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Lab 1 : Getting Started with TIA Portal

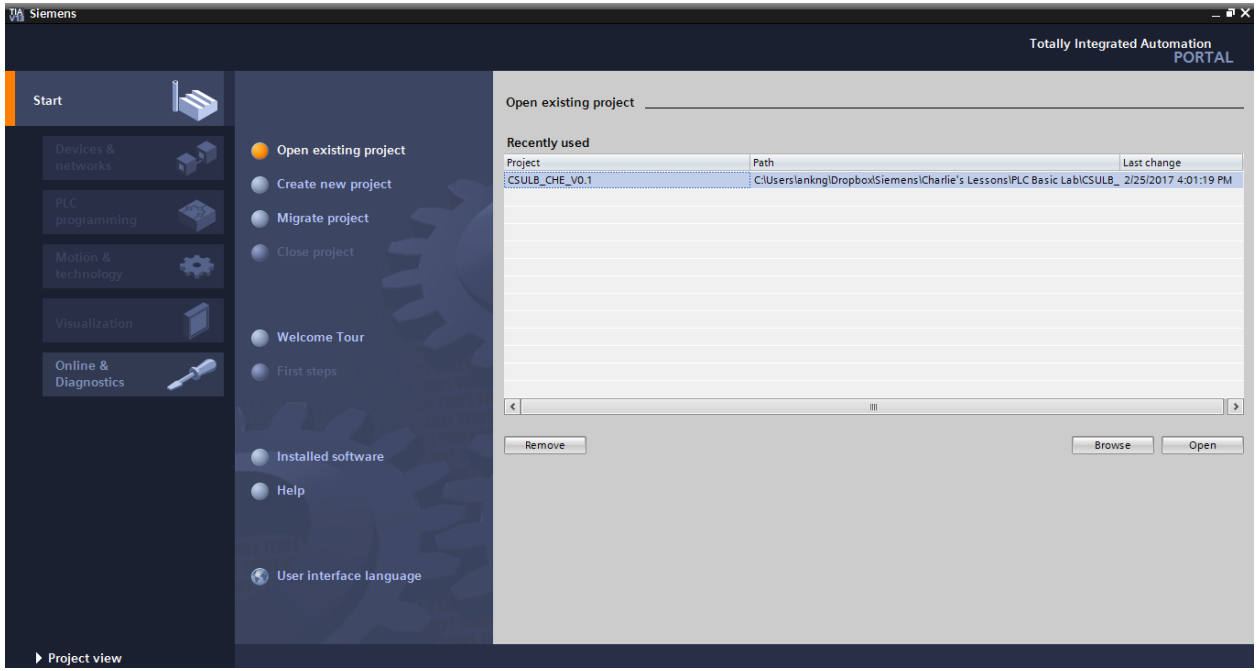
- **Introduction with TIA Portal**
  - This lab will introduce you to the basics of SIMATIC STEP 7 (TIA Portal) V16**.**
  - The program allows students to design electrical networks with various elements to control certain processes.

Create a New Project

- To create a project in TIA Portal, first launch the program on your desktop, if you do not see it, search TIA Portal in the windows search bar at the bottom left of your screen.

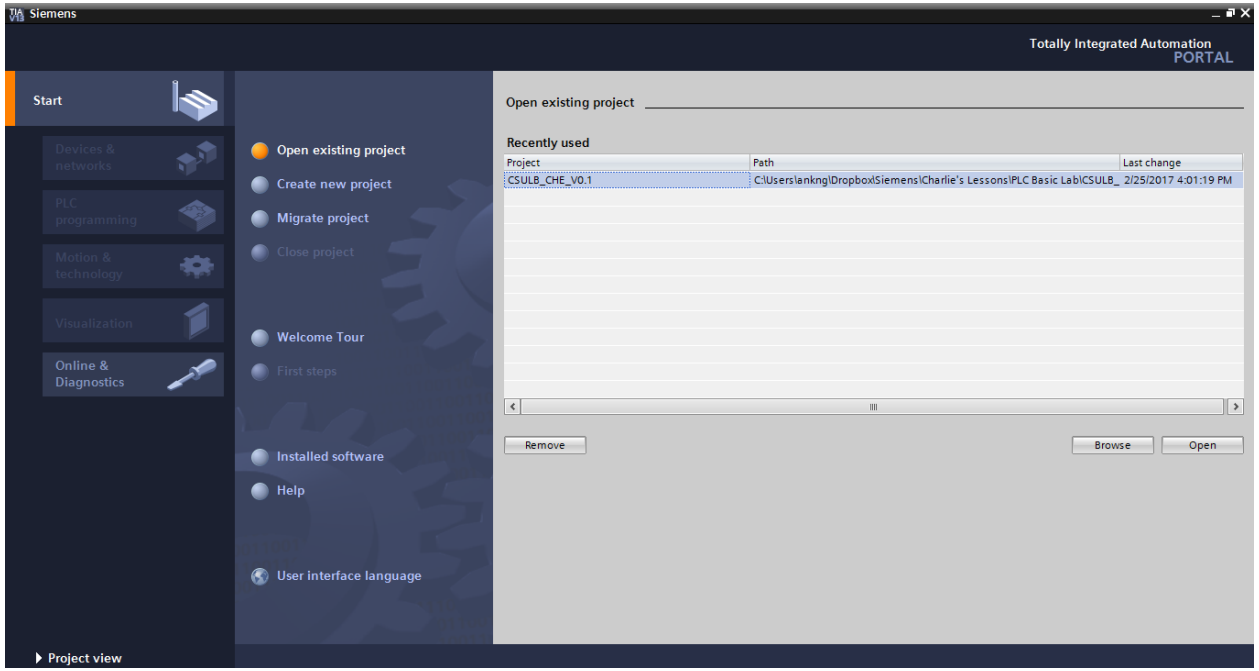
Create a New Project

- After the portal successfully loads, you should be able to see a display like below.



Create a New Project

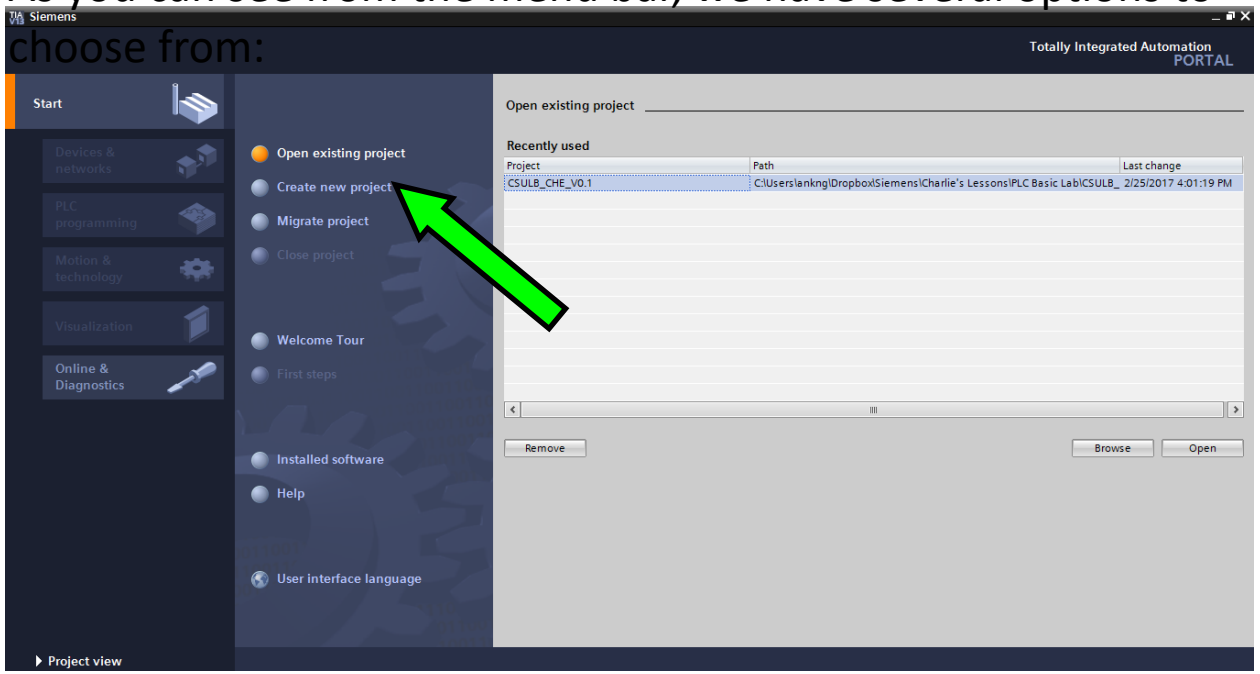
- After the portal successfully loads, you should be able to see a display like below.



Create a New Project

- 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.

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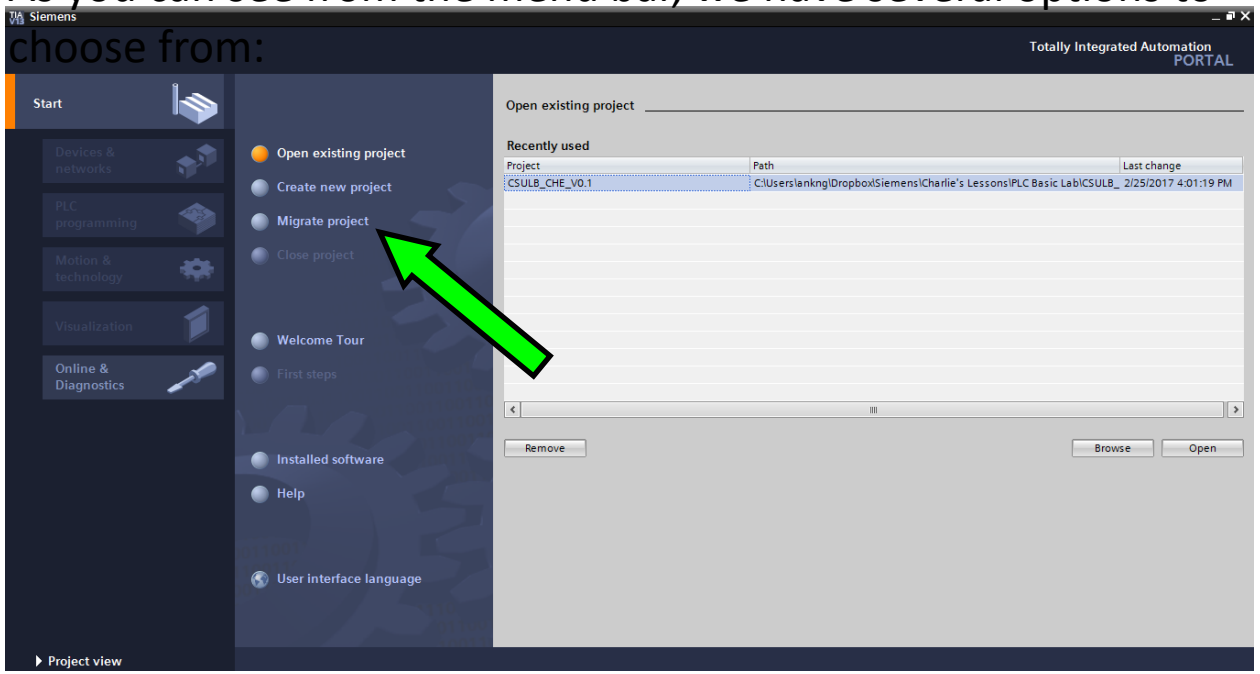
Create a New Project

- 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:

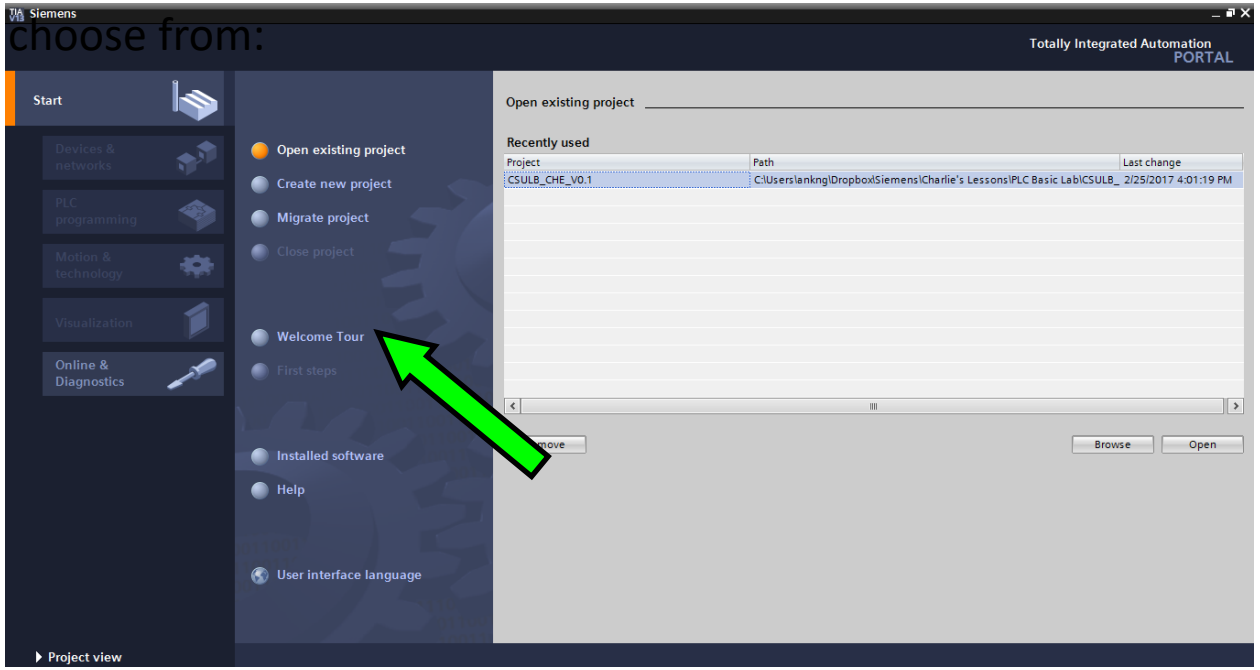


Migrate project takes mature PLC programs and migrate it to new PLC programs.

Create a New Project

- 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:



Welcome Tour shows you the features of TIA portal, if you are interested and have time to spare, you can proceed with that.

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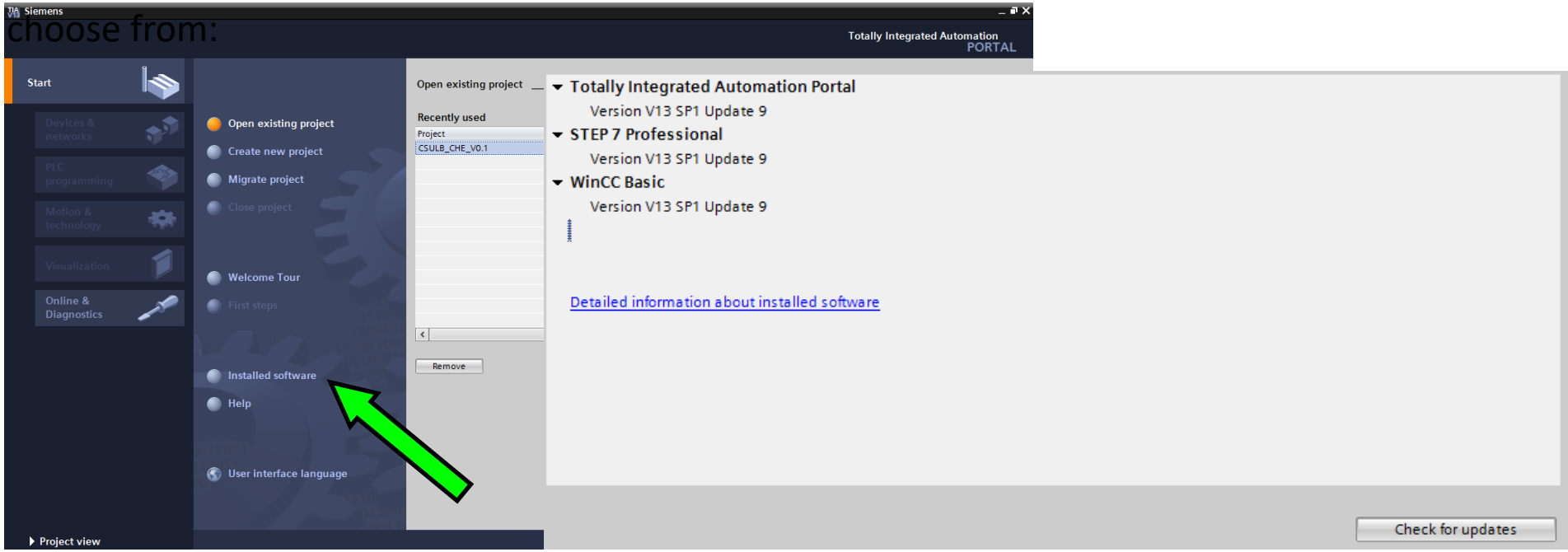
Create a New Project

- After the portal successfully loads, you should be able to see a display like below.

