

# **PLC & HMI TRAINING**

## **for Electrical Team**



---

---

Prepared for:

Electrical team

Prepared by:

Dayel Kim (Electrical Engineering Technologist)

25 June 2021

---

---

## **Introduction**

I am writing this training document to give a brief idea of electrical tech's job.  
This document contains basic instruction on PLC and HMI (Allen Bradley and Siemens).

This document is for reference purposes only.

Some information is only applicable for EVRAZ Maintenance team.

## Table of Contents

|   |    |
|---|----|
| Introduction .....  | i  |
| 1 Rslogix 5000 .....                                      | 1  |
| 1.1 Open PLC program.....                                 | 1  |
| 1.2 Going online .....                                    | 2  |
| 1.3 Communication Paths.....                              | 1  |
| 1.4 Making Changes .....                                  | 1  |
| 1.4.1 Online editing.....                                 | 1  |
| 1.4.2 Download (Offline editing) .....                    | 3  |
| 1.5 Drive Configuration.....                              | 5  |
| 1.5.1 Basic Programming .....                             | 5  |
| 1.5.2 Assign IP Address to Powerflex 525.....             | 7  |
| 1.5.3 Change your laptop's IP Address.....                | 8  |
| 1.5.4 Use "Cmd" to ping (verify communication path) ..... | 12 |
| 1.5.5 Adding drive on your PLC (Rslogix 5000) .....       | 15 |
| 1.6 HMI (FactoryTalk View Studio).....                    | 24 |
| 1.6.1 Upload .....  | 24 |
| 1.6.2 Make changes.....                                   | 33 |
| 1.6.3 Create runtime application and Download .....       | 34 |
| 1.6.3.1 Create runtime application .....                  | 34 |
| 1.6.3.2 Download .....                                    | 40 |
| 1.6.3.3 Load new file on HMI screen .....                 | 42 |
| 2 Siemens TIA portal 14 .....                             | 44 |
| 2.1 Open newest file .....                                | 44 |
| 2.2 Go online .....                                       | 50 |
| 2.3 Monitor.....  | 55 |
| 2.4 Download.....   | 56 |
| 2.5 Upload newest file to share folder .....              | 60 |

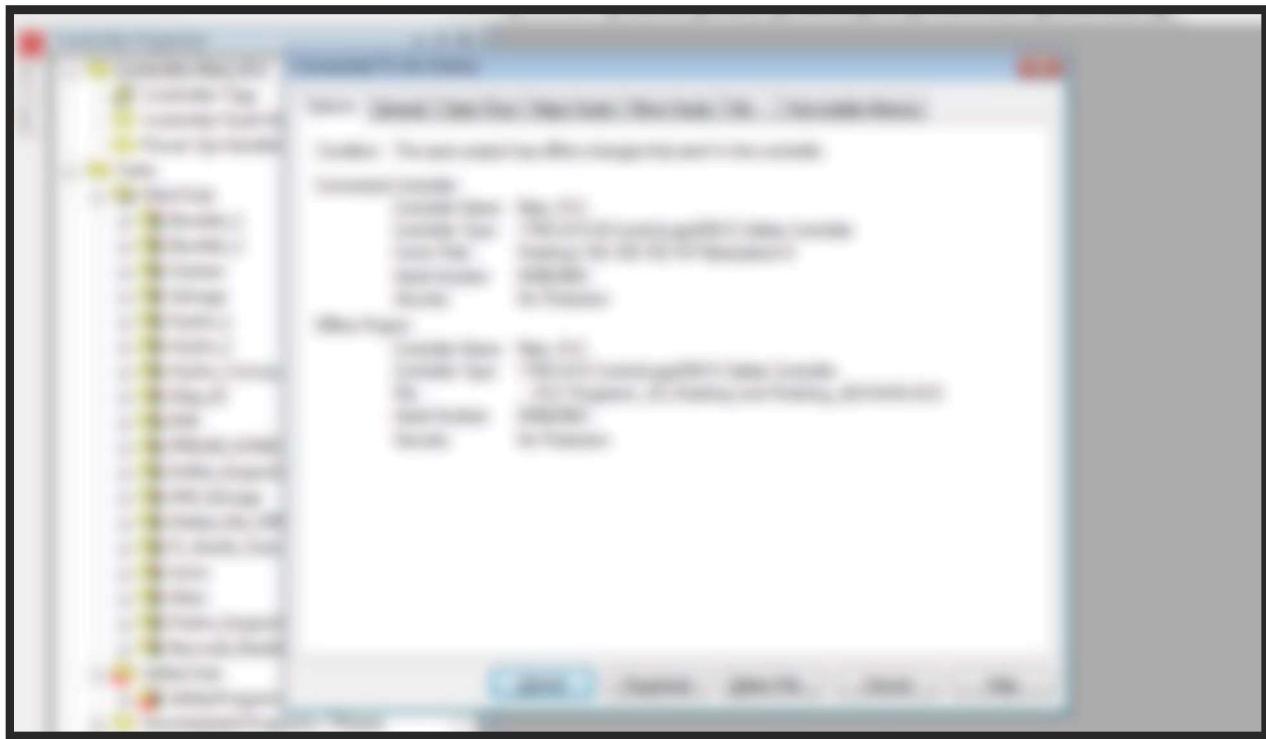
# 1 Rslogix 5000

Most Allen-Bradley programs in ERW are now Rslogix 5000 [except Mill line (Rslogix 5) and Accumulator (Rslogix 500)]

## 1.1 Open PLC program

We save most recent files on share folder so that maintenance team and engineering team can open the newest file all the time.

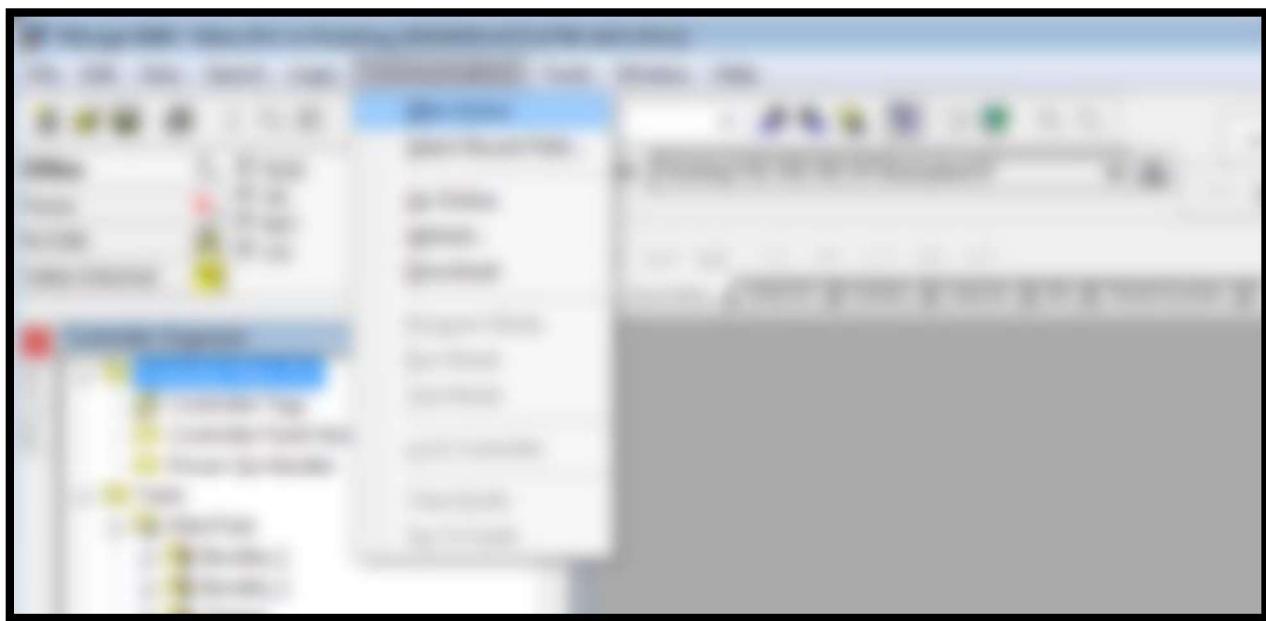
If files are well-managed, we should open the newest file (by file name). Common mistake is that people make changes on older file and save file, which will cause PLC asking you to upload (could be time consuming) next time when other guys open the newest file (by file name) and try to go online (see below example).



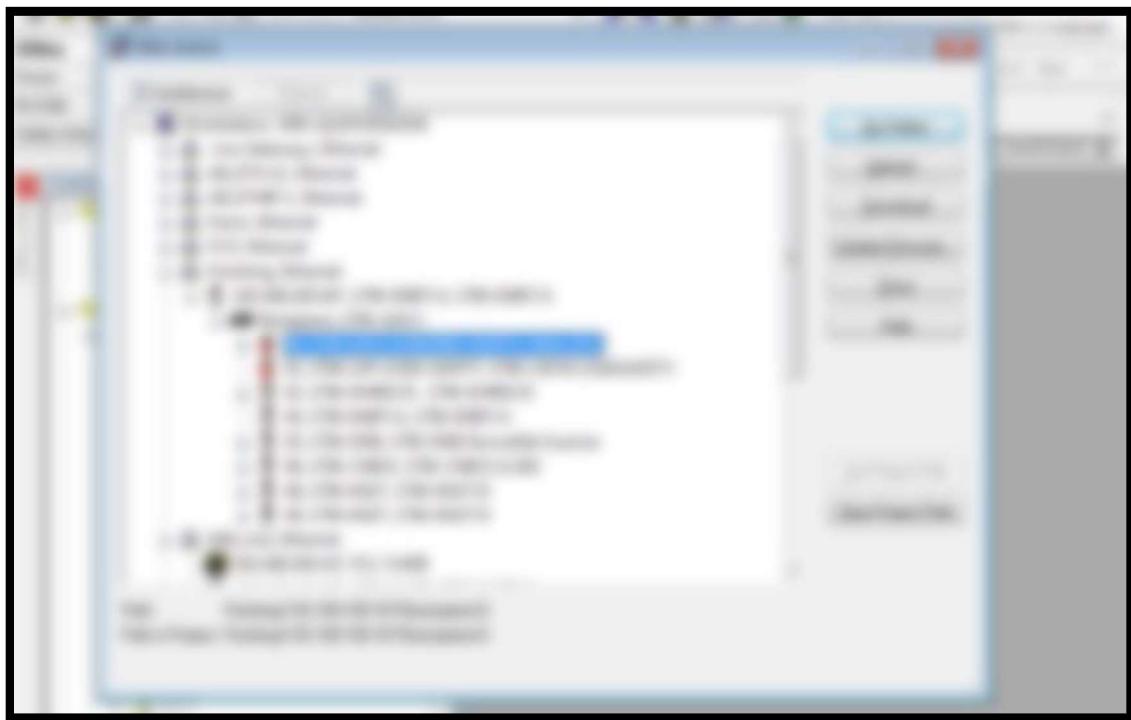
## **1.2 Going online**

Usually I go online when I want to monitor real-time changes on inputs and outputs for troubleshooting purpose. Also, it will show you how to do online editing without downloading PLC (download causes PLC to stop so you should only perform when line is down, and nobody is near machine)

There are multiple ways to Go Online but I will show you how I go online. First, Click "Communication" on tool bar and click "Who Active"



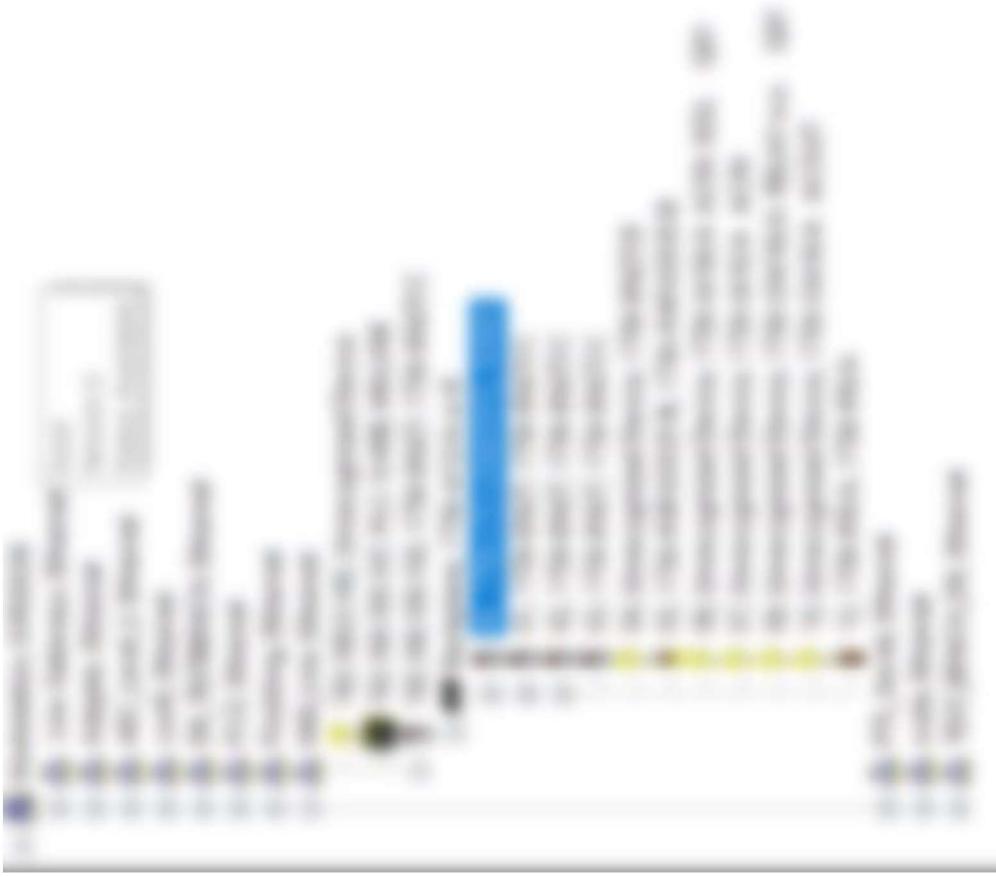
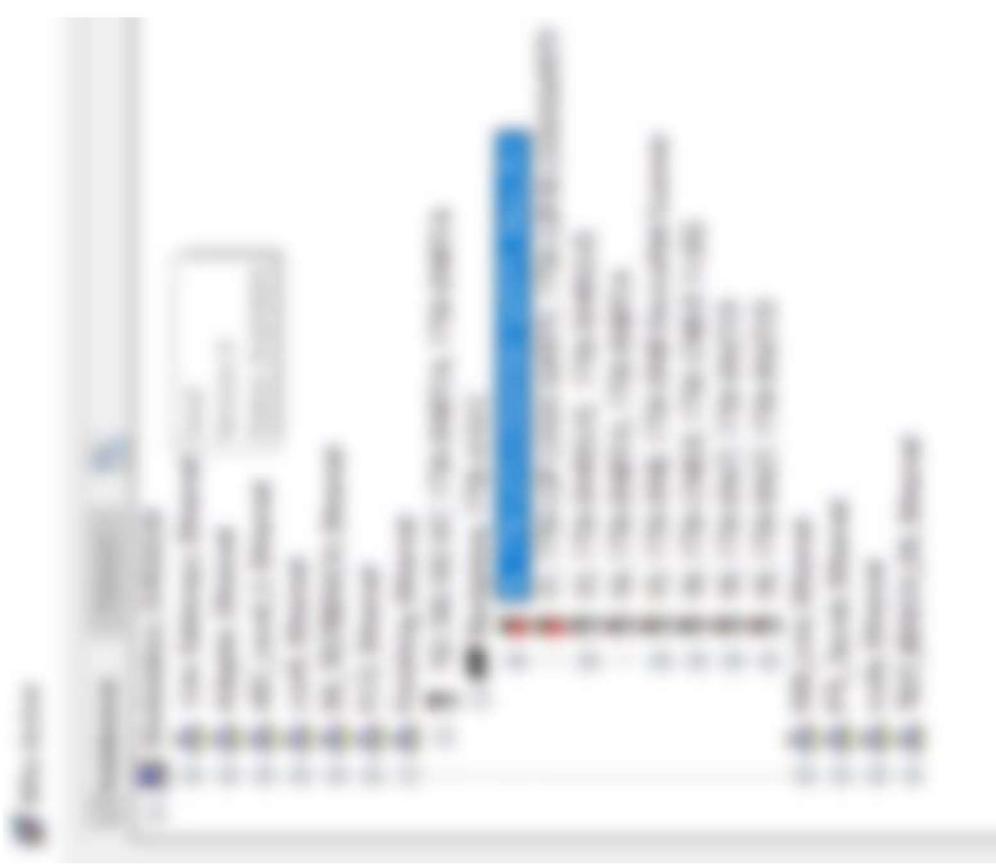
It might already highlight communication path for you. If that is the case, you just click "Go Online".



However, if path is not highlighted or path is not correct, then you should manually find a right path and Click "Go online"

### **1.3 Communication Paths**

For those who are not familiar with communication paths, I took screenshots of each paths.

| MII Drive  | Finishing   |
|--|---|
|  |  |

|                        |            |  |
|------------------------|------------|--|
|                        | <b>FCO</b> |   |
| <b>Final Finishing</b> |            |  |

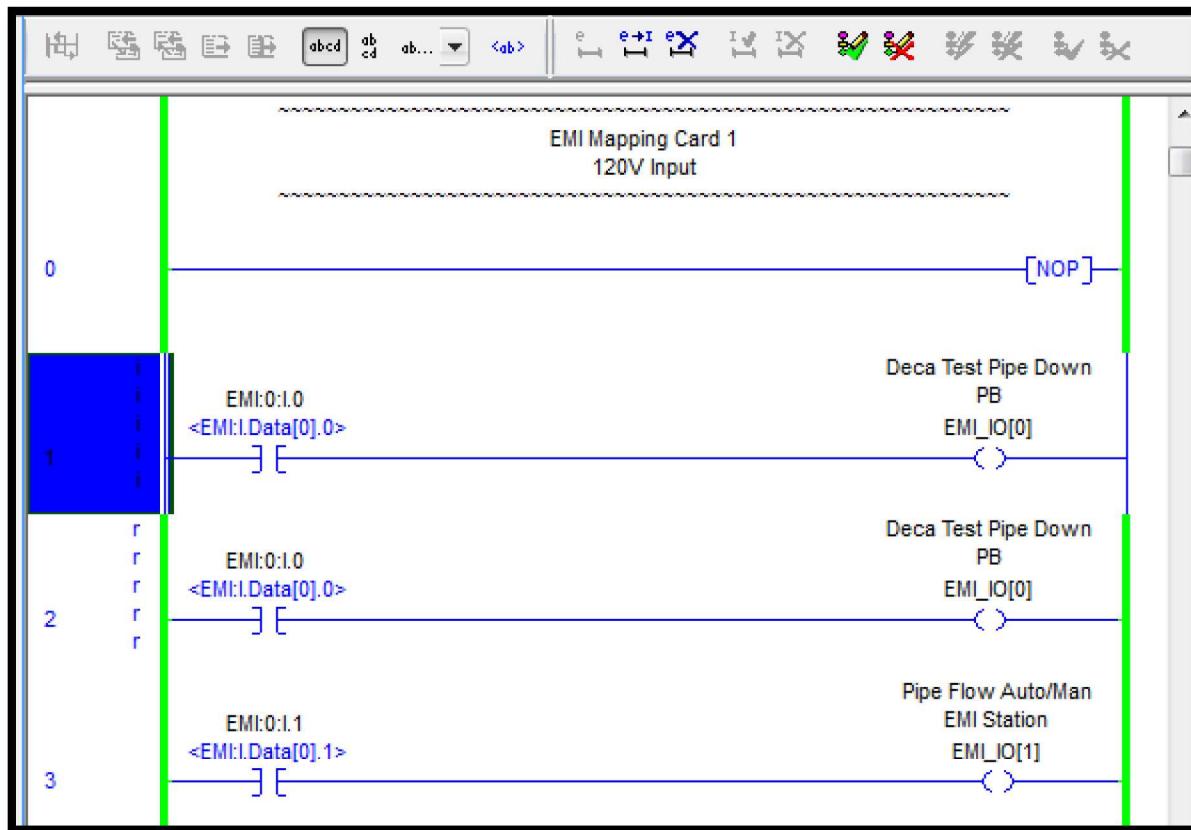
## **1.4 Making Changes**

Rslogix 5000 allow you to make most changes without downloading (online editing). However, it will require to download when you add new drives or card on I/O tree.

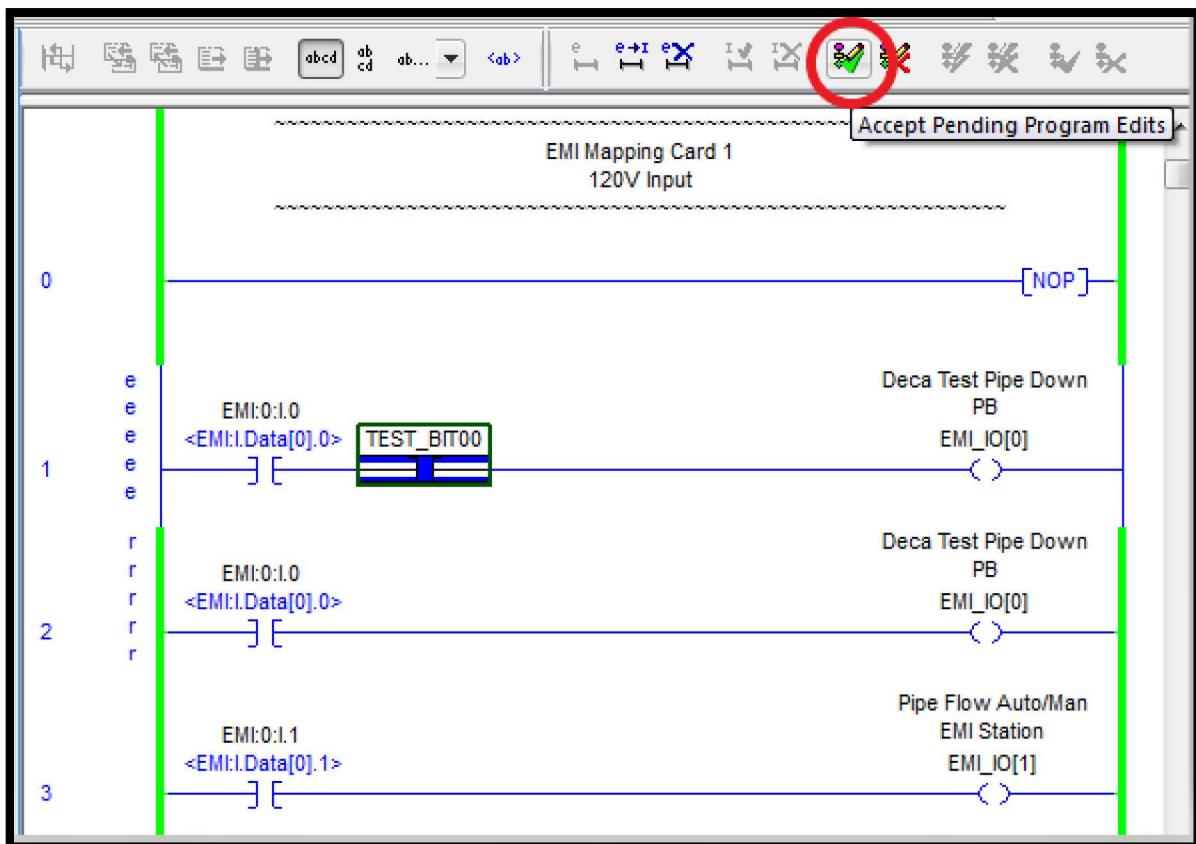
### **1.4.1 Online editing**

First, you need to be in "Online Mode"

Double click the rung that you want to make changes (see figure below)



It will duplicate the rung you double click. You should make changes on upper rung. For example, I added “TEST\_BIT00” to upper rung. Once you made all changes, Click “Accept Pending Program Edits” (See figure below)



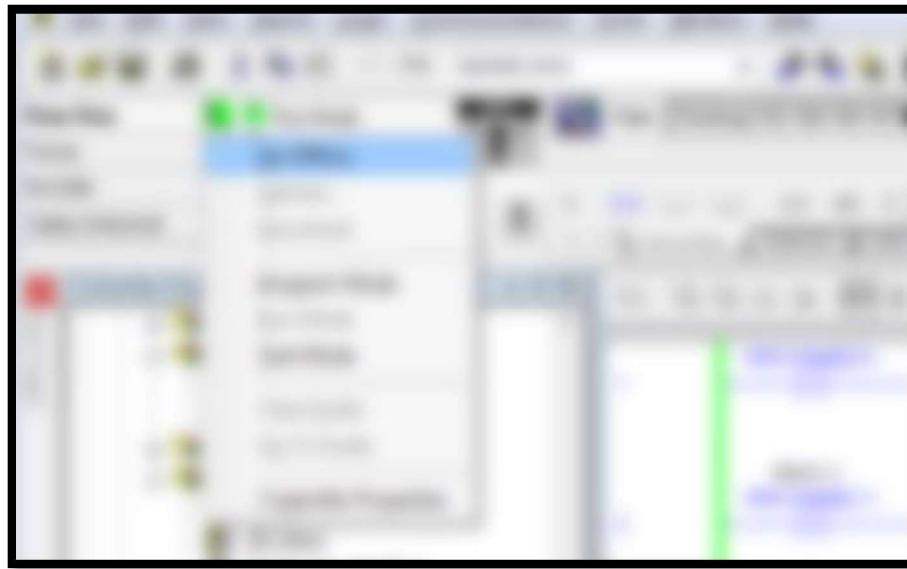
Once you click “Accept Pending Program Edits” button, it will ask your confirmation.  
Click “Yes”

Don't forget to save the file (Ctrl+S) after making changes.

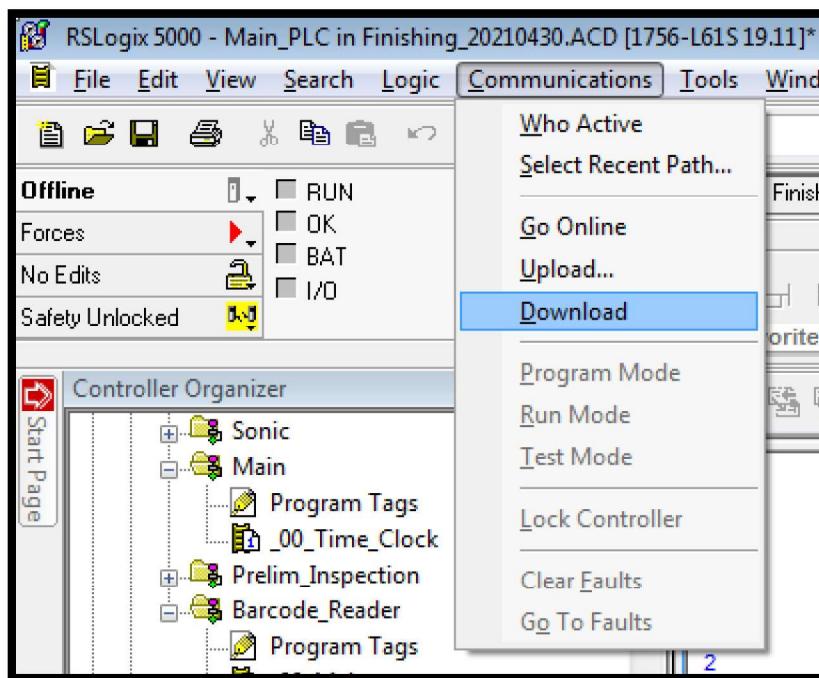
### 1.4.2 Download (Offline editing)

As mentioned above, you only need to download when you are adding new drives, cards, etc. Once you click download, it will stop PLC, which will stop drives (motors).

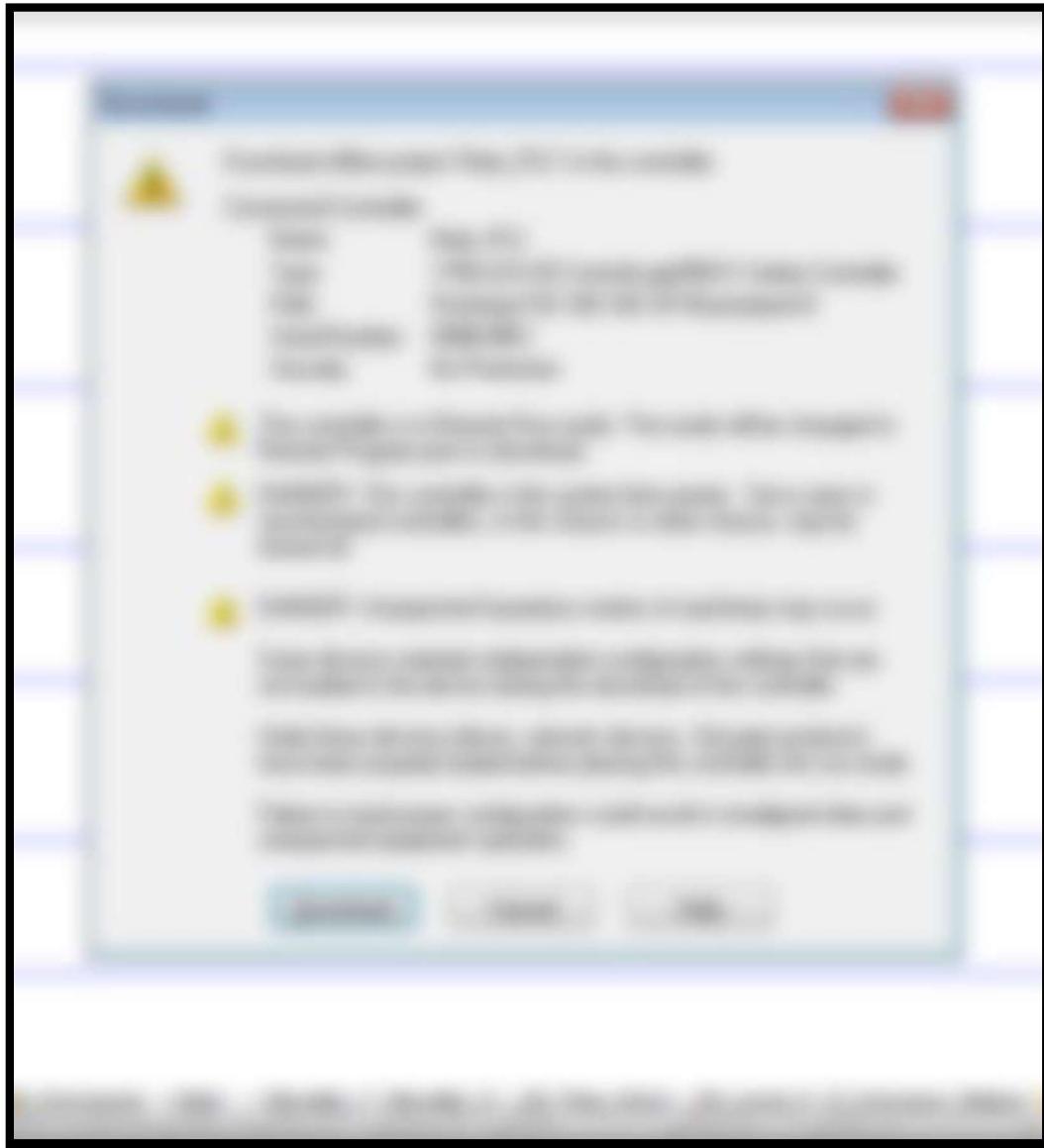
First, Go offline (See figure below). Make necessary changes.



