Lab 1 : Getting Started with TIA Portal
# Introduction with TIA Portal

This lab will introduce you to the basics of SIMATIC STEP 7 (TIA Portal) V13**.** The program allows students to design electrical networks with various elements to control certain processes.

Create a New Project

To create a project in TIA Portal, first launch the program on your desktop, if you don't see it, search TIA Portal in the windows search bar at the bottom left of your screen. After the portal successfully loads, you should be able to see a display like below.
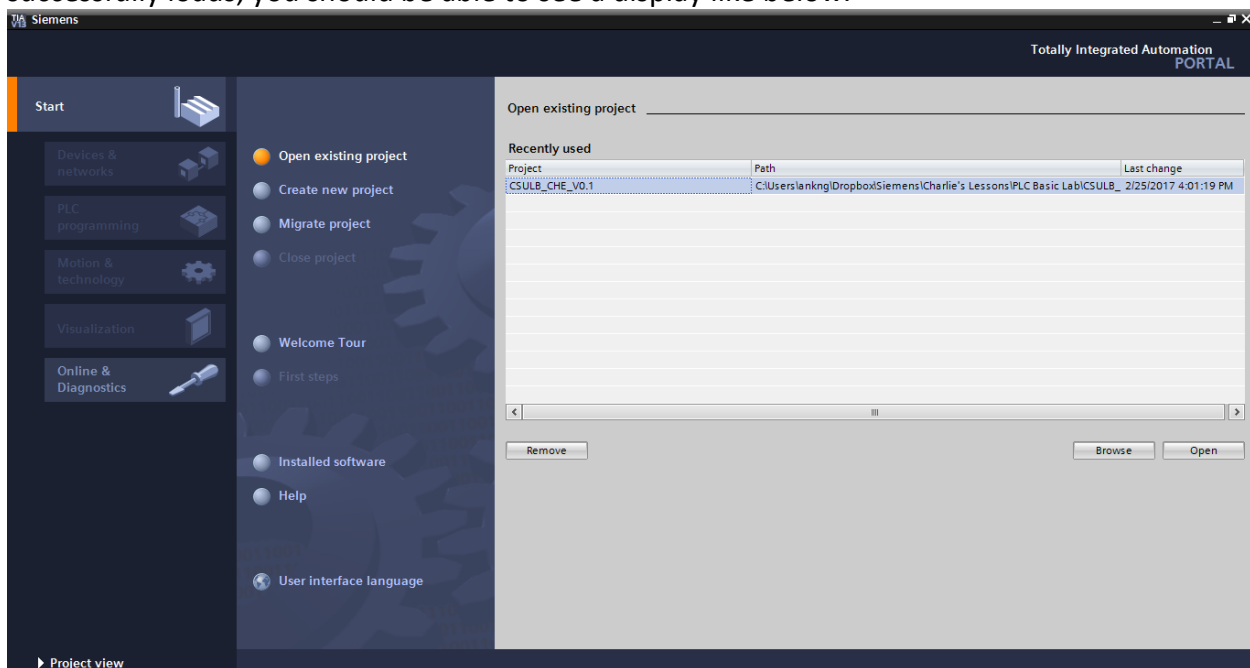
As you can see from the menu bar, we have several options to choose from:
Open existing project and **create new project** are self-explanatory.
Migrate project takes mature PLC programs and migrate it to new PLC programs.
**Welcome Tour** shows you the features of TIA portal, if you are interested and have time to spare, you can proceed with that.
Installed Software shows you the currently software that is installed, which is important to check to see if all your software is up to date. Below is an example of the screen, showing which