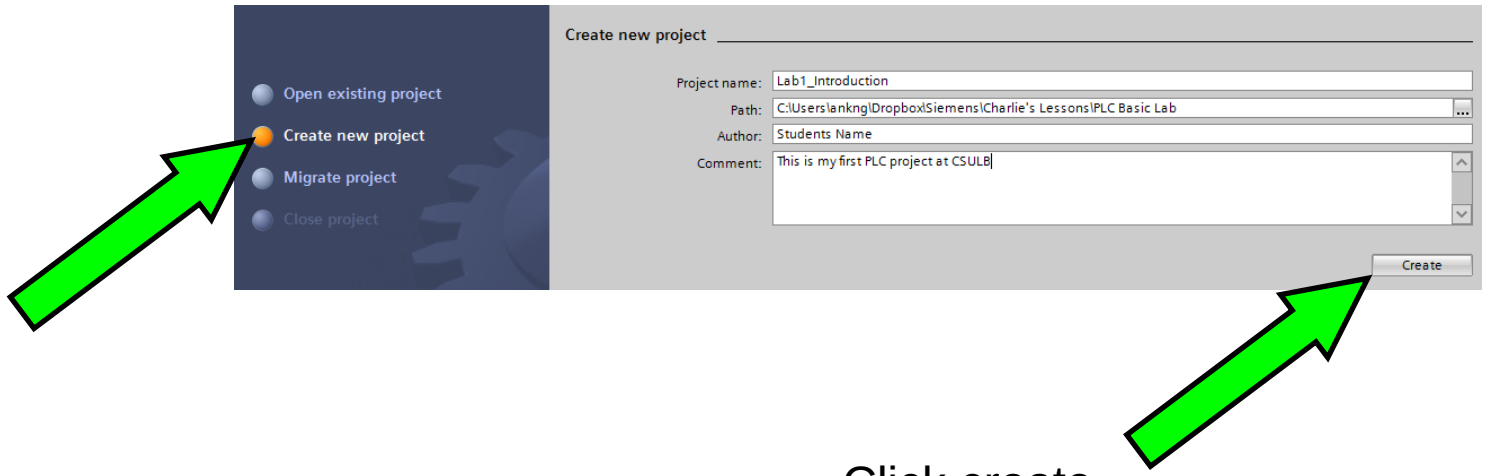
As you can see from the menu bar, we have several options to choose from:



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.

Create a New Project

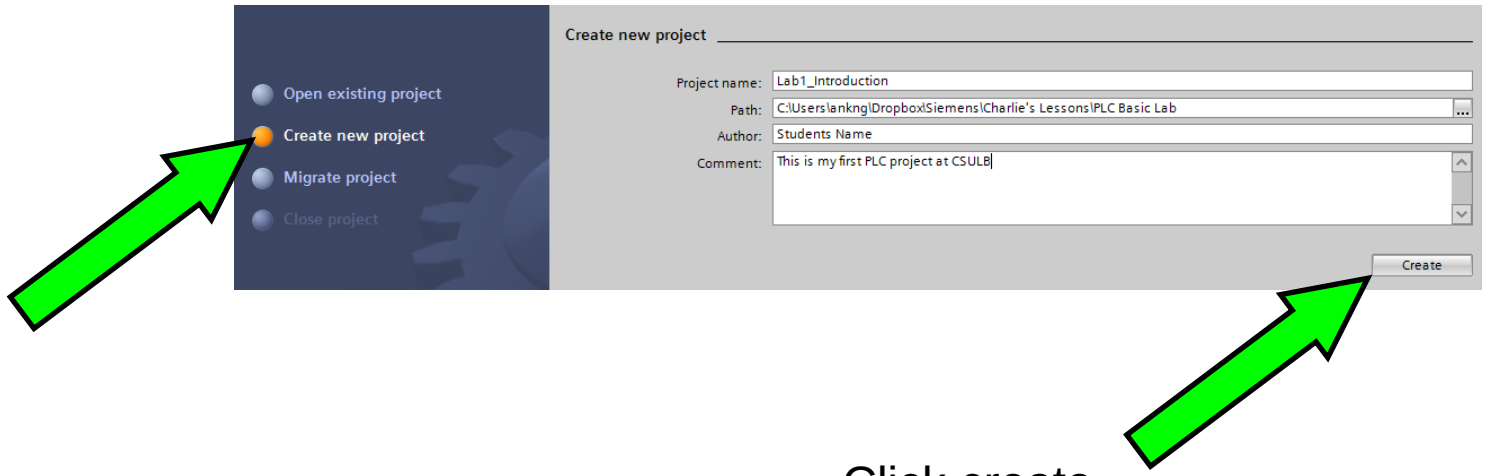
- Let’s go ahead and proceed with creating a new project, next enter the required information as shown below, take note of the path where you save the project so opening it next time will be much easier.



Click create

Create a New Project

- 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.

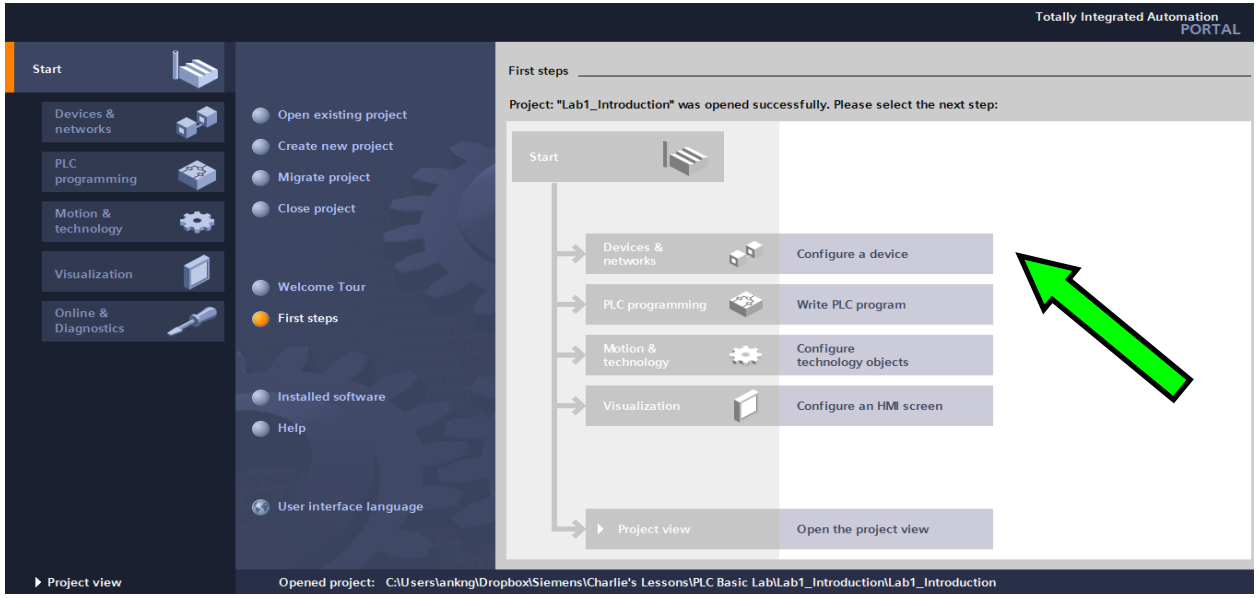


Click create

Configure Device & Network

- Now you should the new addition option on the menu, **First Steps**, here you will see some other options such as:

As you can see from the menu bar, we have several options to choose from:

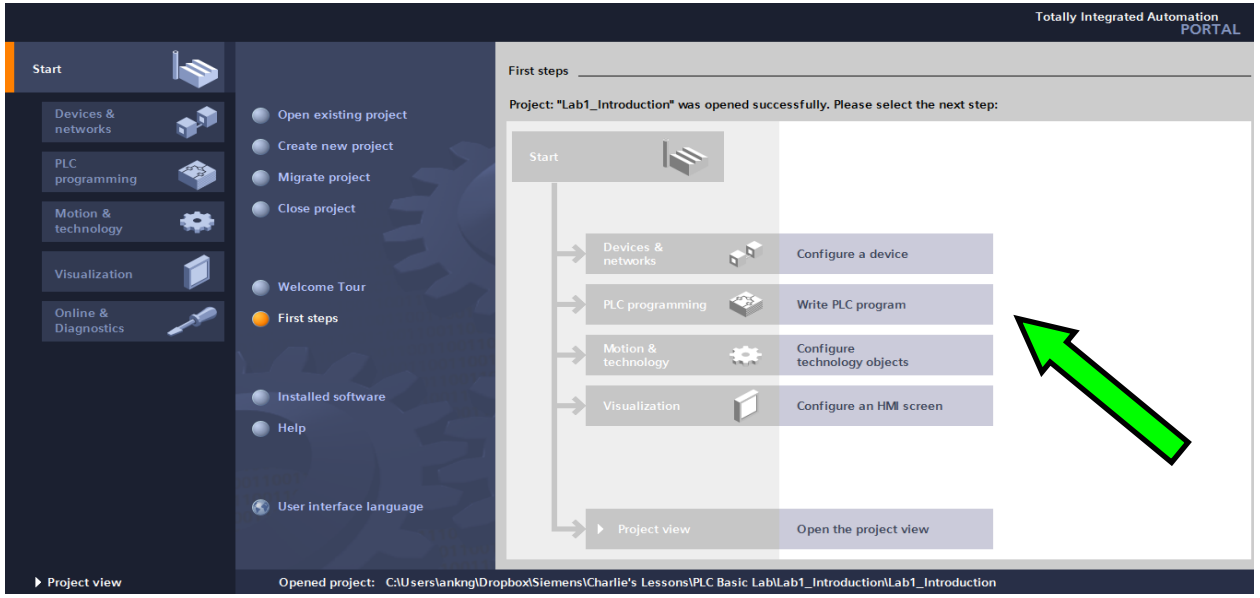


Configure a device – Allows you to link or set up your PLC (Programmable Logic Controller)

Configure Device & Network

- Now you should the new addition option on the menu, **First Steps**, here you will see some other options such as:

As you can see from the menu bar, we have several options to choose from:

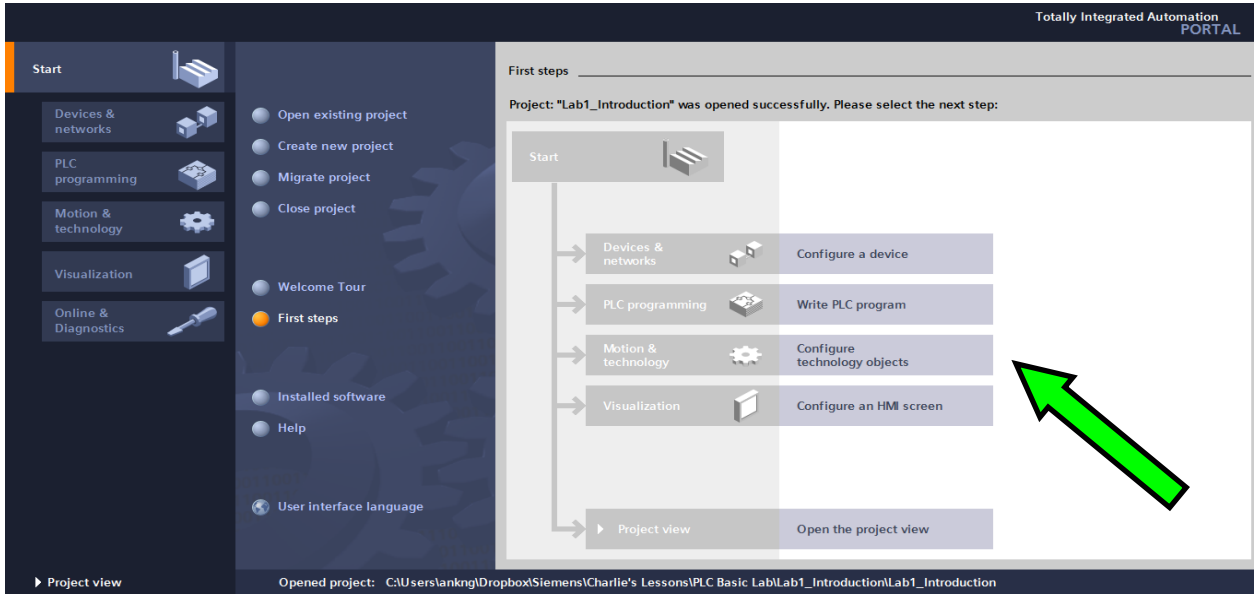


Write PLC program – Allows you to create just the PLC program without any hardware

Configure Device & Network

- Now you should the new addition option on the menu, **First Steps**, here you will see some other options such as:

As you can see from the menu bar, we have several options to choose from:

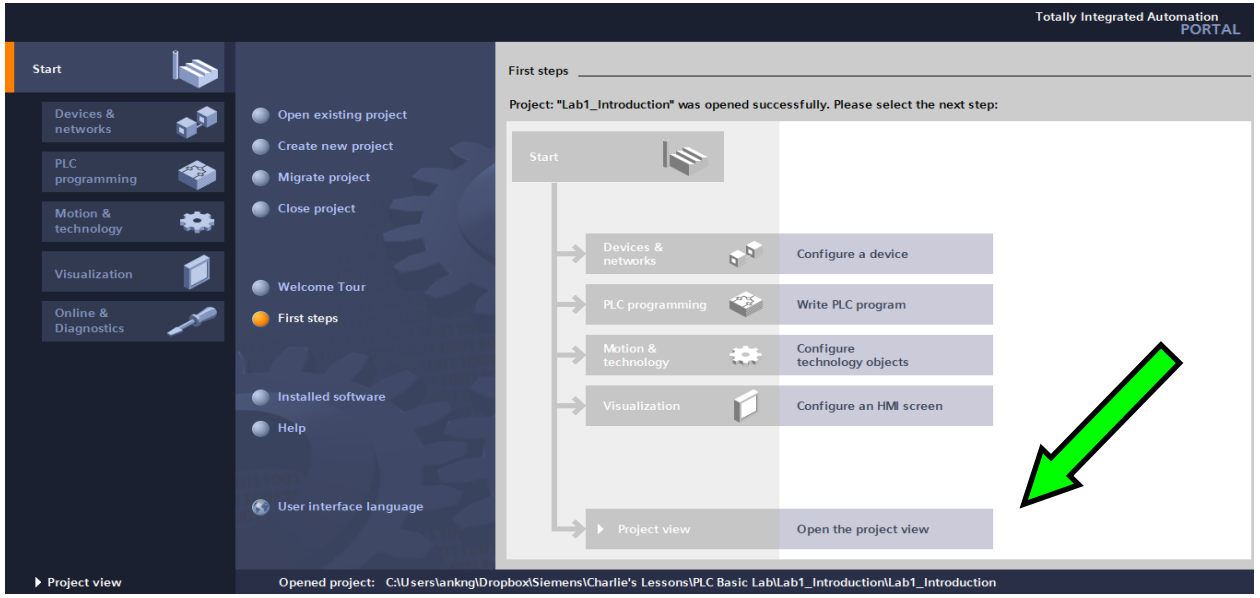


Configure technology objects – Allow you to work in motion modules and drives

Configure Device & Network

- Now you should the new addition option on the menu, **First Steps**, here you will see some other options such as:

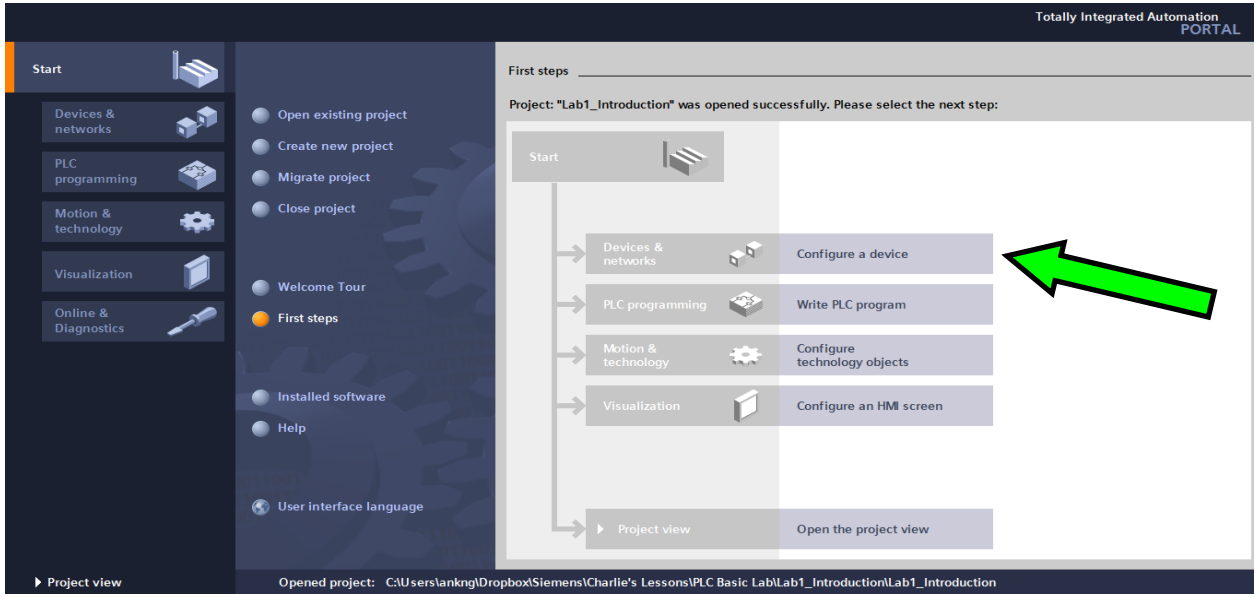
As you can see from the menu bar, we have several options to choose from:



Open the project view – Allows you to access the project view without any of the above options, useful for returning to your older projects.