Once you made all changes you need, click Communication → Download



It will give you caution pop up. Once you are safe to download, Click "Download"



After downloading, you need to reset fault on drives.

## **1.5 Drive Configuration**

We have various range of drive:

Powerflex 525 for small motor applications up to around 20hp

Powerflex 70 for between

Powerflex 755 for 75 – 200 HP applications

If Powerflex comes with EtherNet, its procedures to add onto PLC is somewhat similar. However, I recommend reading manufacture manual and follow specific procedures.

I will show you example of how to add Powerflex 525 on PLC (Rslogix 5000).

### **1.5.1 Basic Programming**

In order to start-up drive, you need to set certain parameters. In case of Powerflex 525 need following parameters (See table below):

| No.                                | Parameter        | Options and typically what we use at EVRAZ  |
|------------------------------------|------------------|---|
| P031<br>(notice first letter is P) | Motor NP Volts   | Take the Voltage from your motor name plate   |
| P032                               | Motor NP Hertz   | Take the Hertz from your motor name plate   |
| P033                               | Motor OL Current | On name plate if<br>1) Service Factor is 1.15 or greater then, FLA x 1.25<br>2) Service Factor is less than 1.15 then, FLA x 1.15 |
| P034                               | Motor NP FLA     | Take the FLA from your motor name plate   |
| P035                               | Motor NP Poles   | Take the Poles from your motor name plate   |
| P036                               | Motor NP RPM     | Take the RPM from your motor name plate   |
| P037                               | Motor NP Power   | Take the Power from your motor name plate   |
| P038                               | Voltage Class    | 1 = "480V"<br>2 = "600V"<br>Choose one depends on your motor  |

|      |                   |   |
|------|-------------------|---|
| P041 | Accel Time 1      | Set the time to accelerate drive to reach max speed   |
| P042 | Decel Time 1      | Set the time to decelerate drive to min speed   |
| P043 | Minimum Freq      | Set at 0Hz  |
| P044 | Maximum Freq      | Set at 60Hz   |
| P045 | Stop Mode         | 0 = "Ramp, CF" (Set this, if you don't have DC Brake)<br>1 = "Coast, CF"<br>2 = "DC Brake, CF" (Set this, if you have a DC Brake)<br>3 = "DC BrkAuto,CF"<br>4 = "Ramp"<br>5 = "Coast"<br>6 = "DC Brake"<br>7 = "DC BrakeAuto"<br>8 = "Ramp+EM B,CF"<br>9 = "Ramp+EM Brk"<br>10 = "PointStp,CF"<br>11 = "PointStop"  |
| P046 | Start Source 1    | 1 = "Keypad" (Set this if you want to start and stop with keypad)<br>2 = "DigiIn TrmBlk"<br>3 = "Serial/DSI"<br>4 = "Network Opt"<br>5 = "Ethernet/IP" (Set this if you want to start and stop with PLC tags(Rslogix 5000))   |
| P047 | Speed Reference 1 | 1 = "Drive Pot" (Set this if you want to control speed by knob on keypad)<br>2 = "Keypad Freq"<br>3 = "Serial/DSI"<br>4 = "Network Opt"<br>5 = "0-10V Input"<br>6 = "4-20mA Input"<br>7 = "Preset Freq"<br>8 = "Anlg In Mult"<br>9 = "MOP"<br>10 = "Pulse Input"<br>11 = "PID1 Output"<br>12 = "PID2 Output"<br>13 = "Step Logic"<br>14 = "Encoder"<br>15 = "Ethernet/IP"(1) (Set this if you want to set speed by PLC (Rslogix5000) MOVE command)<br>16 = "Positioning"(1) |

### **1.5.2 Assign IP Address to Powerflex 525**

Out of box Powerflex 525 does not have a static IP address, so you need to assign IP address through either 1) using keypad on drive 2) using software called Boot-P.

In this document, I will explain how to set IP address 1) using keypad on drive. In order to set IP address with keypad, you must first disable Boot-P otherwise, assigned IP address will not be saved after power cycling.

| No.                                 | Parameter   | Options and typically what we use at EVRAZ   |
|-------------------------------------|-------------|--|
| C128<br>(notice first letter is C.) | EN Addr Sel | 1 = "Parameters" (Set this if you want to save your IP address after power cycling)<br>2 = "BOOTP" |

After BOOTP is disabled (by set C128 to 1 = "Parameters"), cycle power and then configure the IP address and subnet mask. When you set IP address, follow naming convention (numbering system that already exists) of other IP address in program but do not use the identical IP address (It will cause duplicated IP address fault). If you are not sure which IP address to assign, then ask Electrical supervisor.

| No.  | Parameter        | Options and typically what we use at EVRAZ                        |
|------|------------------|---|
| C129 | EN IP Addr Cfg 1 | Follow naming convention<br>Typically we use 192 or 198           |
| C130 | EN IP Addr Cfg 2 | Follow naming convention<br>Typically we use 168                  |
| C131 | EN IP Addr Cfg 3 | Follow naming convention<br>Typically we use 100 or 0             |
| C132 | EN IP Addr Cfg 4 | Follow naming convention and you don't want to use the same twice |

Ex) IP address could be something like, 192.168.100.xxx, 192.168.0.xxx

198.168.100.xxx and so on.

Typically, our subnet address is 255.255.255.0

| No.  | Parameter       | Options and typically what we use at EVRAZ |
|------|-----------------|--|
| C133 | EN Subnet Cfg 1 | 255  |
| C134 | EN Subnet Cfg 2 | 255  |
| C135 | EN Subnet Cfg 3 | 255  |
| C136 | EN Subnet Cfg 4 | 0  |

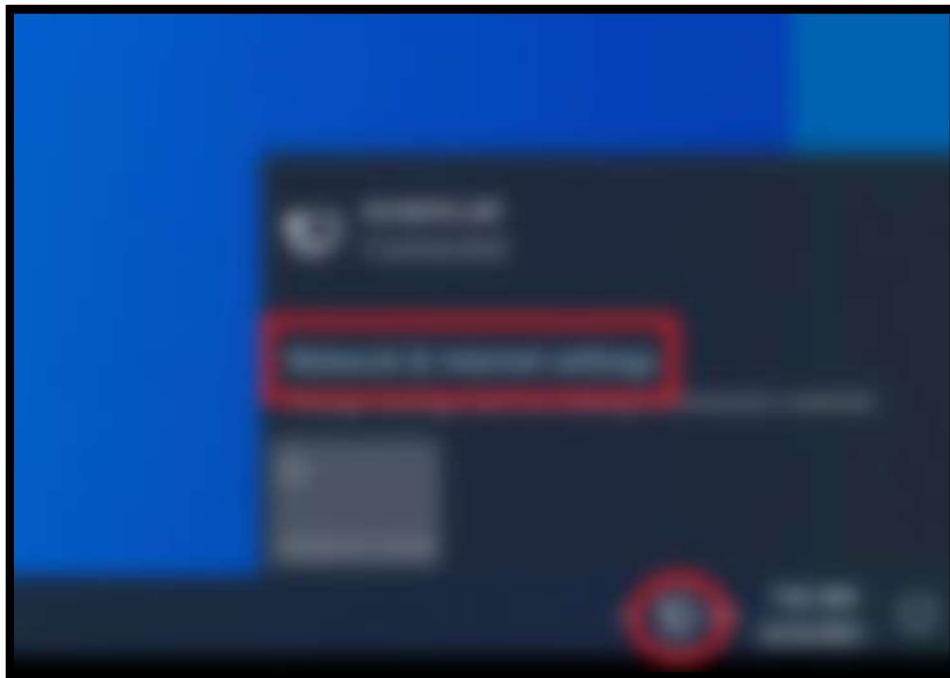
After IP address and subnet address are assigned, again cycle power.

Now your drive should have its static IP address.

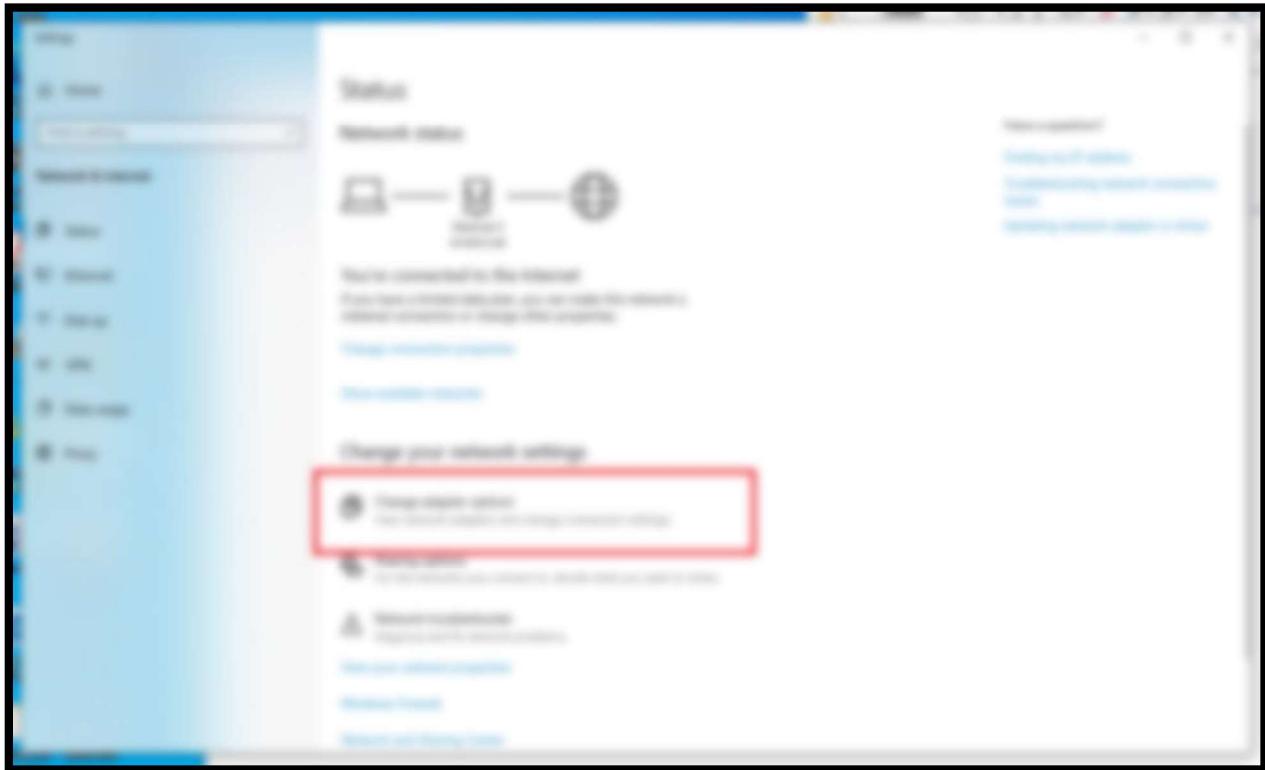
### **1.5.3 Change your laptop's IP Address**

We will use "cmd method" to check if drive is communicating well with your laptop. First, you need to change your laptop's IP address (so your drive and laptop can "see" and "talk" each other).

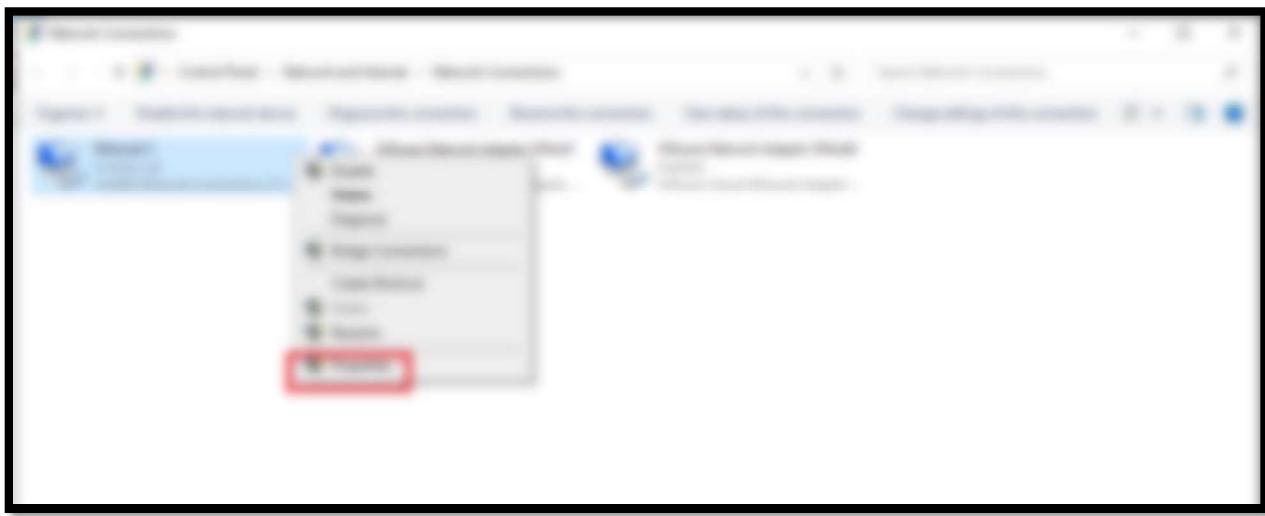
Click computer looking icon on the bottom right corner. Click "Network & Internet setting" (See figure below)



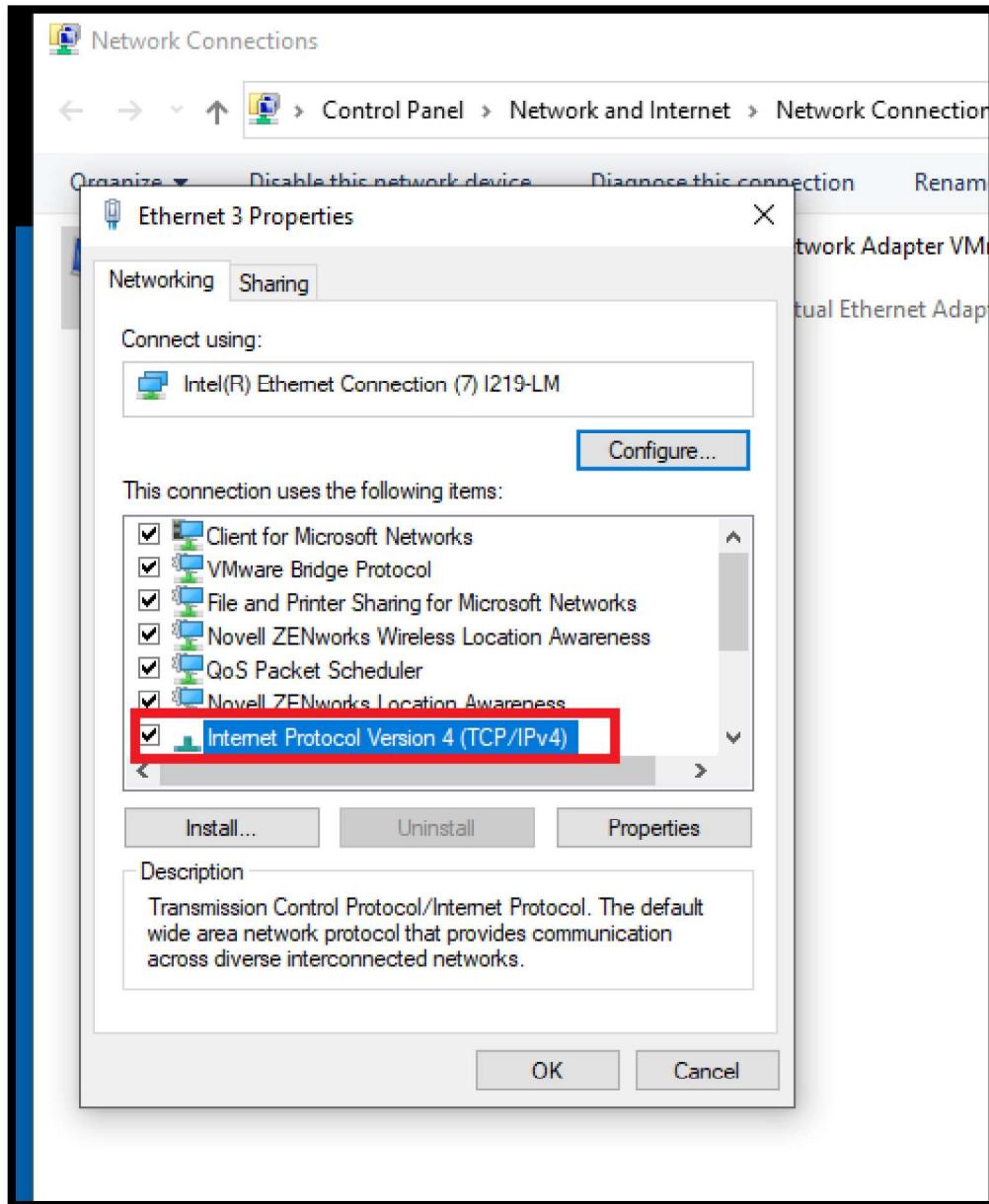
Click "Change adapter options" (See figure below)



Right click "Ethernet" and click "Properties" (See figure below)



Double click "Internet Protocol Version 4 (TCP/IPv4)" [See figure below]

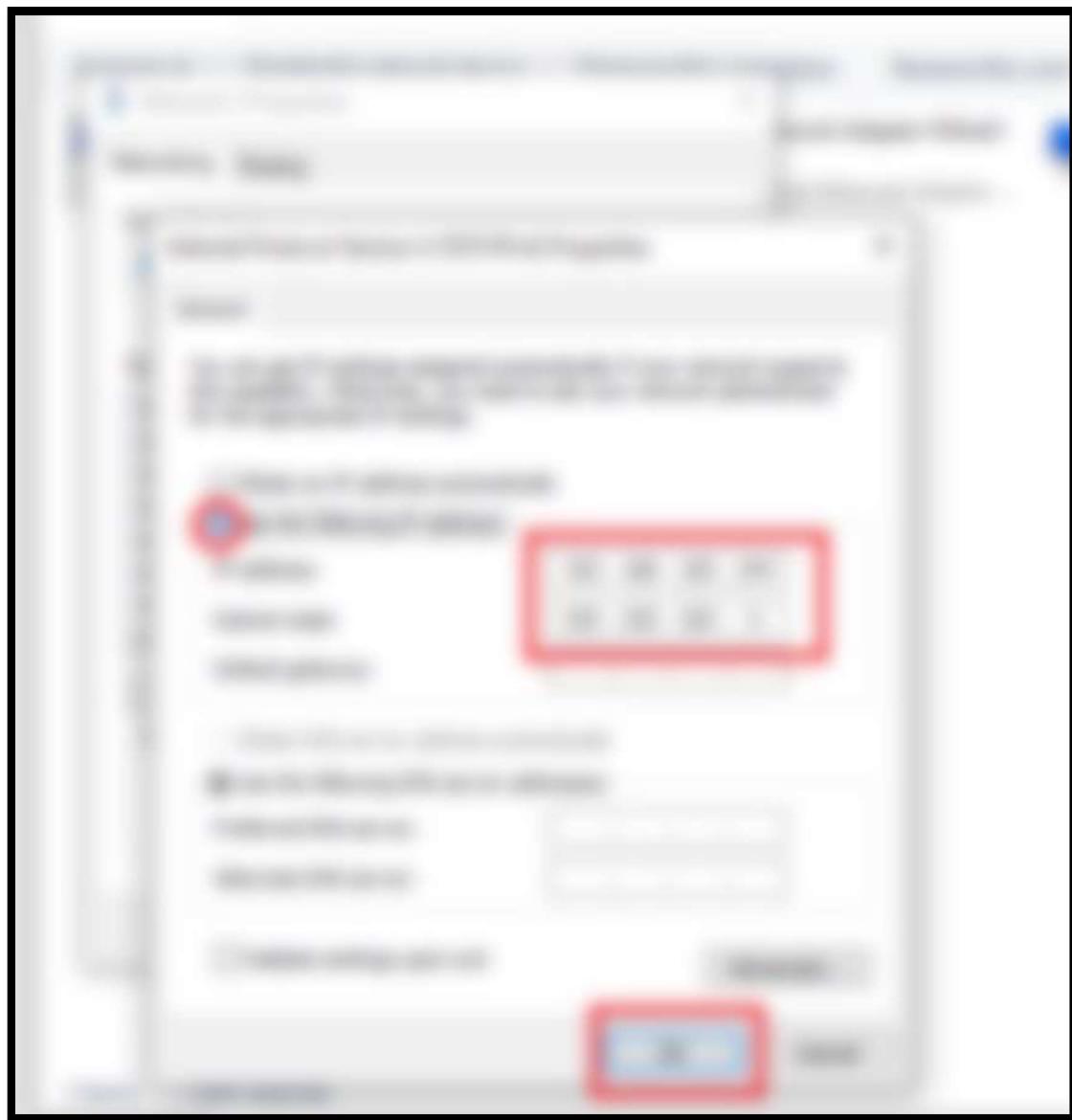


Click check box "Use the following IP address" and set IP address:

First three sets, you want to match with drive's IP address. For example, if your drive's IP address is 198.168.xxx.1 then your laptop IP address should be 198.168.xxx.xxx where xxx is arrange of 0 – 254 (but you don't want to use duplicated IP address so I recommend choosing something from 230 to 250).

After that, match subnet address identical to drive subnet IP address (typically 255.255.255.0)

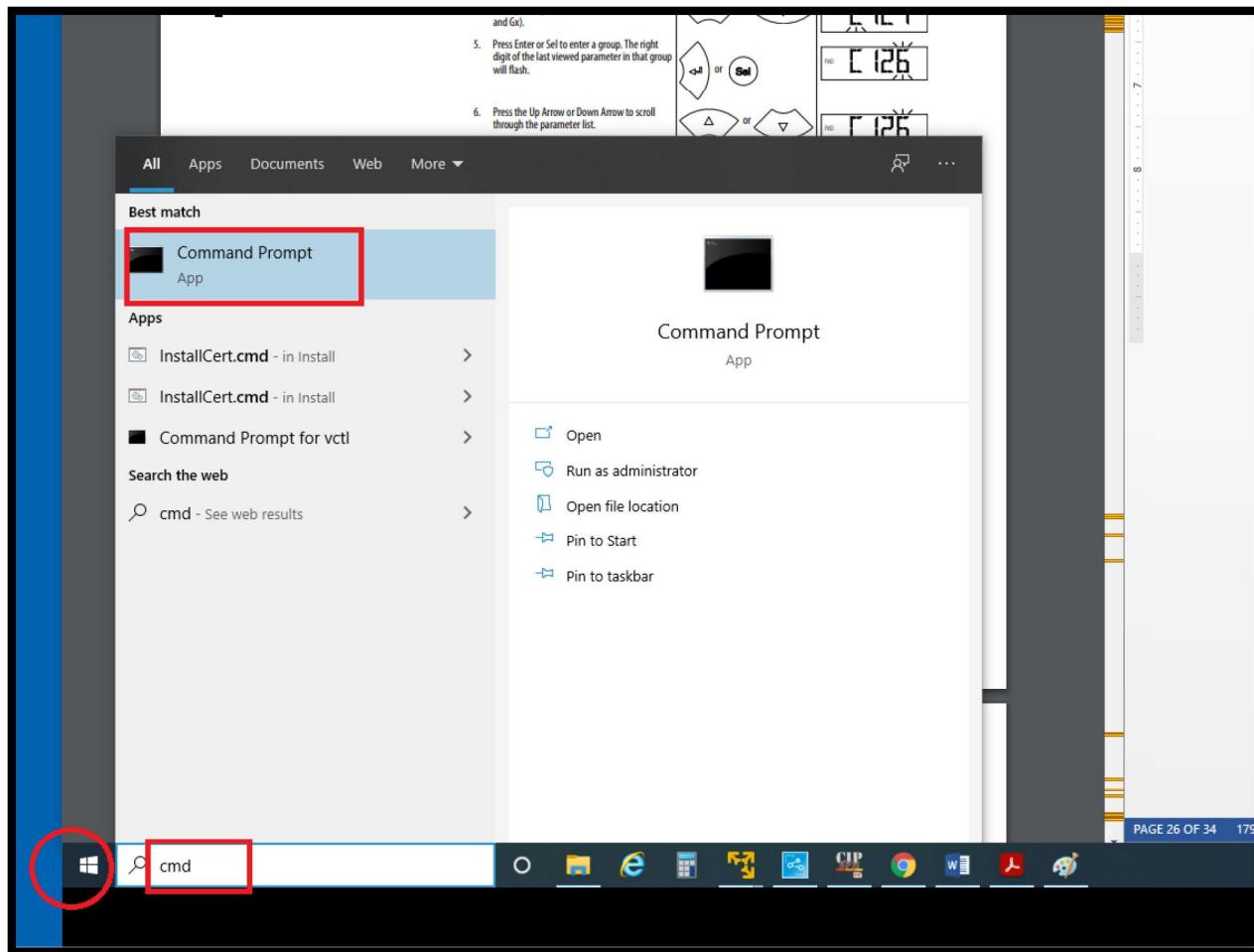
Click "OK"



#### 1.5.4 Use “Cmd” to ping (verify communication path)

Plug Ethernet cable from your laptop to drive (or switch where the drive is connected to).

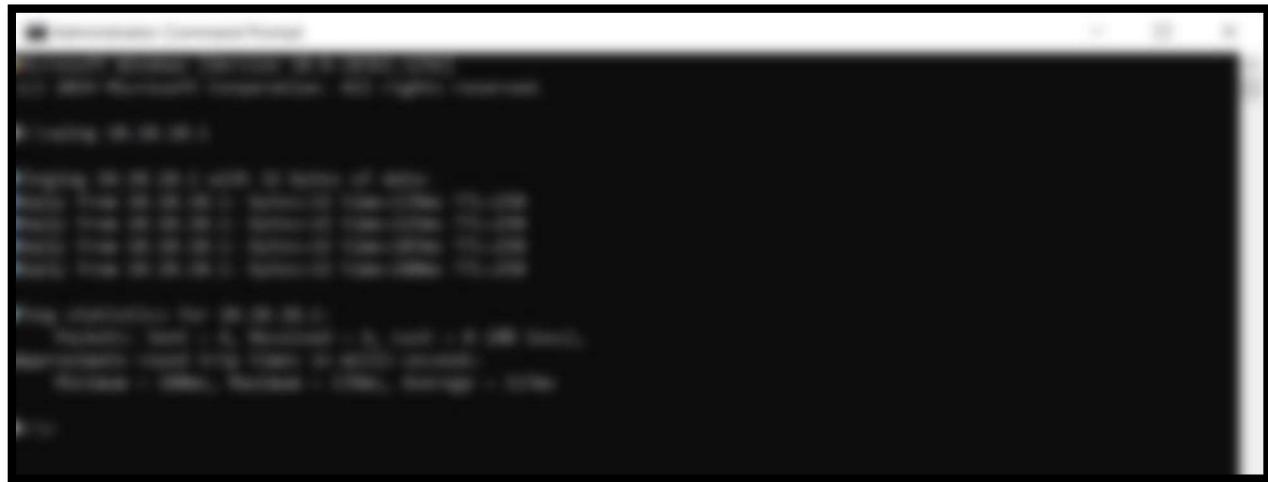
Press Start Window key , and type “cmd”, click “Command Prompt” (See figure below)



Type ping + drive's IP address that you want to check if it is communicating well. For example, "ping 192.168.0.1".

If your device is communicating well with your laptop message will be like:

Reply from 192.168.100.xxx : byte=32 time=125ms TTL=250



If your device is not communicating then message will be like:

Request timed out.

Request timed out.

Request timed out.

Request timed out.

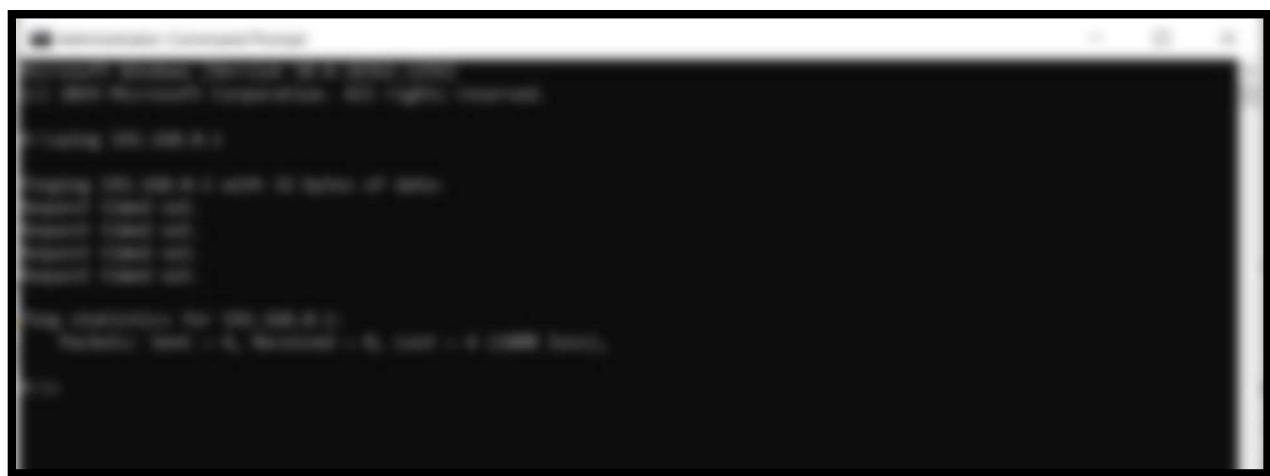
Or

Destination host unreachable.