software is installed and their versions.
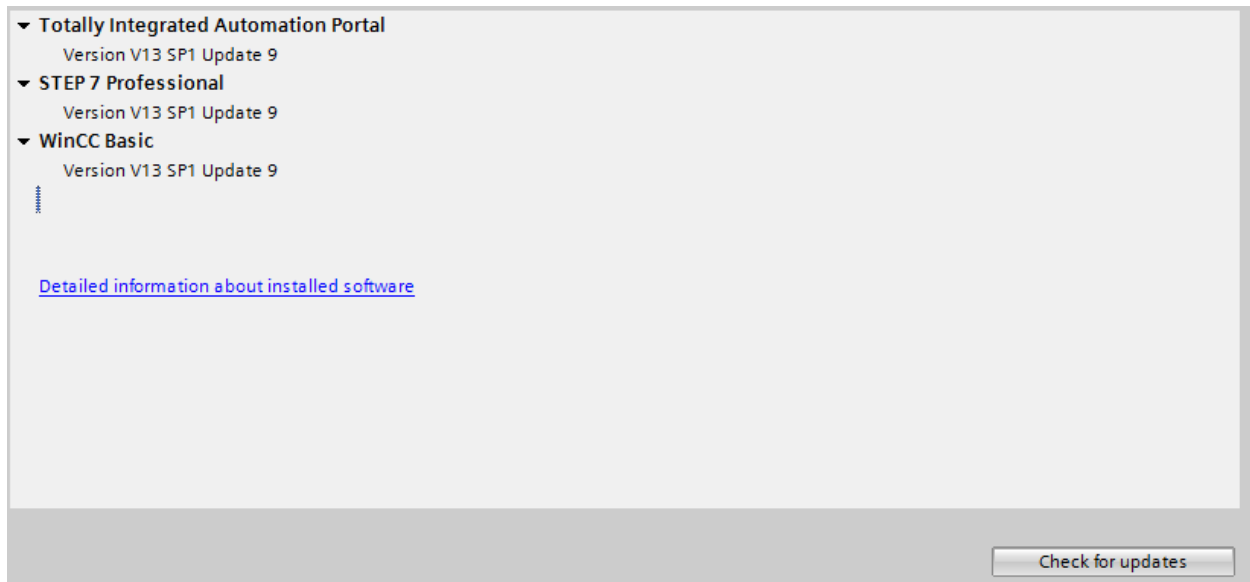
Let's go ahead and proceed with creating a new project, next enter the required information as shown below, take note of the path where you save the project so opening it next time will be much easier.
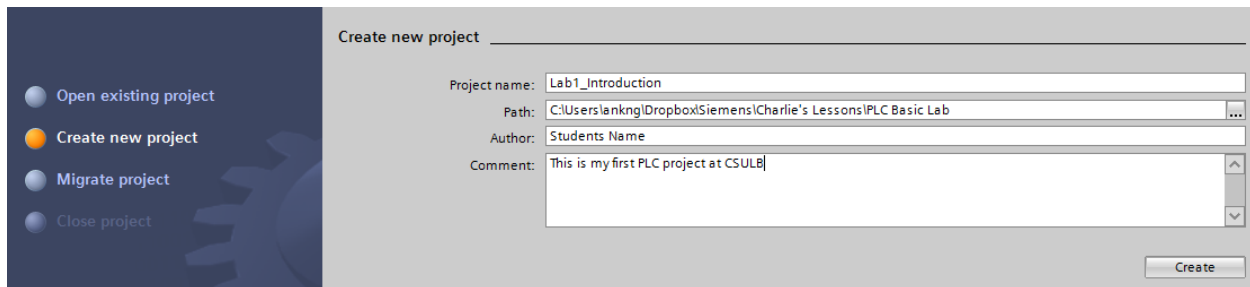
Click create

Configure Device & Network

Now you should the new addition option on the menu, **First Steps**, here you will see some other options such as:
Configure a device – Allows you to link or set up your PLC (Programmable Logic Controller)
Write PLC program – Allows you to create network
Configure technology objects – Allow students to work in motion modules and drives
Configure an HMI screen – Allows you to create a HMI screen (Human Machine Interface)
Open the project view – Allows you to access the project view without any of the above options, useful for returning to your older projects.
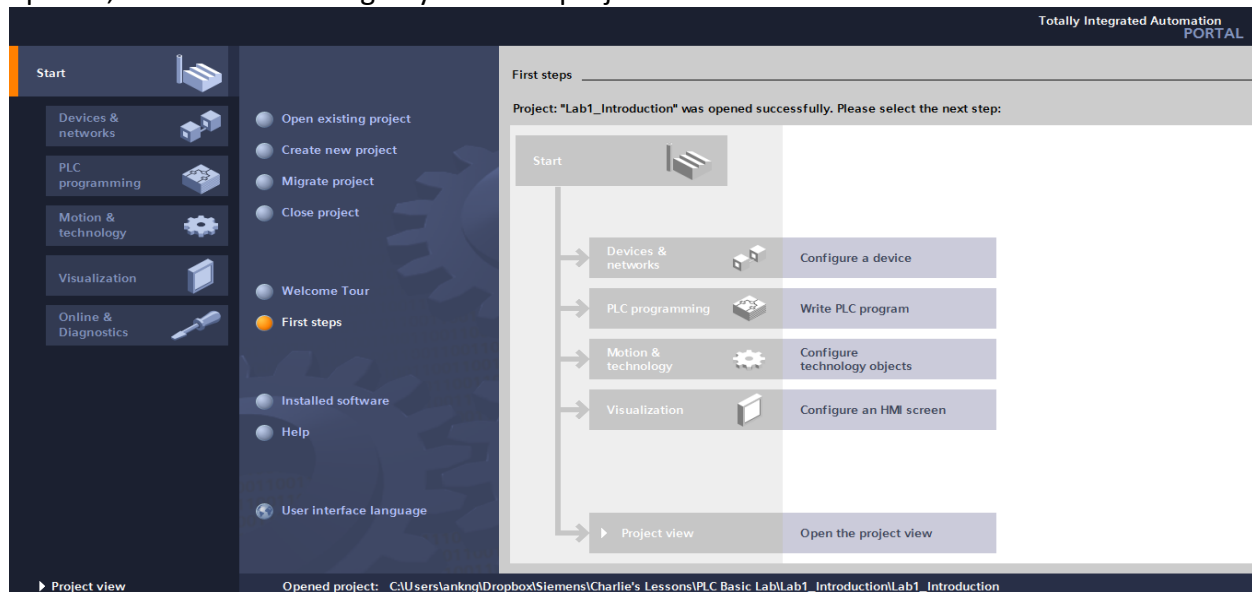