Configure Device & Network

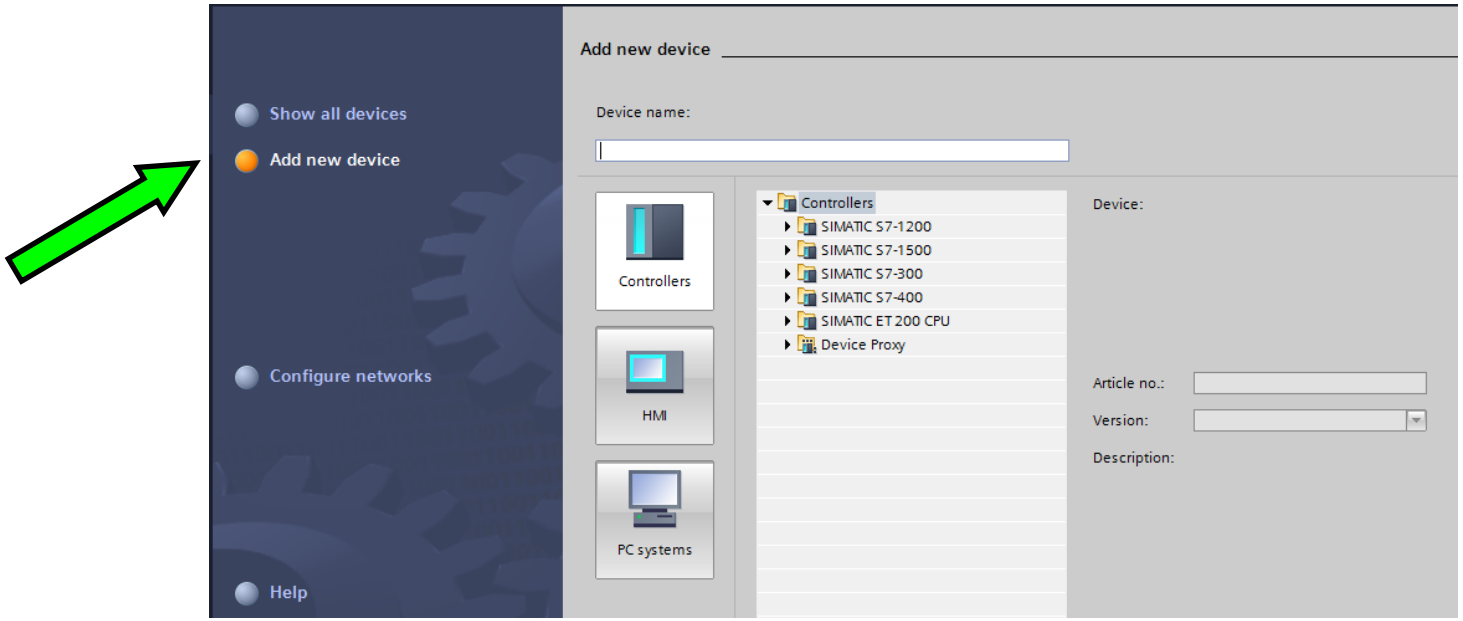
- Since it is our first program, go ahead and click on **configure a device**.



Configure Device & Network

- 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



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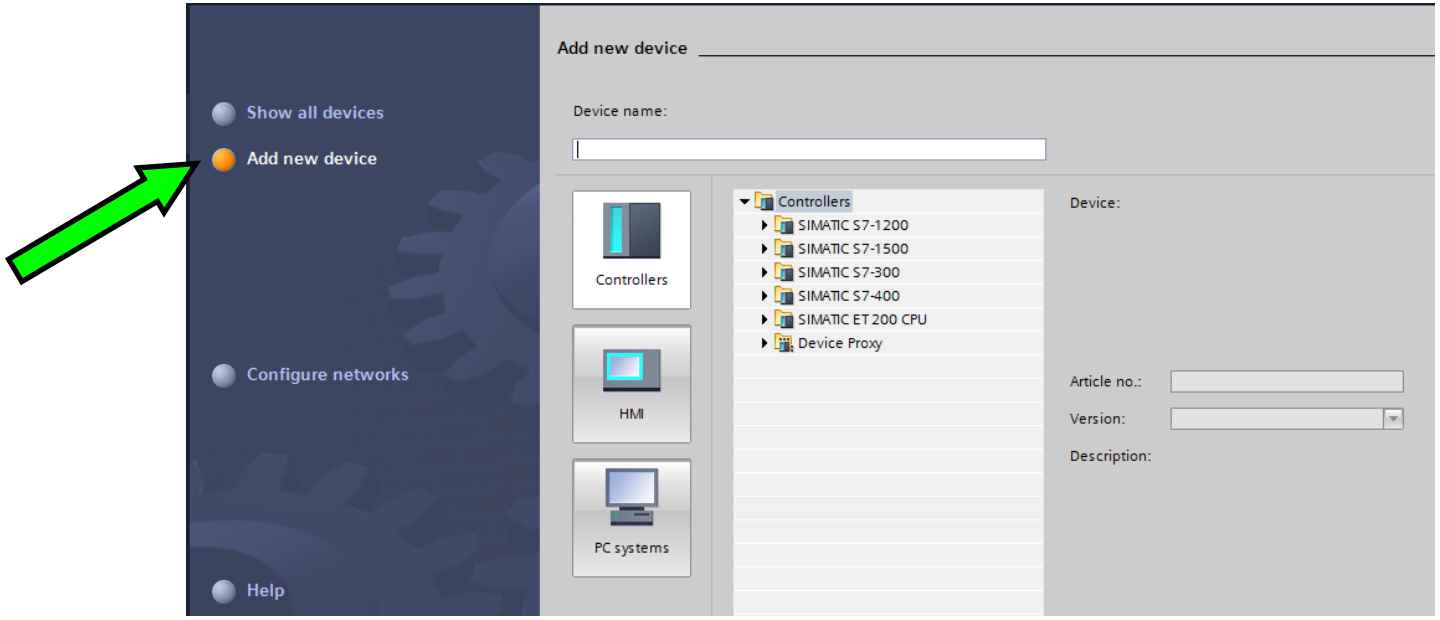
Configure Device & Network

- Since it is our first program, go ahead and click on **configure a device**.

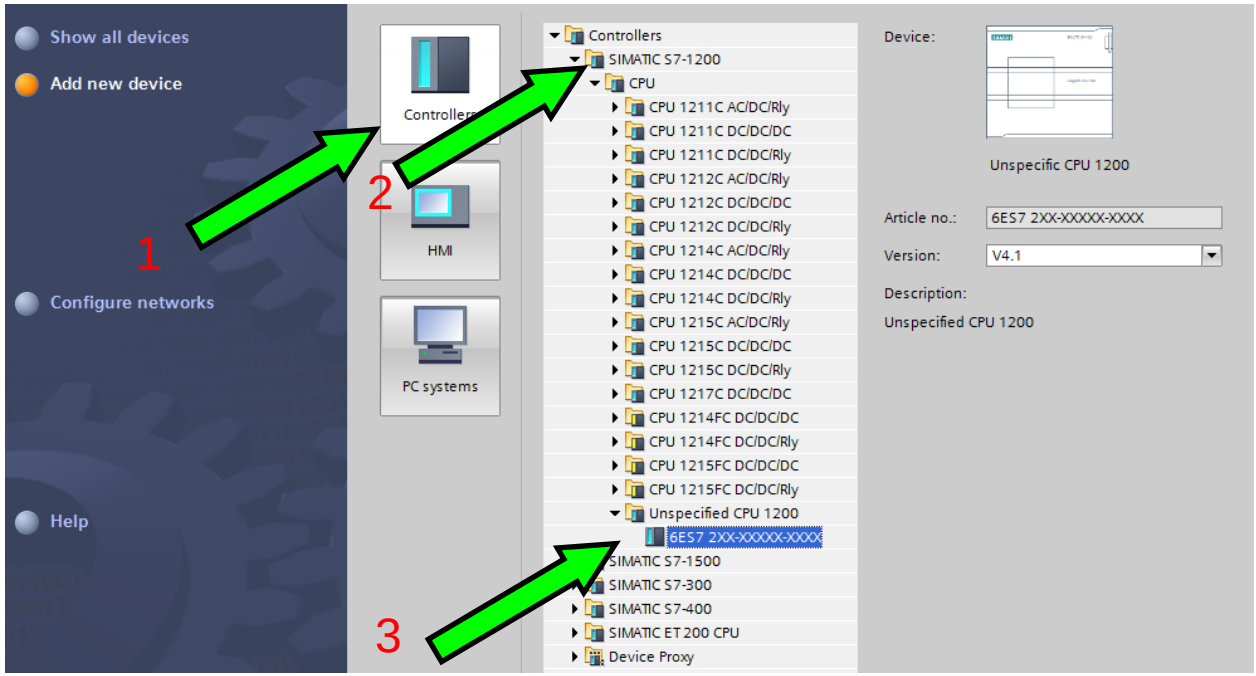
  Click on **Add new device**. You can see a similar display as the bottom figure. Here you can configure your Controllers (which are PLCs), HMI screens, and PC systems.
  Here you can name your PLC however you like. Such as Ryan's PLC 0.1



Configure Device & Network

- Since it is our first program, go ahead and click on **configure a device**.

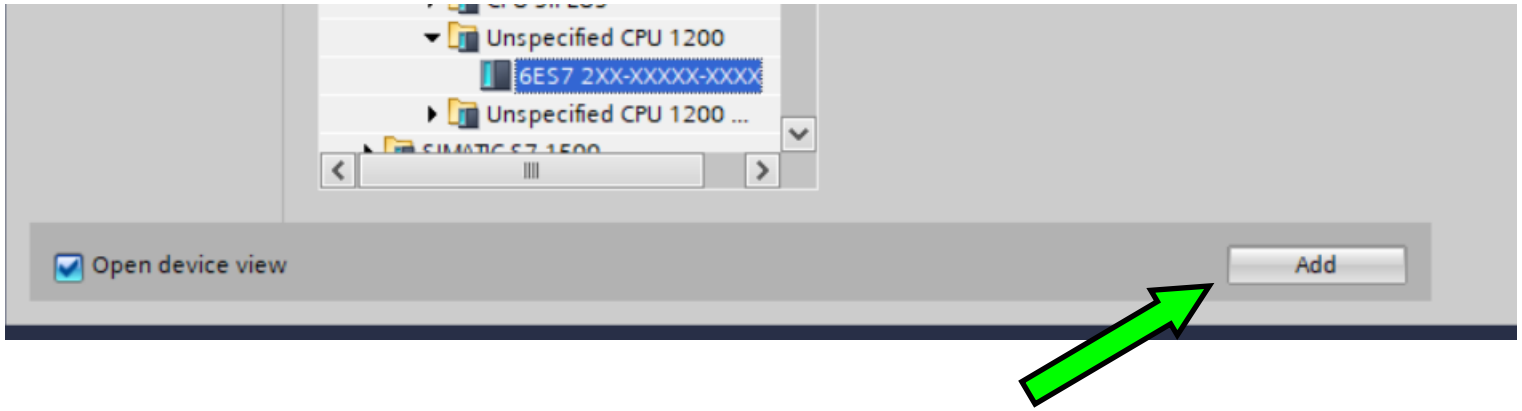
  Click on **Controllers**, you will see a drop-down menu that has all sorts of different types of PLC. The one we will be using is one of the SIMATIC S7-1200, so click on the small black arrow next to SIMATIC S7-1200 to get another drop menu one. Continue until you see
  Unspecified → 6ES7 2XX-XXXXX-XXXX.



Configure Device & Network

- Since it is our first program, go ahead and click on **configure a device**.

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



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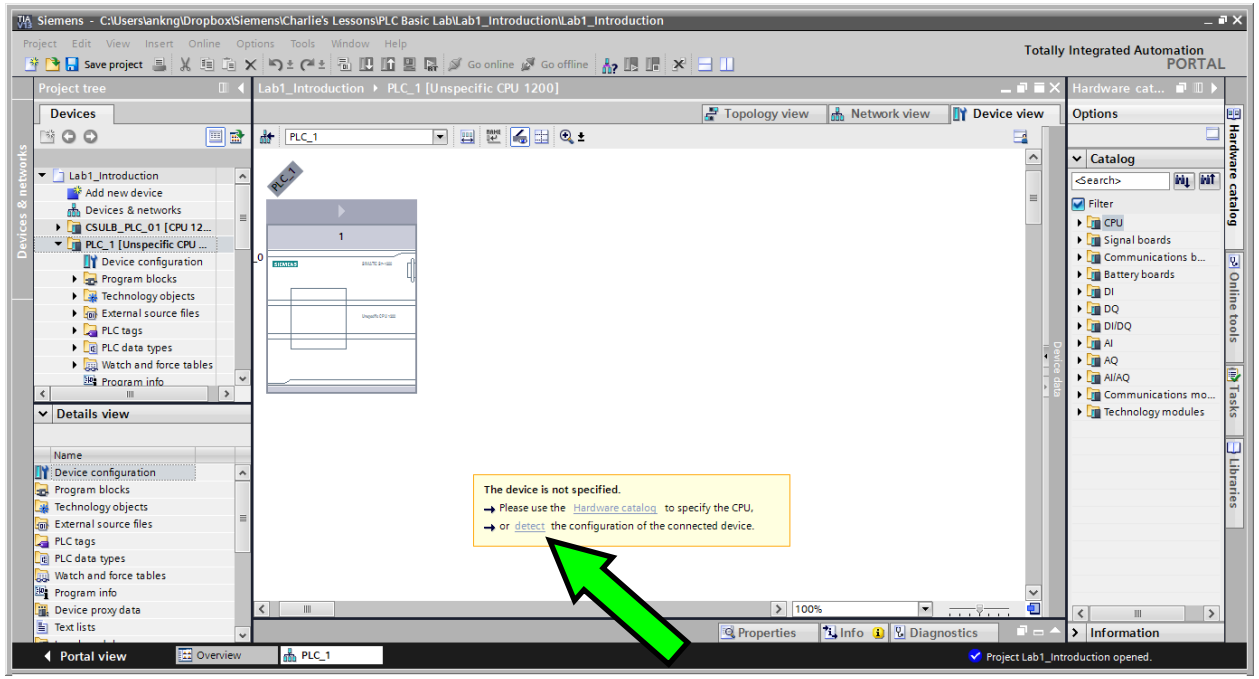
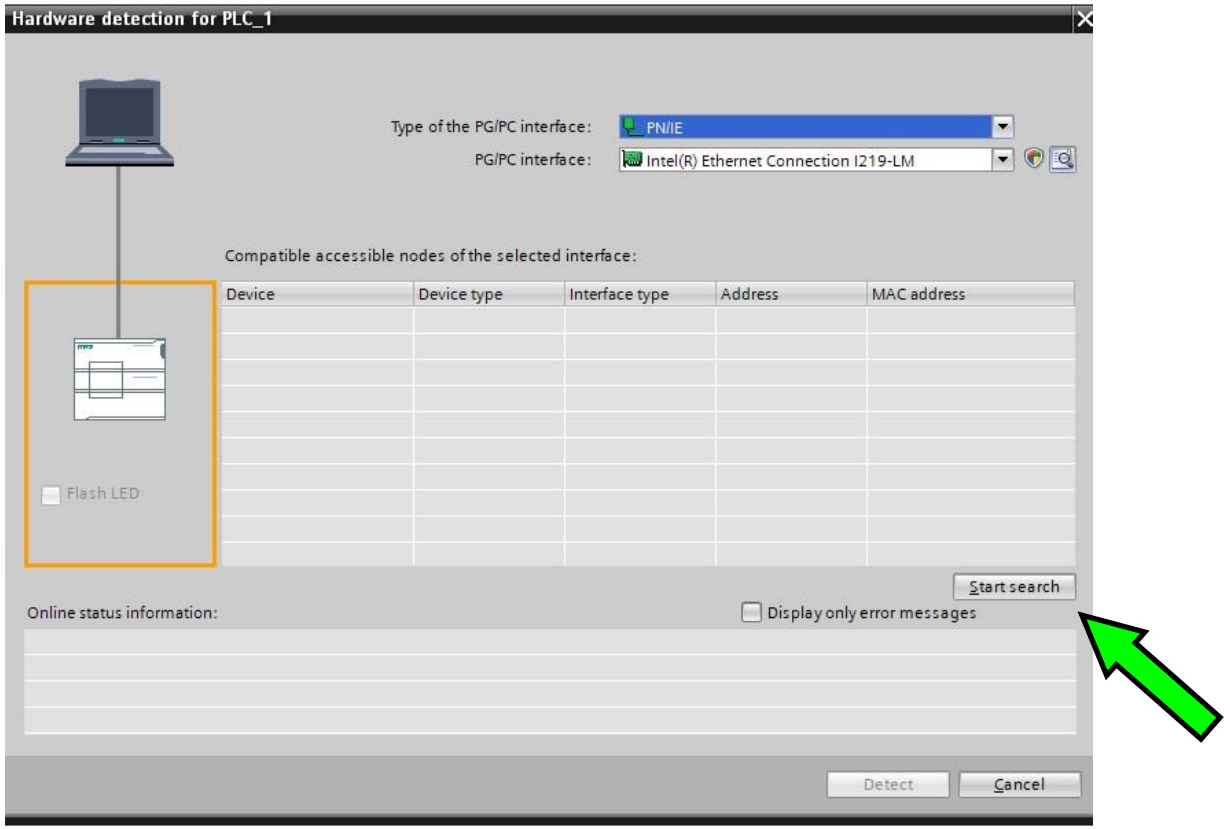
Configure Device & Network

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.



Configure Device & Network

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**.