Destination host unreachable.

Destination host unreachable.

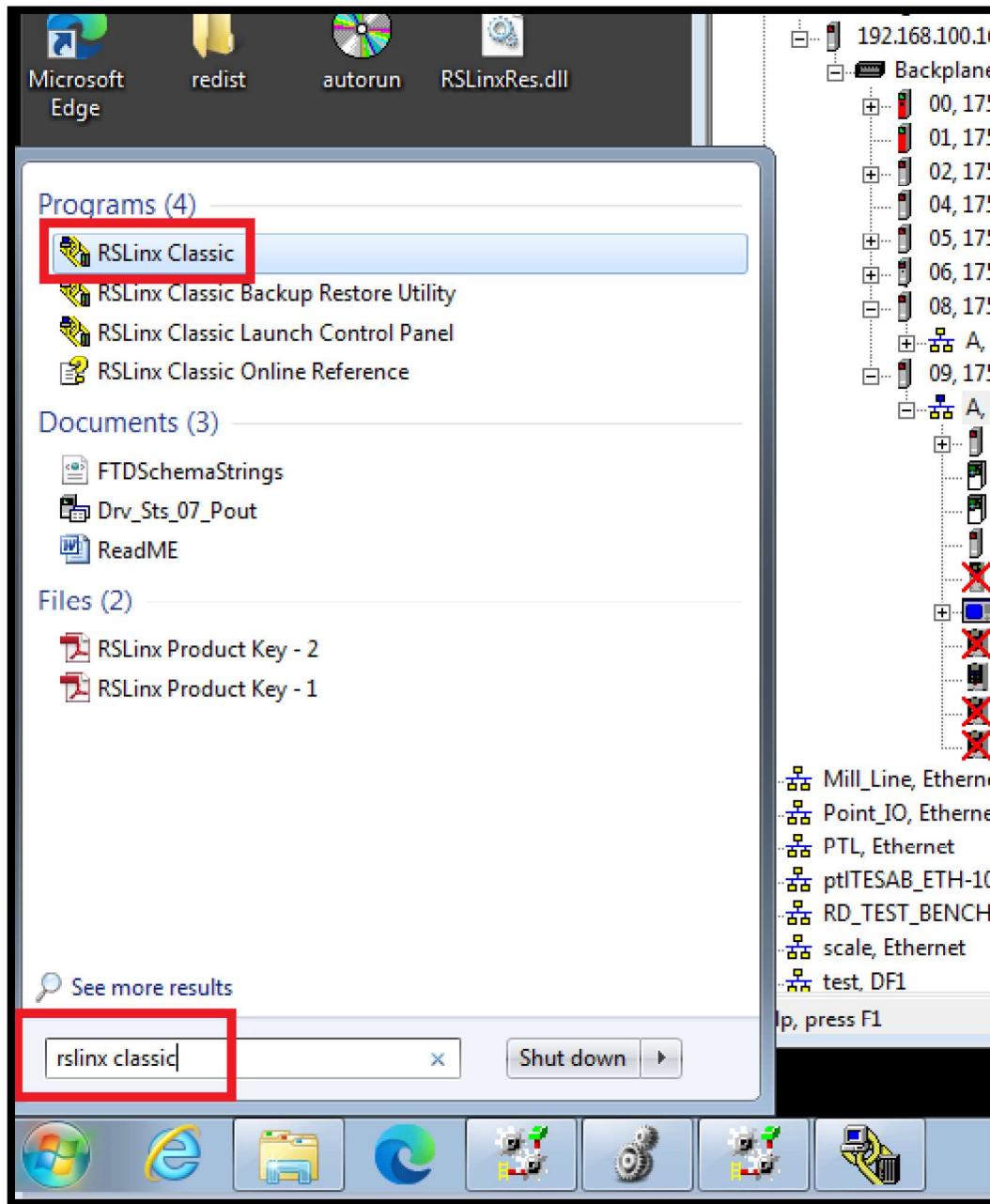
Destination host unreachable.



### 1.5.5 Adding drive on your PLC (Rslogix 5000)

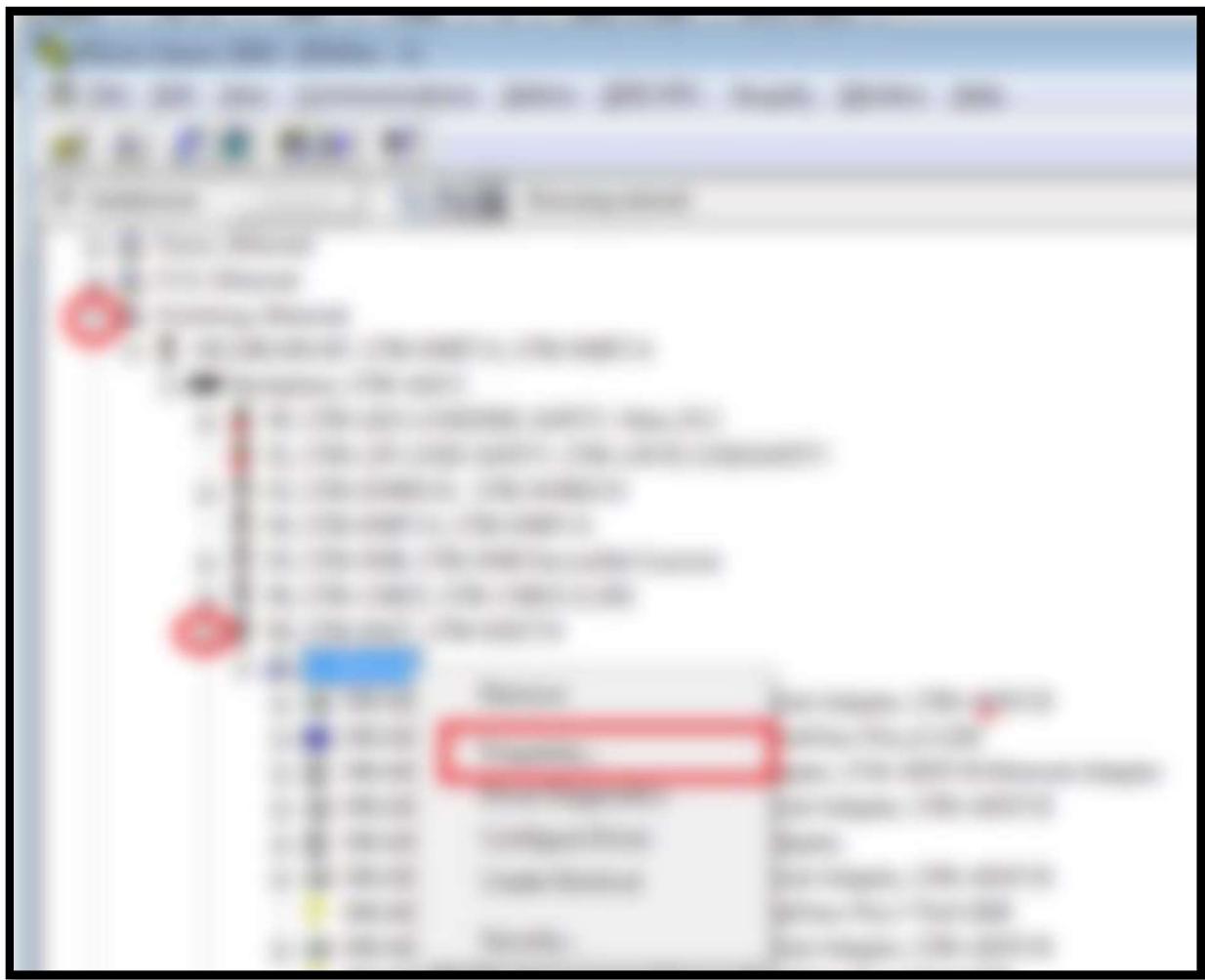
In order to add drive on PLC (Rslogix 5000), you first need to configure communication path on "RSLinx Classic"

Press Window Key , and type "RSLinx Classic" and start software by clicking it.

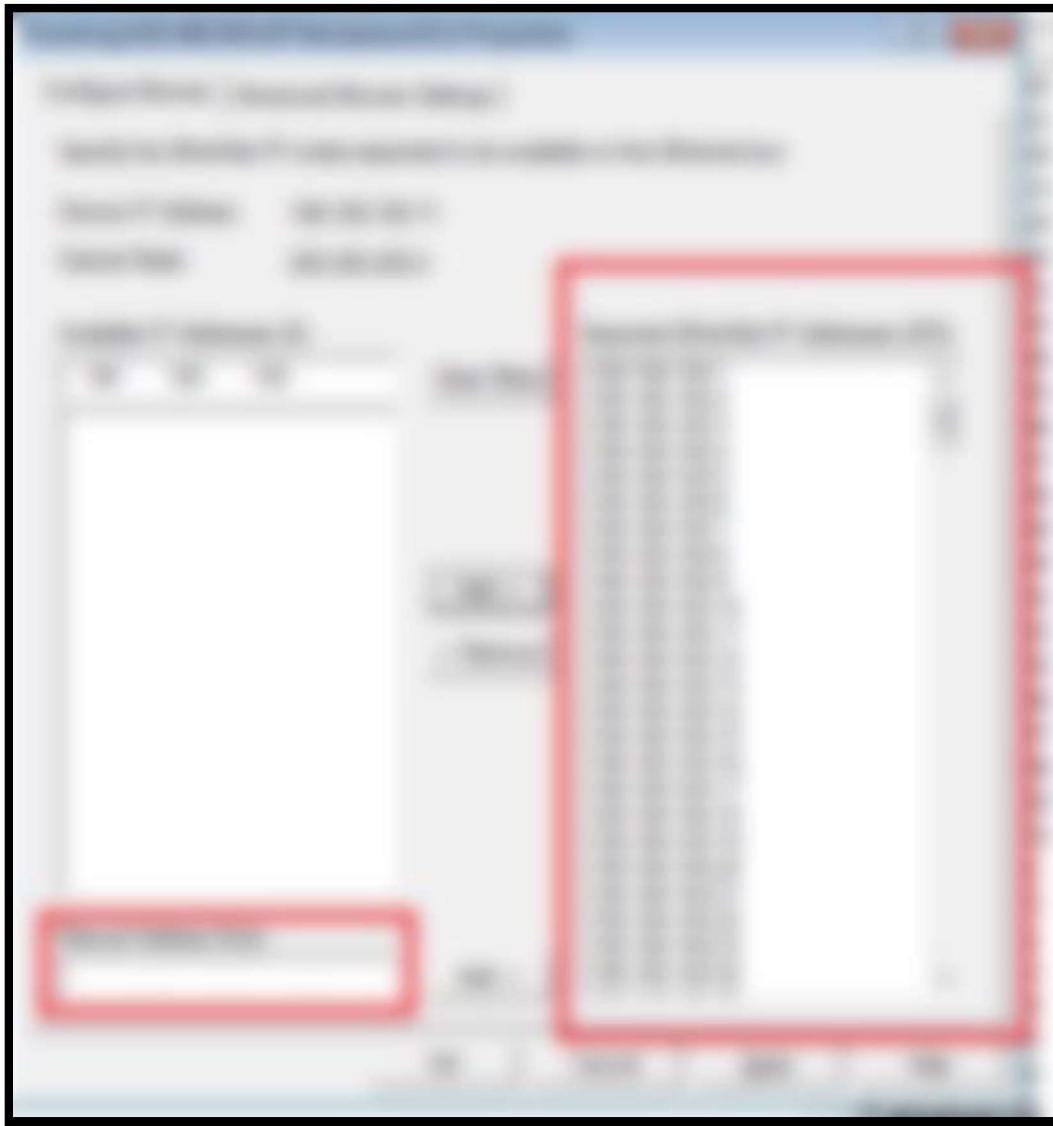


Before adding new Ethernet device (in this case, drive), you need to know where you want to add it.

If you are adding under existing Ethernet card (most case), then expand Ethernet card and right click "A, Ethernet" and click "Properties..." (See figure below)



Check if your drive's IP address is on the right side "Expected Ethernet IP addresses". If not, you can add by typing on Manual Address Entry and click "Add" (See figure below)

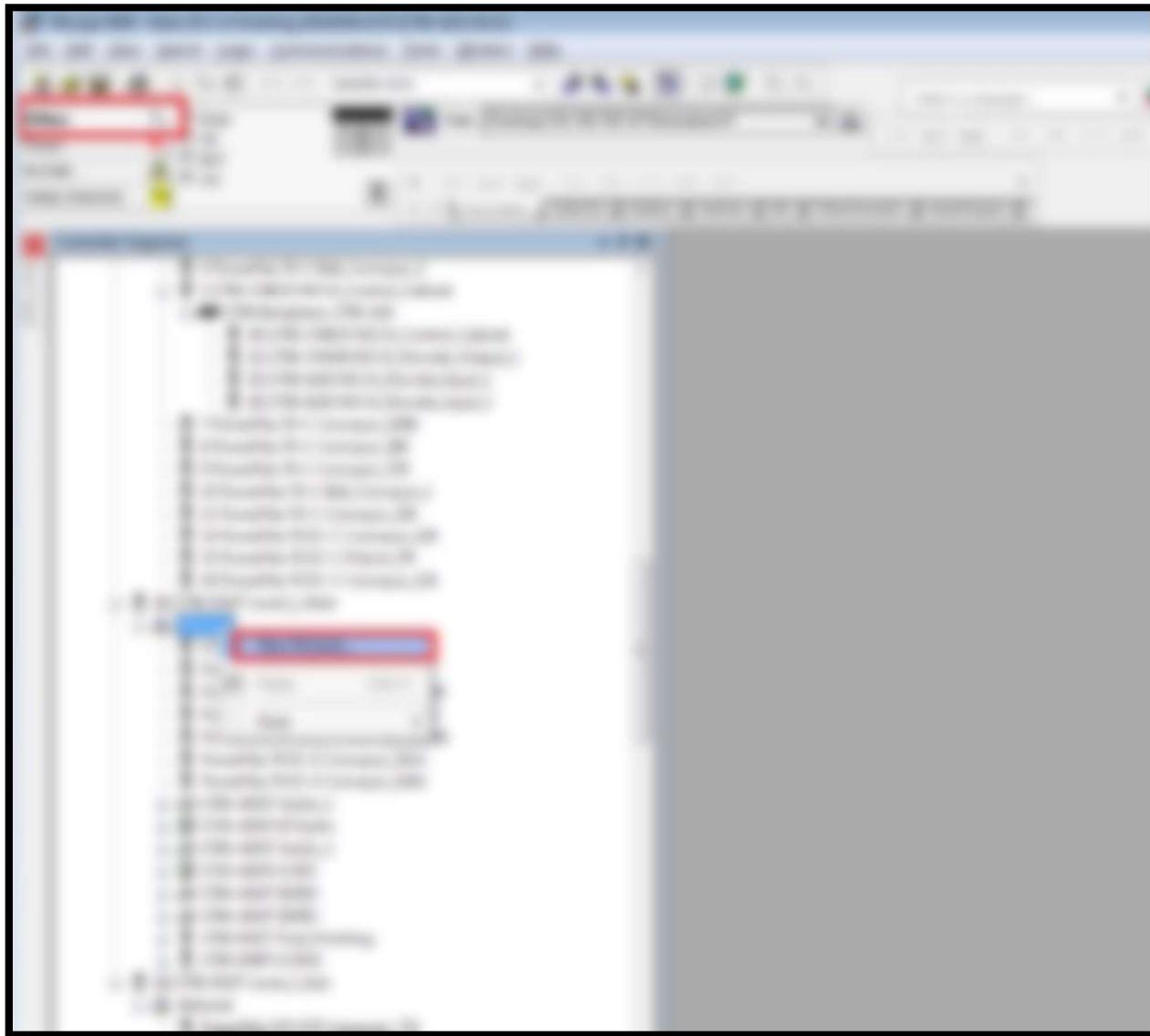


You should be able to see your new drive under "A, Ethernet".

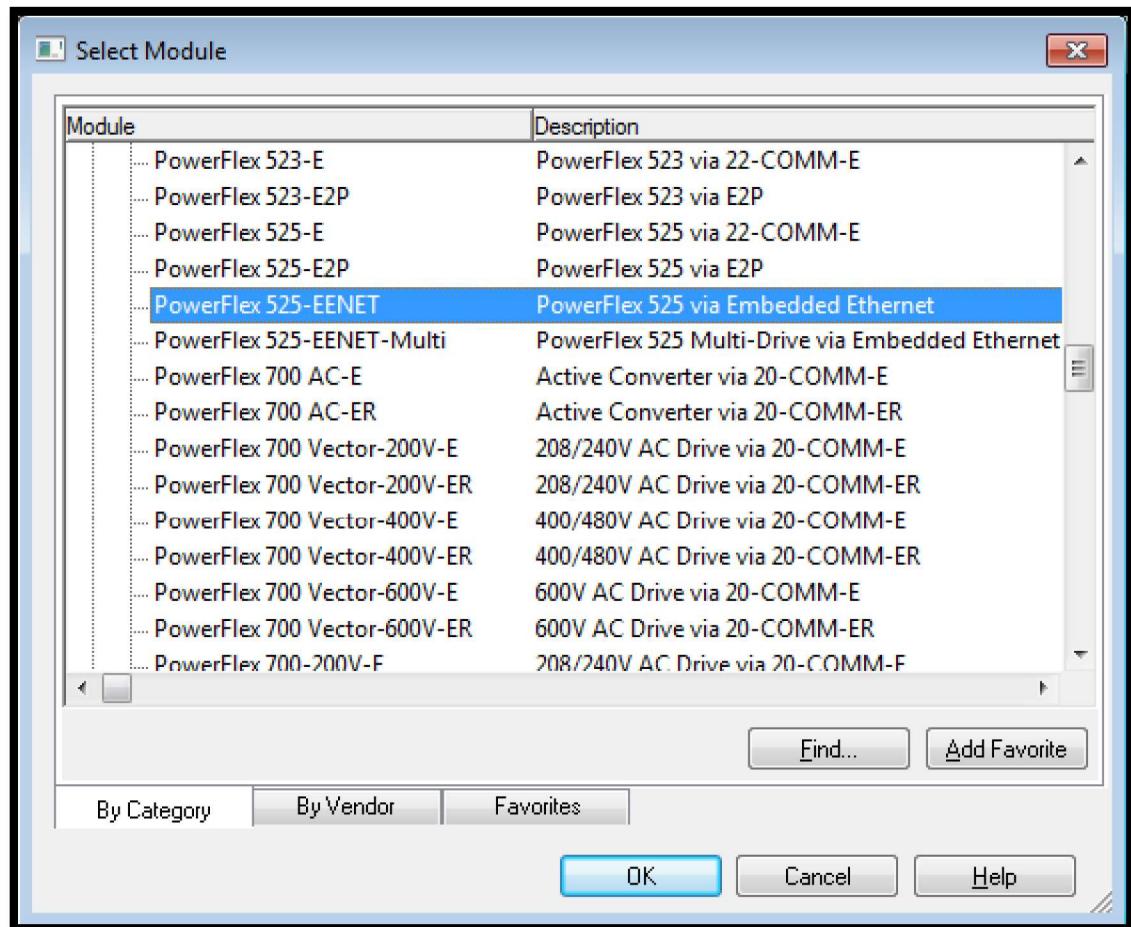
As I mentioned above, adding drive to your PLC project requires downloading, so make sure line is stopped and check if it is safe to perform download.

Now let's add the drive on your PLC project. Open PLC project and make sure it is off line. Drill down to the same location you added drive on "Rslinx Classic"

Right Click "Ethernet", and click "New Module..."

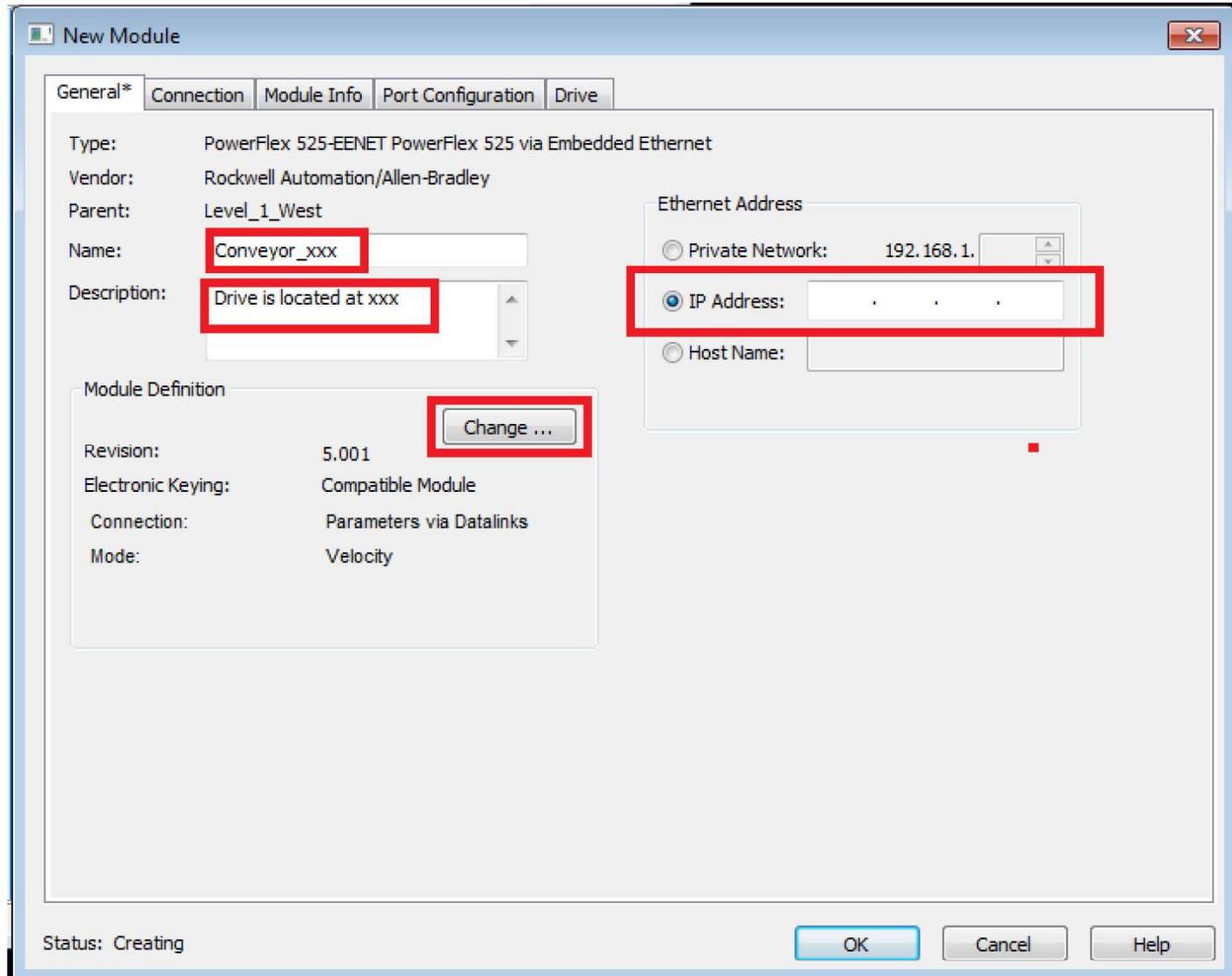


Find exact model number on your drive (usually on the side of actual drive, you can see spec). Select the right model, and click OK



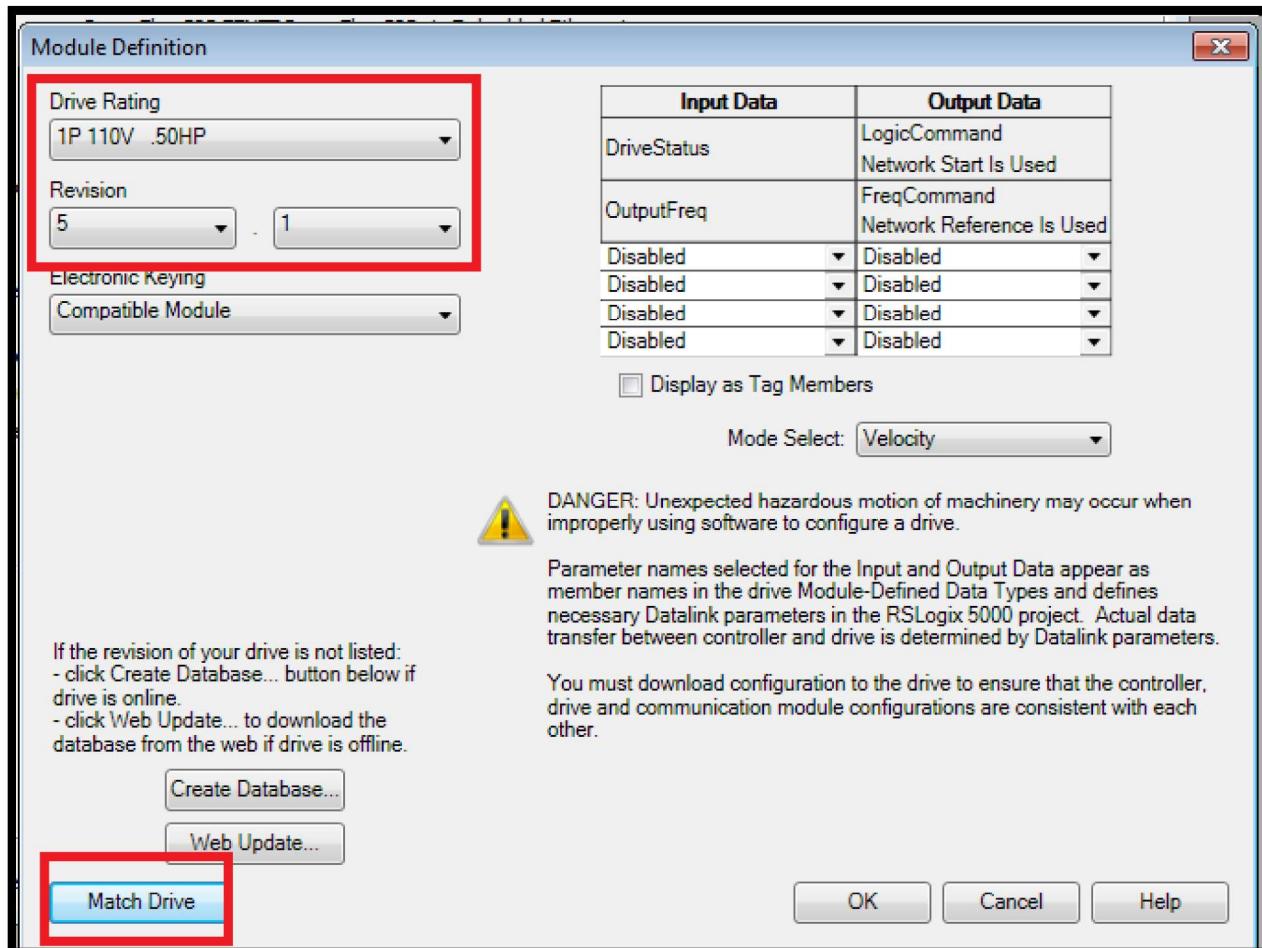
Give proper name, and type brief location of the drive in "Description". Then, type IP address that you assigned.

Click "Change..."

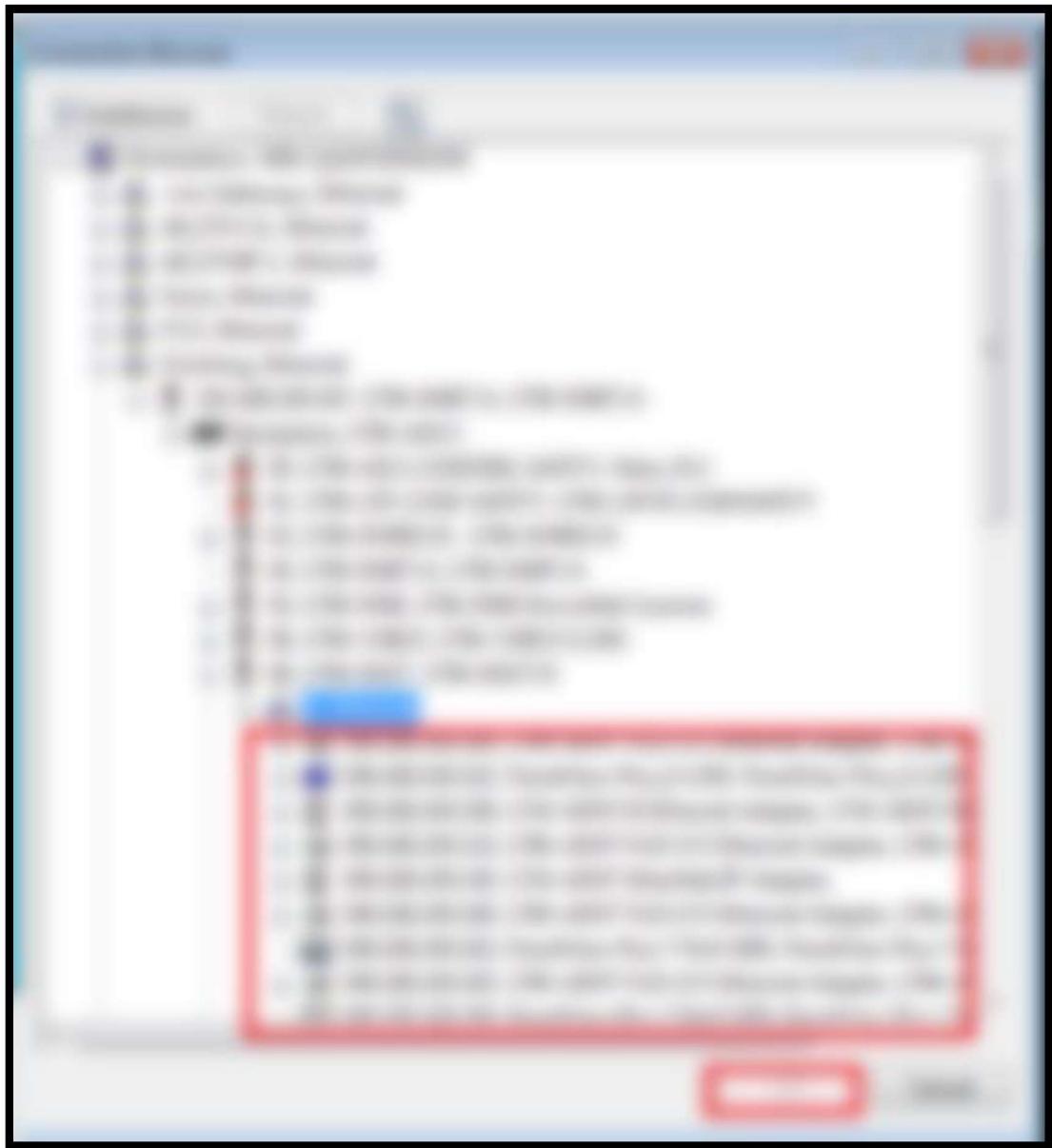


Select proper "Drive Rating" and "Revision" (you can find the information on sepc).