Since it is our first program, go ahead and click on **configure a device**. You can see two options:
Show all devices- Show all the devices you have on your project
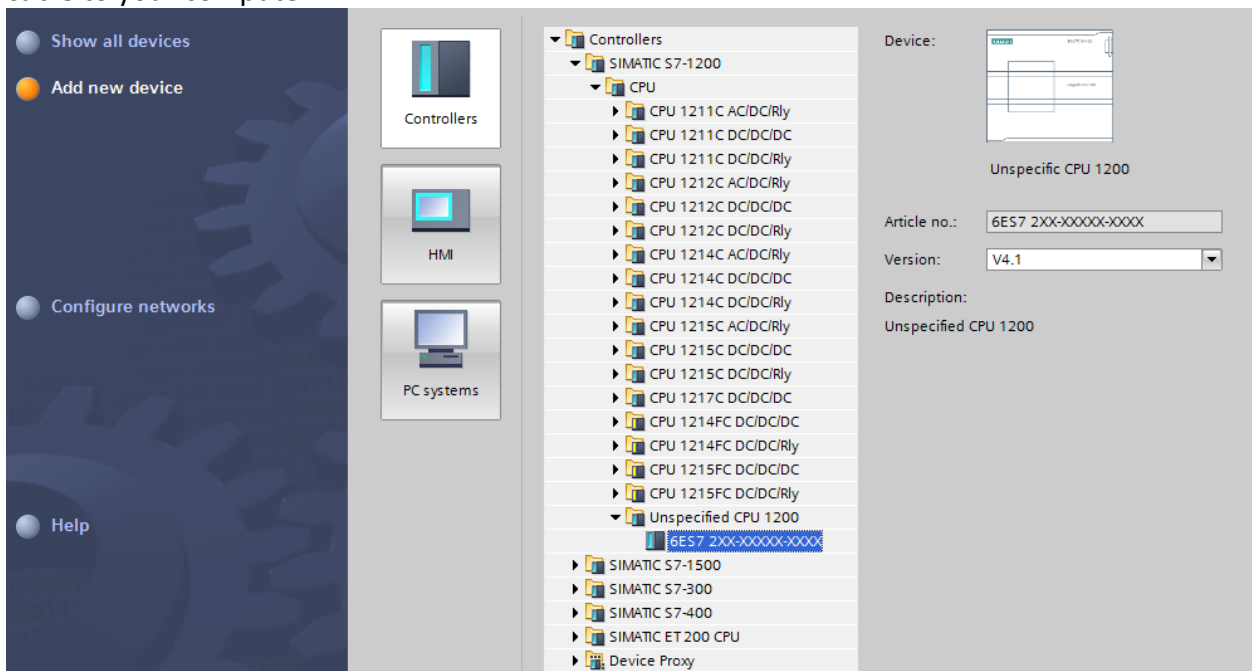**Add new device**-Configure a new device
Click on **Add new device**. You can see a similar display as the bottom figure. Here you can configure your Controllers (which are PLCs), HMI screens, and PC systems.
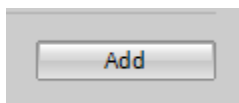Here you can name your PLC however you like. Such as Ryan's PLC 0.1
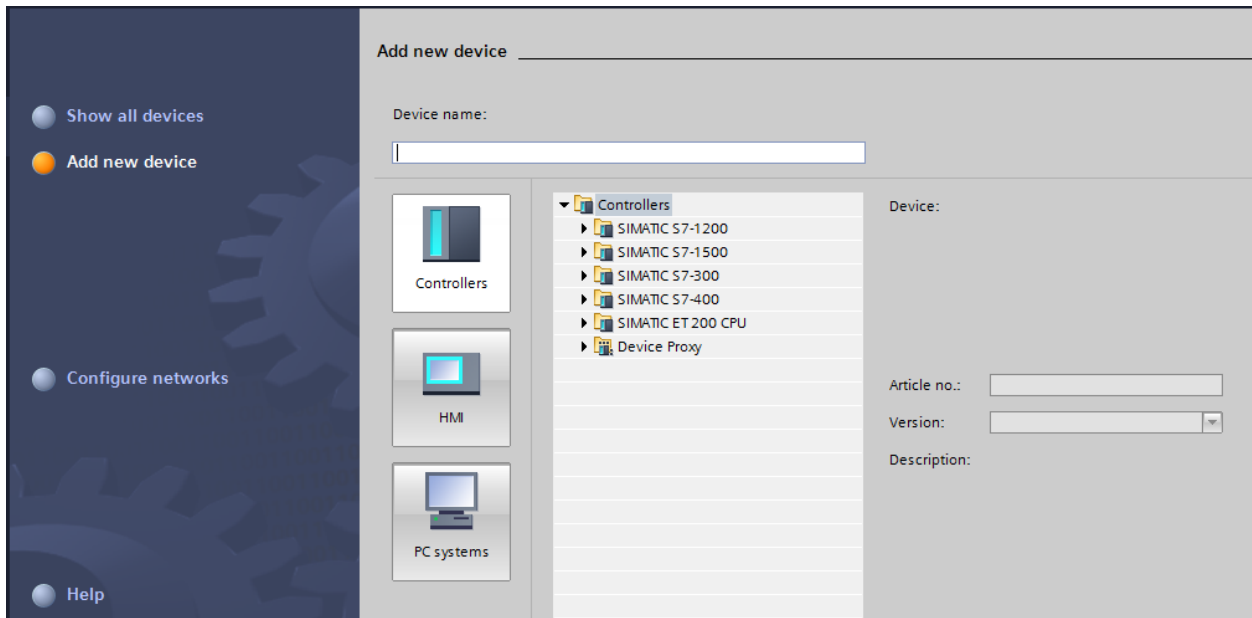
Click on **Controllers**, you will see a drop-down menu that has all sorts of different types of PLC. The one we will be using is one of the SIMATIC S7-1200, so click on the small black arrow next to SIMATIC S7-1200 to get another drop menu one. Continue until you see 6ES7 2XX-XXXXX-XXXX. At this point, if it has not been connected yet, connect the Ethernet cable to your computer.