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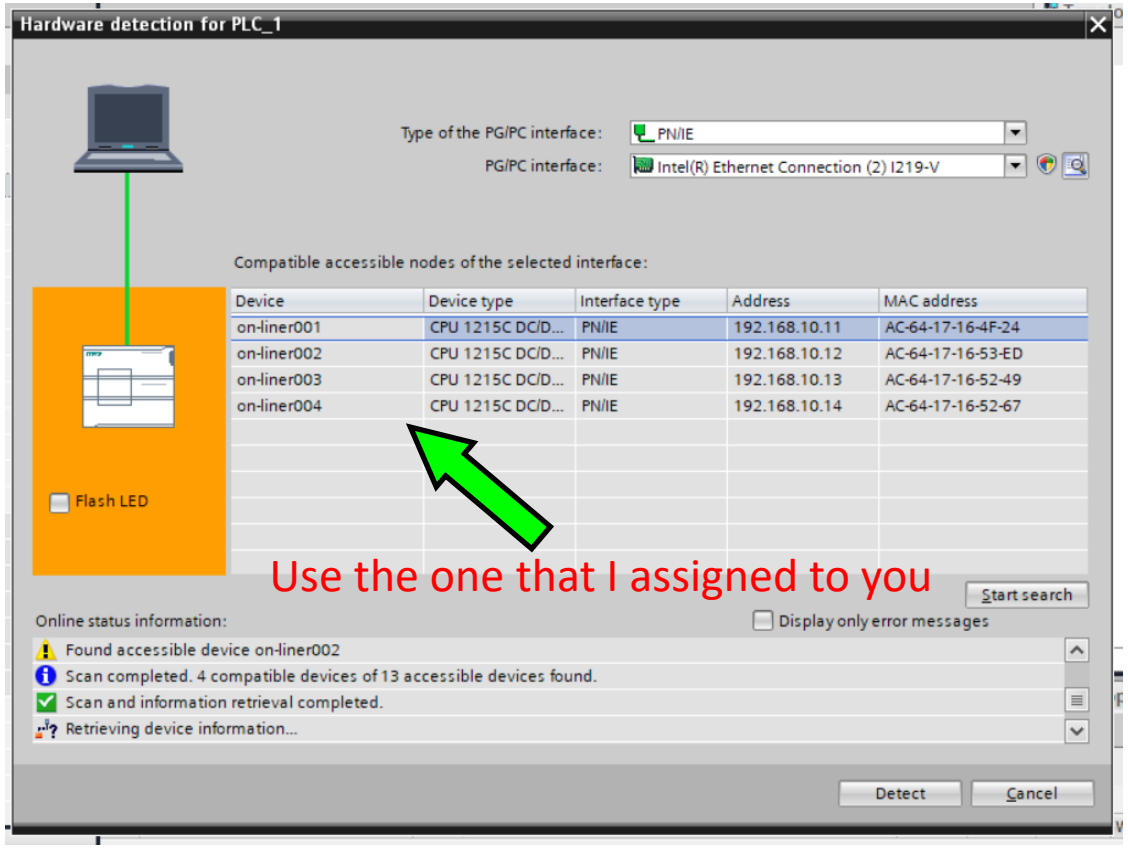
Configure Device & Network

After successfully searching, you will see this, be care, you need the correct controller.



There are several controllers on this network, pick your correct one

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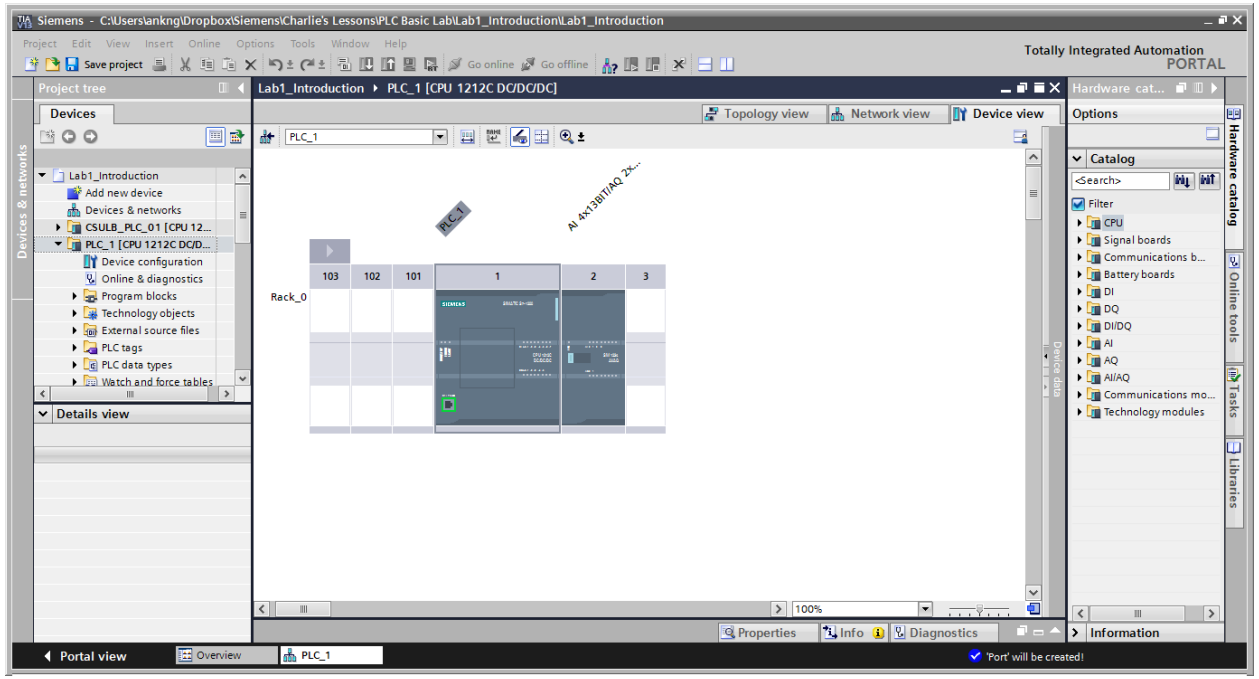
Configure Device & Network

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



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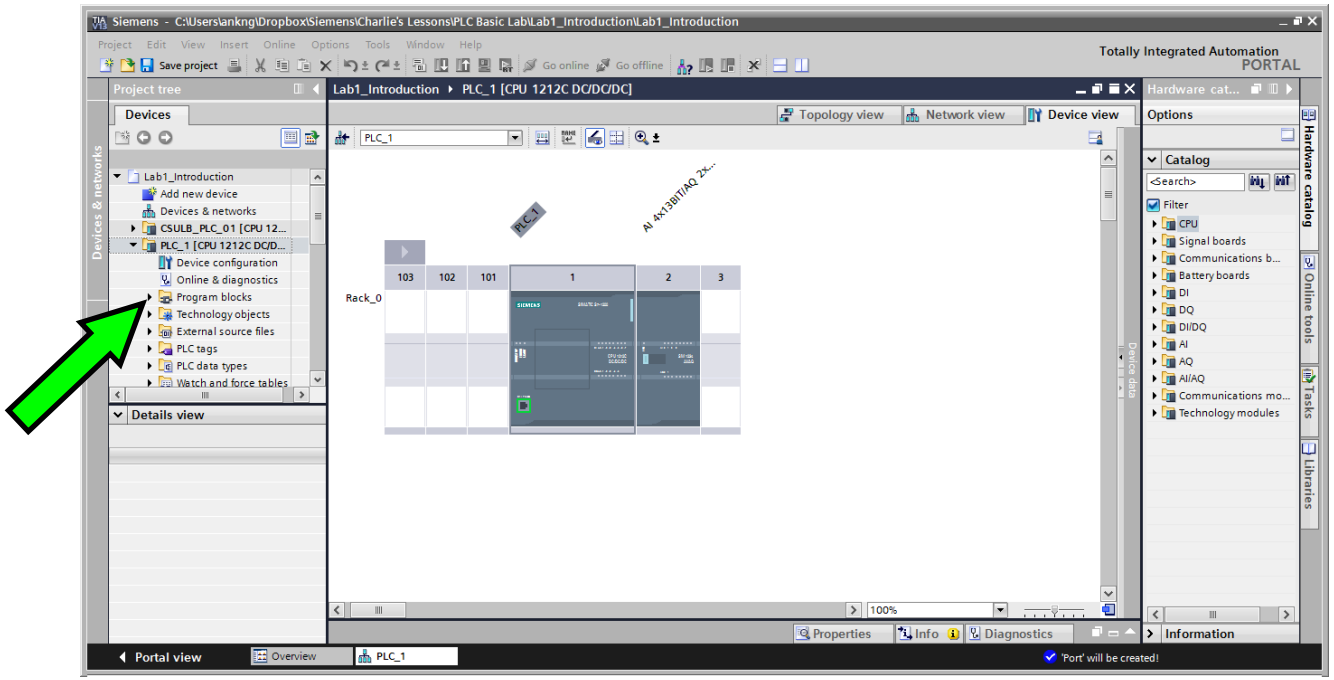
Programming Blocks

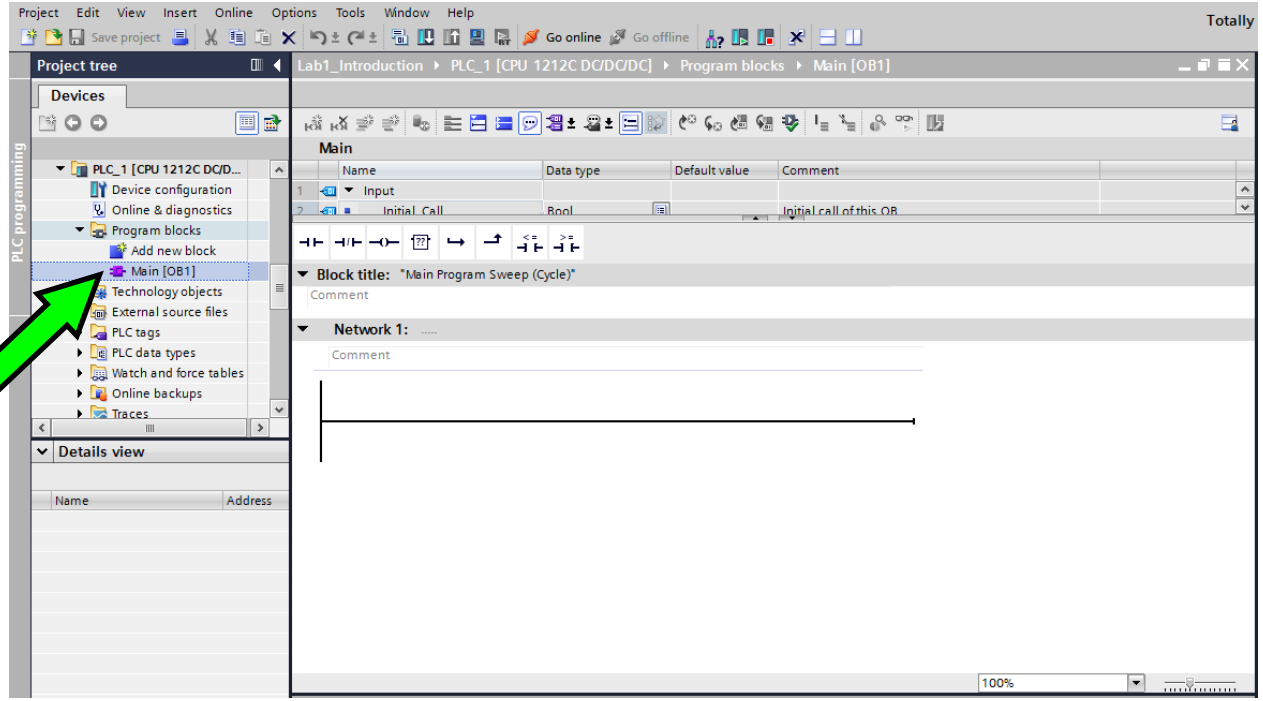
This portion of the lab shows you how to create your first program using network. A network is like an electrical wire, where you can place components such as contacts and assignments.



To access the networks, drop down the menus from your PLC in the Project Tree, until you see Program Blocks

Programming Blocks

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



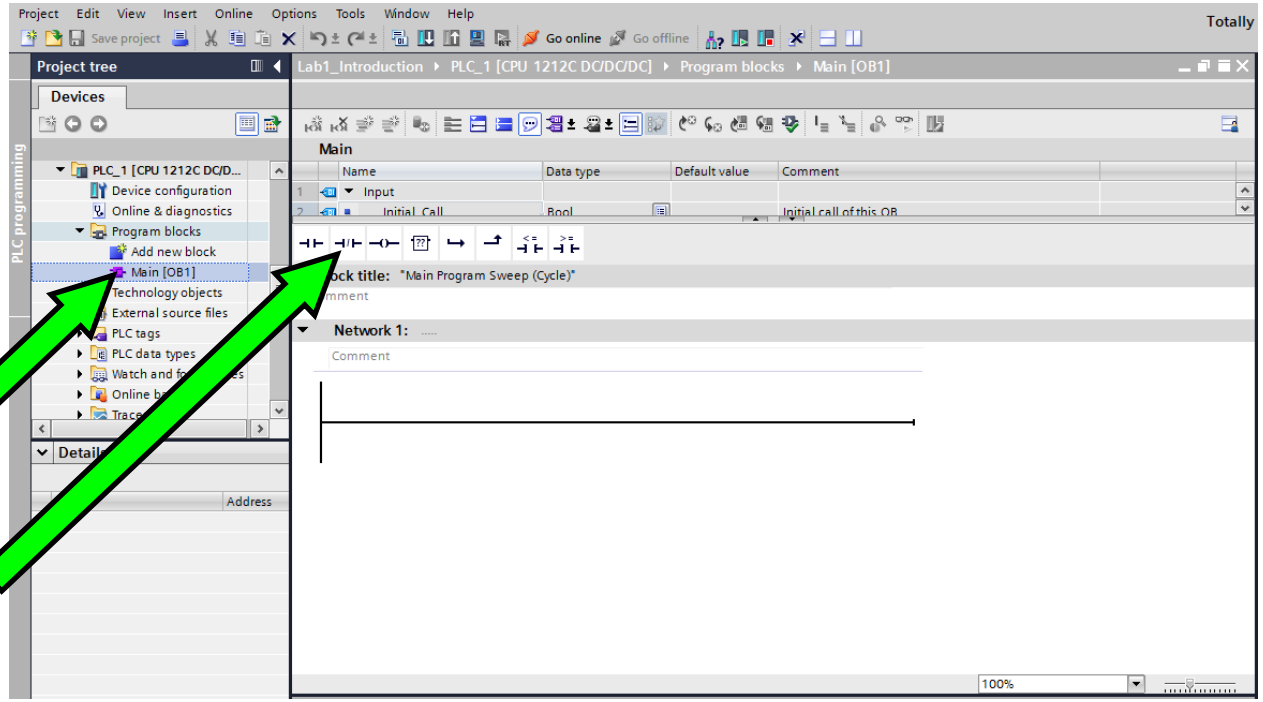
Drop down from that and double click Main[OB1].

Programming Blocks

Network 1 is already made for you
Also you can see some of the favorite blocks on the top of the workspace.
These are contacts and this is a coil
The coil is necessary to complete the line and assign the output.