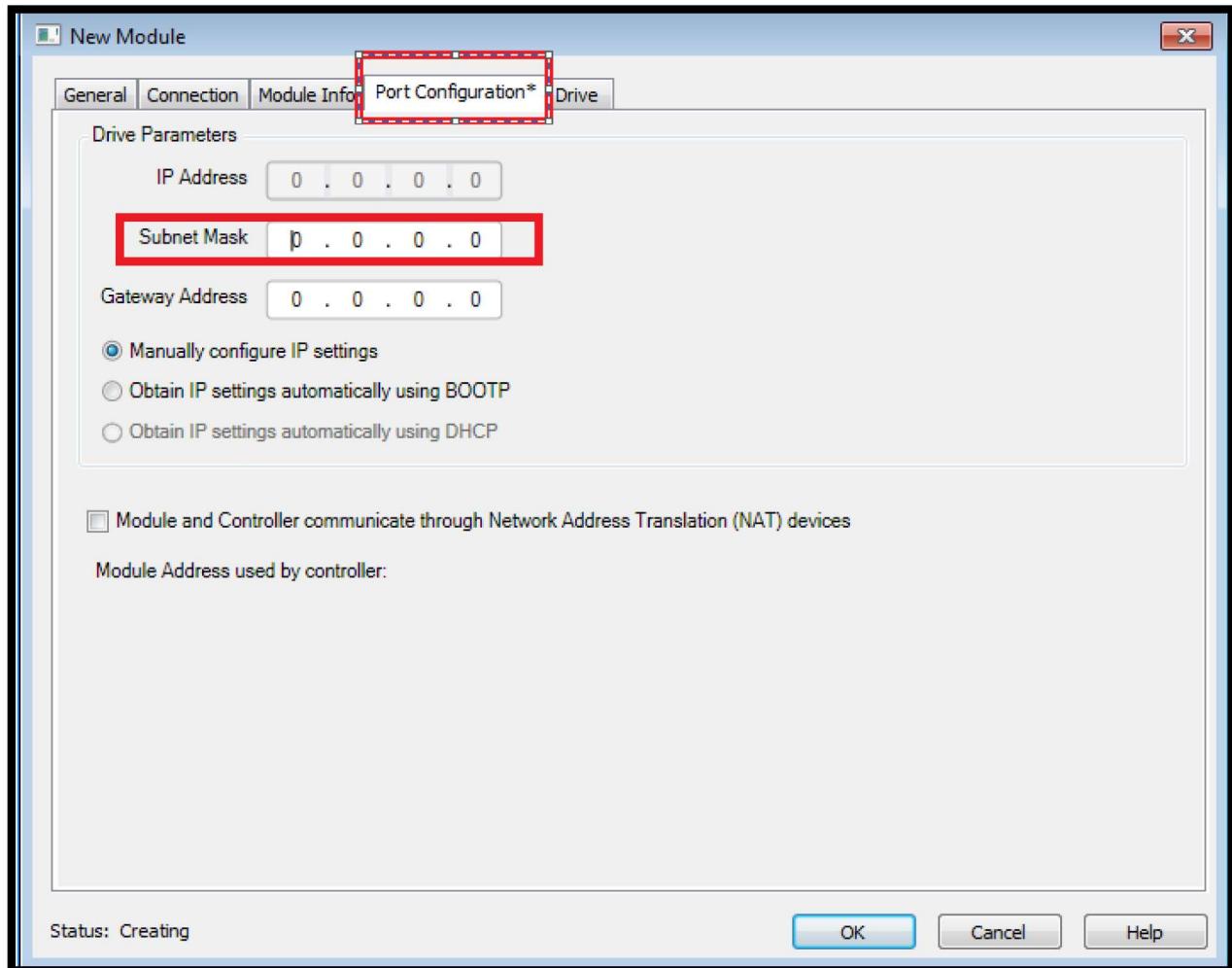
And Click "Match Drive"



Drill down to the same location you added drive on "Rsllinx Classic", and select the drive you added. Click OK



Change Subnet Mask to 255.255.255.0 and click "Ok"



Now download this change to PLC. Downloading procedure is on **1.4.2 Download (Offline editing)** section.

## **1.6 HMI (FactoryTalk View Studio)**

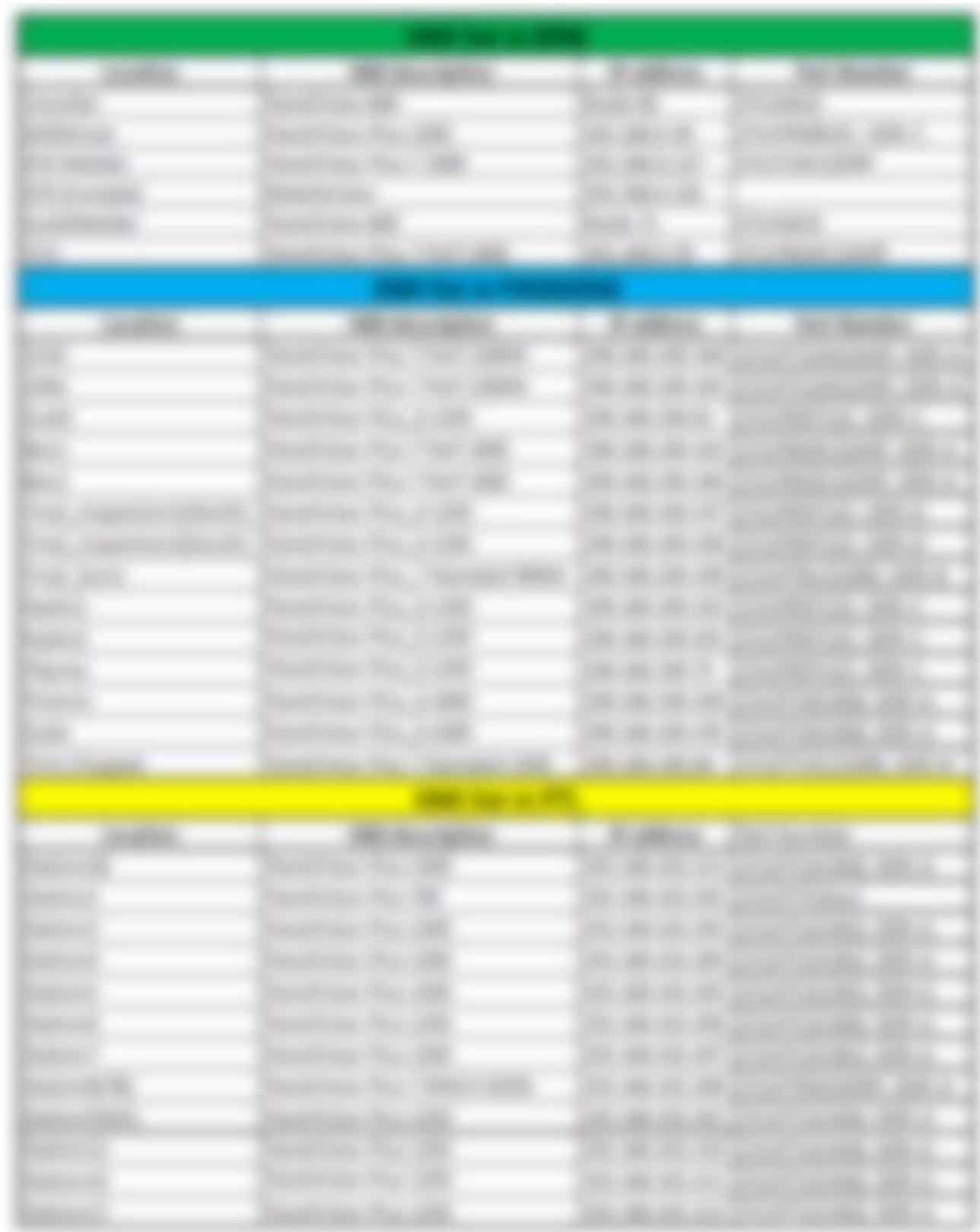
In this section, I will show how to upload HMI .mer file from HMI device (PanelView series), where to make changes, and how to download HMI .mer file to HMI device.

### **1.6.1 Upload**

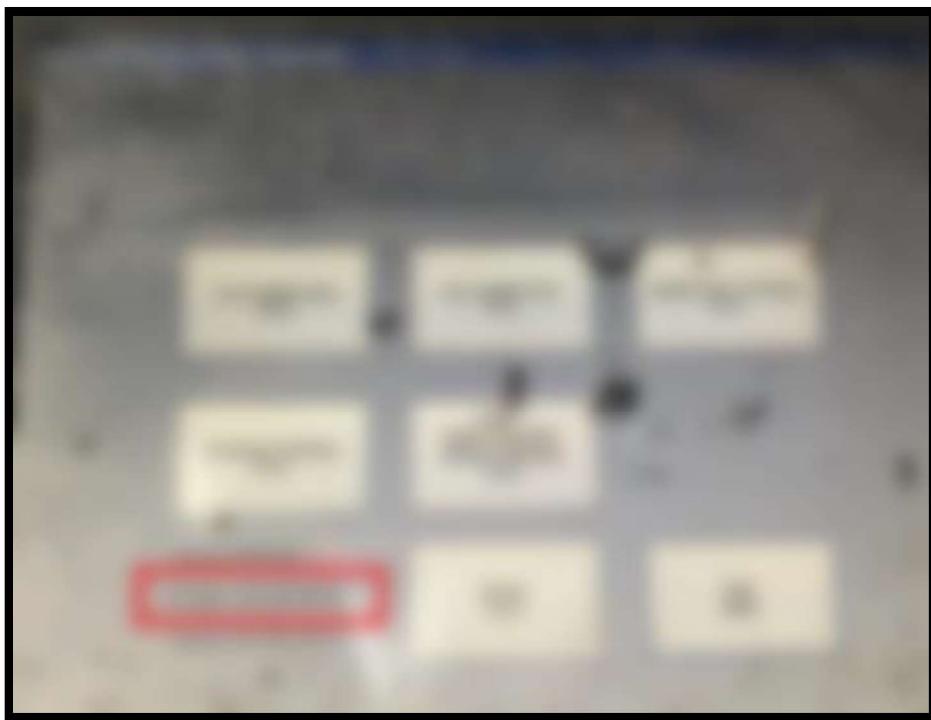
Upload is used when you want to upload the newest file from HMI.

I will explain based on assumption that communication paths are already established in "Rslnx Classic" Software.

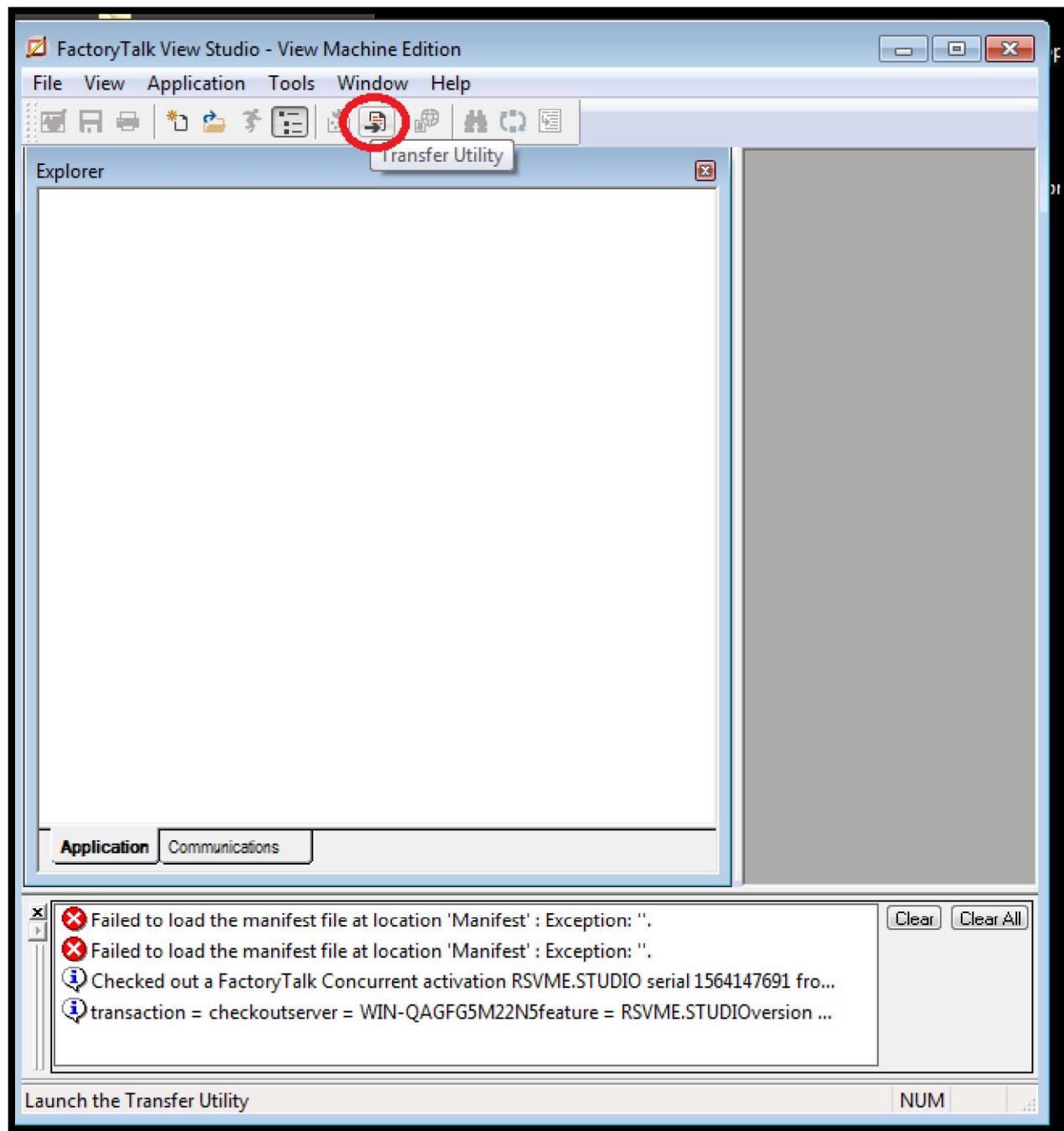
First, you need to know your HMI's IP address. I made a simple list of HMIs in ERW, Finishing and PTL. (See table next page) Remember this list can be outdated.



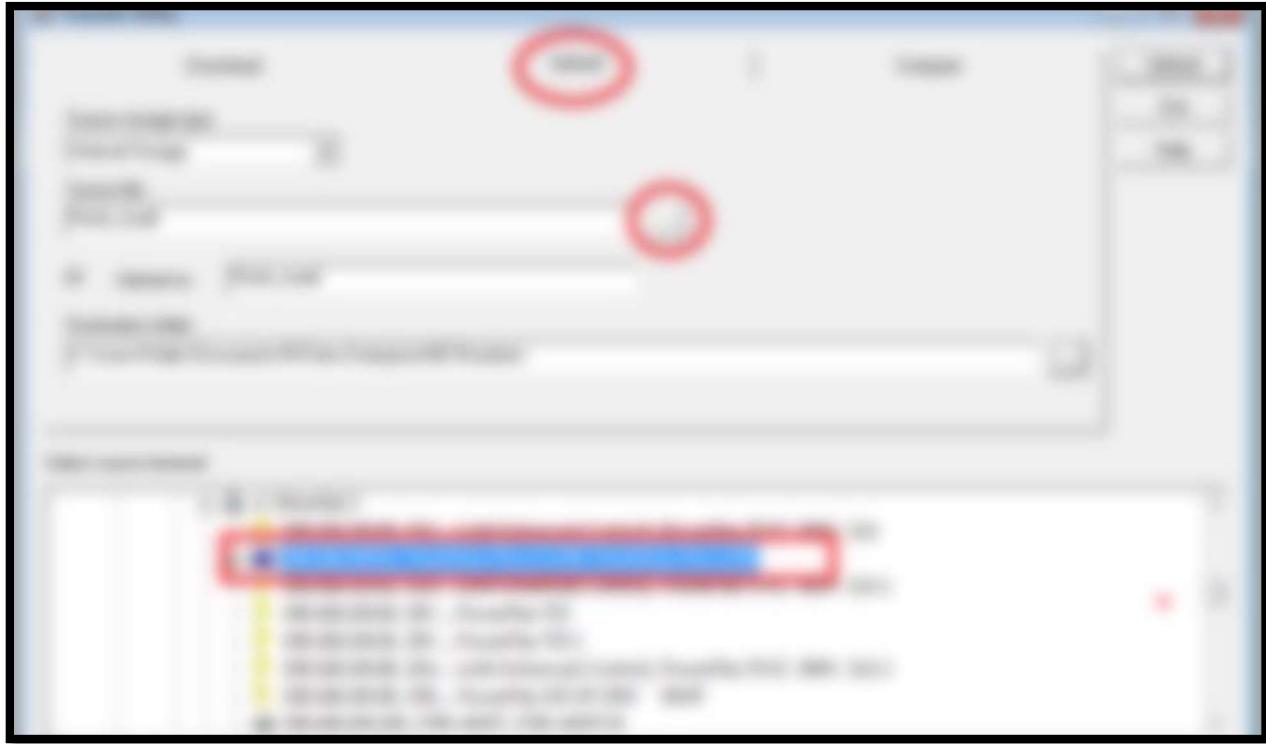
If you can't find IP address from the list or not sure if list is up to date, then you can check IP address on HMI device onsite. Figure below is configuration mode screen on HMI. If you don't know how to get to that screen, see end of section **1.6.3.1 Create runtime application (page 36)**



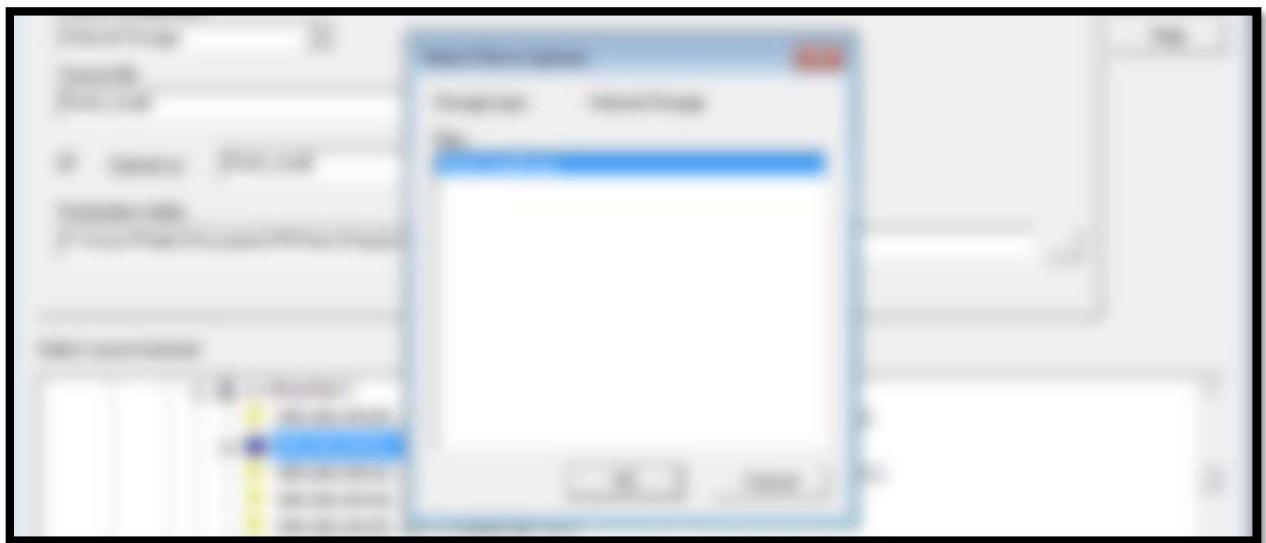
Open “Factorytalk View Studio” software. Click Transfer Utility.



Click Upload tab, and drill down to HMI that you want to upload .mer file from, and select. (In this example, I selected 198.168.100.81 which is Final Finishing Audit). Once the HMI icon is highlighted then click “...”

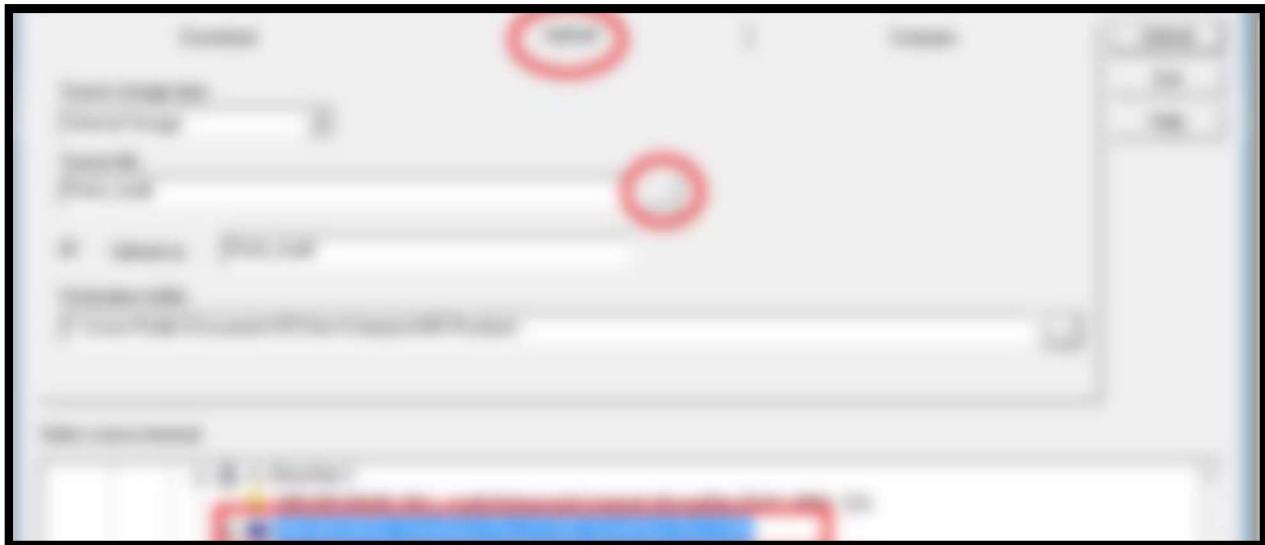


If selected HMI is communicating well, then it will show screen like this (See figure below). Shown file list is the same as if you check file list on your HMI onsite.



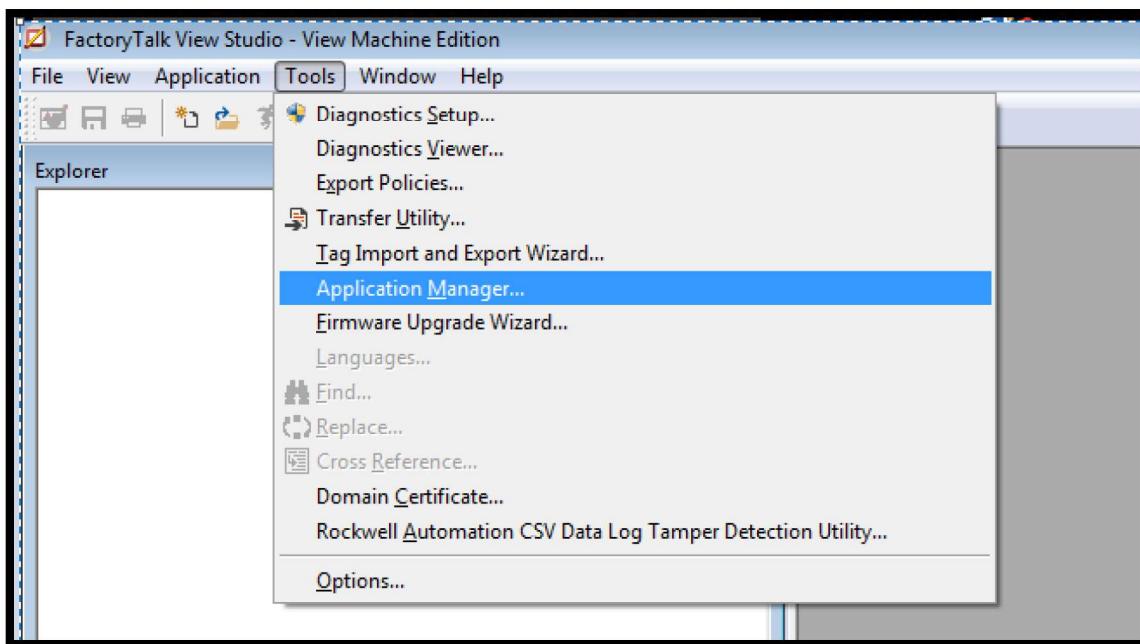
Destination folder should already be set, but if not, use this file location (C:\Users\Public\Documents\RSView Enterprise\ME\Runtime\).

Click Upload. Now your “Finish\_Audit.mer” is uploaded from your HMI to file location that you designated.

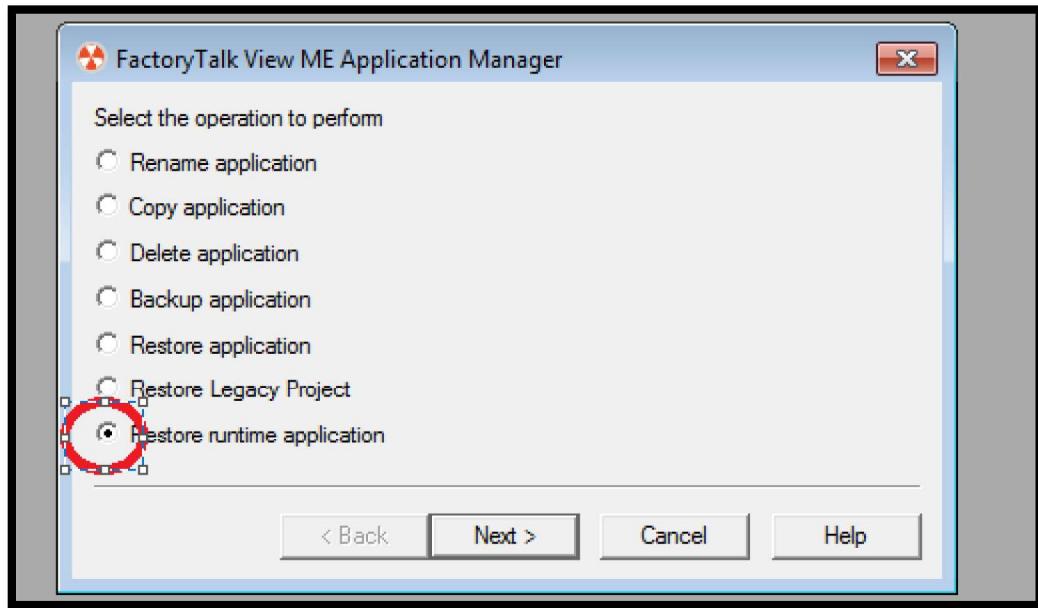


However, you can't simply open uploaded file yet. You need to go through extra step to open this file in your “FactoryTalk View Studio”

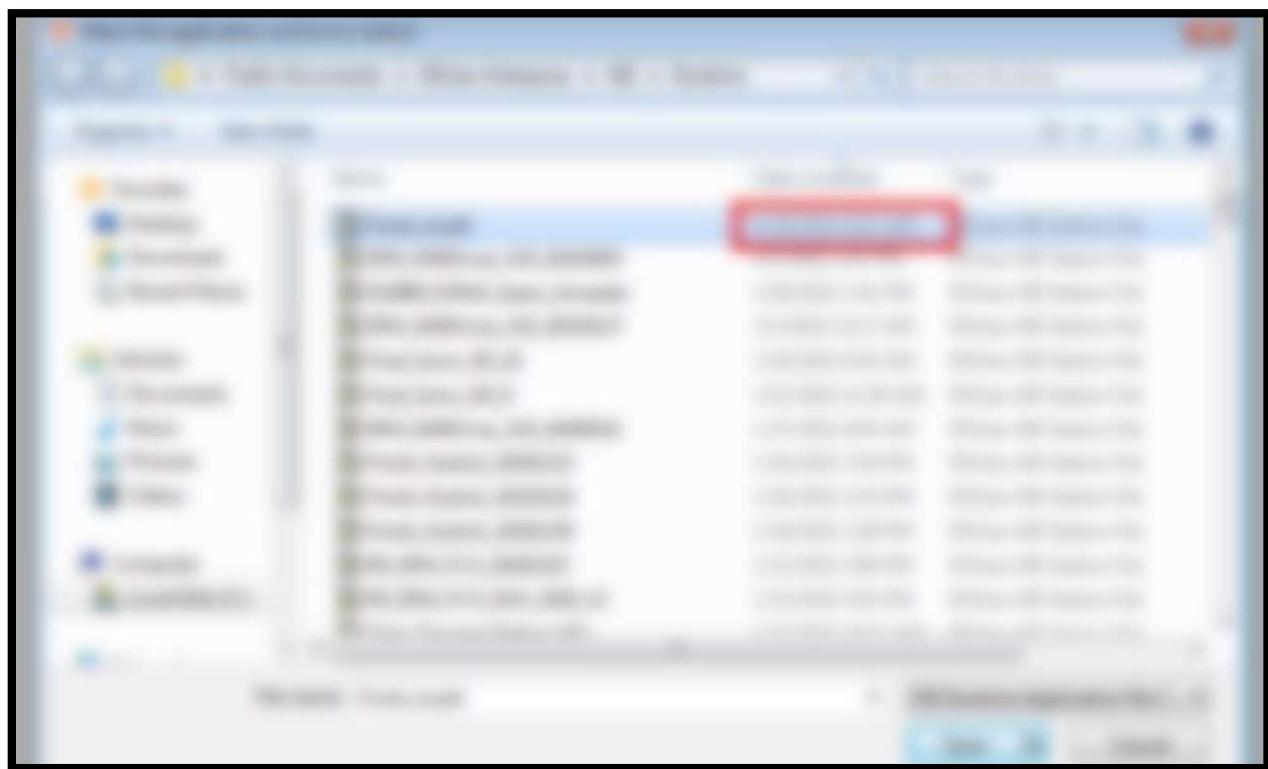
Click Tools → Application Manager...