Scroll down a bit to see the add button and click it.

After successfully adding the PLC, the Portal View will be displayed, this is the main screen you will work on. Currently your PLC is not configured yet, click detect to configure your device. Make sure you have connection between your PLC and your Computer via Ethernet.

Another window should show up as shown below

There are several drop down options but we won't bother with that for now, click **Start Search**. Your computer will try to find compatible devices. After successfully searching, you will see this. If you can't get the compatible PLC to show up, ask your lab instructor for help.

The green connection shows that you are connected with the PLC. To check, you can click **Flash LED** and it should blink on the PLC.
Highlight the plc_1 and click detect.

If this pops up, click yes

When the structure of the PLC is greyed out as below, you have successfully configured the device.
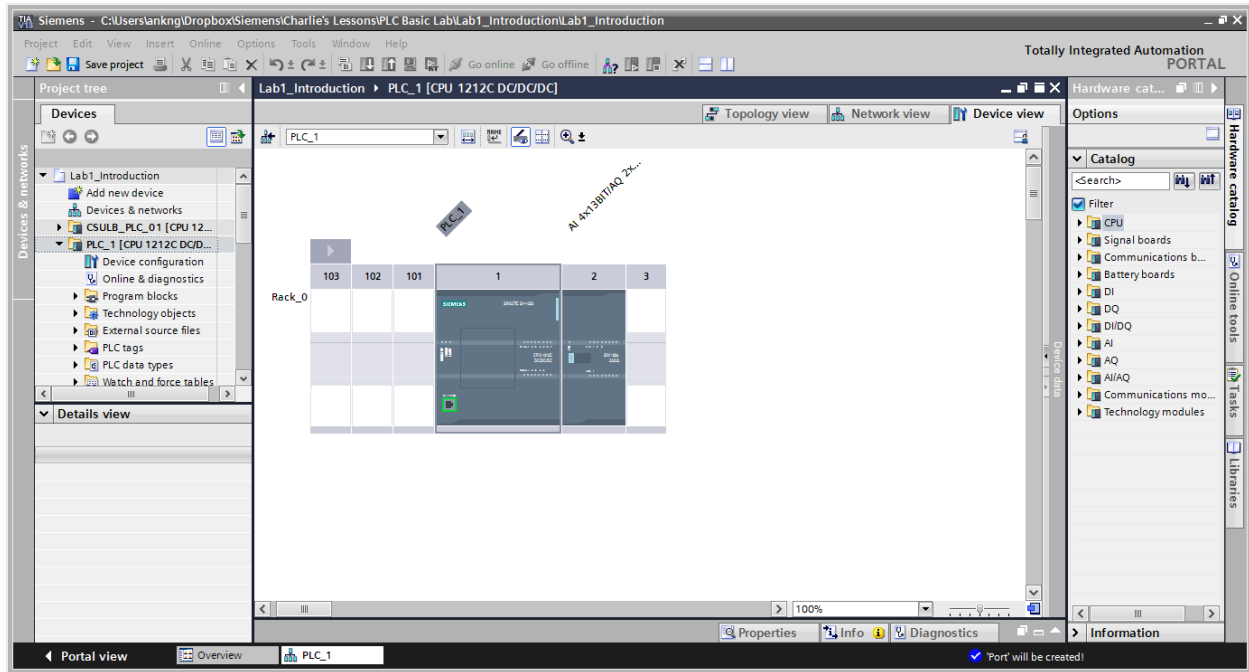

Programming blocks

This portion of the lab shows you how to create your first program using network. A network is similar to an electrical wire, where you can place components such as contacts and assignments.

To access the networks, drop down the menus from your PLC in the Project Tree, until you see Program Blocks. Drop down from that and double click Main[OB1].

Another window should pop up in the middle.

As you can see, Network 1 is already made for you, also you can see some of the favorite blocks on the top of the work space.