Main OB1

Favorite Bar



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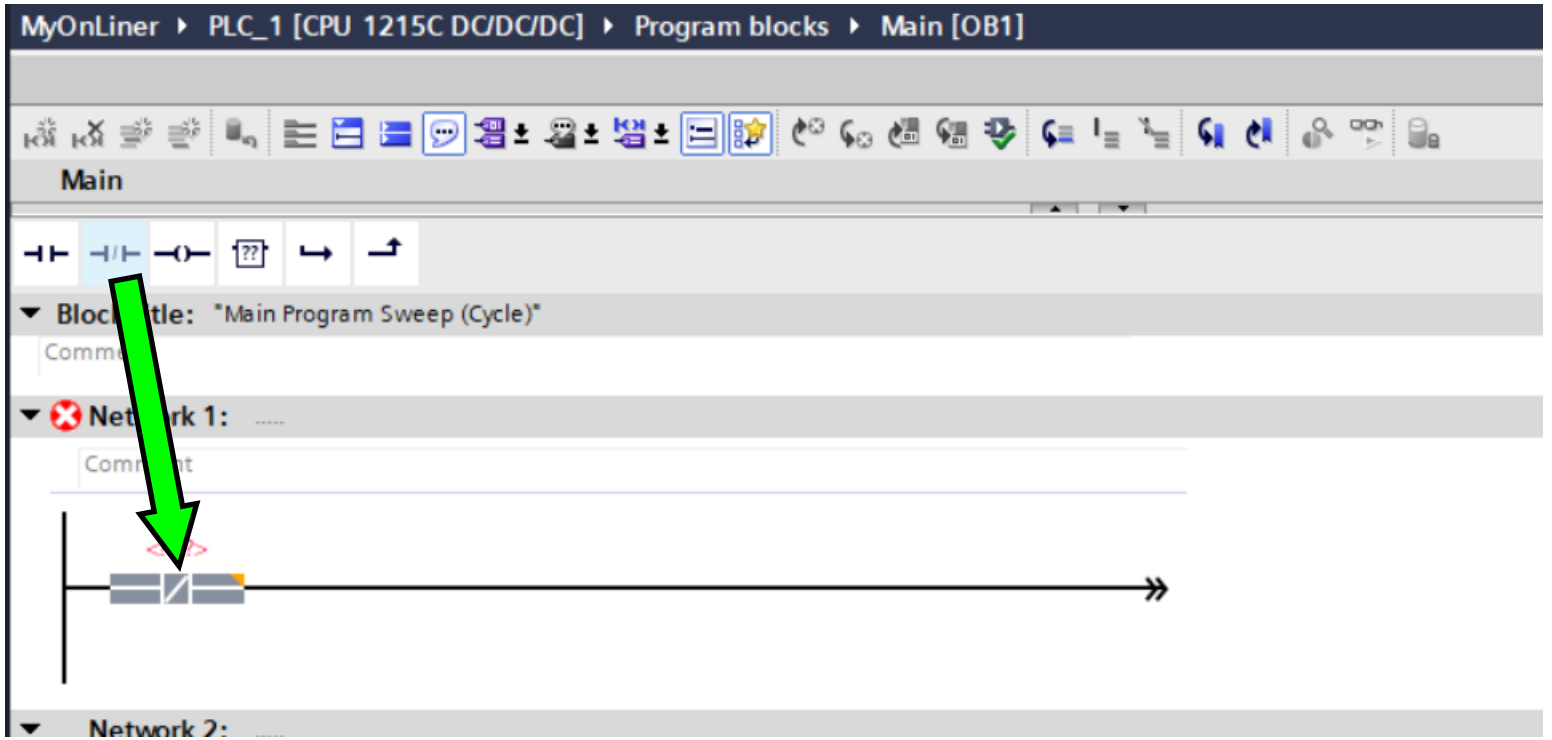
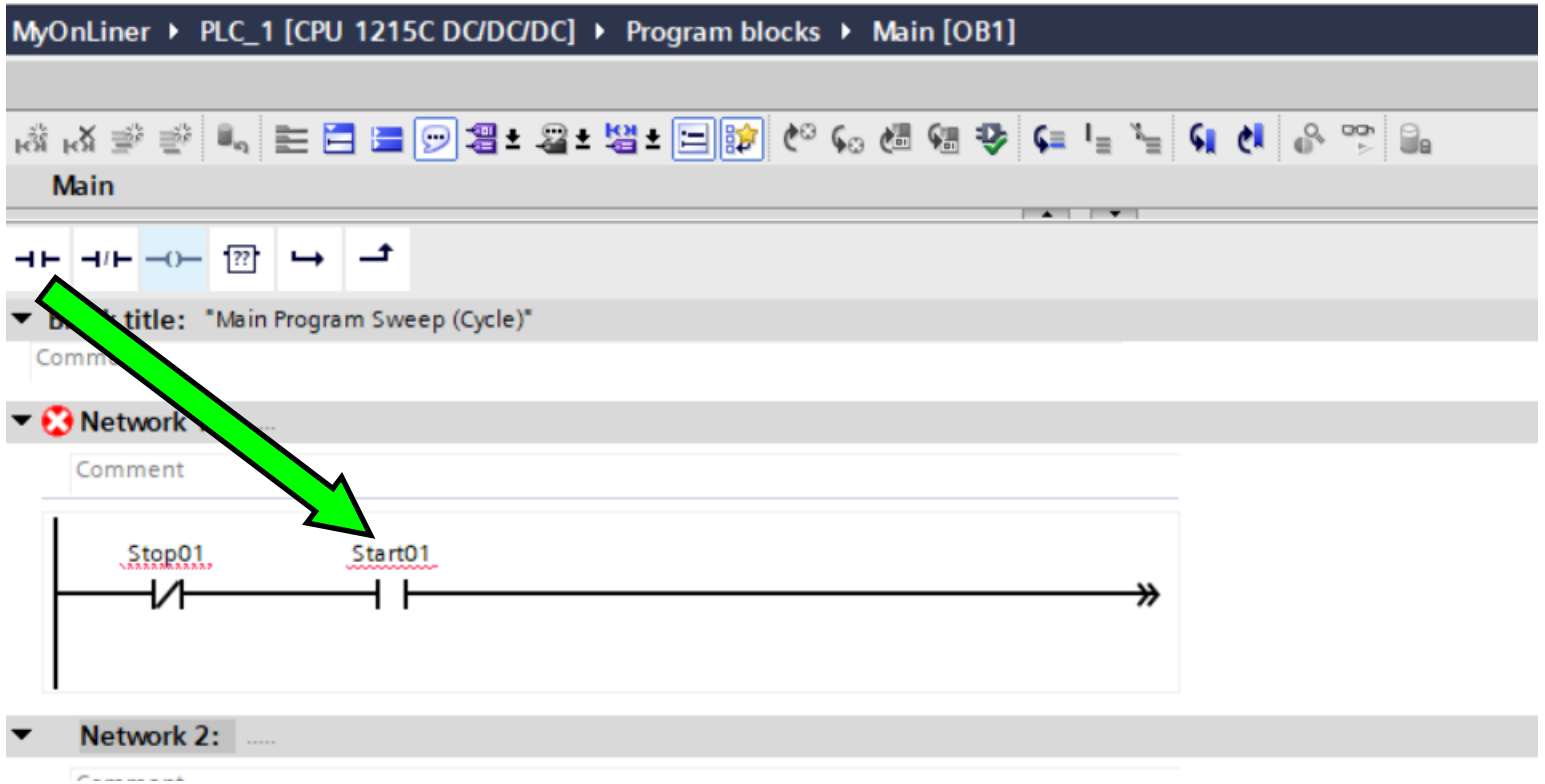
Programming Blocks

Begin with grabbing the normally closed contact (N/C)  from the favorite's bar at the top.



Programming Blocks

Now grab the normally open contact (N/O)  from the favorite's bar at the top. Drag it on to the network line and name it "Start01".



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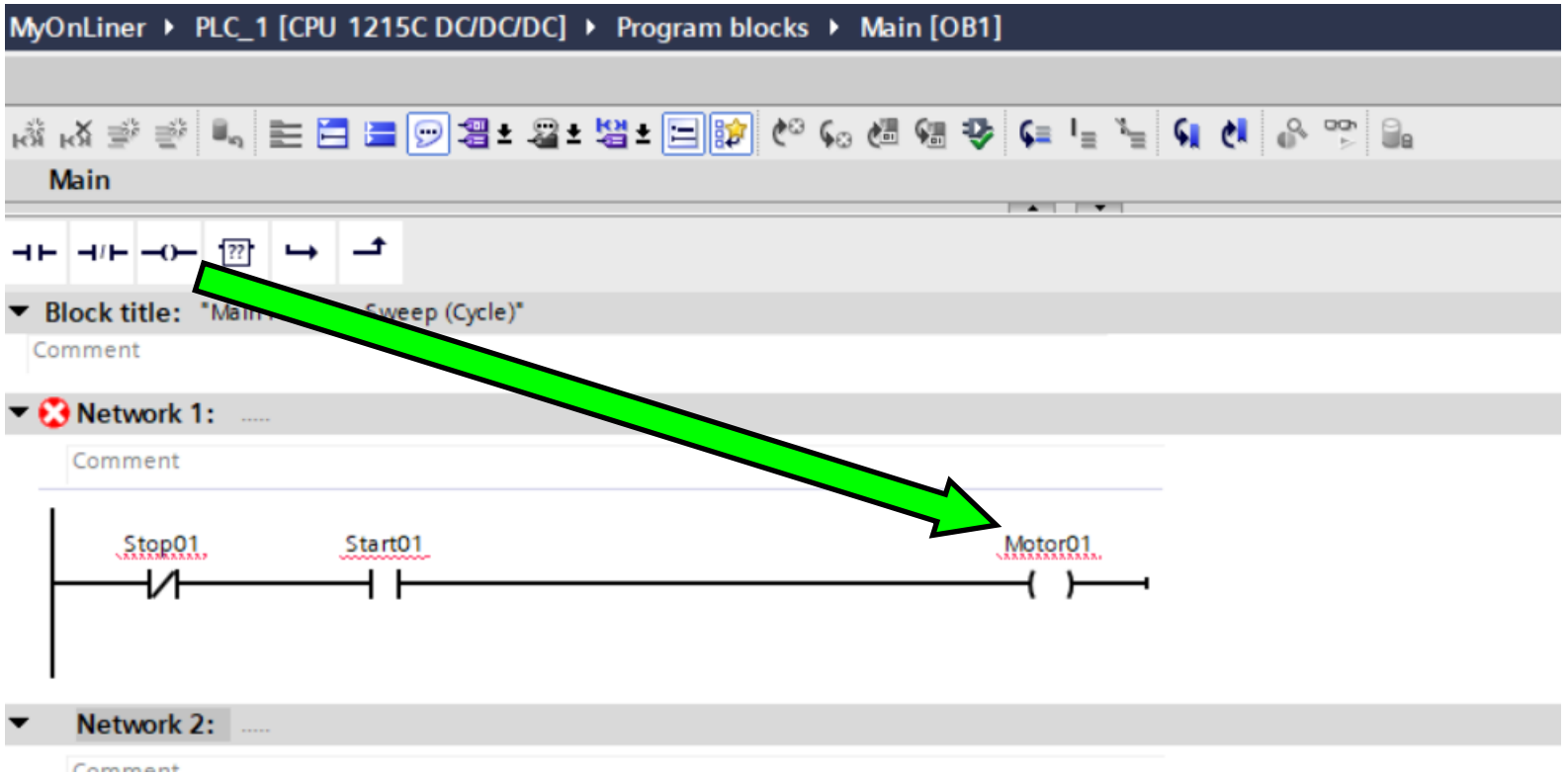
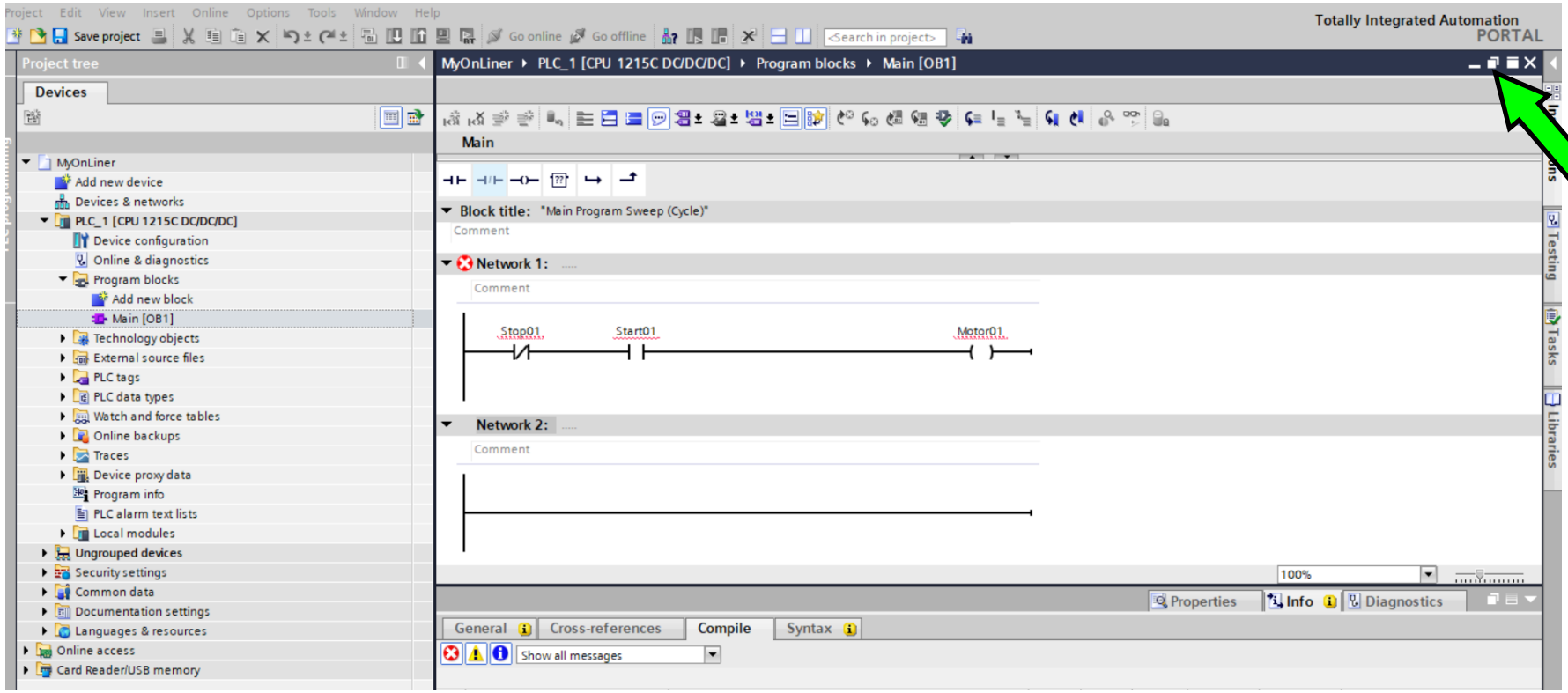
Programming Blocks

Grab the coil to complete the circuit
Drag it on to the network line and name it “Motor01”.



Programming Blocks

Now everything is set up and we are going to float the screen by selecting the float option on the upper right-hand side. You should now be able to see the Device configuration (PLC) window (your plc) and the Program block window over it.



float

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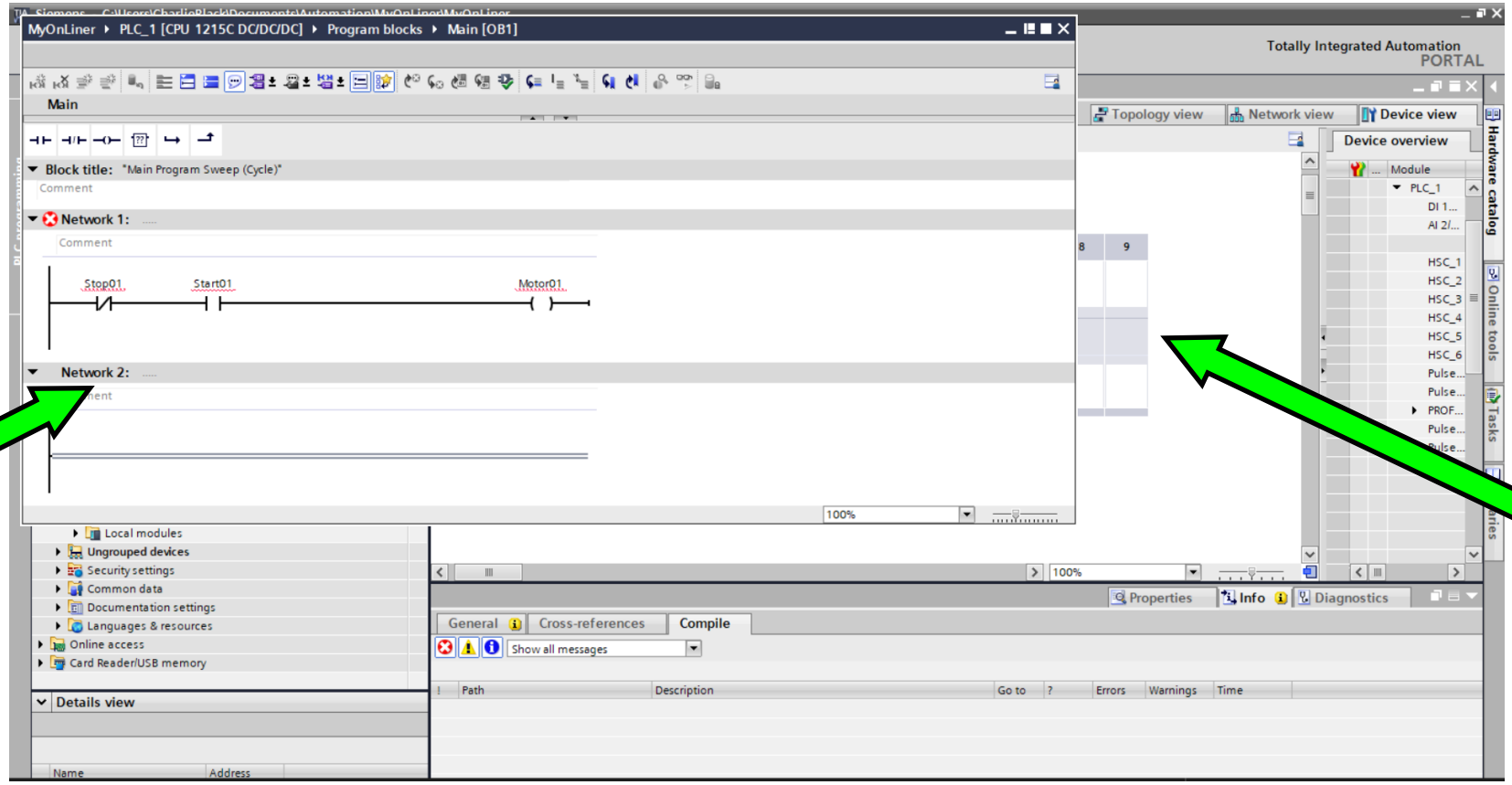
Programming Blocks

You should now be able to see the Device configuration (PLC) window behind the Program block window



Program block window

Device configuration window

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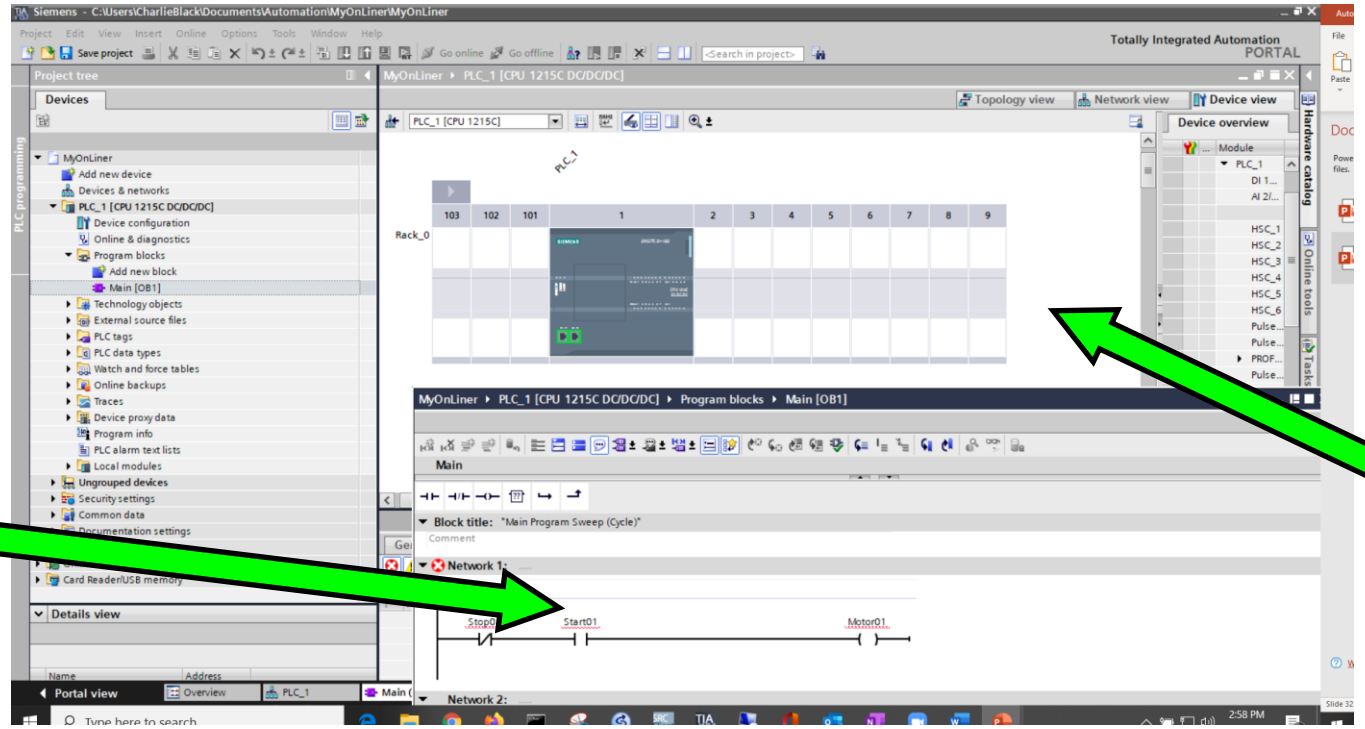
Programming Blocks