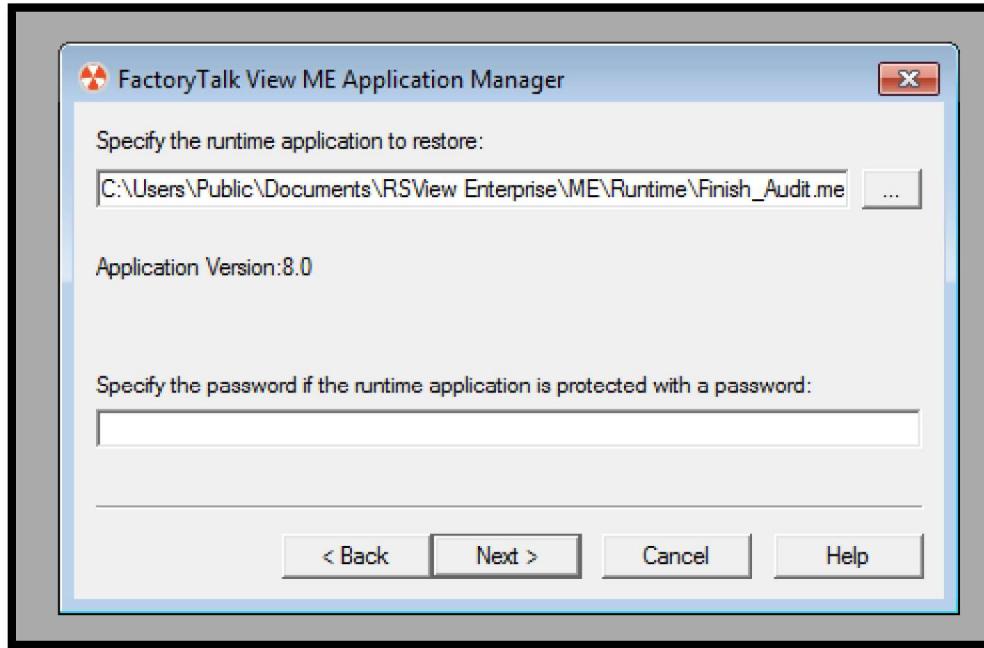
Select “Restore runtime application” and click “Next”



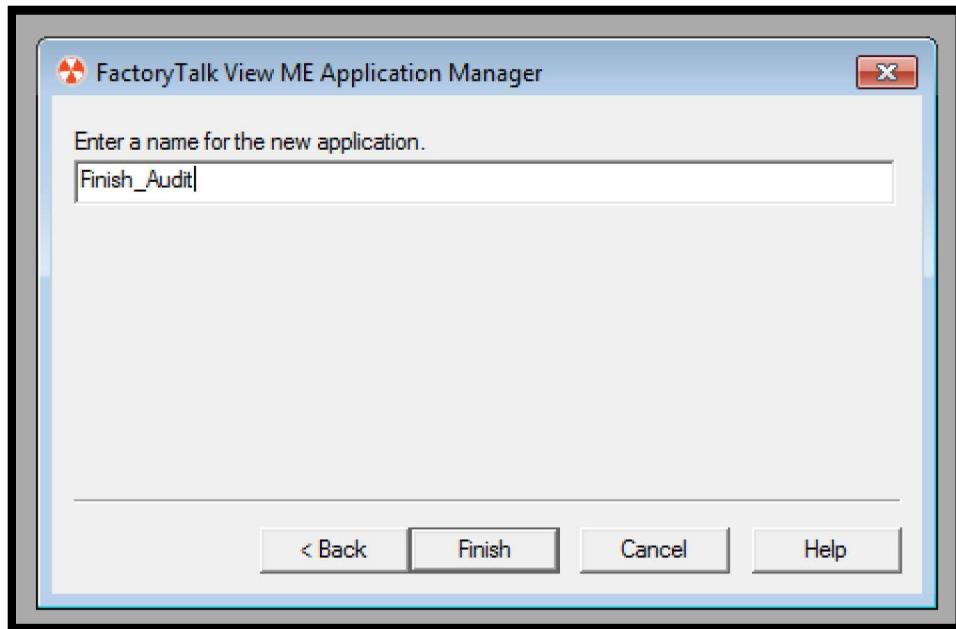
Click “...” and drill down to file location you uploaded your “Finish\_Audit.mer” file (by default, C:\Users\Public\Documents\RSView Enterprise\ME\Runtime\). Make sure that “Date modified” matches time that you uploaded your mer file.



Click "Next"

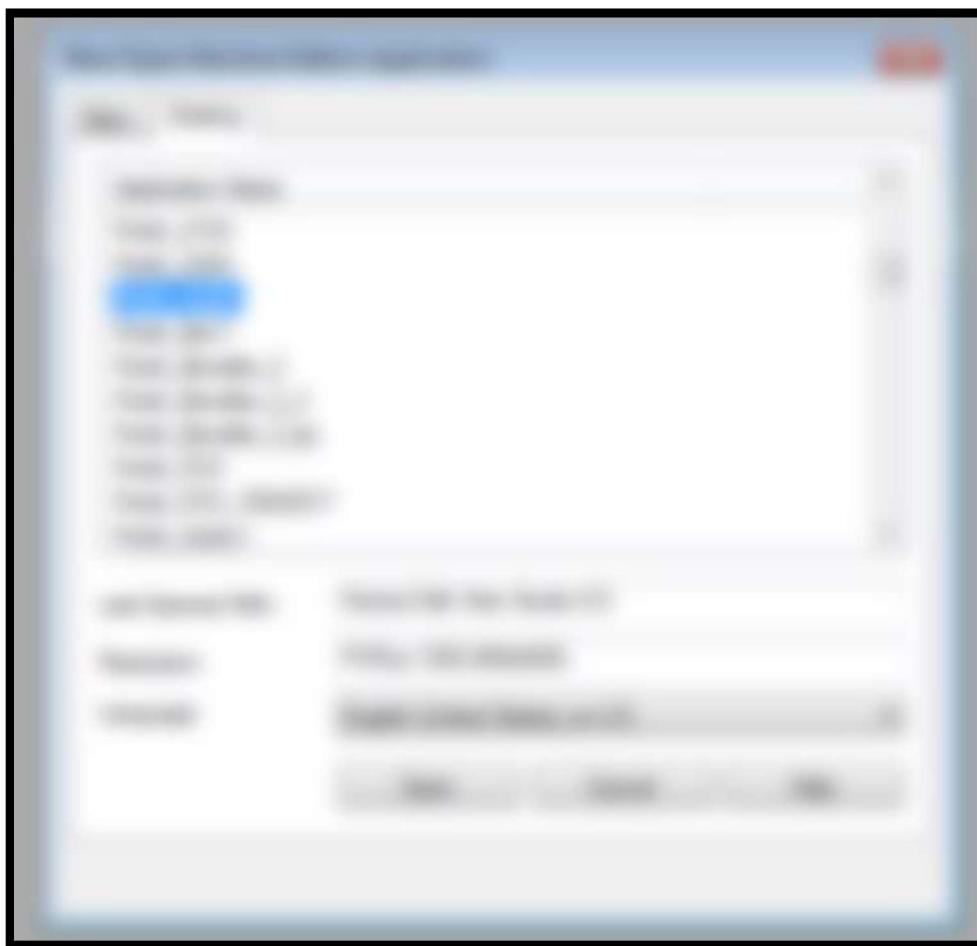
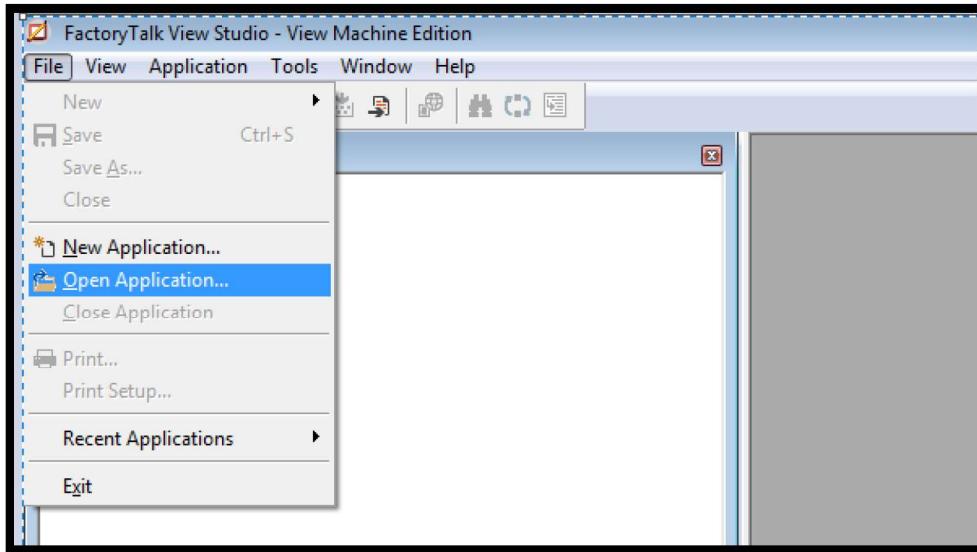


Click "Finish"



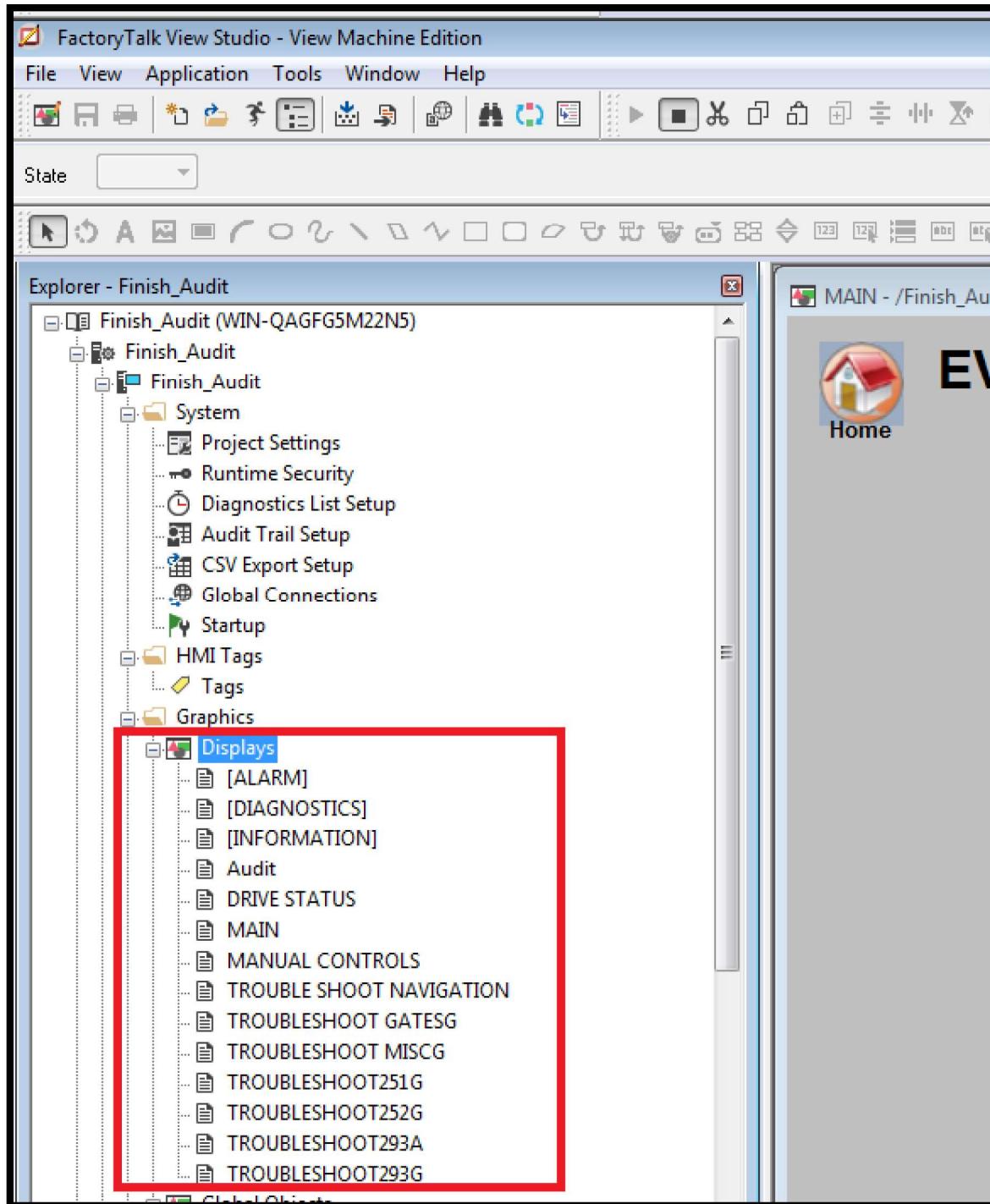
Done!

Now you will be able to see the HMI file on "File" → "Open Application"



### 1.6.2 Make changes

I don't have time to cover how to make changes but I will just show where you make HMI changes (Finish\_Audit→Graphics→Displays).

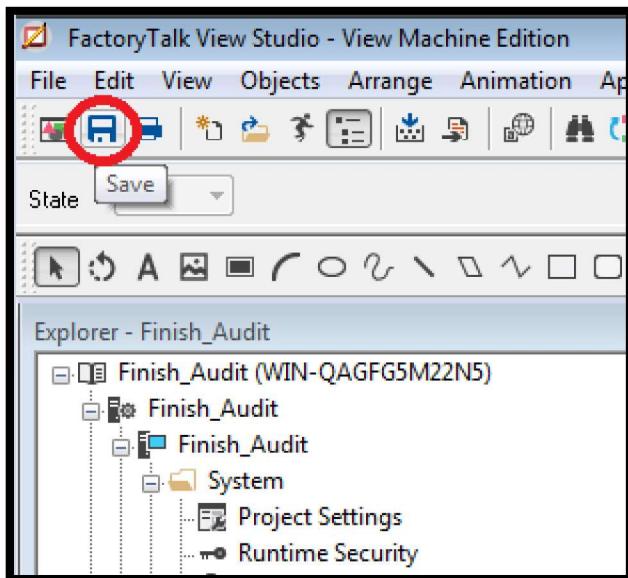


### **1.6.3 Create runtime application and Download**

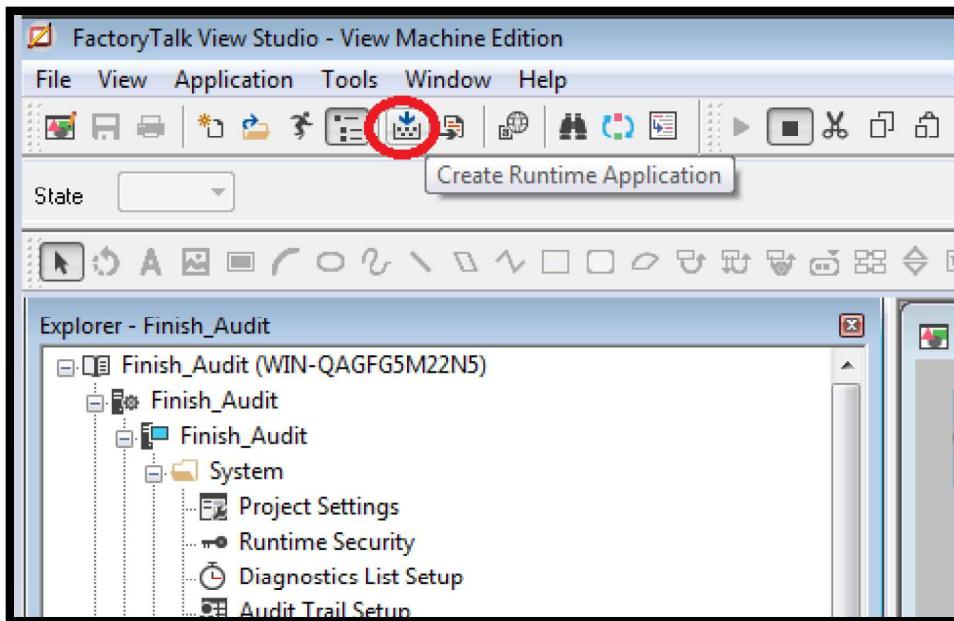
After making changes, you need to 1. create runtime application and 2. download mer file to HMI.

### **1.6.3.1 Create runtime application**

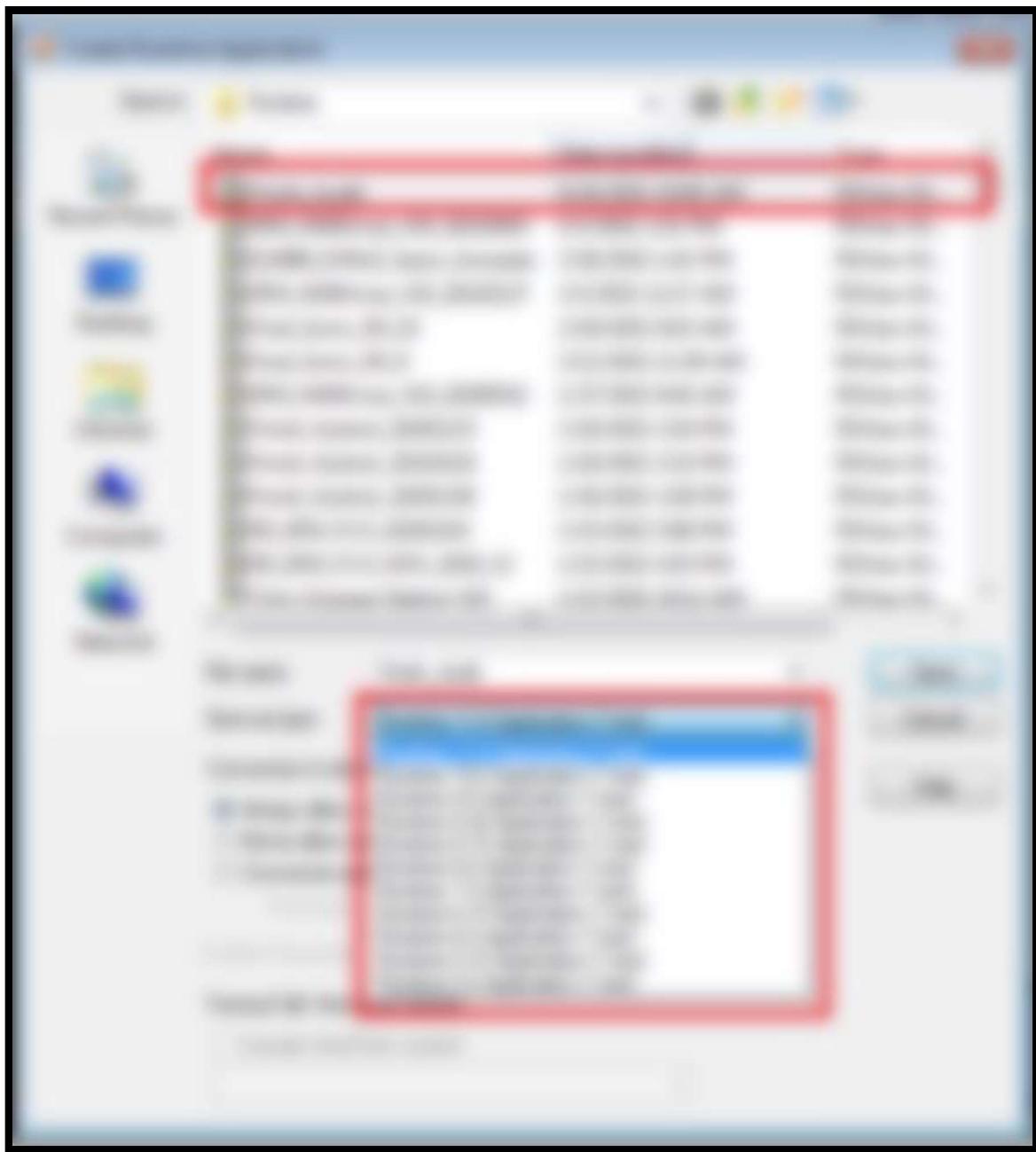
Save changes, before you create runtime application.



Click “Create Runtime Application”



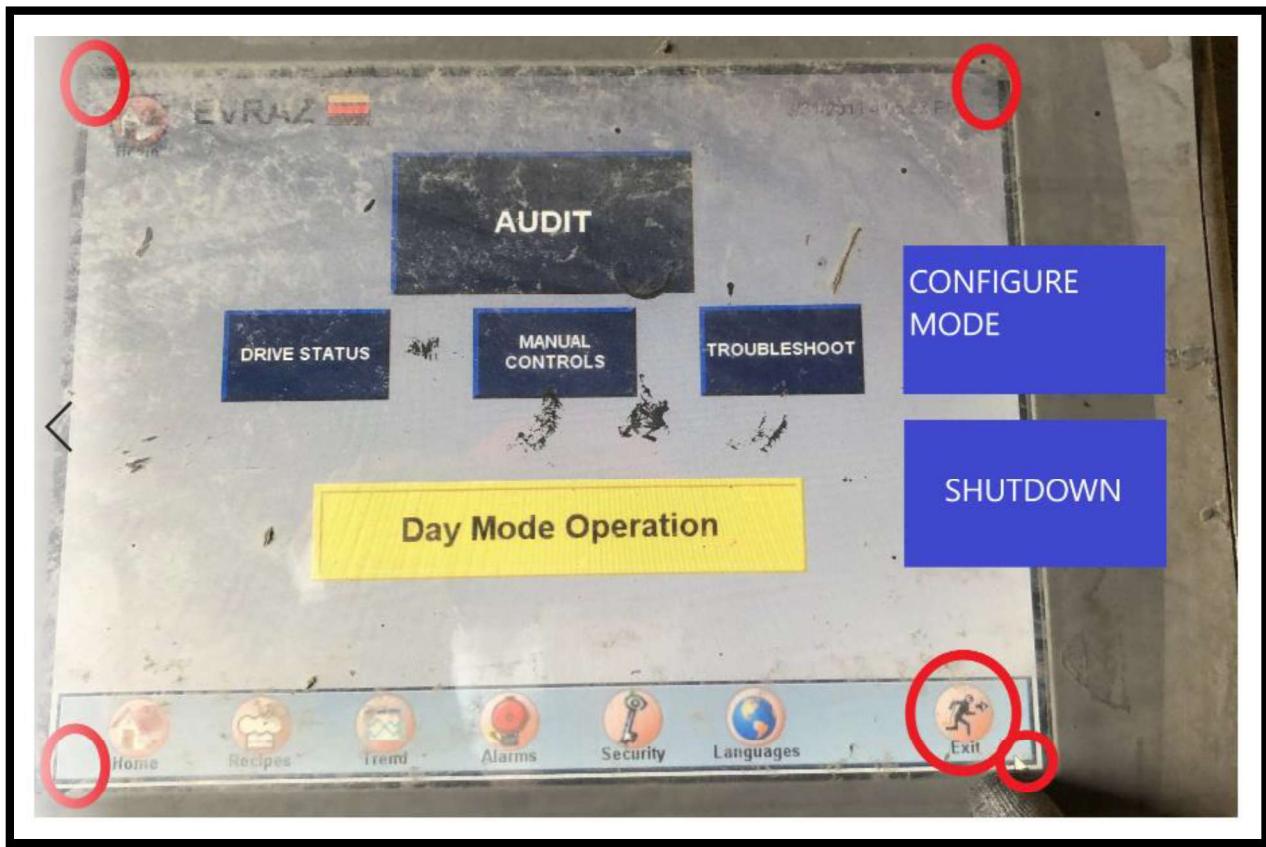
You want to create .mer file (by default, C:\Users\Public\Documents\RSView Enterprise\ME\Runtime\). Select file that you want to create runtime application. After that, you have to choose right Runtime Application version. You can check version at your HMI onsite.



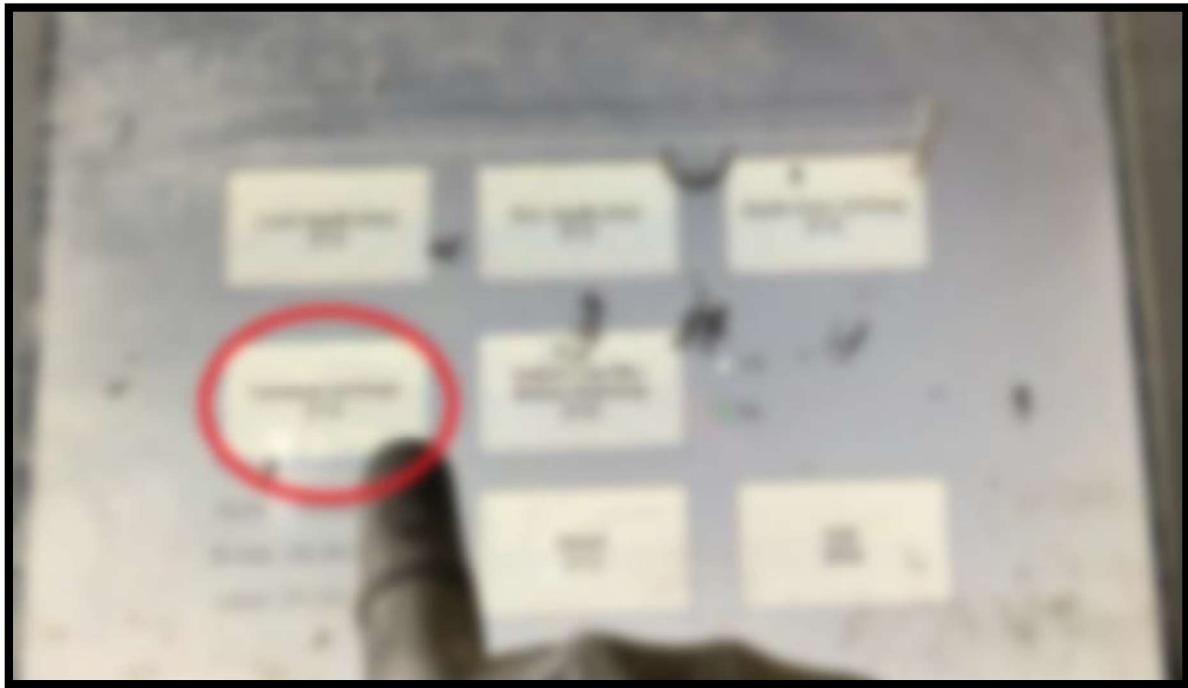
I will stick with Audit HMI example,

Depending on who programmed HMI screen, there are different ways to exit from operation screen to Configuration mode:

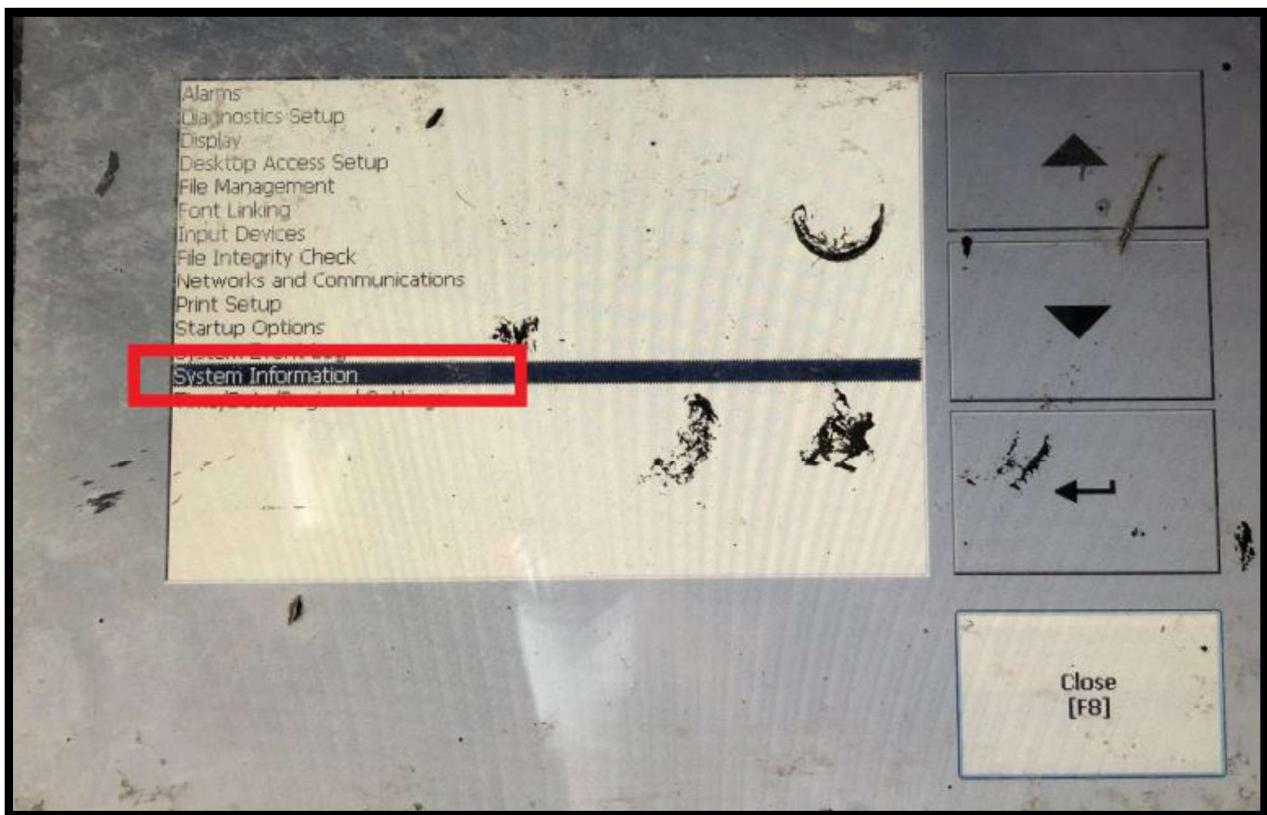
1. Push "EXIT" or "Configuration mode" or "Shutdown" (could be any name)
2. If you can't find any of above, push 4 corners
3. Not recommended, but if option 1 and 2 doesn't work, HMI power cycle will take you to configuration mode