These are contacts ⊣⊢ ⊣/⊢ and this is a coil ⊣()⊢ . The coil is necessary to complete the line and assign the output.
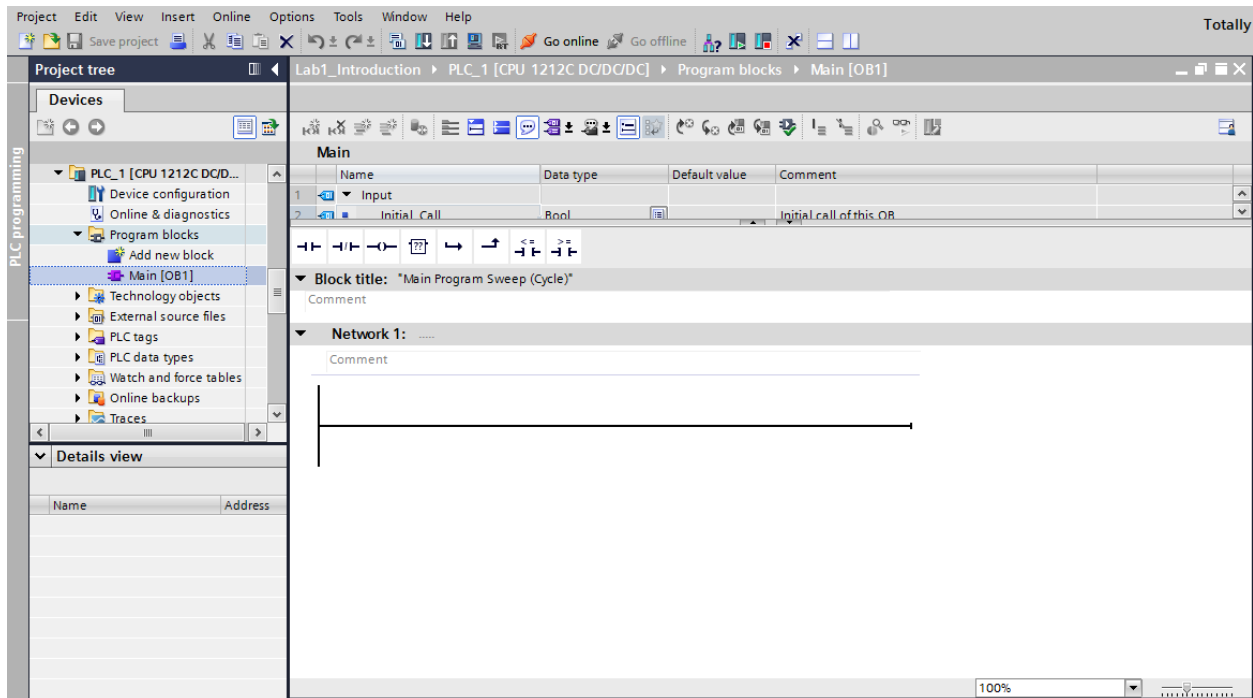
Network 1: The following steps will introduce you to the beginnings of writing a PLC.

1.) Begin with grabbing the normally open contact (N/O) from the favorite's bar at the top. Drag it on to the network line and name it "Stop01".
2.) Now go to the Bit Logic menu on the right and grab another N/O contact, placing it into the network. Name this one "Start01".
3.) From either options, grab the coil to complete the circuit, naming it "Motor01". When complete, it should look like image below.
4.) When everything is set up, float the screen by selecting the float option on the upper right hand side. You should now be able to see the Device configuration window and

