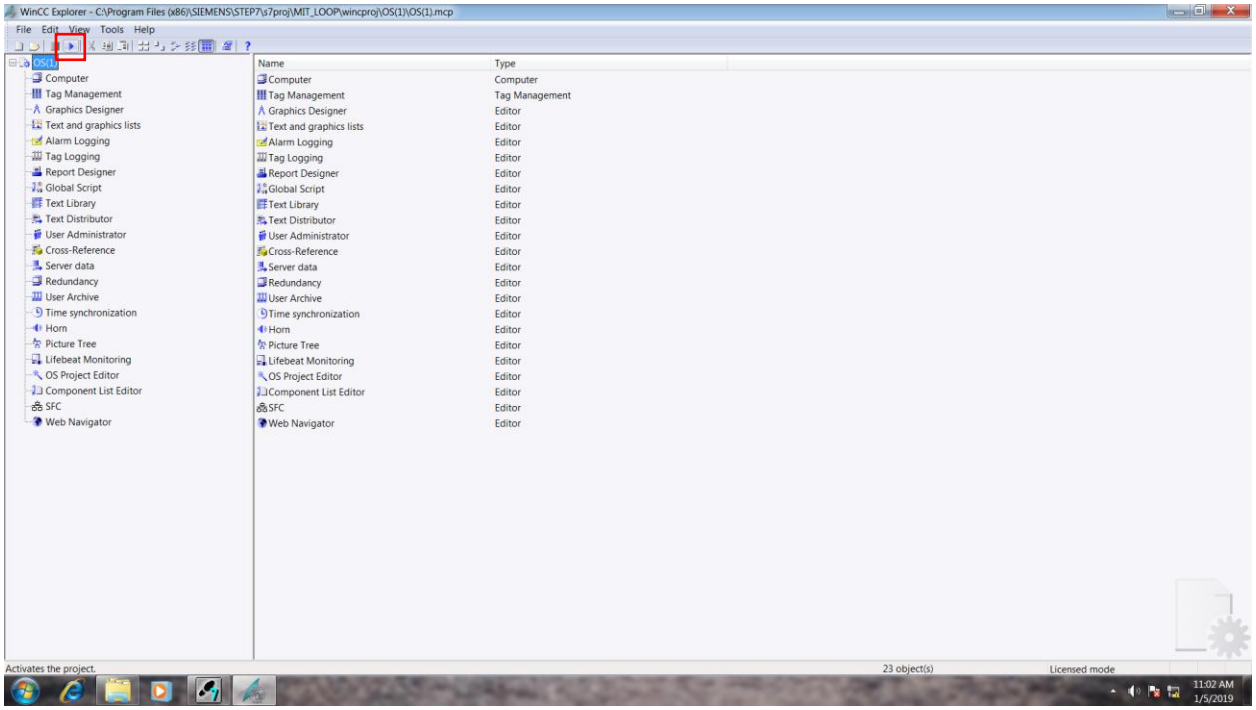
Go to **Component** view.



Compile the OS and Open the OS(1)



Activate the OS.



From the OS, we can set the set point for the **PID Block** and verify the result