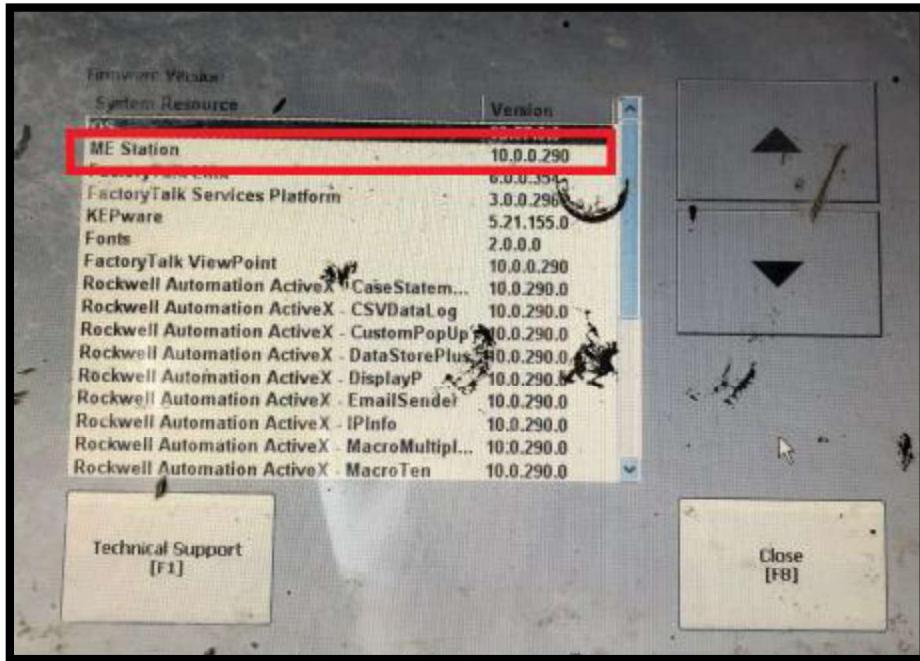
Push "Terminal Settings"



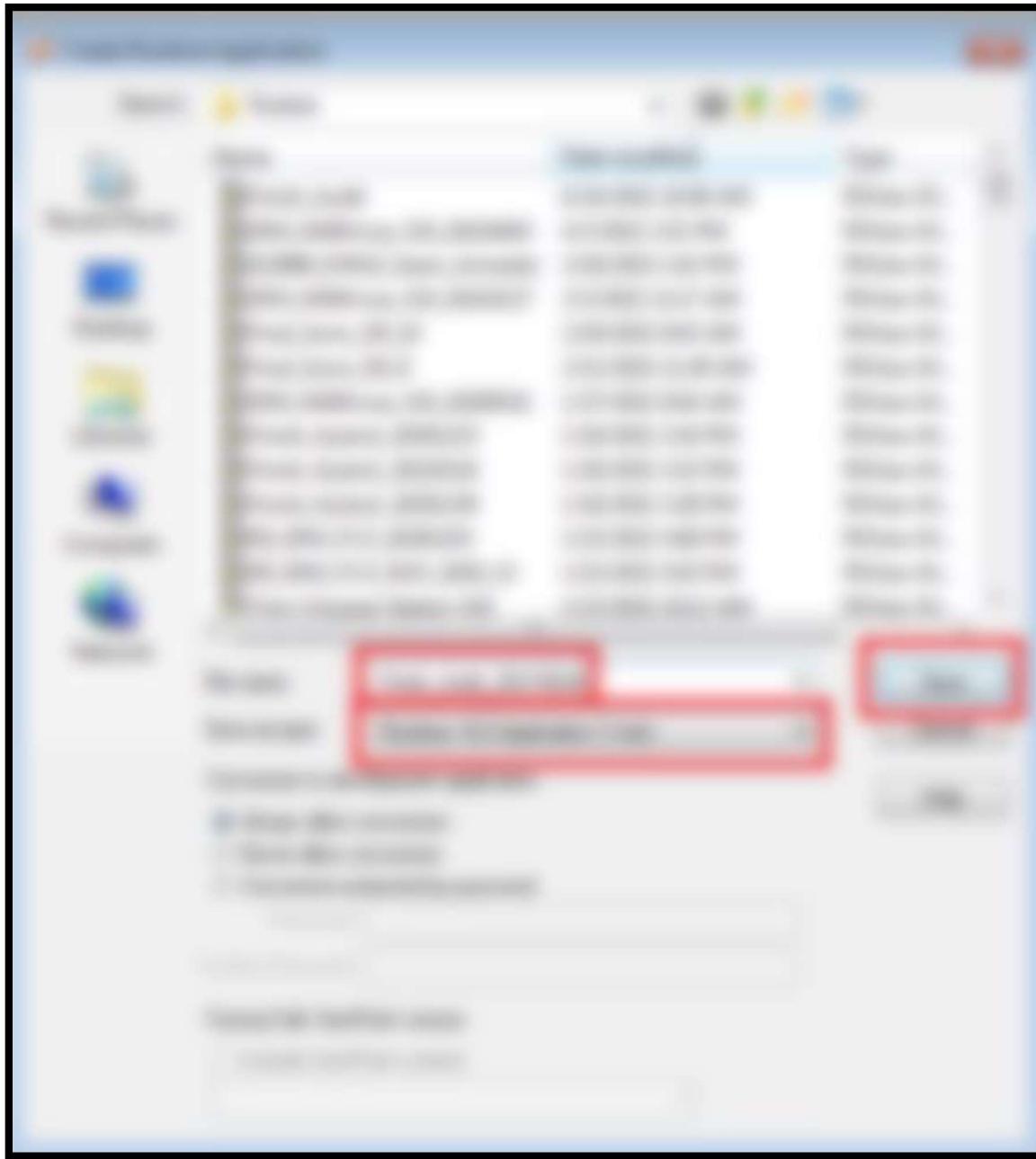
Push "System Information"



Check which version it is. In this case, version 10



Back to Creating runtime Application, now we know which version we should select. In this particular example, I selected “Runtime 10.0 Application (\*.mer)”. Make sure that you follow assign proper name with yyyyymmdd format. Click “Save”



Now your modified .mer file is created and saved in  
(C:\Users\Public\Documents\RSView Enterprise\ME\Runtime\ folder).

### **1.6.3.2 Download**

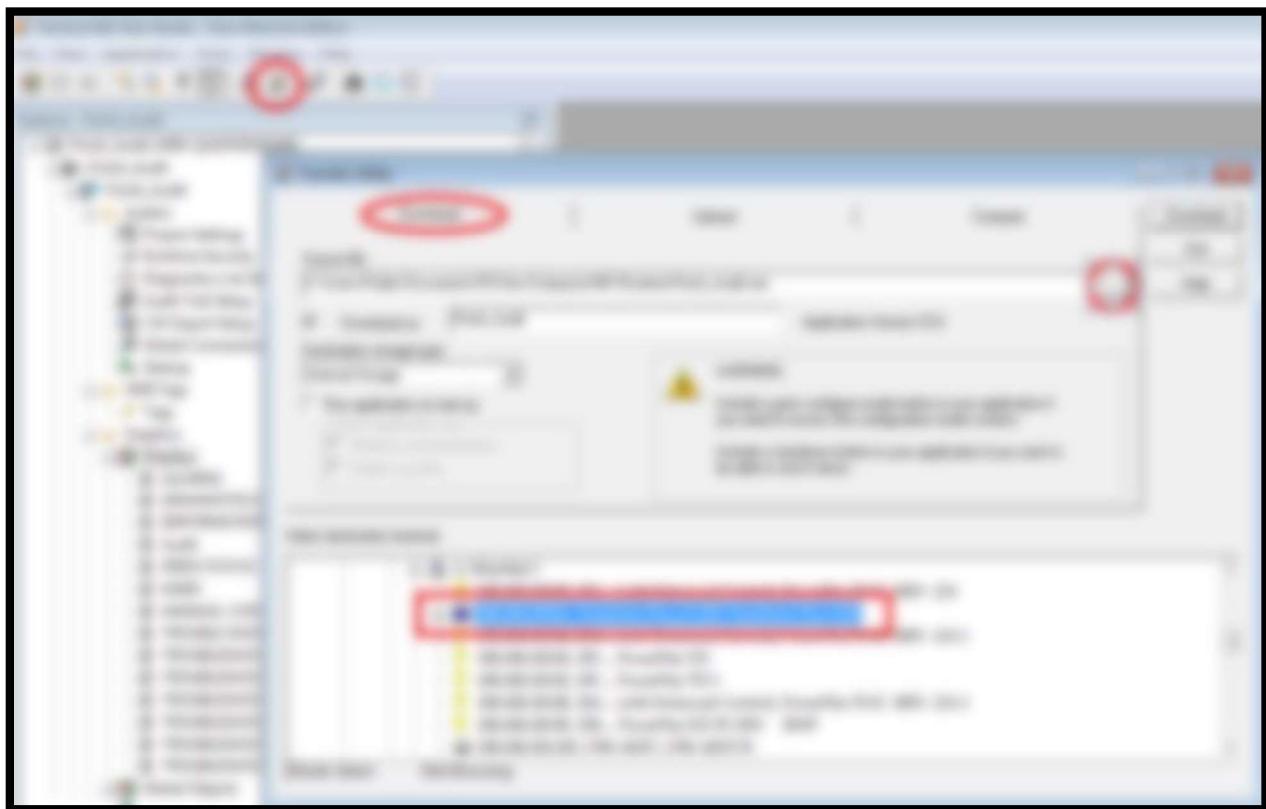
Download procedures are similar to upload procedures.

Click "Transfer Utility".

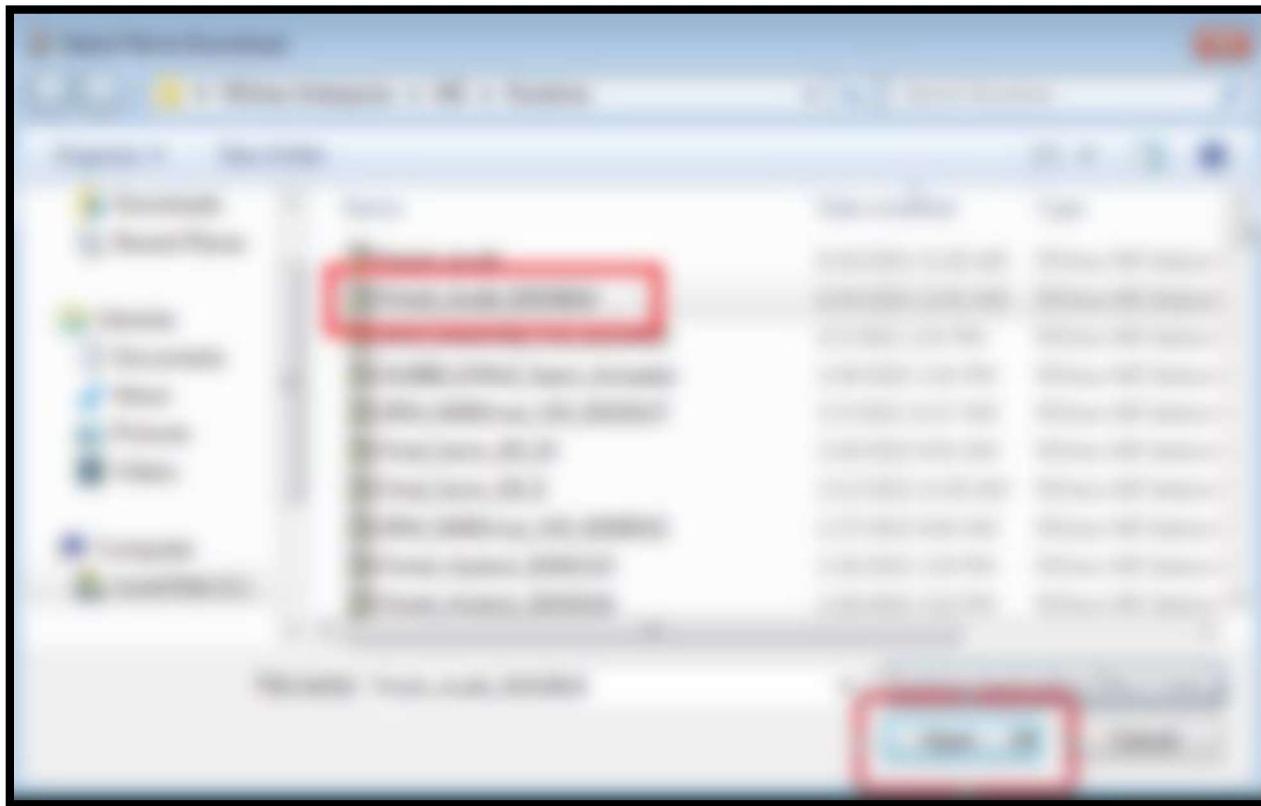
Click Download tab.

Highlight desired HMI on the list

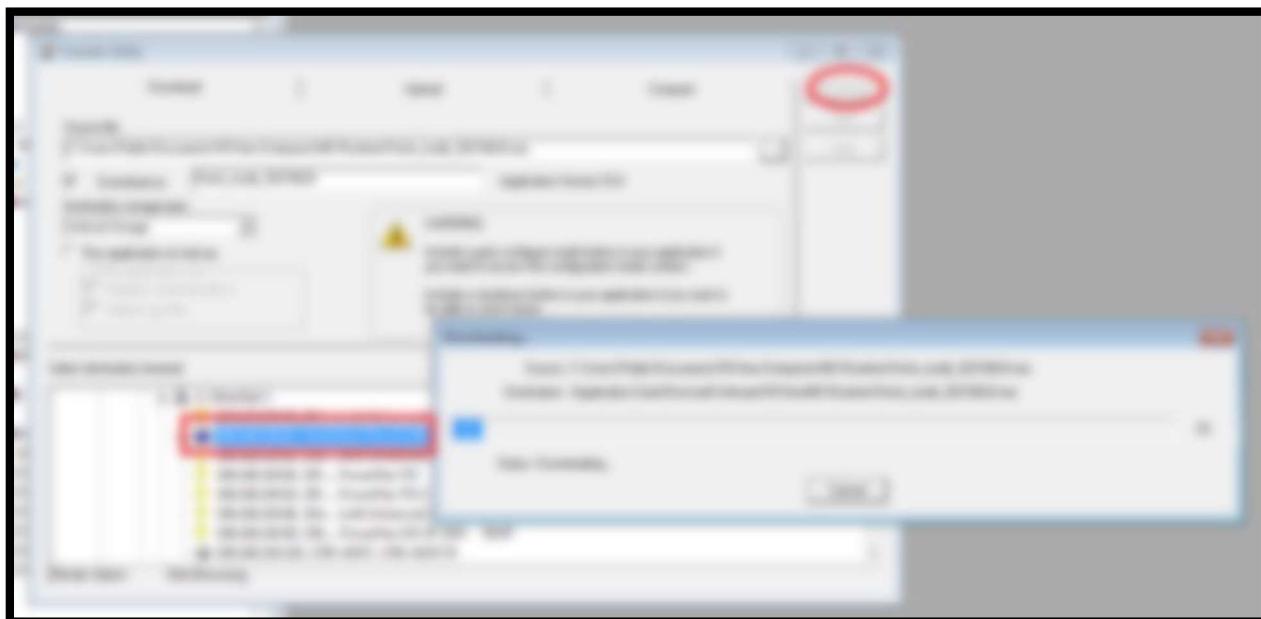
Click "..." to select Source file.



Select runtime application file that you created. Click "Open".



Make sure your desired HMI is still highlighted, and click "Download"

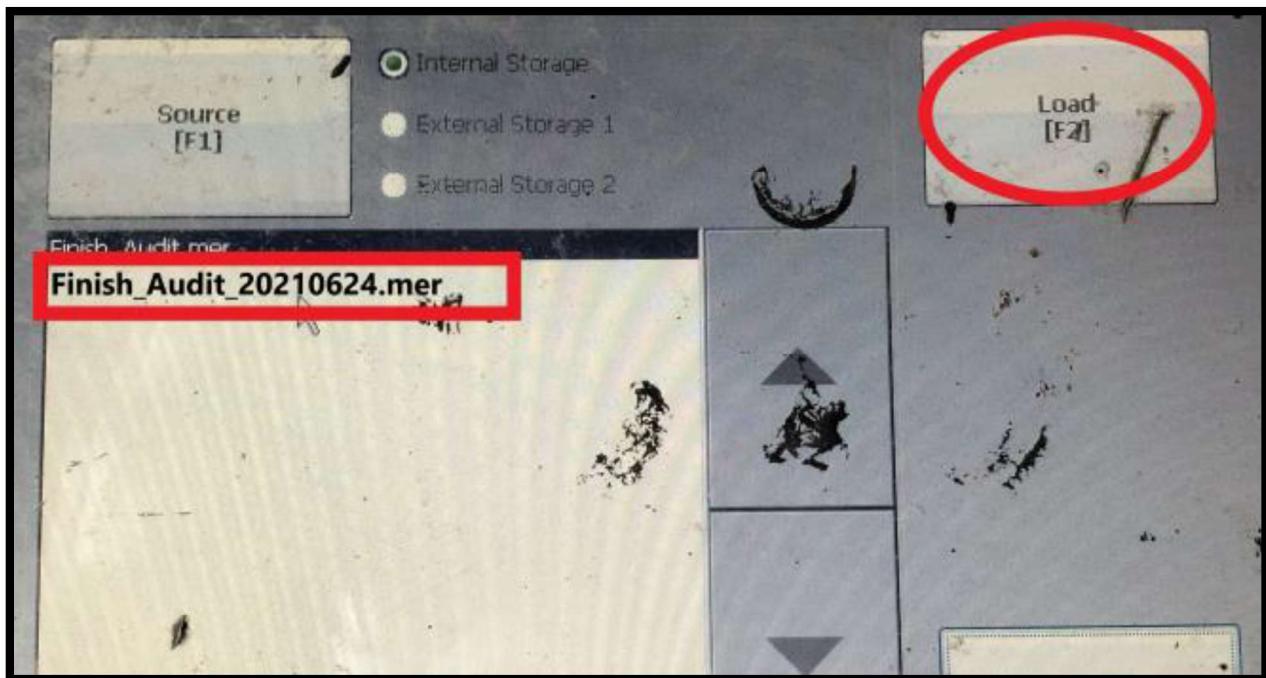


### **1.6.3.3 Load new file on HMI screen**

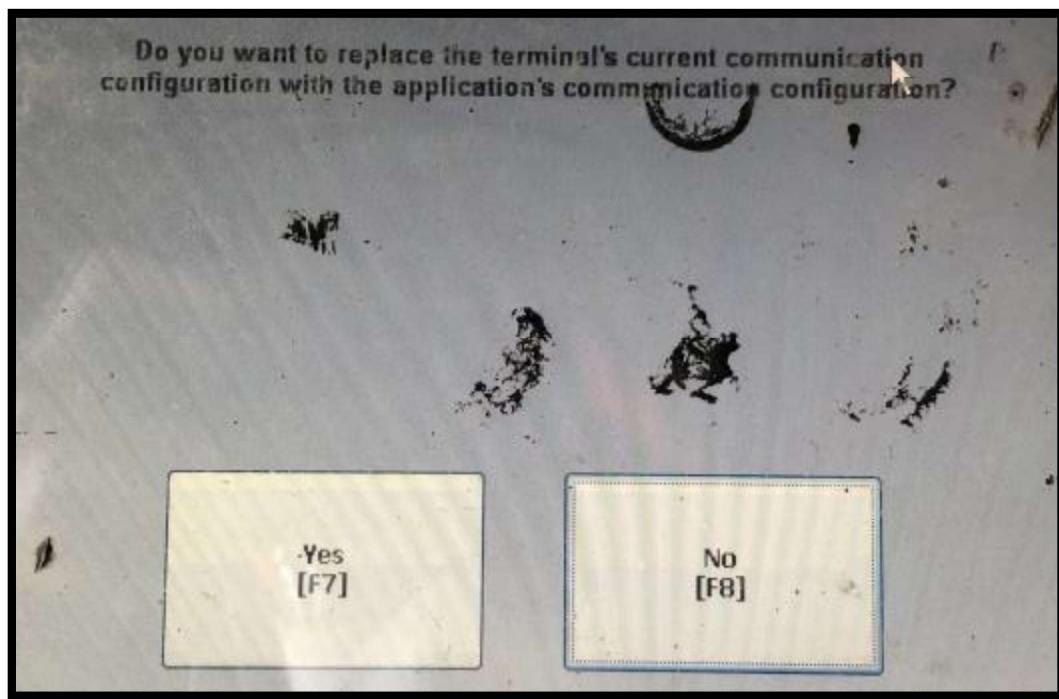
Back to HMI onsite. Push "Load Application"



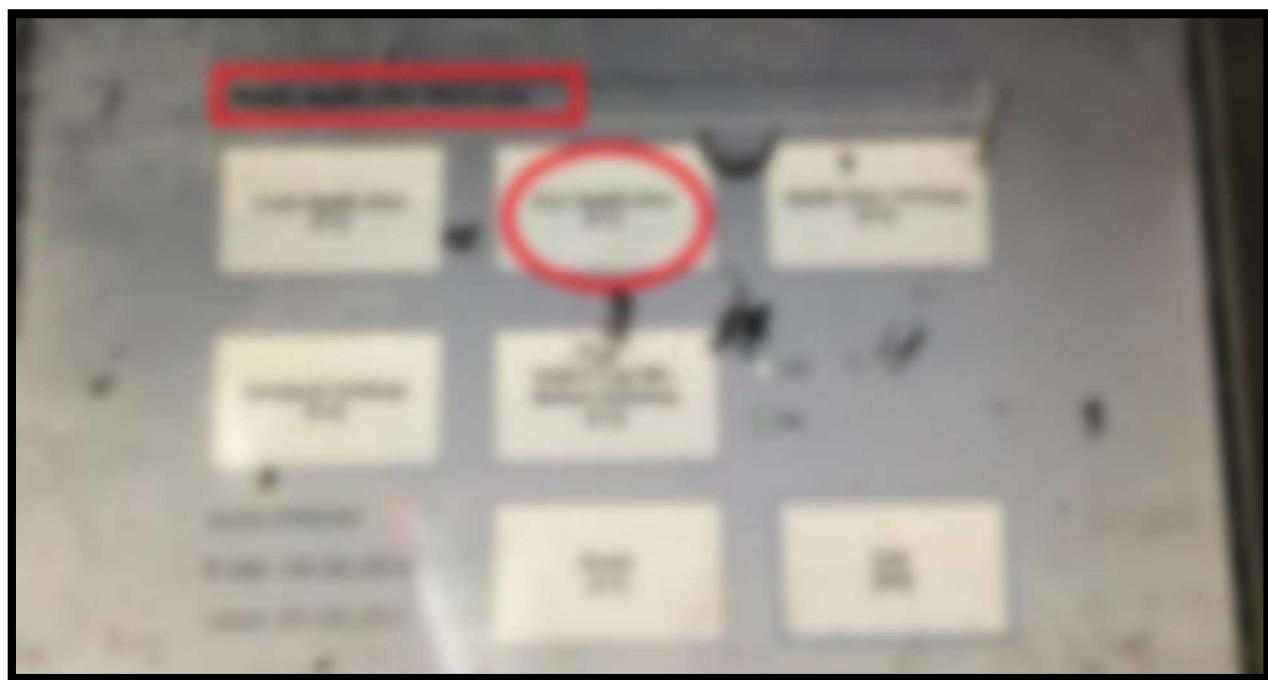
You should be able to see new added file on the list. Push new added file, and push "Load"



If you get a message asking that whether you want to replace communication path then push "No" unless you know for sure you need to replace comm path.



Make sure you loaded your new mer file, and push "Run Application"



## 2 Siemens TIA portal 14

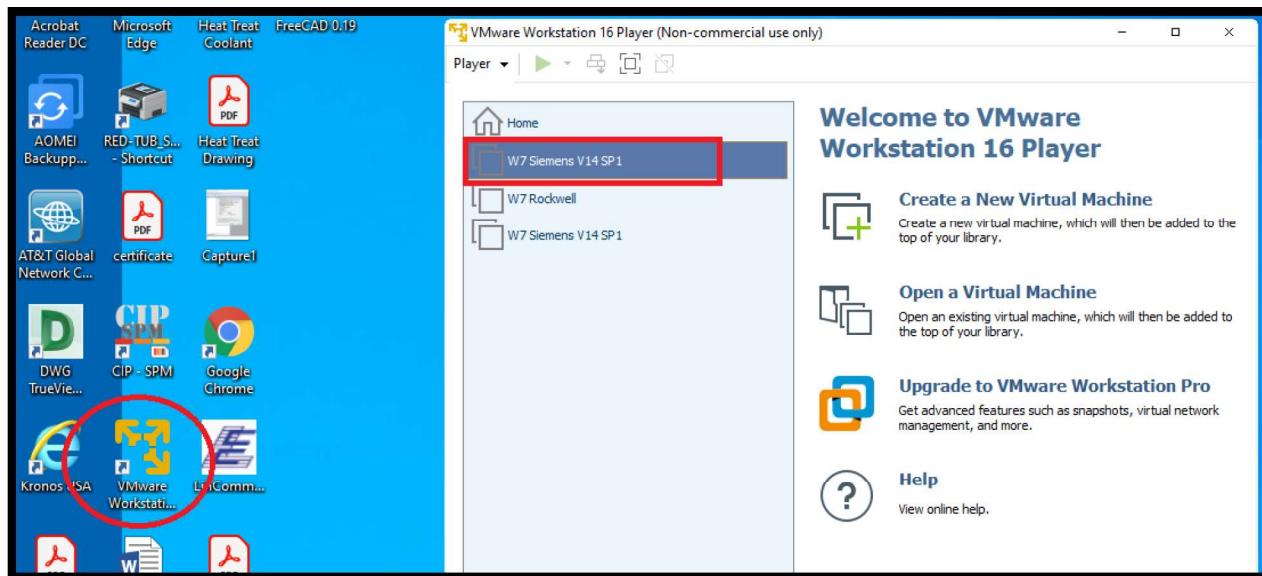
TIA stands for Totally Integrated Automation. Unlike Allen Bradley, you can do both PLC and HMI with one software.

In this section, I will cover basic instruction such as how to open file, "Go online" and monitor program etc.

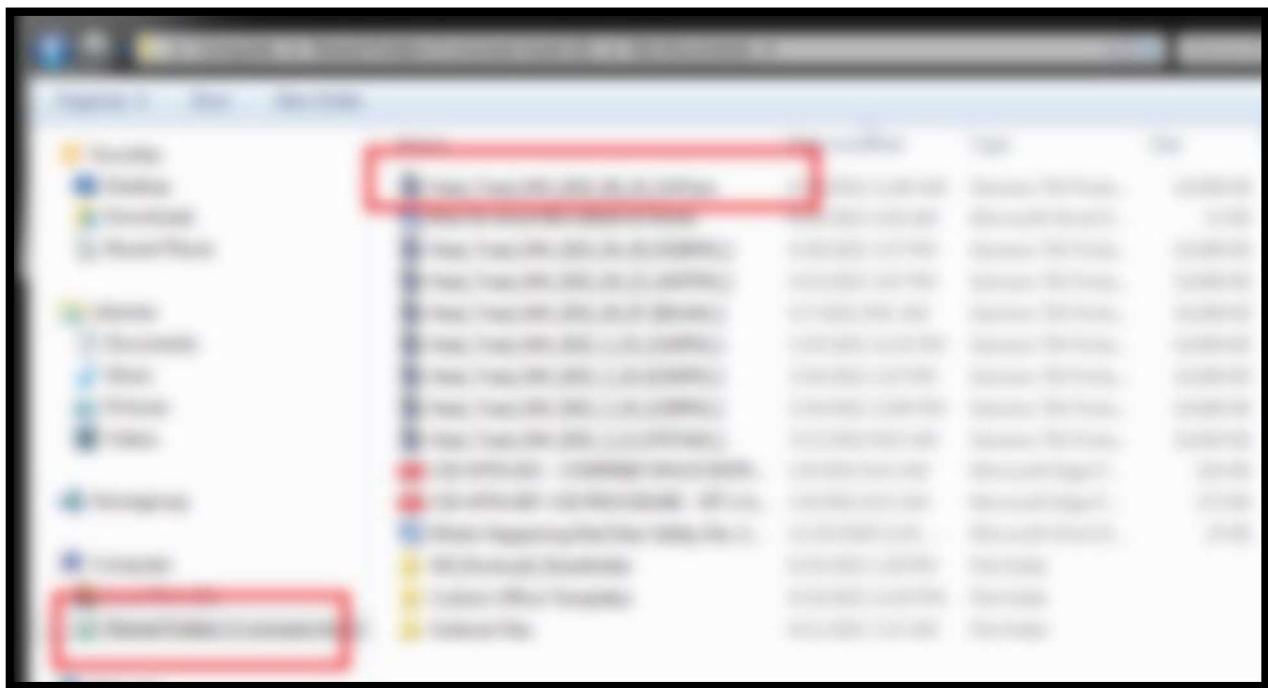
### 2.1 Open newest file

Engineering team has a good practice of uploading new file to share folder. It is important to follow the same practice for better file management. Otherwise, you might open old file and not able to monitor (go online) program.

Open VMware, and double click "W7 Siemens V14SP1"



Since maintenance desktop and VMware is connected, you should be able to see the newest compressed file on VM's Shared Folders.