also the Program block window over it.
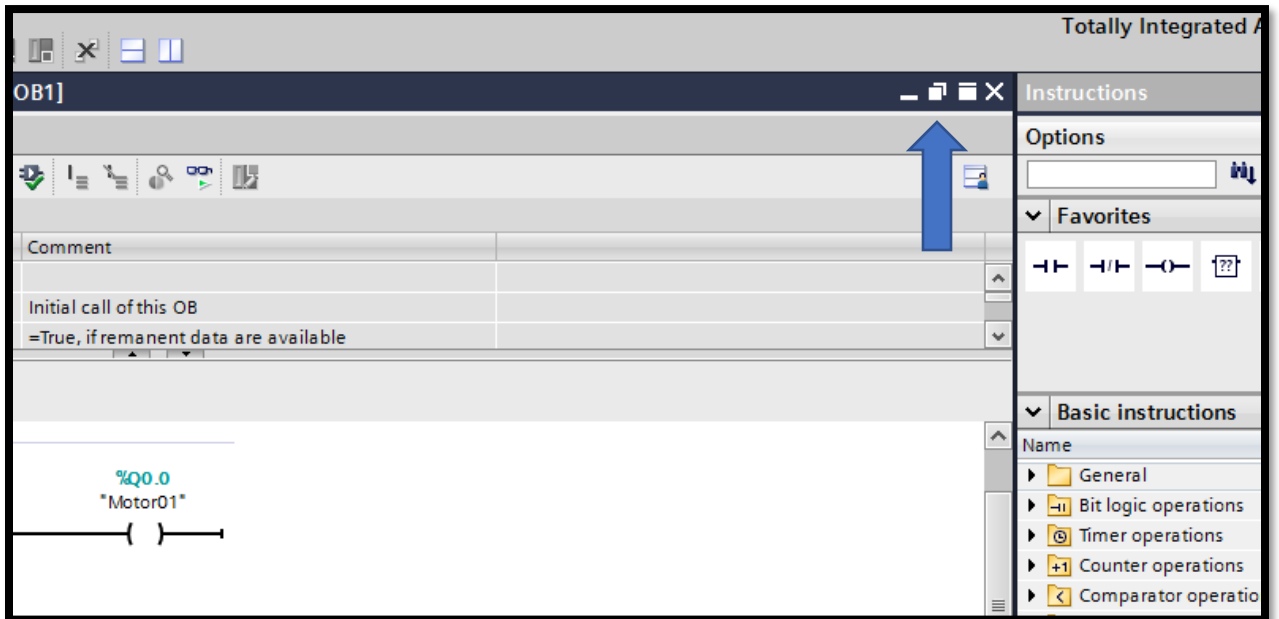
5.) Zoom in onto the CPU on the Device configuration screen. From here, select the "Stop01" contact on the program block window and drag "%I0.0" on the CPU.
6.) Drag "Start01" contact to "%I0.1" and drag "Motor01" to "%Q0.0".
7.) Embed the Program block window and download the program to the device by clicking the download icon at the top. Also, turn on the monitoring option, which icon is a set of glasses.
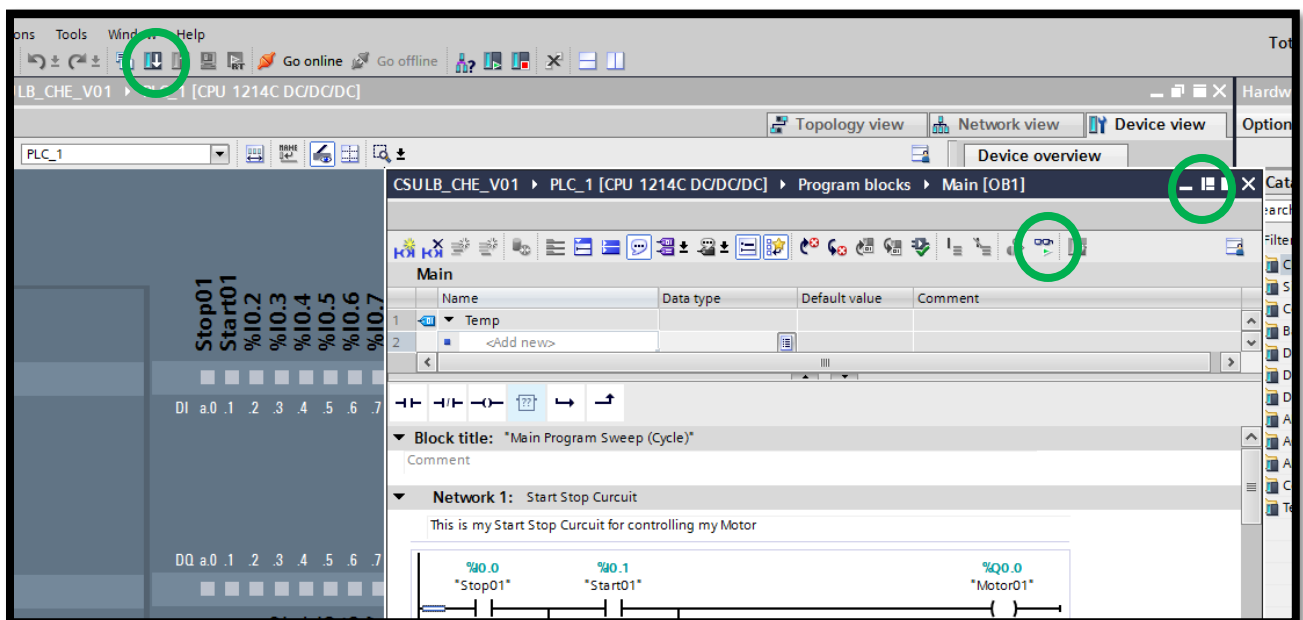
8.) Notice that the red light turned on. This is not the action we were looking for. We wanted the white light to flash. So we need to fix this. To fix this issue, enter the tag library on the left column.

9.) Select Show all tags. From here, we will name all of the tags being used. Start by re-addressing the Motor01 tag to %Q0.4 under the address column.

10.) Now we will add the rest of the tags as below:

		Name	Tag table	Data type	Address	Retain	Visibl...	Acces...	Comment	
1		Stop01	Default tag table	Bool	%I0.0	☐	☑	☑		
2		Start01	Default tag table	Bool	%I0.1	☐	☑	☑		
3		Red	Default tag table	Bool	%Q0.0	☐	☑	☑		
4		Green	Default tag table	Bool	%Q0.1	☐	☑	☑		
5		Motor01	Default tag table	Bool	%Q0.4	☐	☑	☑		
6		Jumpout01	Default tag table	Bool	%Q0.2	☐	☑	☑		
7		Jumpout02	Default tag table	Bool	%Q0.3	☐	☑	☑		
8		<Add new>				☐	☑	☑		

CSULB_CHE_V01 ▸ PLC_1 [CPU 1214C DC/DC/DC] ▸ PLC tags — Tags | User constants | System constants — PLC tags

11.) Once done, download to device again. If done correctly, the white light should emit when pressing the green button.