Move Program block window so you can see Device configuration window

Program block window



Device configuration window

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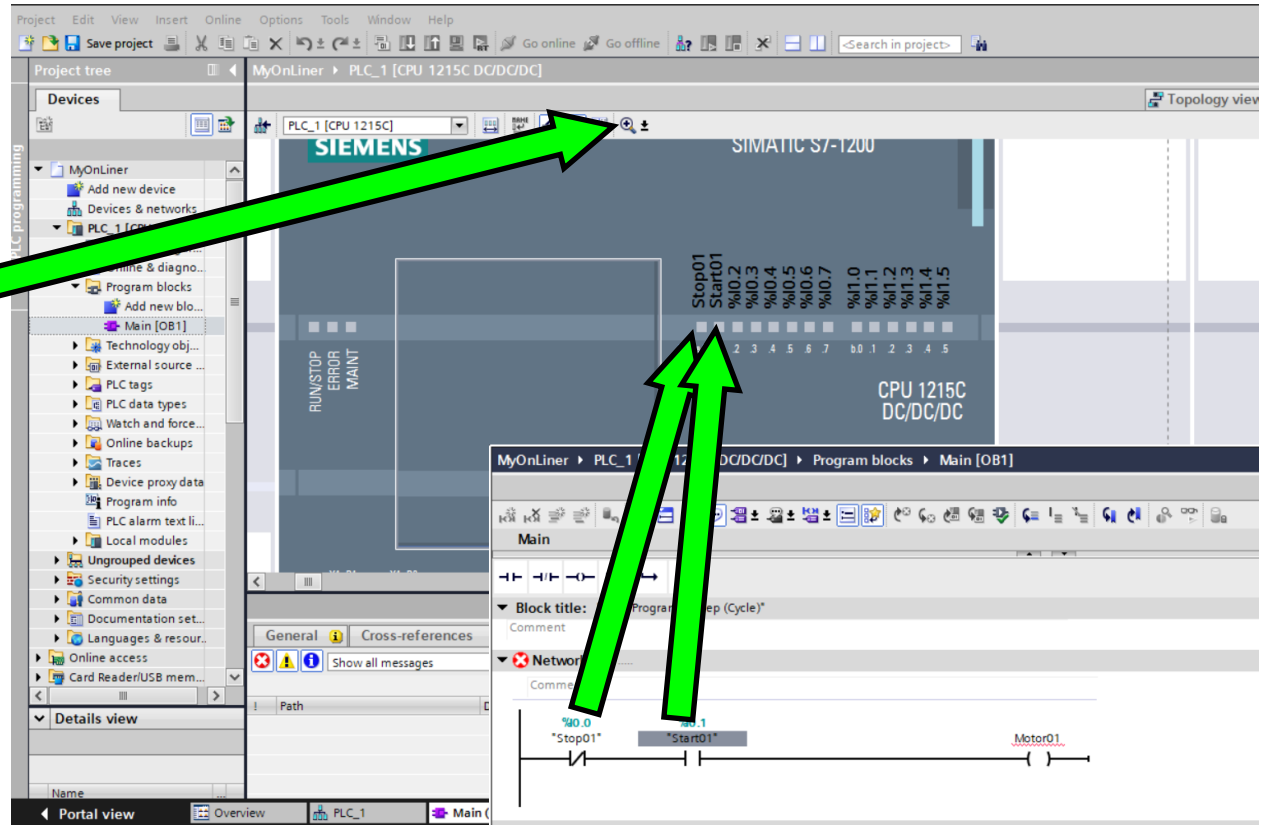
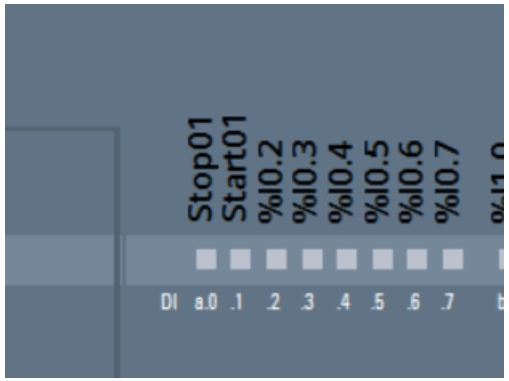
Programming Blocks

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” then “Start01” to “%I0.1” on the CPU.

Zoom in to enlarge





I0.0 Stop01
I0.1 Strat01

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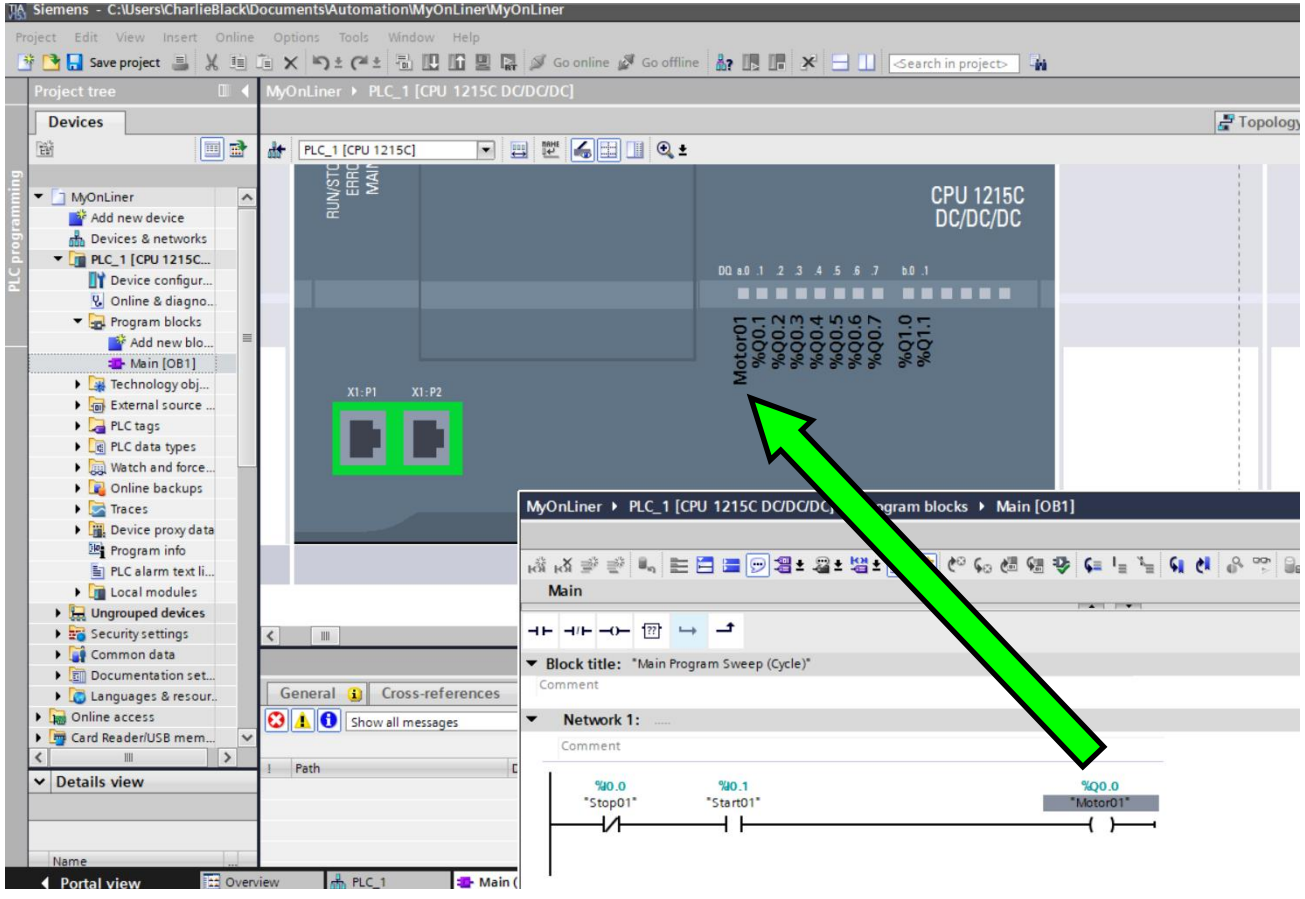
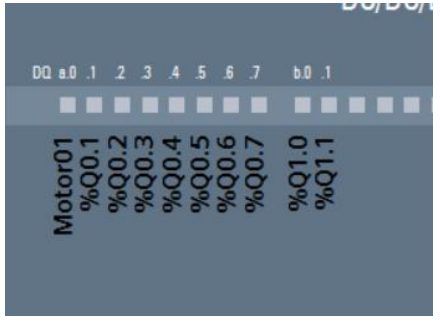
Programming Blocks

Move Device configuration screen to see outputs. From here, select the “Motor01” coil on the program block window and drag “%Q0.0”





Q0.0 Motor01

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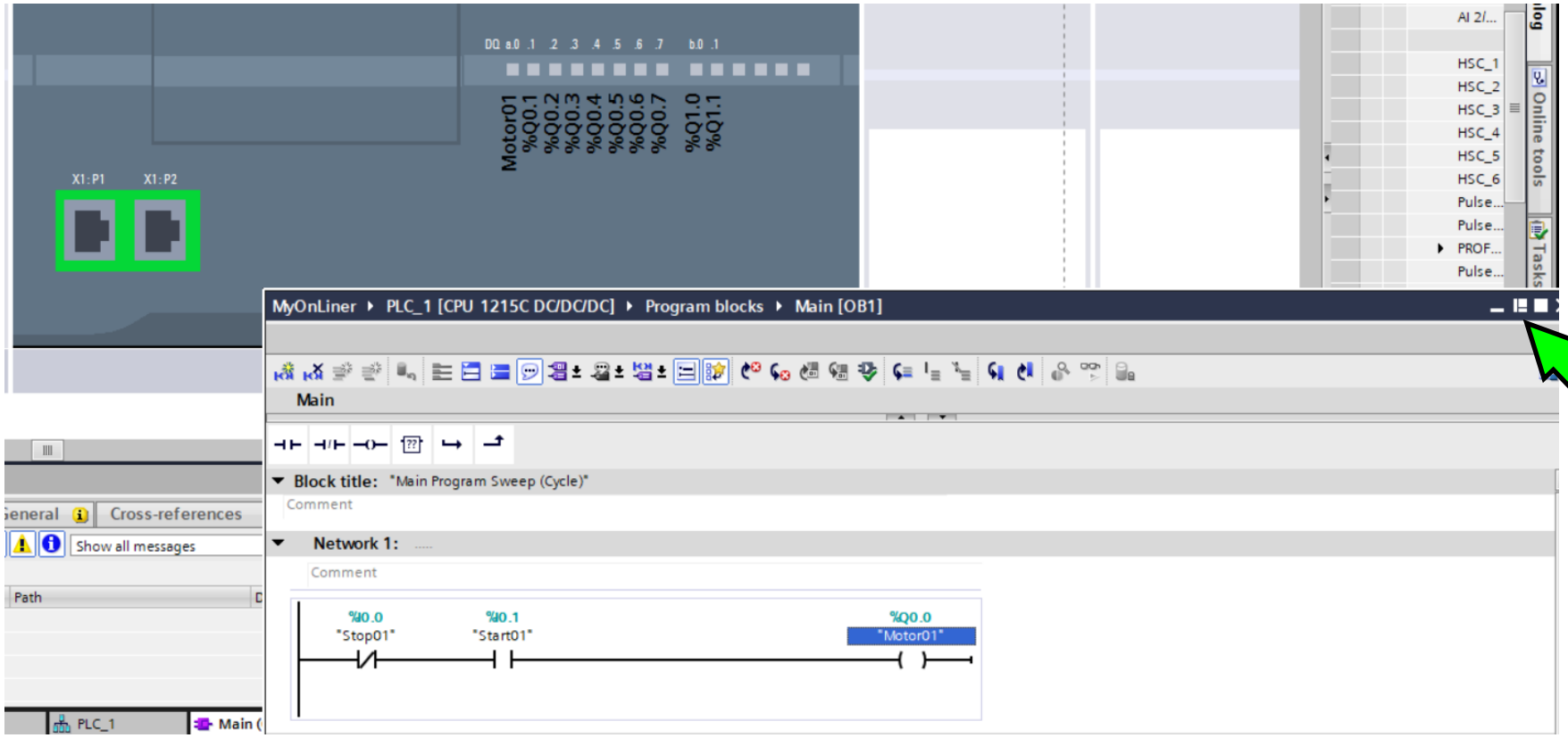
Programming Blocks

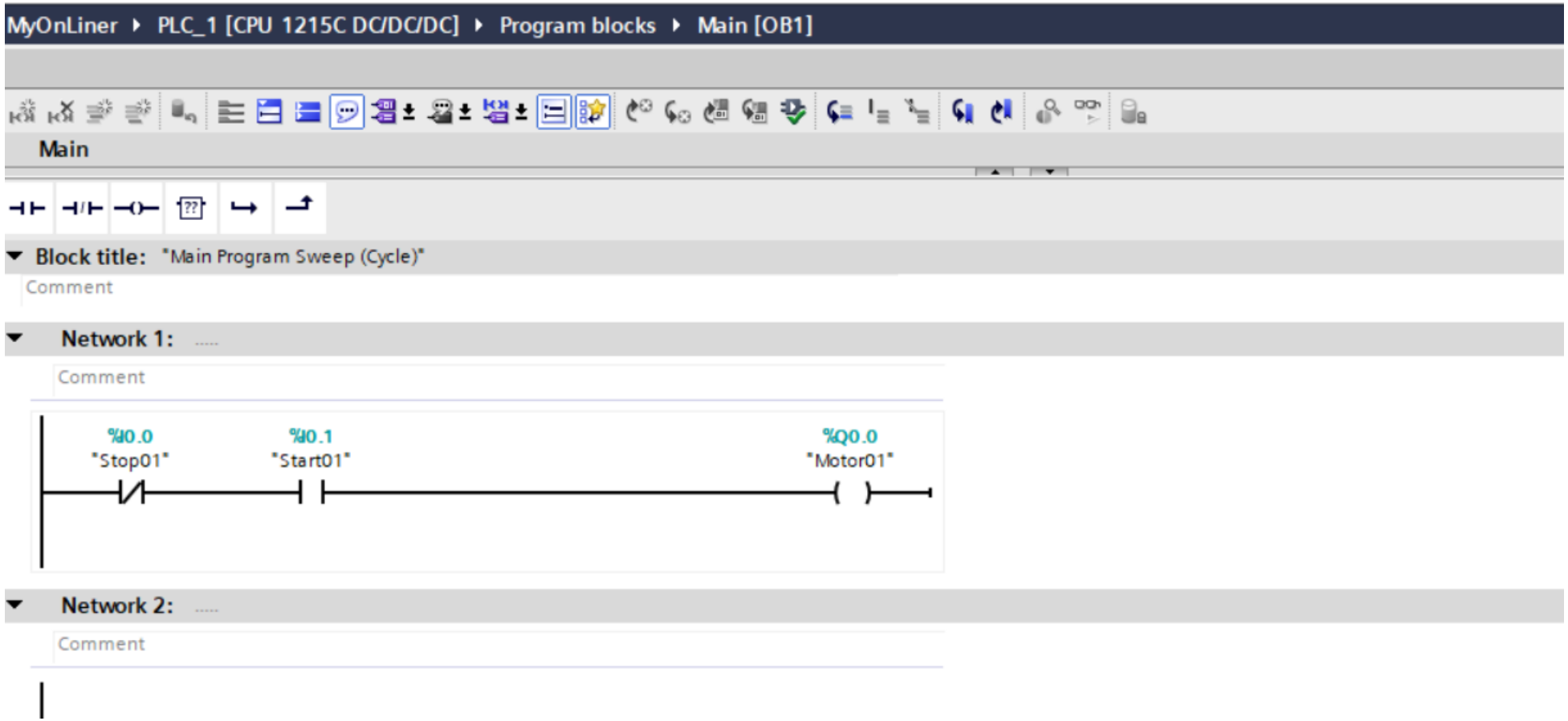
Now put the screen back to the way we started. Click the Program screen, then Embed