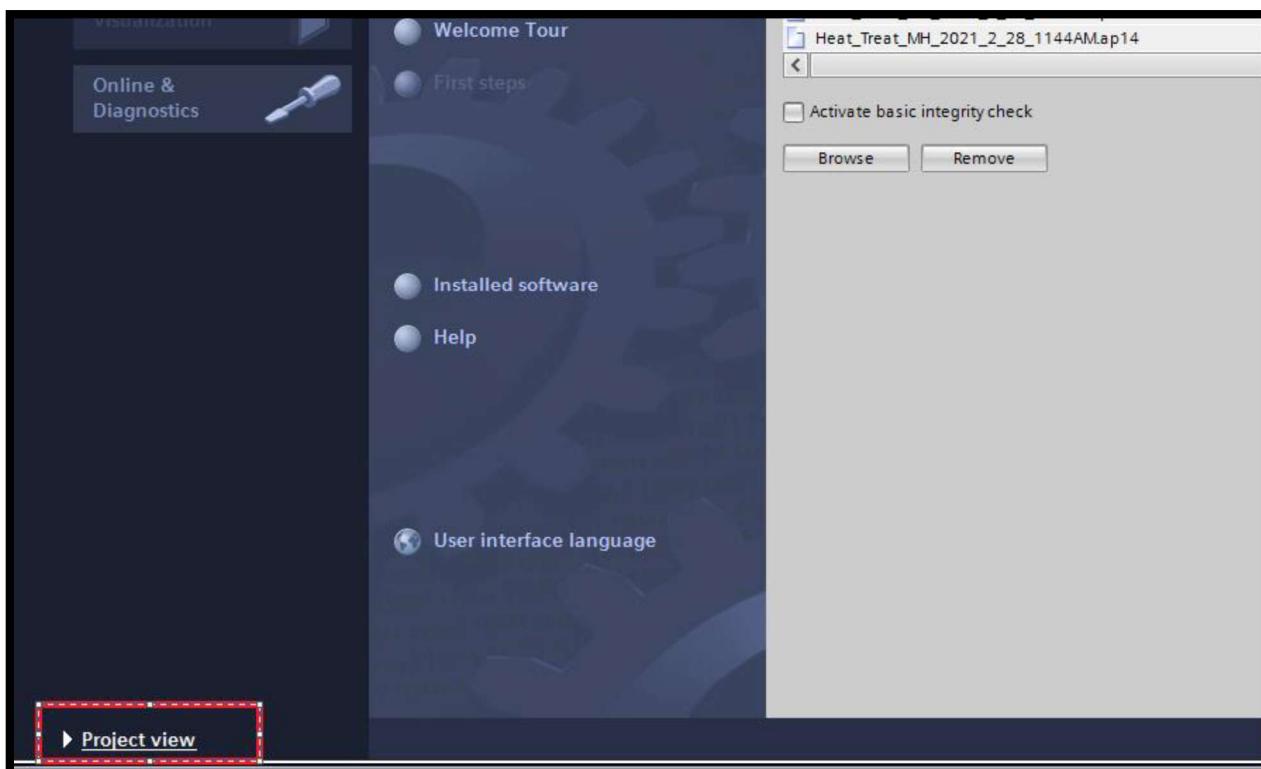


This file is compressed file (archived file) so you can't just double click to open. You have to retrieve the file.

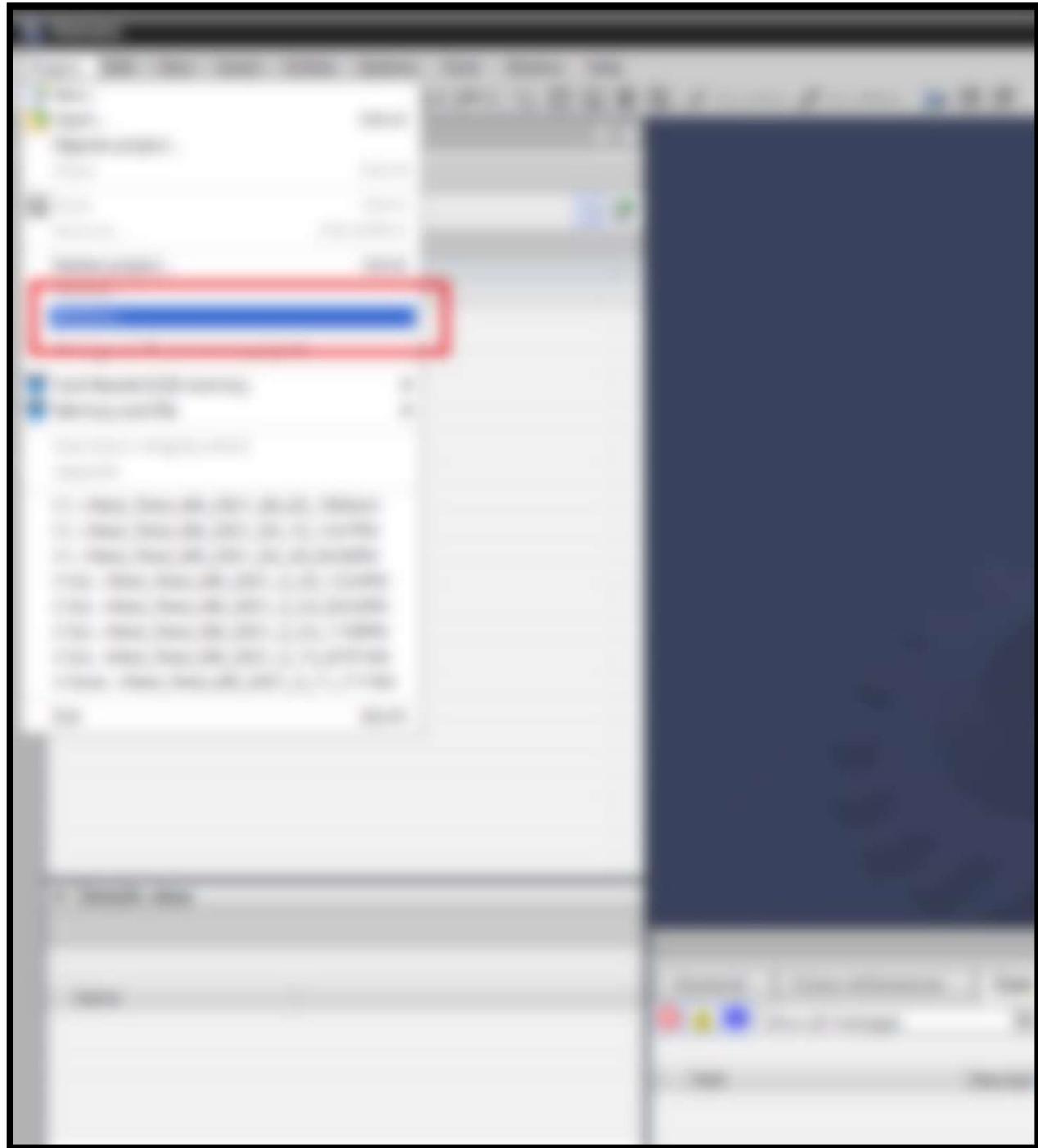
Open "TIA V14"



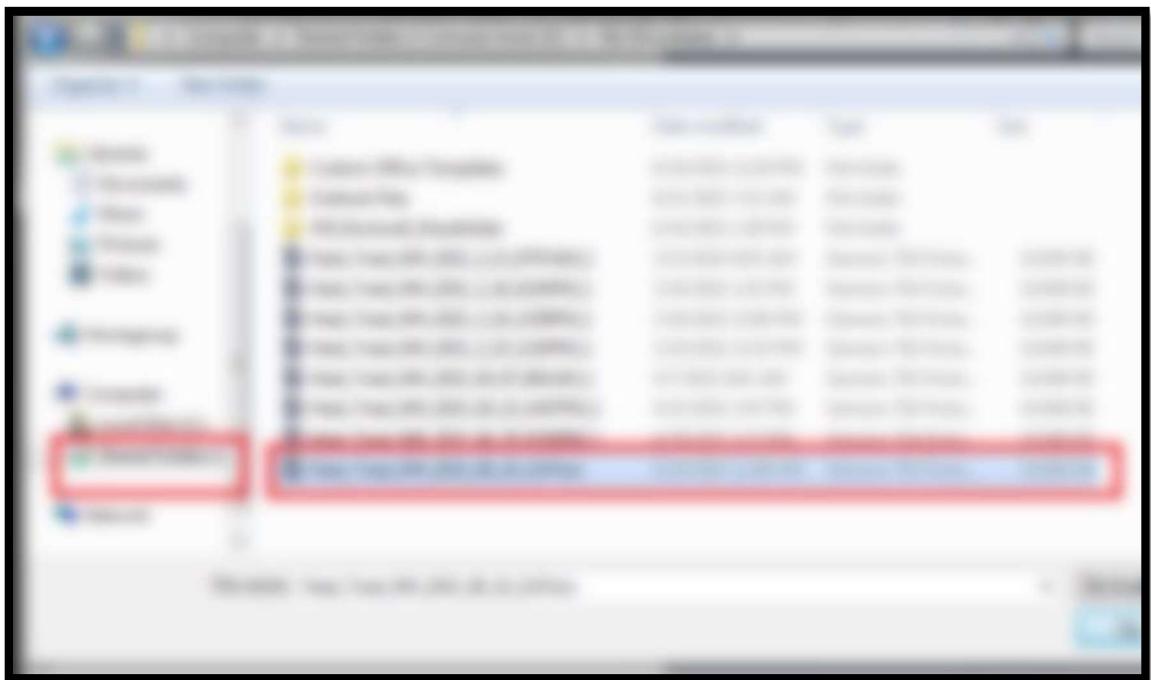
Click "Project view" on the bottom left corner.



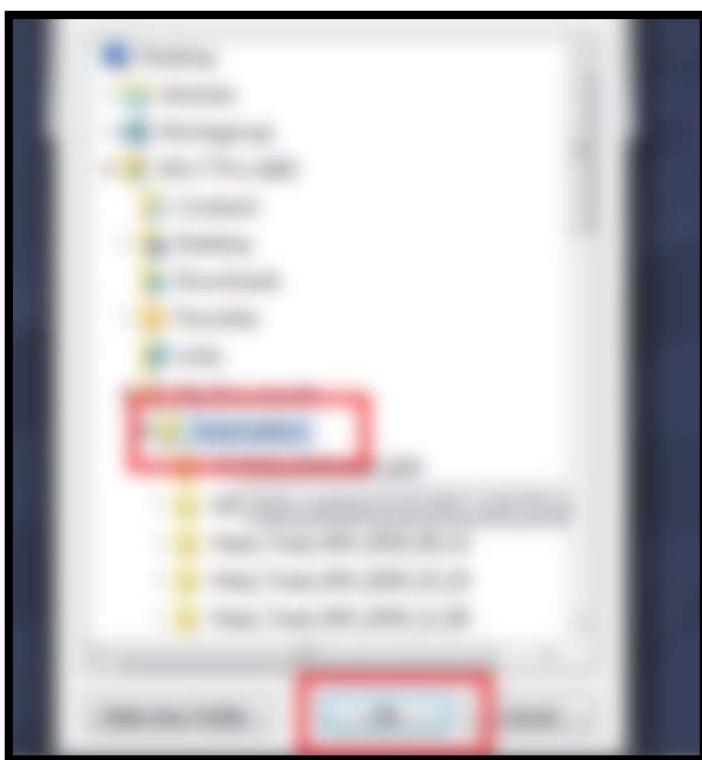
Click "Project" → "Retrieve..."



Click Shared Folders and select the newest compressed file that you copied and pasted.

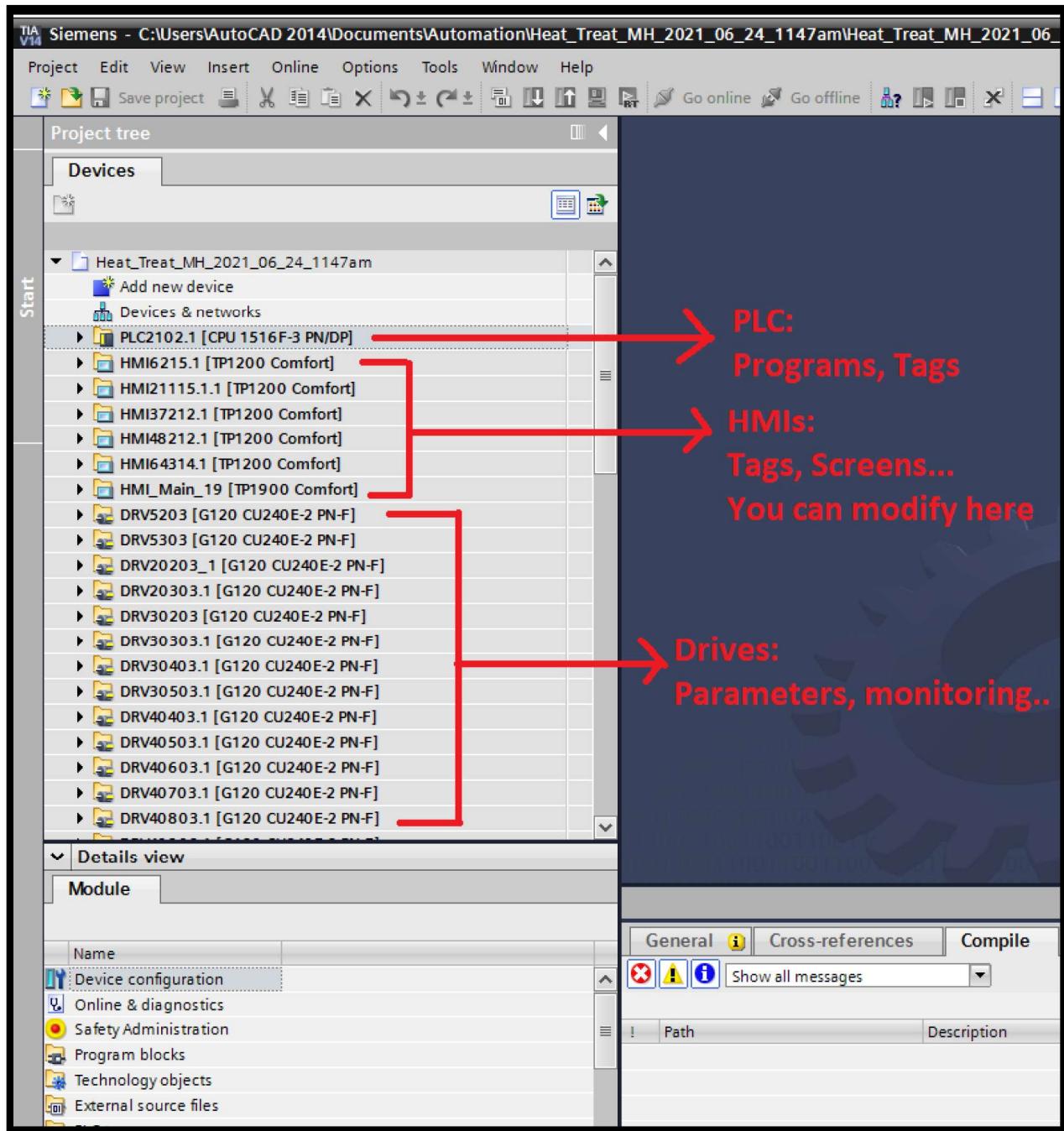


Retrieve the file to folder (you want to be consistent) and click "Ok".



It will retrieve the compressed file and open for you.

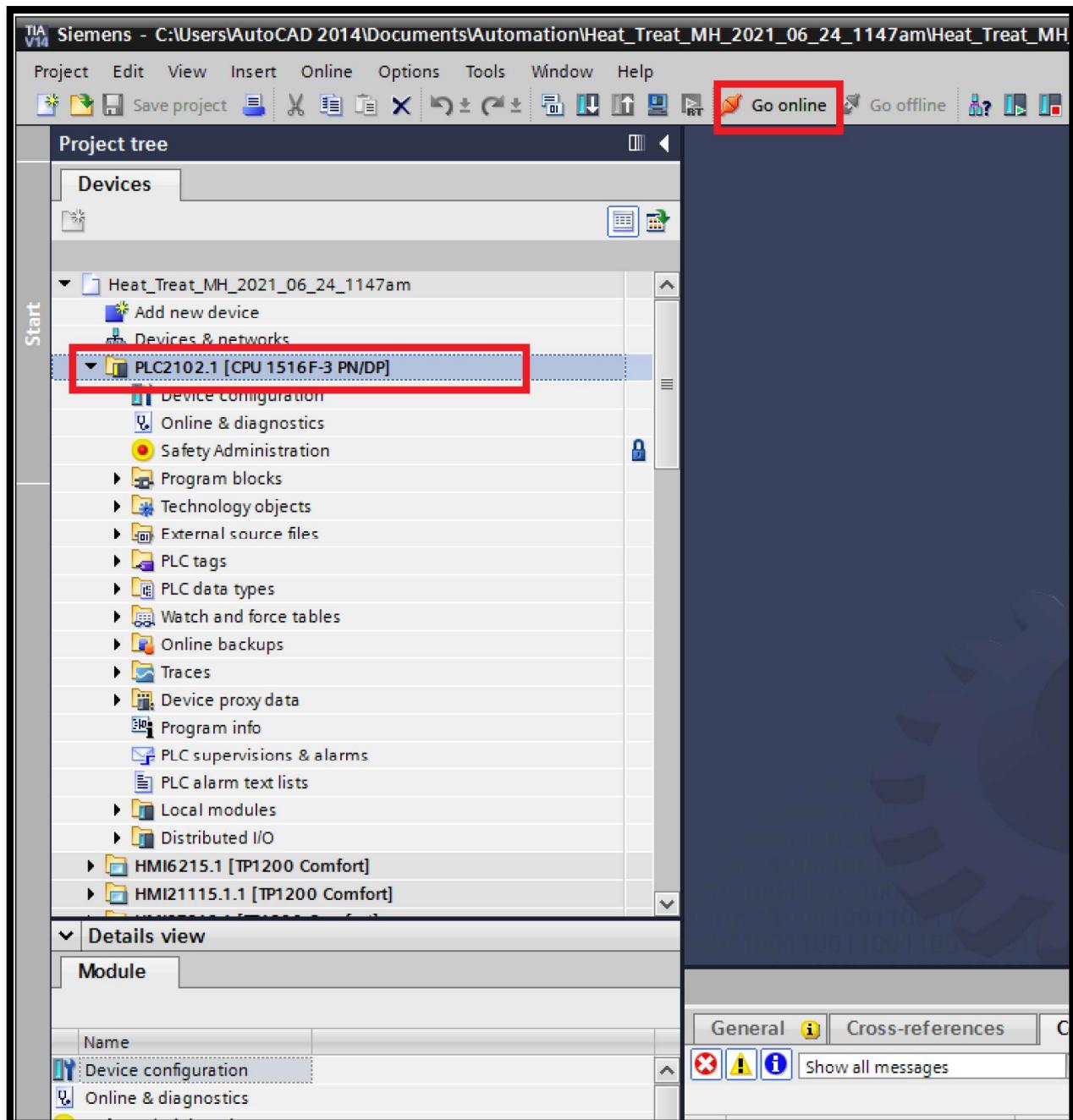
Like I mentioned, you have PLC, HMIs and drives in this TIA Portal software.



## **2.2 Go online**

In this example, we will go online with Material Handling program.

In order to monitor programs (Go online), Click PLC folder and when it is highlighted, Click "Go online".



Heat treat has two different PLC program:

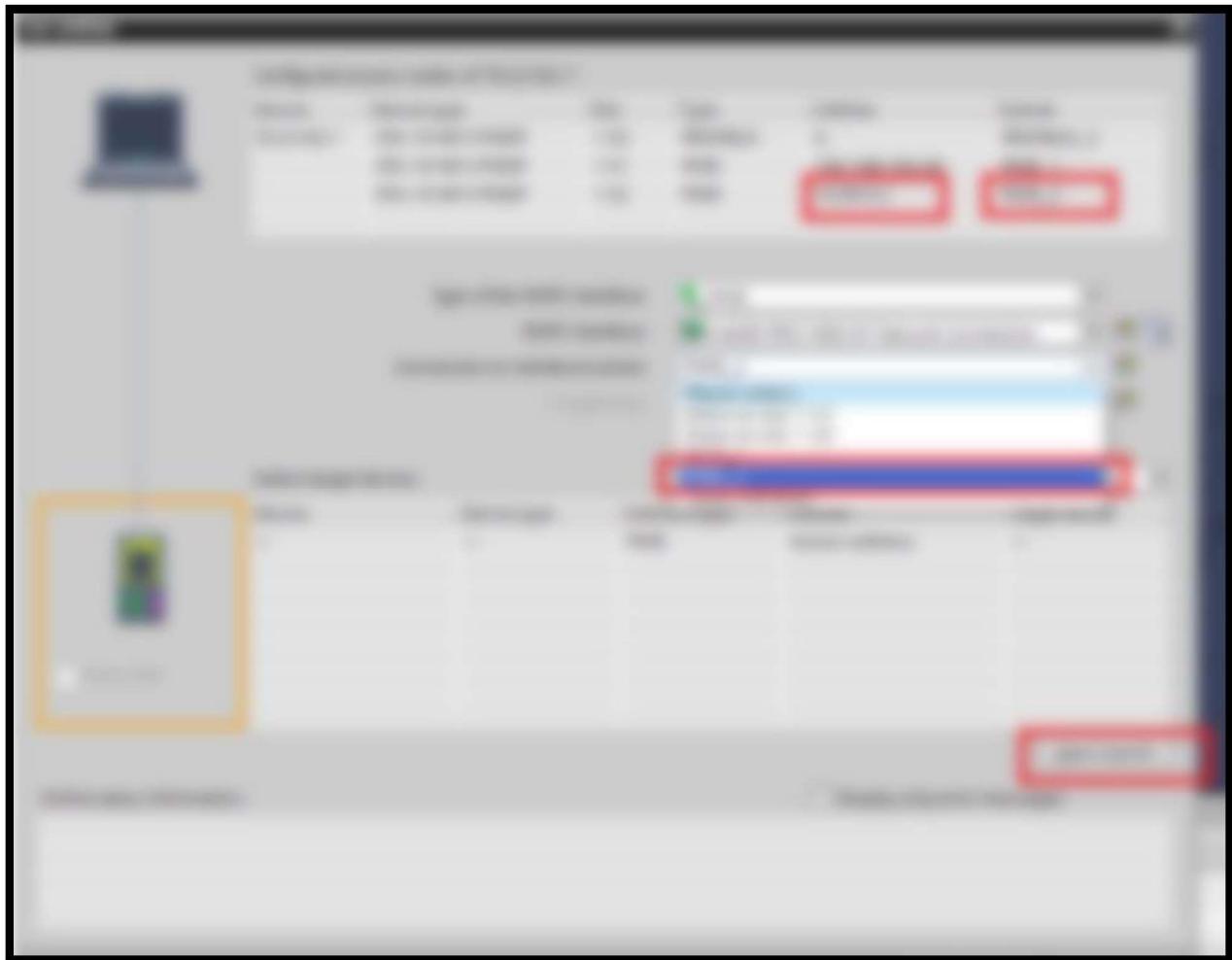
Material Handling → Consists of 1 PLC

Elotherm → Consists of 2 PLCs



We know that Material Handling's IP address is 10.99.9.2

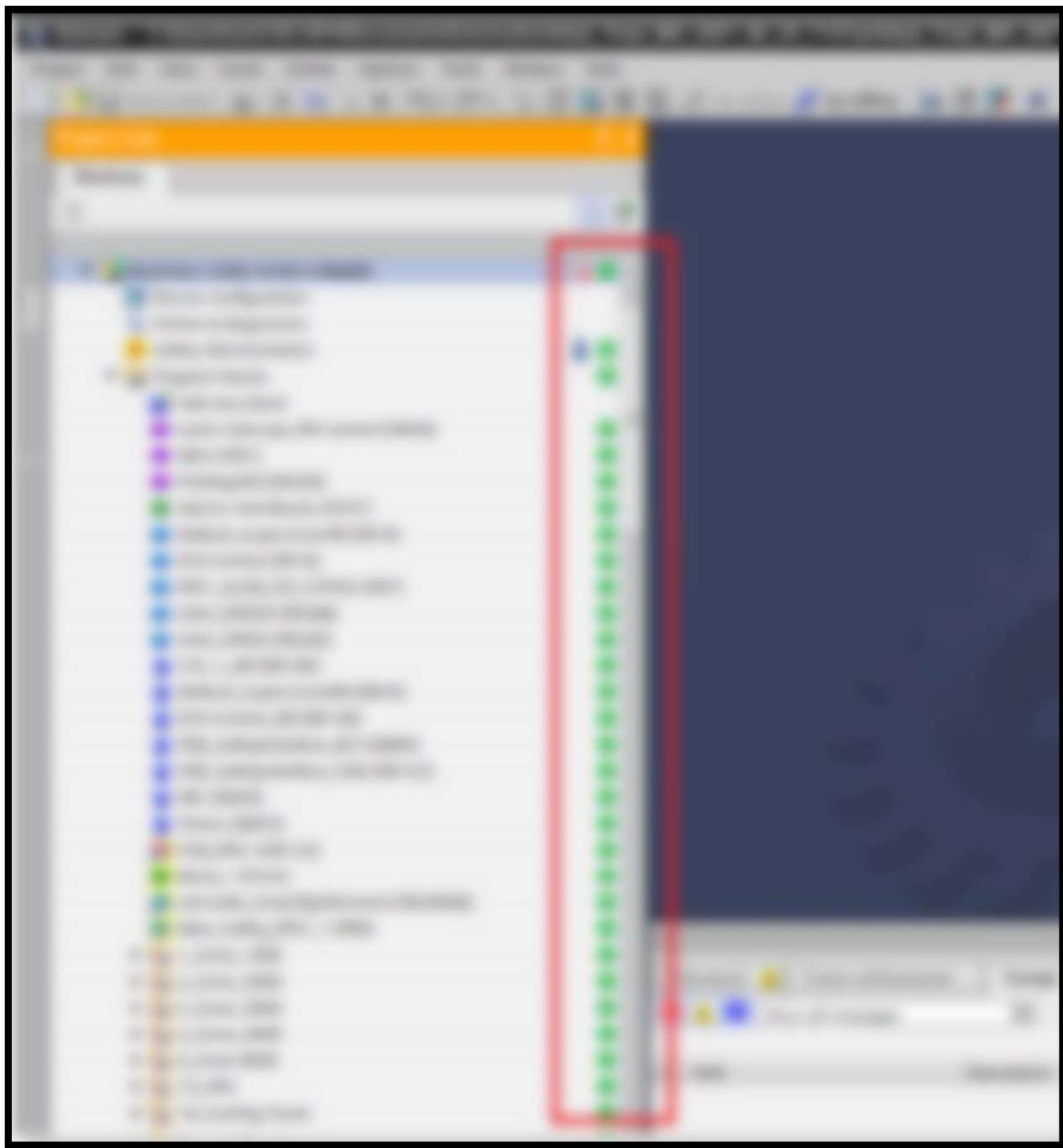
If you look at first set of table, you see Subnet is PN/IE\_2. Expand "Connection to interface/subnet" and select "PN/IE\_2". Click "Start search"



Click "PLC2102.1" in second table and Click "Go online"



You can see it "Program blocks" are all green which means its online program and offline program are the same. This means, you can monitor program in real time.



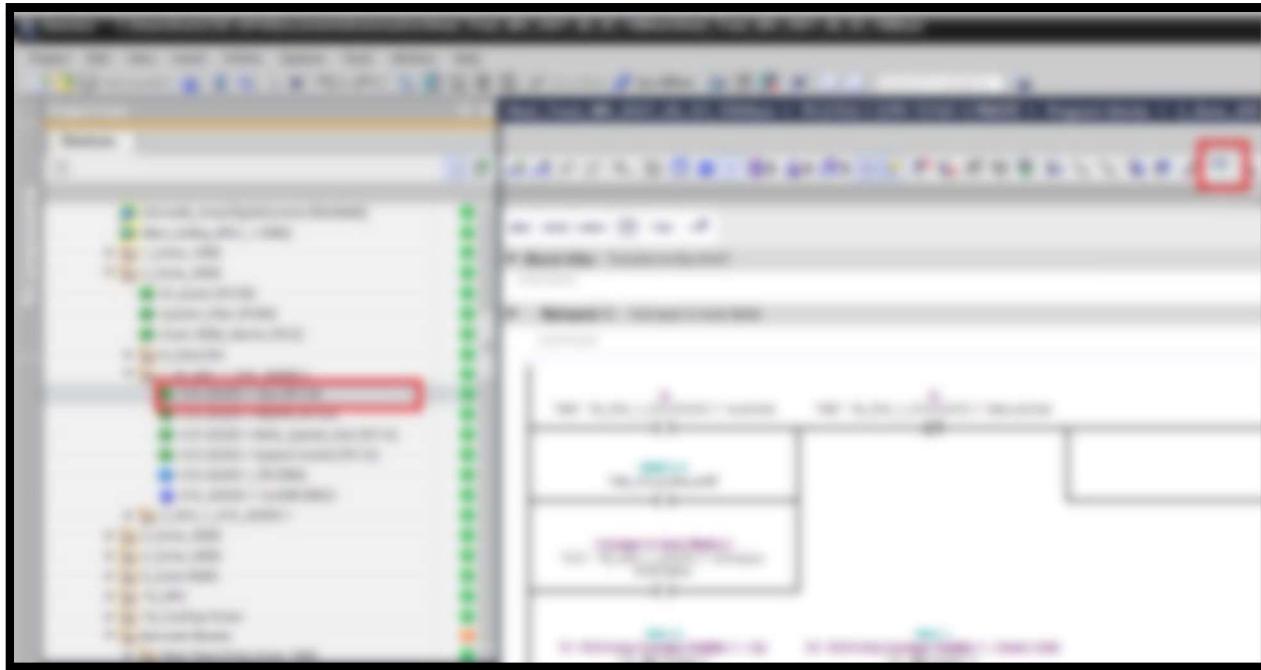
However, if you see a half blue half orange circle, that means online and offline program is different which means you can not monitor that particular FC (function) in real time.