Creating a Latch: The latch is a continuous loop action that activates when an initial action is done.

12.) Grab the open branch option from the favorites bar and drag it to the network in-between the Stop01 contact and the Start01 contact.

13.) At the end of the open branch, place another N/O contact and addressing it to Motor01.

14.) Complete the branch by dragging the end of it back to the network, placing it after the Start01 and before the Motor01 coil.

15.) Download to the device again and open monitoring.

16.) If done correctly, pressing the green button would activate the white light and keep it on.

When complete, title the network "Start Stop circuit" and comment "This my start stop circuit for controlling my motor"

Network 1: Start Stop Curcuit

This is my Start Stop Curcuit for controlling my Motor
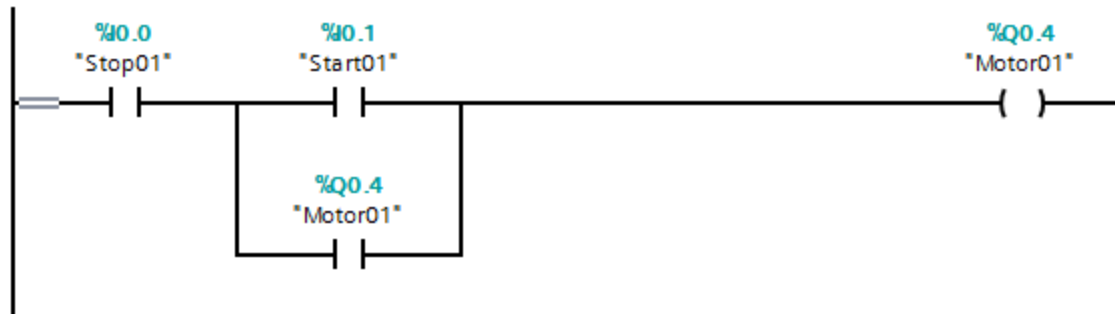
**Network 2 & 3:** Here, a mere light association is being done
1.) Right click to insert new network.
2.) For network 2, the green light will be on if the Motor01 is running. So to do this, insert a N/O contact and address it to Motor01. Finish the network by adding a coil and addressing that to Green light.
3.) Title the network: Green Motor 01 is Running
4.) Right click to insert a new network.
5.) For Network 3, the red light will be on if Motor01 is NOT running. So to do this, insert a Normally Closed contact (N/C) and address that to Motor01. Finish the network by adding a coil and addressing that to Red light.
6.) Title the network: Red Motor 01 is stopped.
7.) Download to the device and monitor.

If done correctly, the Green light will emit when Motor 01 is running and the Red light will emit when Motor 01 is stopped.

**The Following Networks will introduce the usage of a Timer Data Block**

Network 4

1.) To begin, right click to insert a new network.
2.) Under Basic instructions, find the drop down menu named Timer operations. Grab the TON data block (DB) and drag it to the new network.
3.) When prompt, name the DB "MainTimerDB", then click Okay.
4.) Place an N/O contact before the DB and address it to Motor01.
5.) Under PT, input "15s", which stands for 15 seconds.
6.) For ET, input the internal address "%MD20".
7.) Right click MD20 and go to Rename Tag. For MD20, rename it "TimerValue01" then click change.
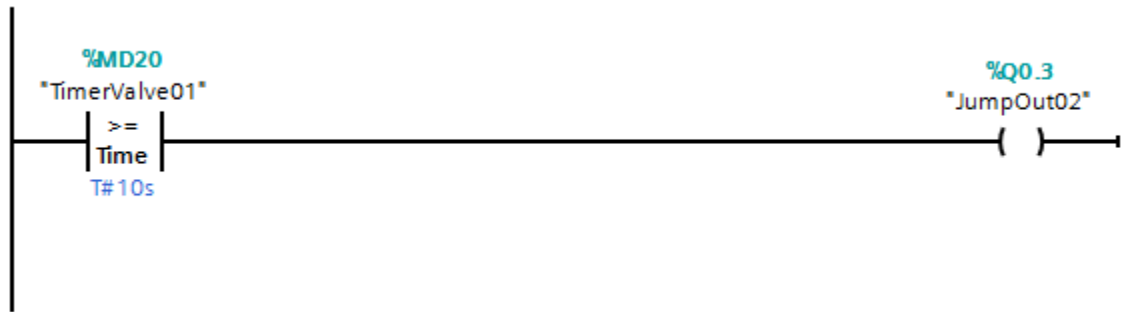 8.) Title the network "Timer01" and comment "My Ride Timer". Download to the device.
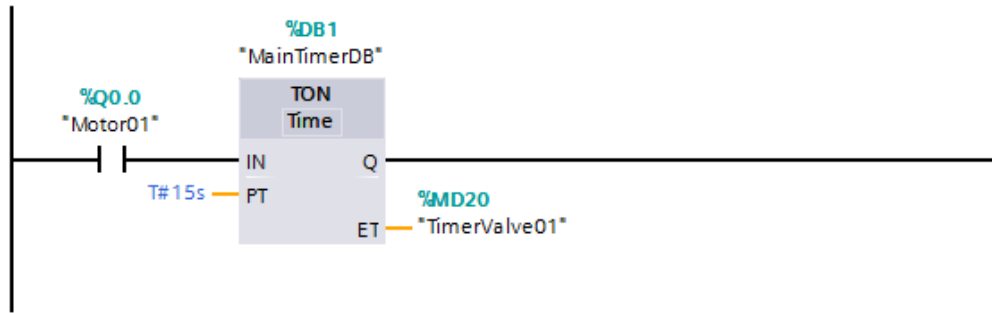
Network 5