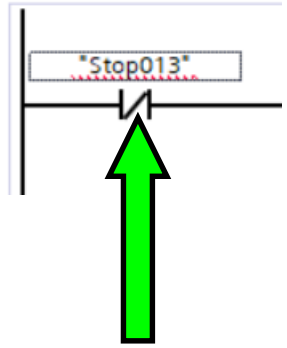


Embed

Programming Blocks

Your screen should look like this, no red lines where you have configured the contacts and coils





No Red

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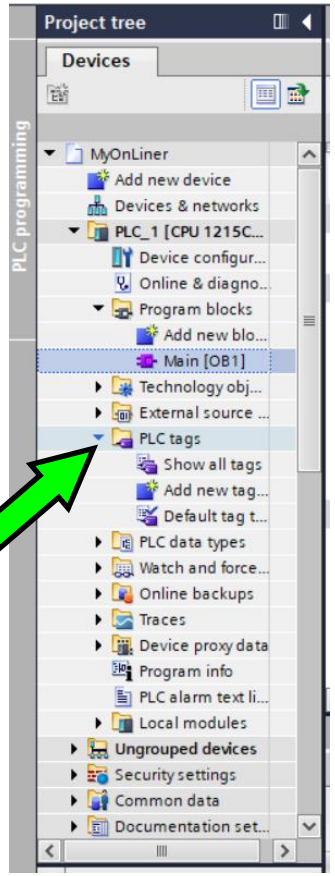
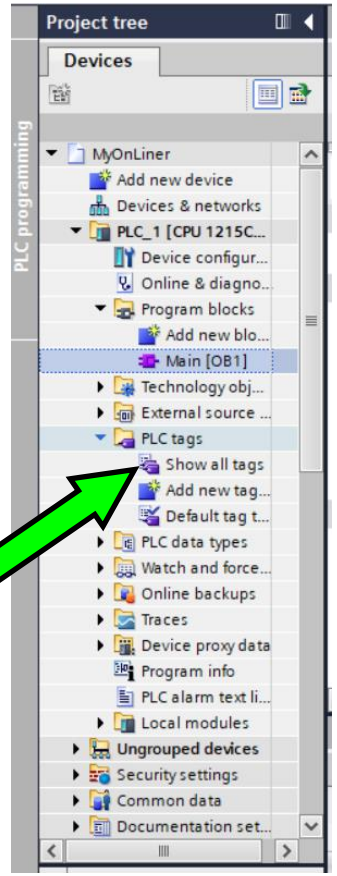
Programming Blocks

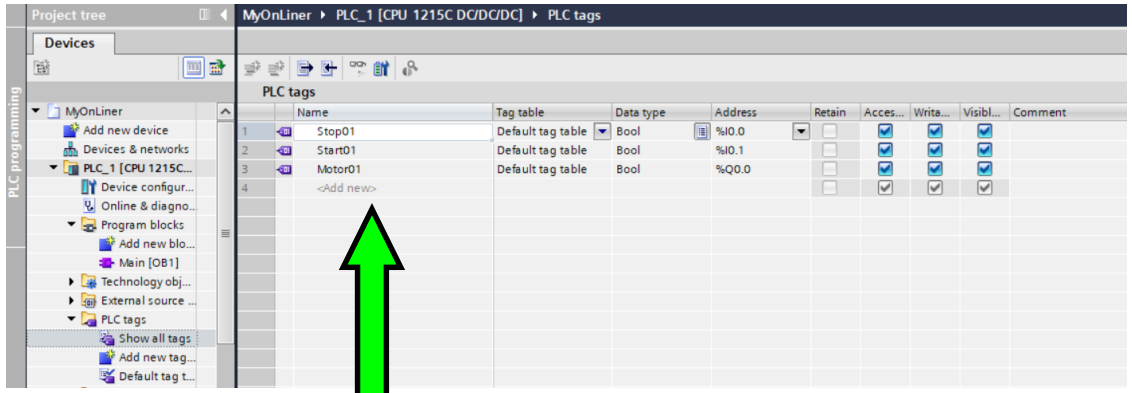
If you have Red, we need to go to the PLC Tags area.



PLC Tags



Show all Tags



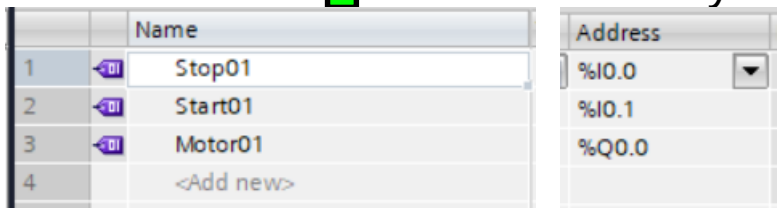
Your Tags must look like this:

Stop01 I0.0

Start01 I0.1

Motor01 Q0.0

Just fill in if you have issues



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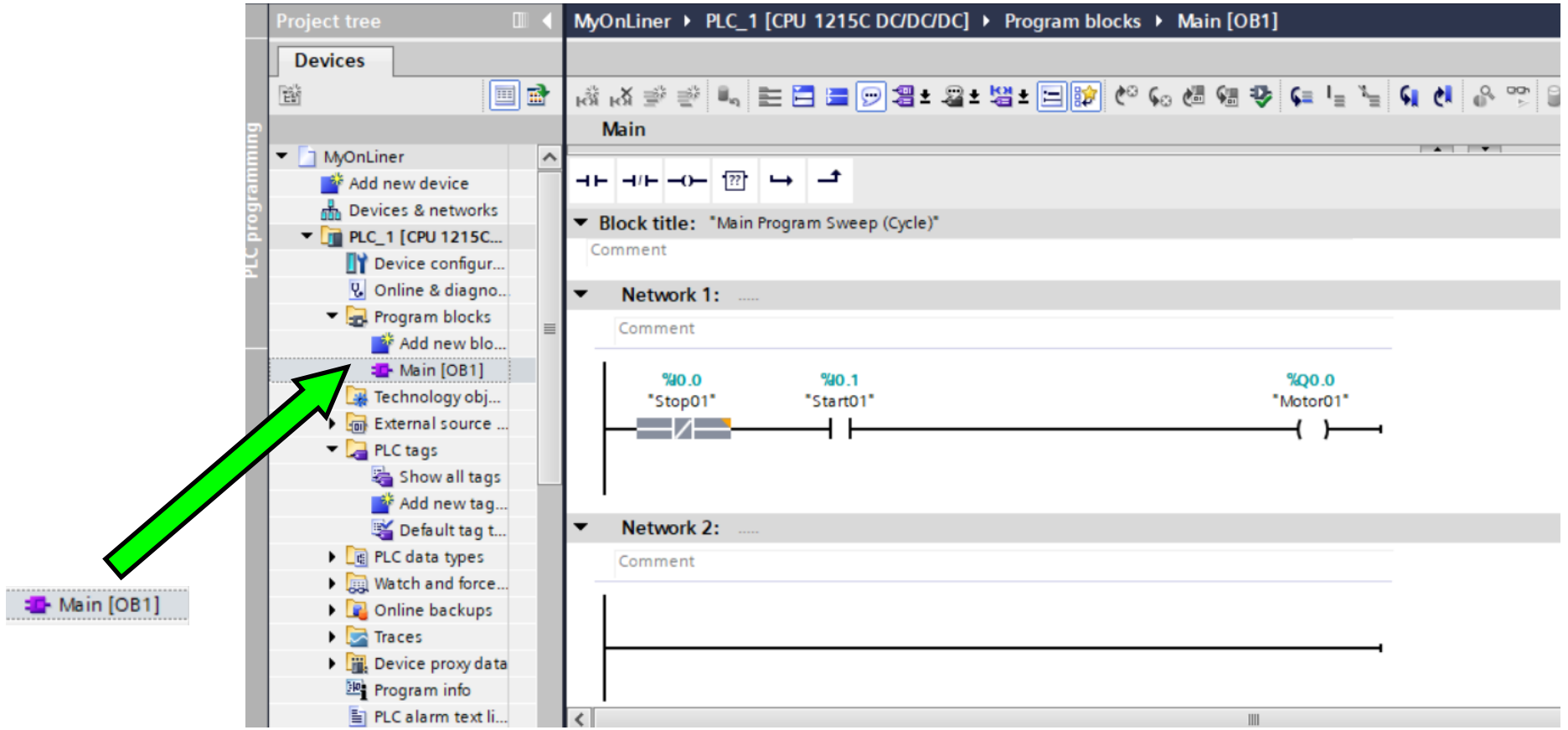
Programming Blocks

Now go back to your Program blocks area, then Main OB1



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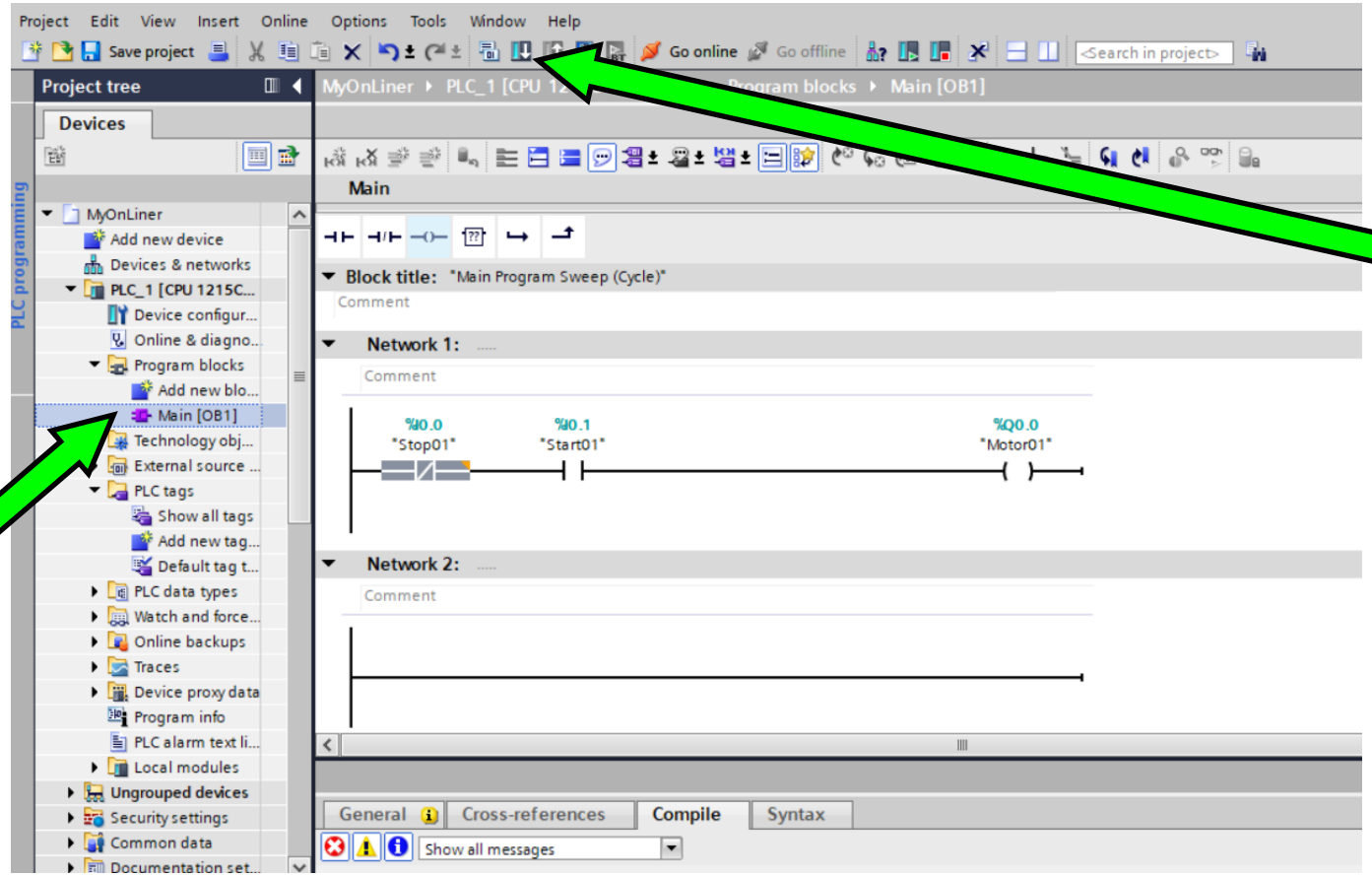
Programming Blocks

Now click the download icon at the top

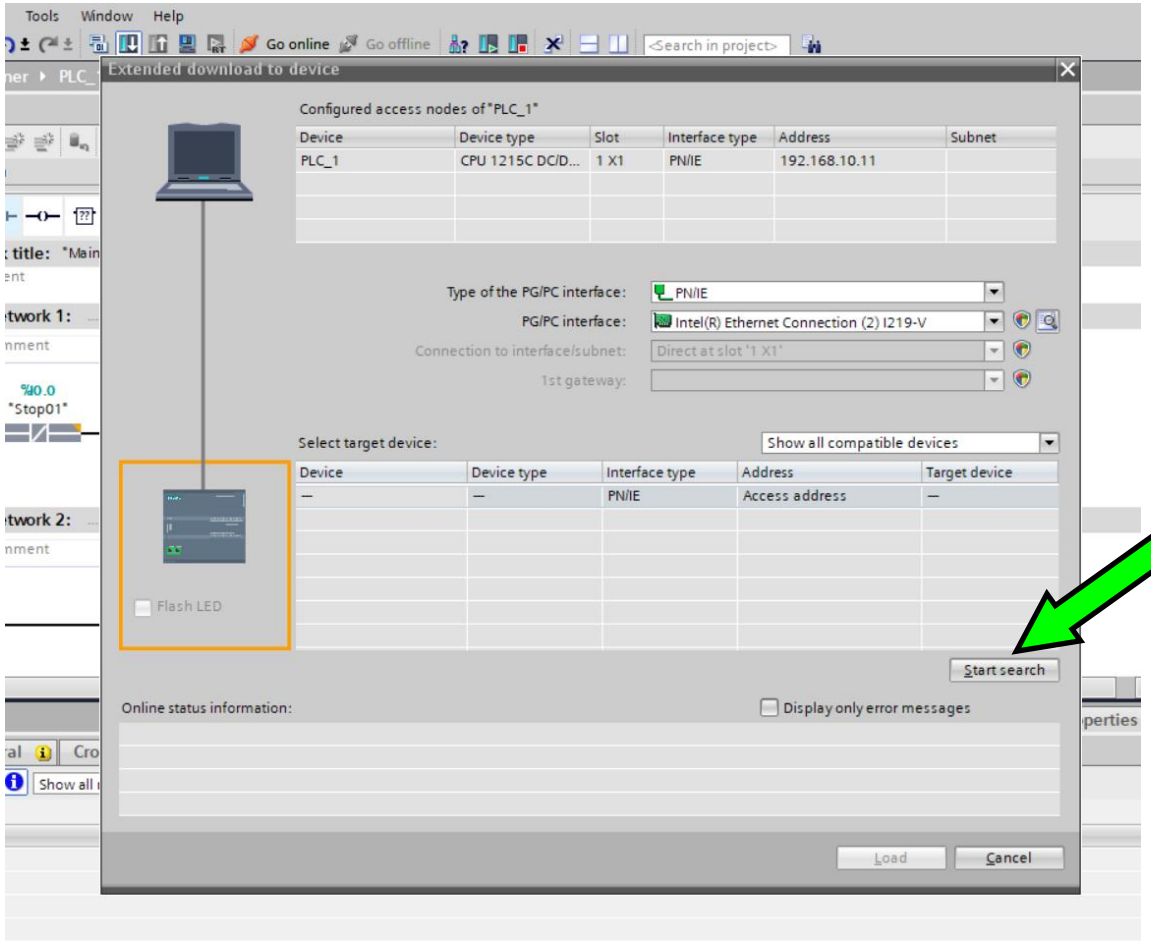


Click download Icon

Main OB1
must be high lighted

Programming Blocks

Click “Start search”