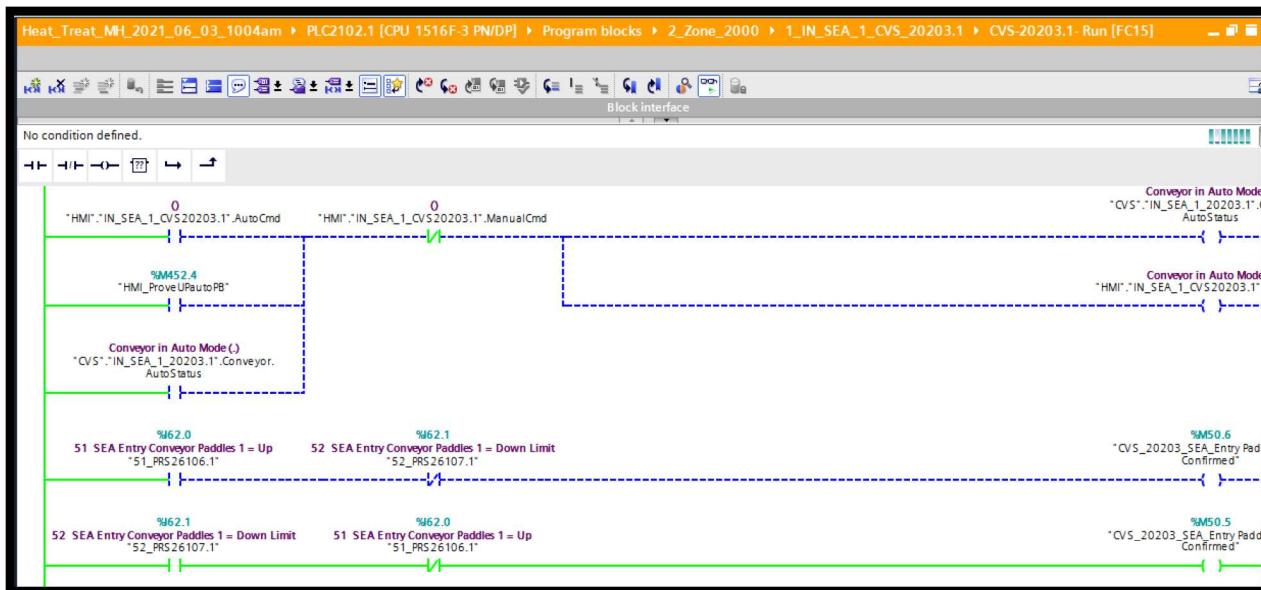
## **2.3 Monitor**

Siemens “Monitoring” is same as “Go online” in Rslogix 5000. You can see Input output bits come on and off in real time to help you troubleshooting.

Open FC (Function) that you want to monitor, and Click “Monitoring” icon.



Notice that now color changed.



## **2.4 Download**

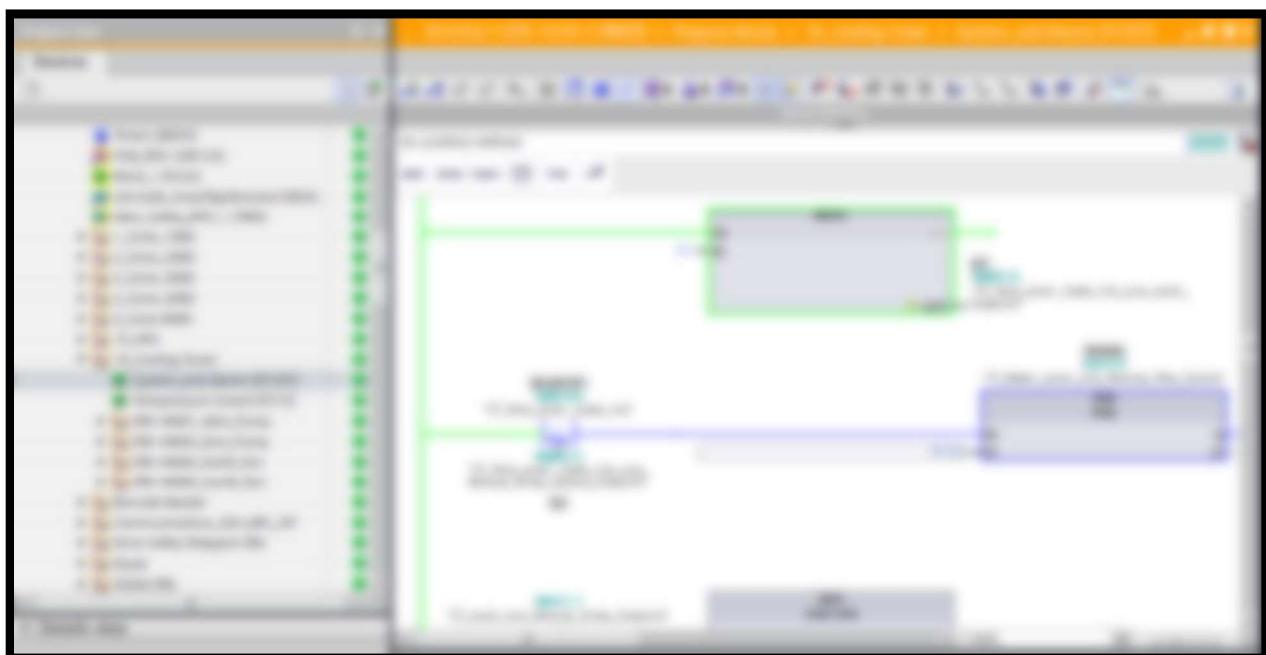
Making changes in Siemens PLC is little bit more limited than Rslogix 5000 in my opinion. While Rslogix 5000 allow you to do online editing, Siemens requires you to download every time you make changes.

Depends on changes (minor or major), TIA Portal might require CPU to STOP to download. I don't have a clear definition of minor changes and major changes but my understanding is:

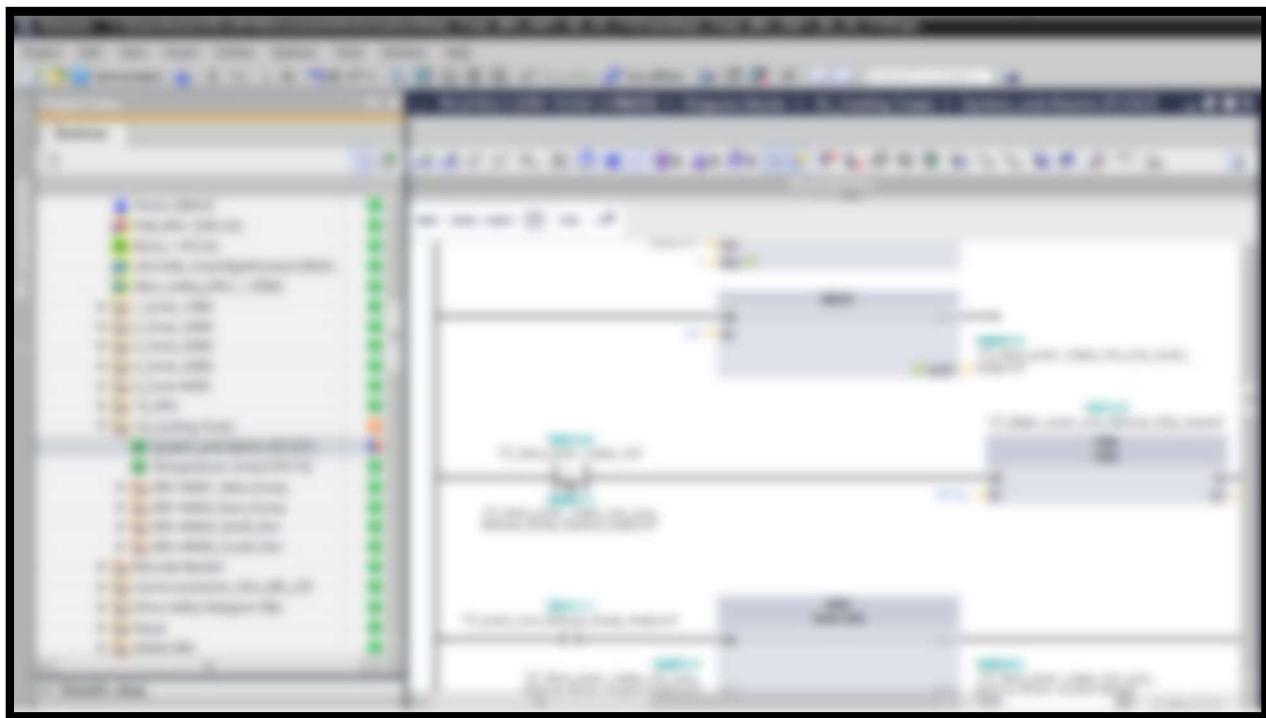
Minor changes → changing parameter value, putting NO/NC bits ...

Major changes → Hardware configuration, changing DB, creating OB, deleting OB ...

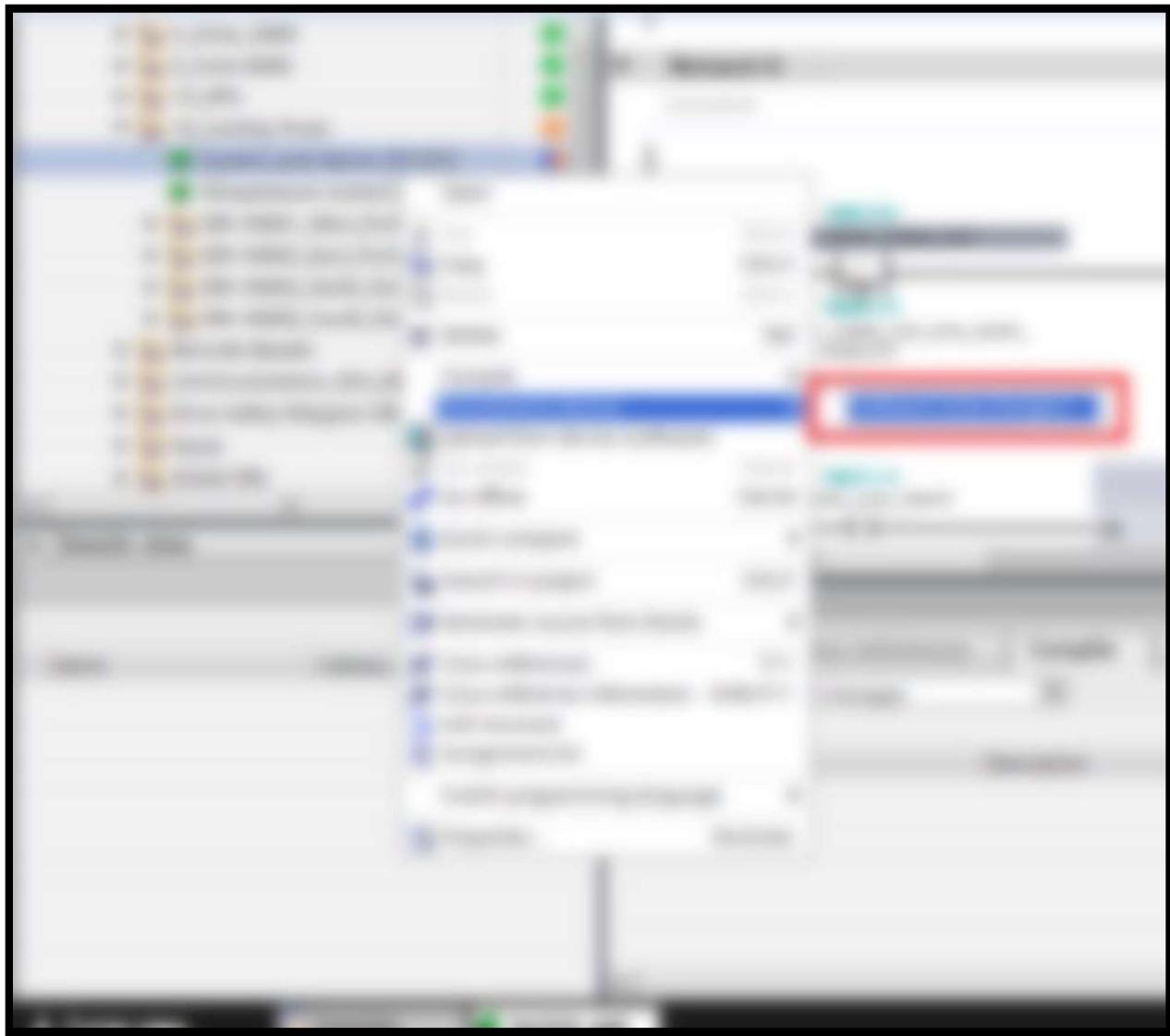
Before make any changes, make sure all program has green circle (which means program file you opened is up to date)



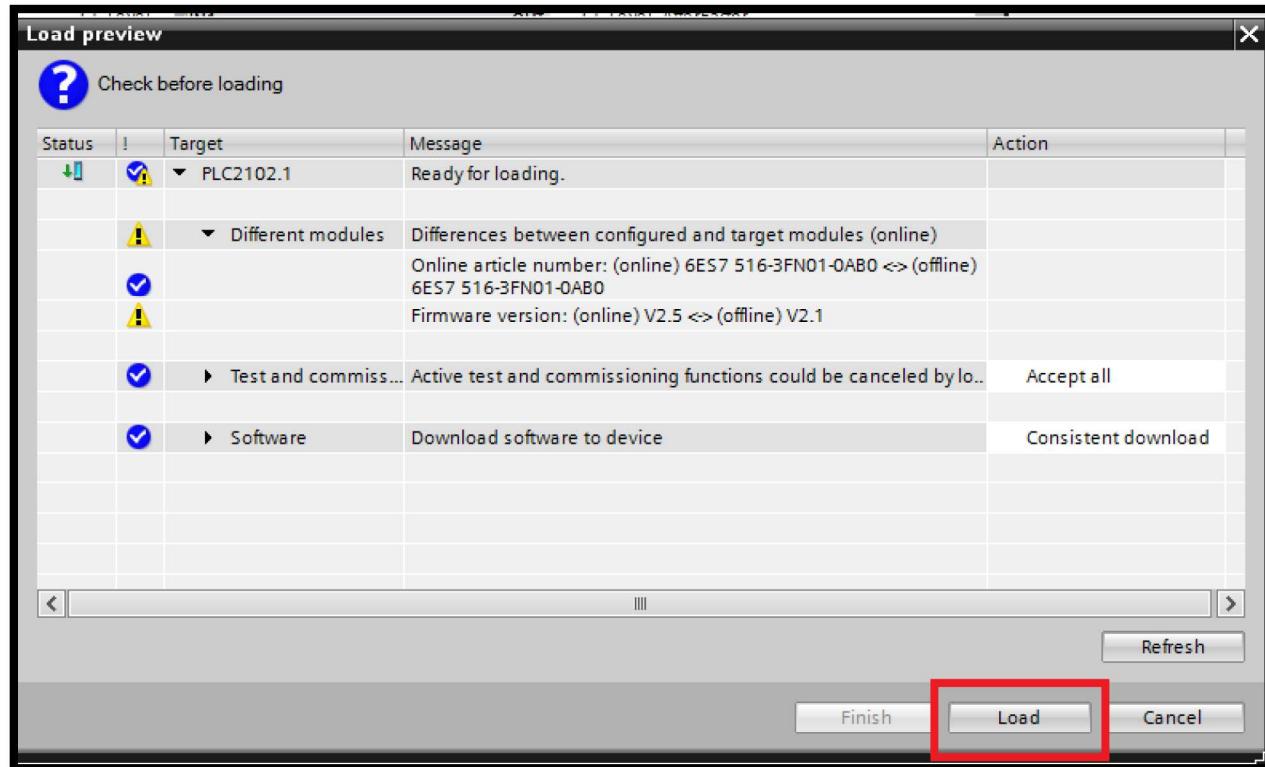
As long as I modify a timer, it will go offline and green circle changes to half blue and half orange circle.



Right click FC (function) that you made changes, and click "Download to device" → "Software (only changes)"



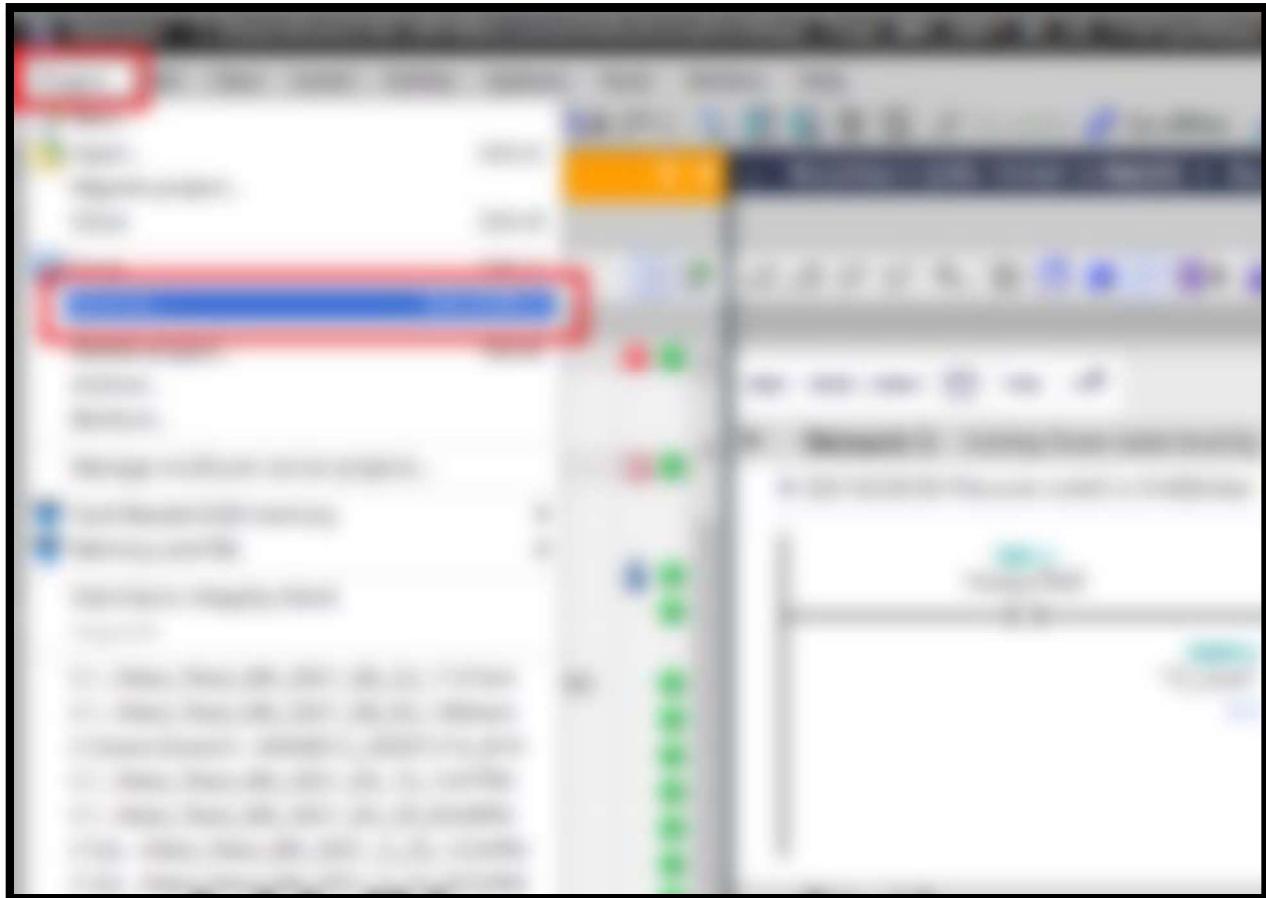
Since I only made a minor change, it did not scare me with bunch of warnings but if you encounter situations, where error message or warning message comes up that you don't fully understand, I recommend you to ask engineering team's help.



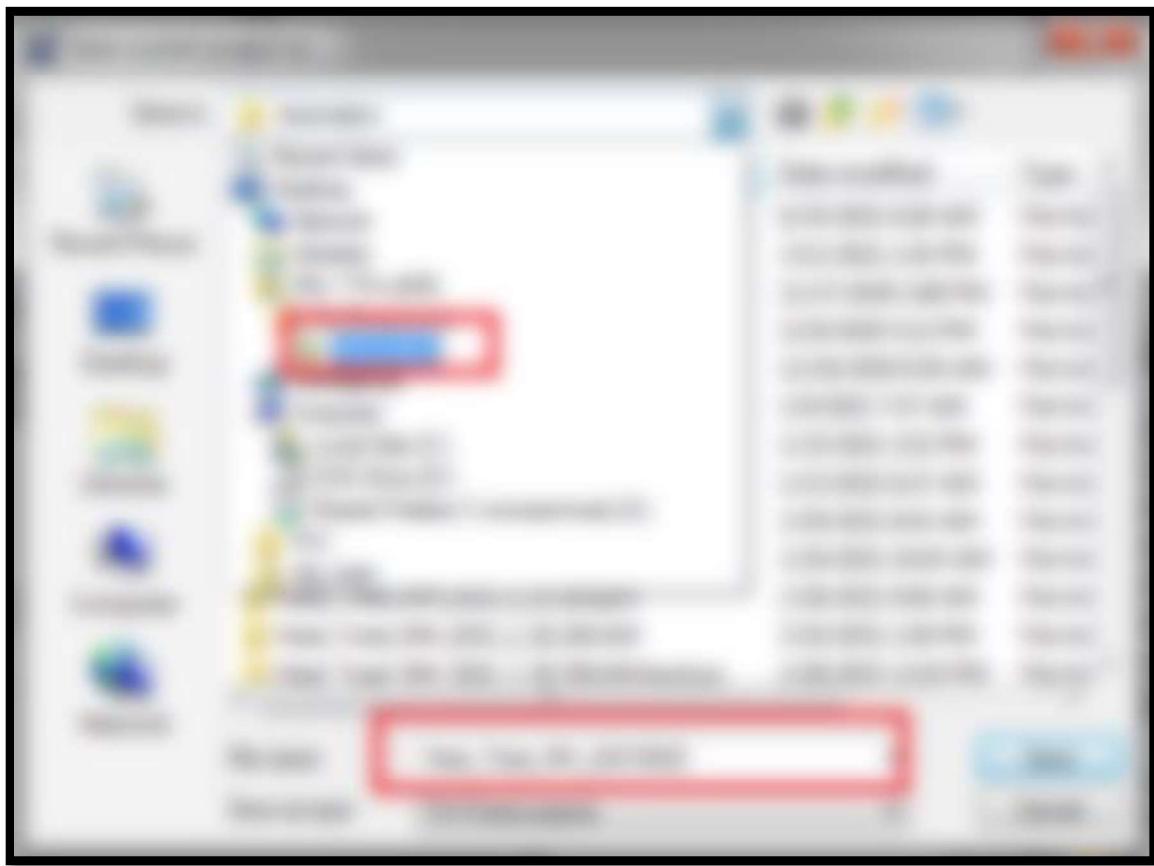
## **2.5 Upload newest file to share folder**

Any time you make changes (regardless minor or major), you should save your new file with date (yyyymmdd), archive file, and copy/paste to share folder.

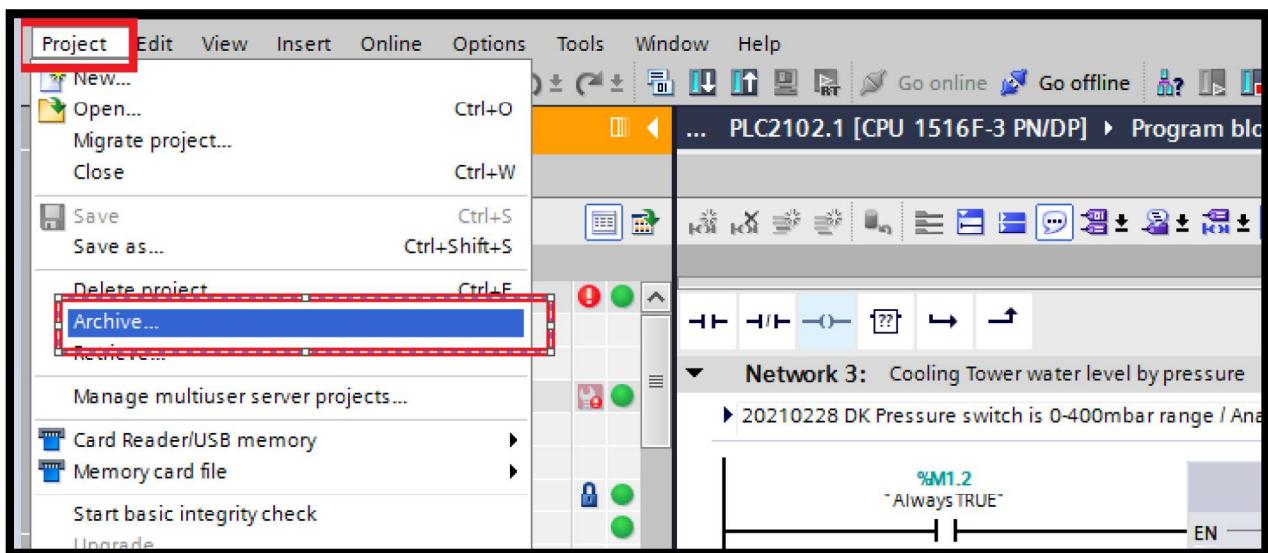
Click "Project" → "Save as..."



Drill down to file location (C:\Users\AutoCAD 2014\Documents\Automation). Give a new file name with date and Click "Save".

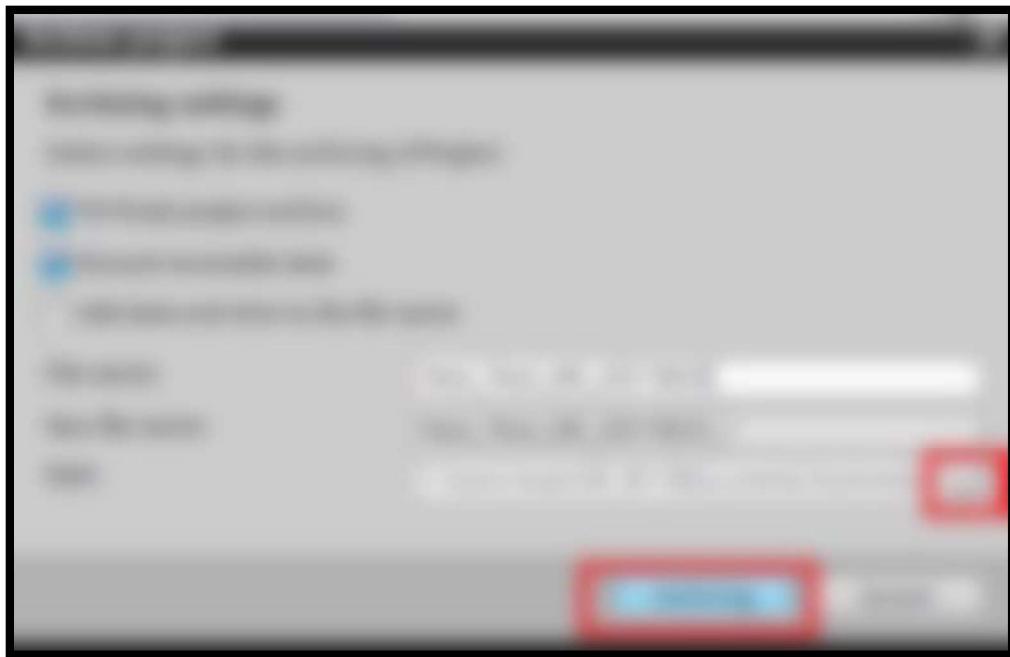


Click "Project" → "Archive..."

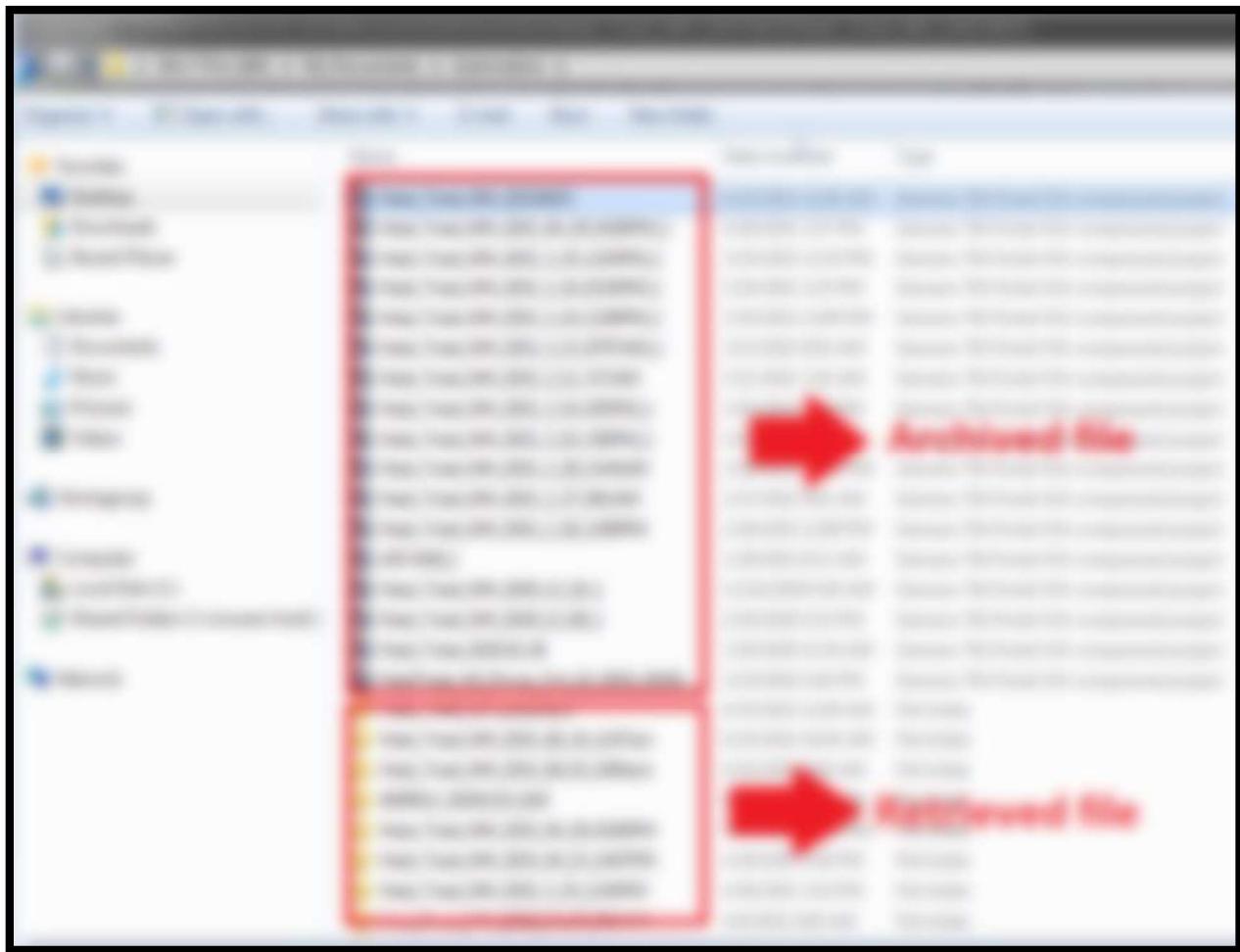


Click “...” and give right file location to save (C:\Users\AutoCAD 2014\Documents\Automation).

Click “Archiving”.



You see those archived files (compressed files), and retrieved file. You copy and upload an archived file to a share folder (H:\RED\_Public\Siemens PLC\Heat Treat - Material Handling).



*I hope someone find this document helpful.*

*Thank you.*