1.) Create a new network.
2.) On the right under the Comparator operations, obtain the CMP >= contact and place into the network.
3.) Here, address the contact to TimerValue01 by selecting the top input option on the contact.
4.) On the bottom input option, type in "T#5s".
5.) Finish the network by adding a coil and addressing it to "Jumpout01".
6.) Title the network "First Jump Out 01"
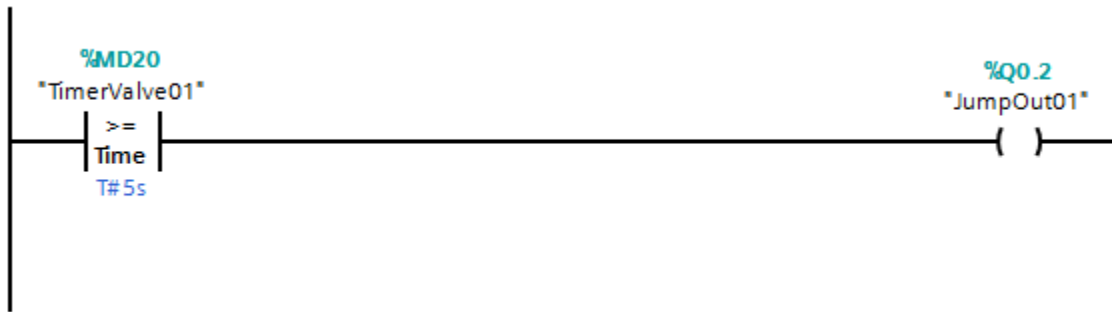
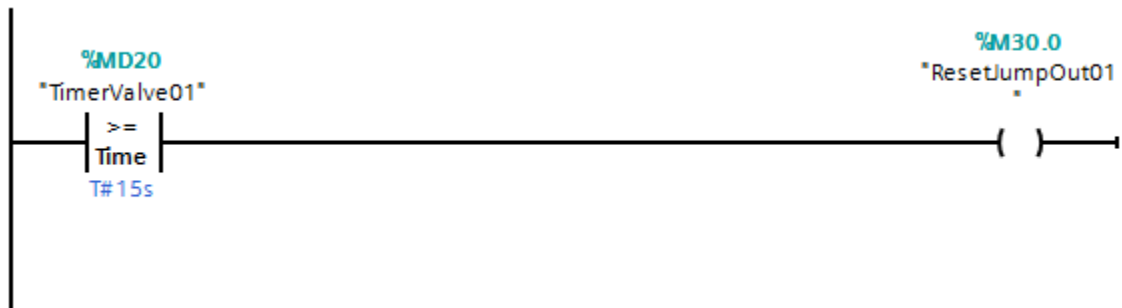## Network 6

1.) Create a new network.
2.) Copy network 5 by highlighting the contact and coil.
3.) Paste it into the new network and update the comparative block to "T#10s"
4.) Readdress the coil to "Jumpout02".
5.) Title the network "Second Jump Out 02"

```
        %MD20                                                    %Q0.3
     "TimerValve01"                                           "JumpOut02"
          >=
         Time
        T#10s
```

Network 7

1.) Create a new network.
2.) Copy network 6 and paste it onto the new network.
3.) Update the coil to "T#15s" and readdress the coil to "M30.0".
4.) Rename the tag "M30.0" to "ResetJumpout01".
5.) Title the Network "This is my ride Reset 01".
6.) Download to the PLC and monitor.

```
                                                                %M30.0
        %MD20                                                "ResetJumpOut01
     "TimerValve01"                                                .
          >=
         Time
        T#15s
```

The following Networks will introduce the topic of Counter Data Blocks

Network 8

1.) Create a new network.
2.) Place a N/O contact on the network and address it to "ResetJumpOut01".
3.) Now, under Counter operations on the right, obtain the "CTU" Data block and place it into the new network.
4.) When prompt, name the DB "MainCounterDB".
5.) For the Preset Value (PV), input "100".
6.) Input "%MW40" in the CV. Rename the tag to "RideCount01"
7.) Title the network "My Ride Counter 01"

Network 9

1.) Create a new network.
2.) Under Math functions, obtain the "MUL" function and place it into the network.
3.) For IN1, input "RideCount01".

4.) For IN2, input "12"
5.) For OUT, address it to "%MW42". Rename the tag to "RideDollars01".
6.) Title the network "Dollars Per Ride 01".
7.) Download to the PLC and monitor.