Click start search

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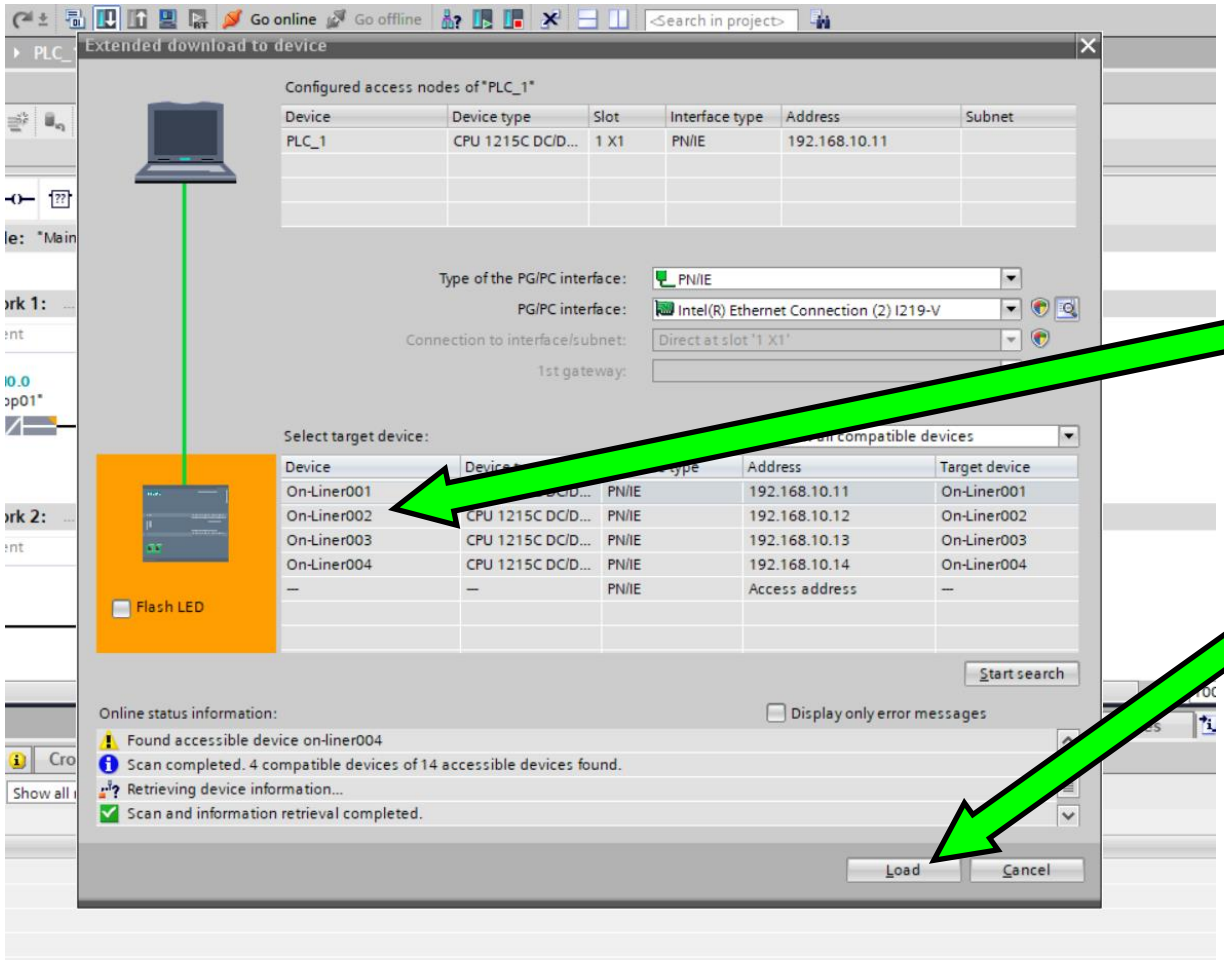
Programming Blocks

Again… find your correct connector, high light, then click “Load”



Make sure you high light the correct controller

Click Load to download

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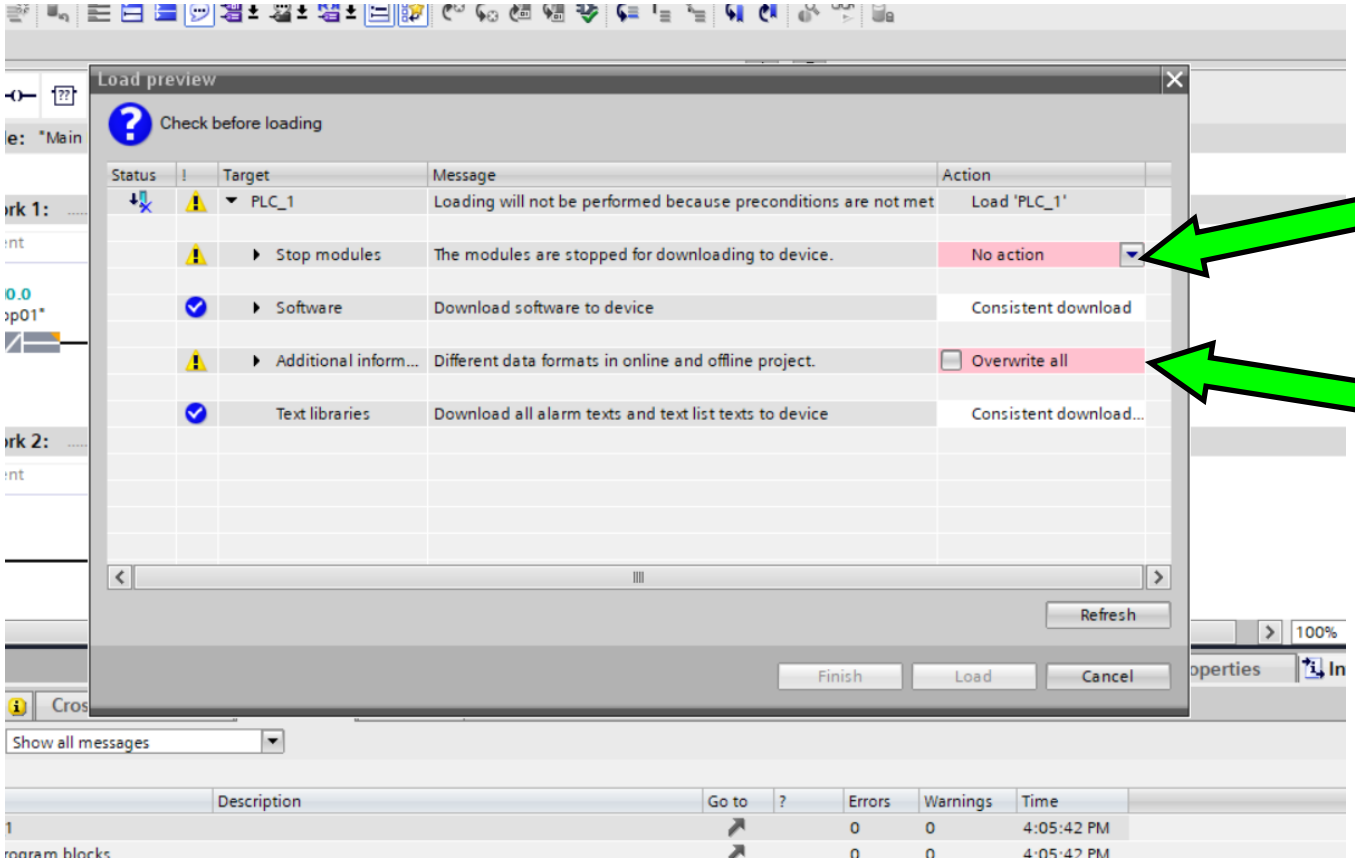
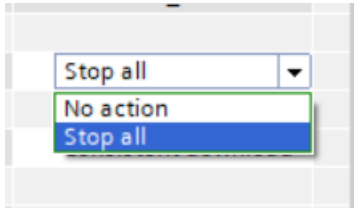
Programming Blocks

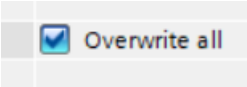
Continue loading…



Change from “No Action”
to “Stop all by pulling down box



Check “Overwrite all”



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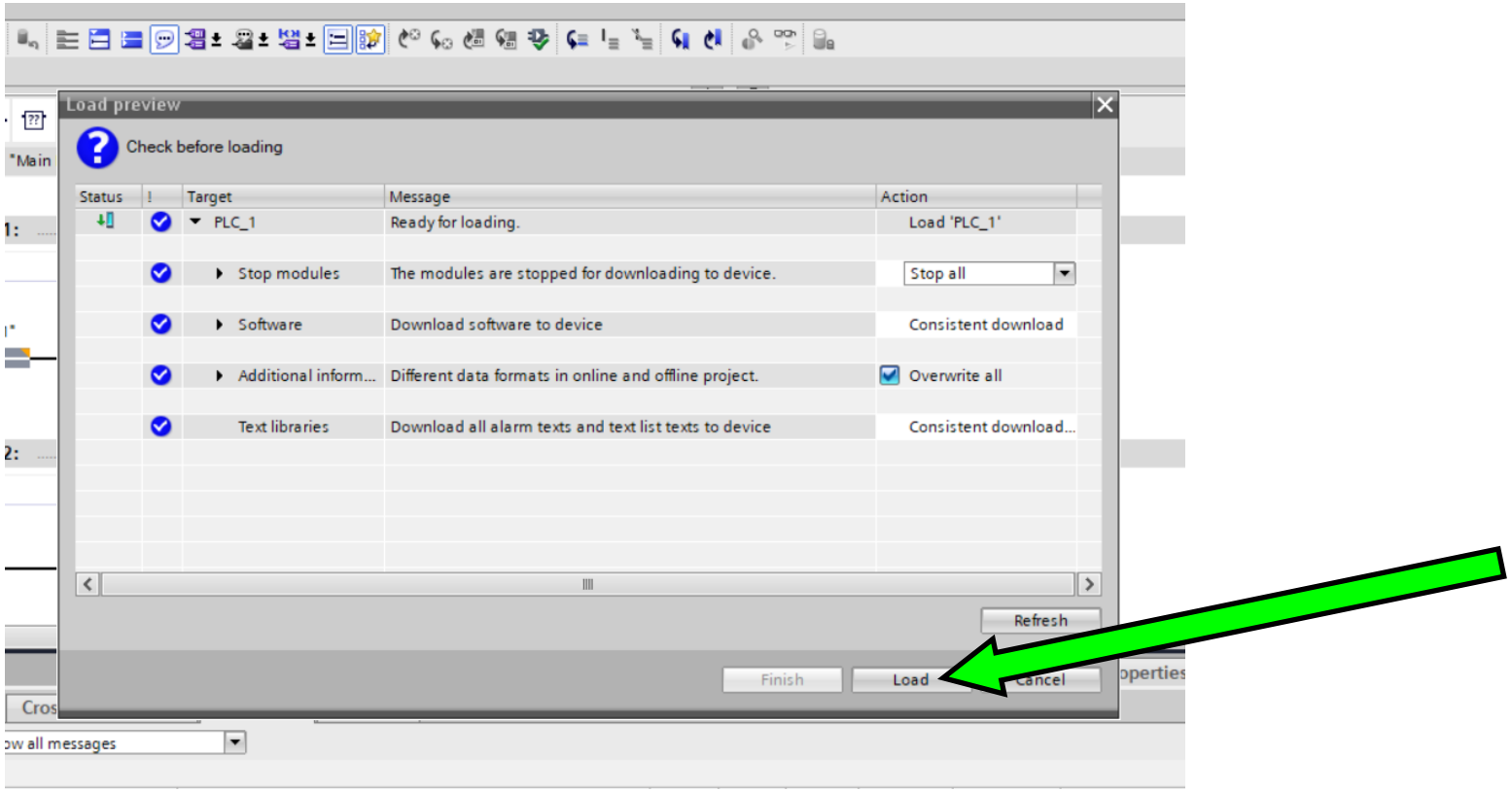
Programming Blocks

Finish loading…



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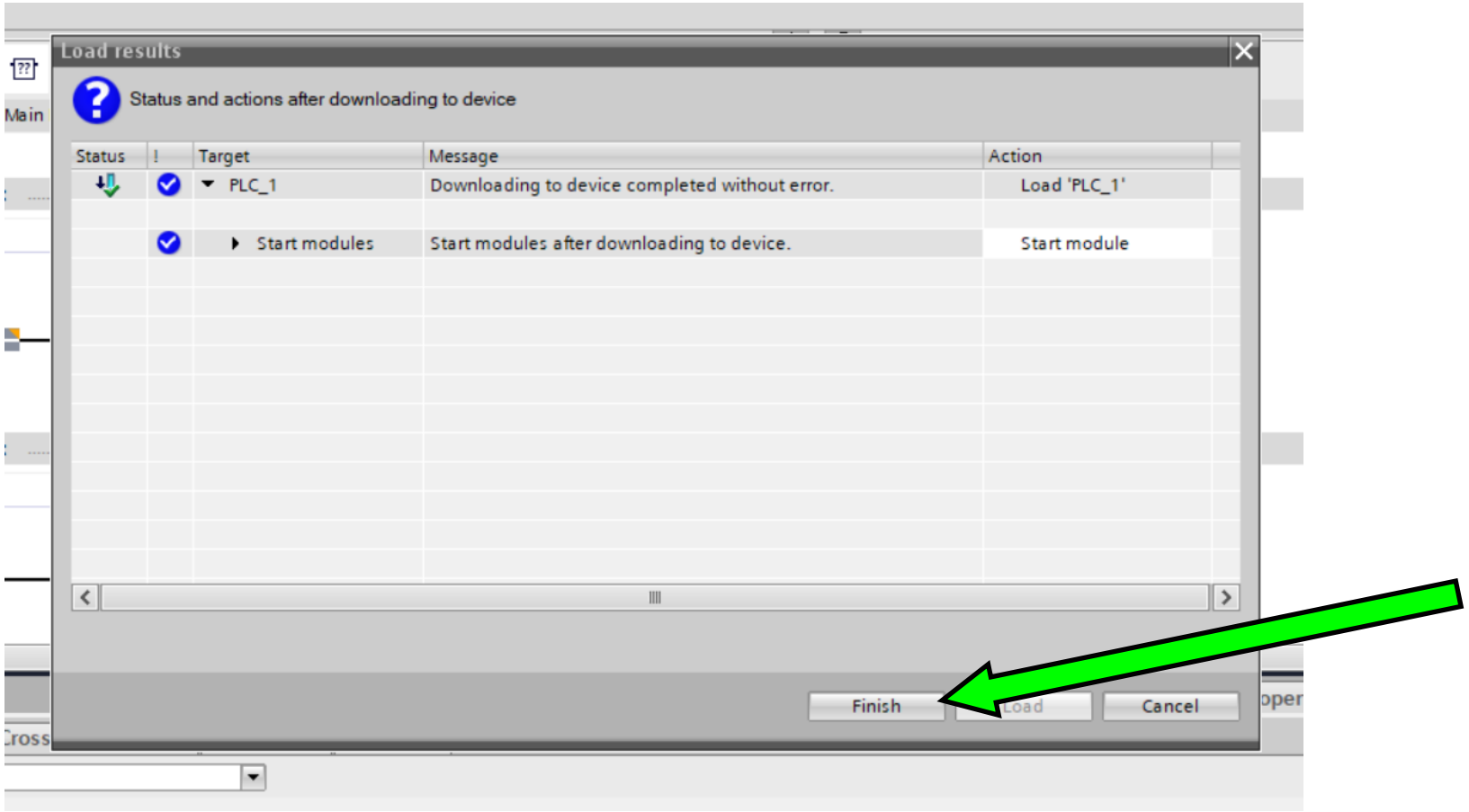
Programming Blocks

Start module, put controller back in run mode.



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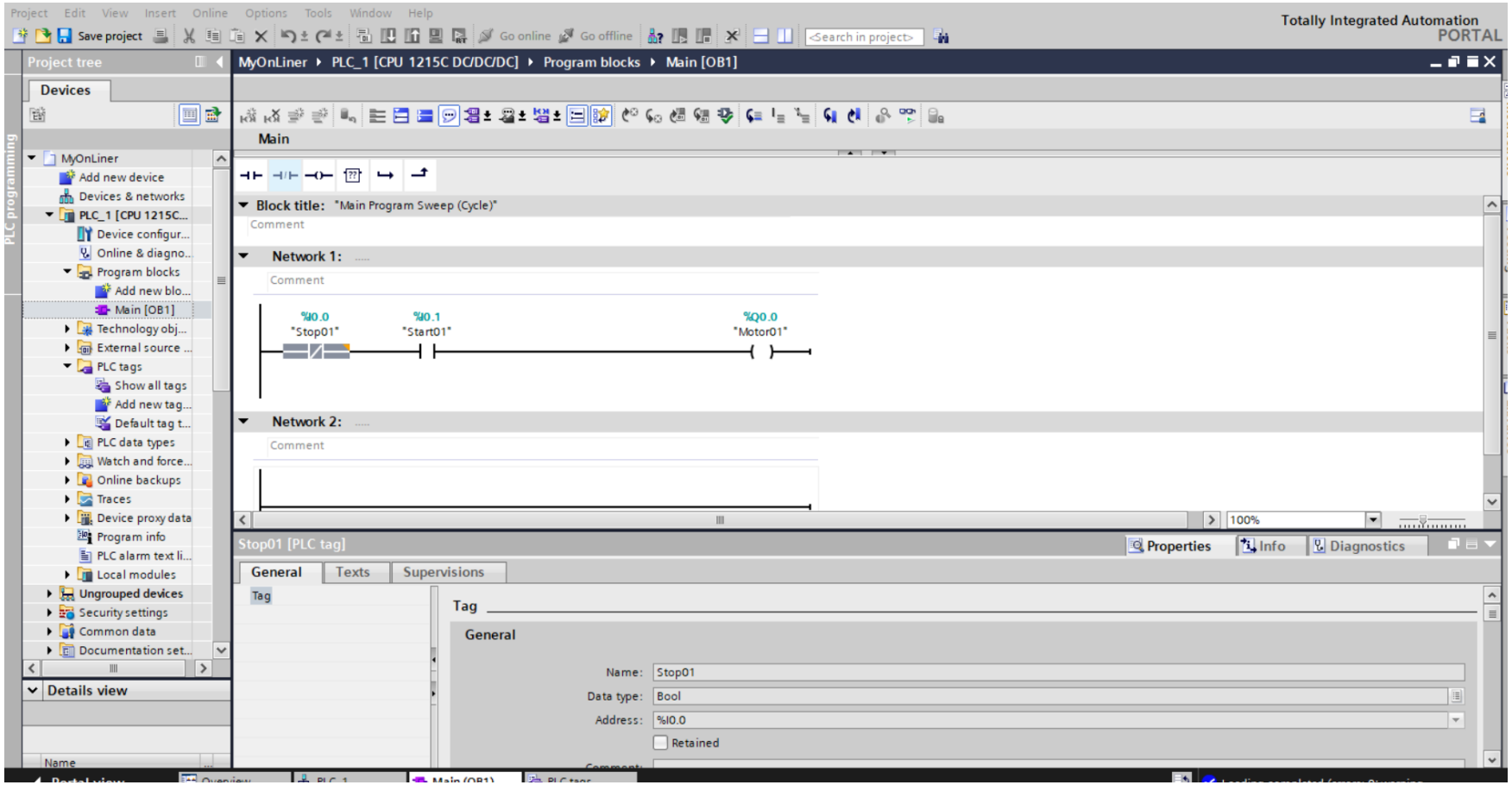
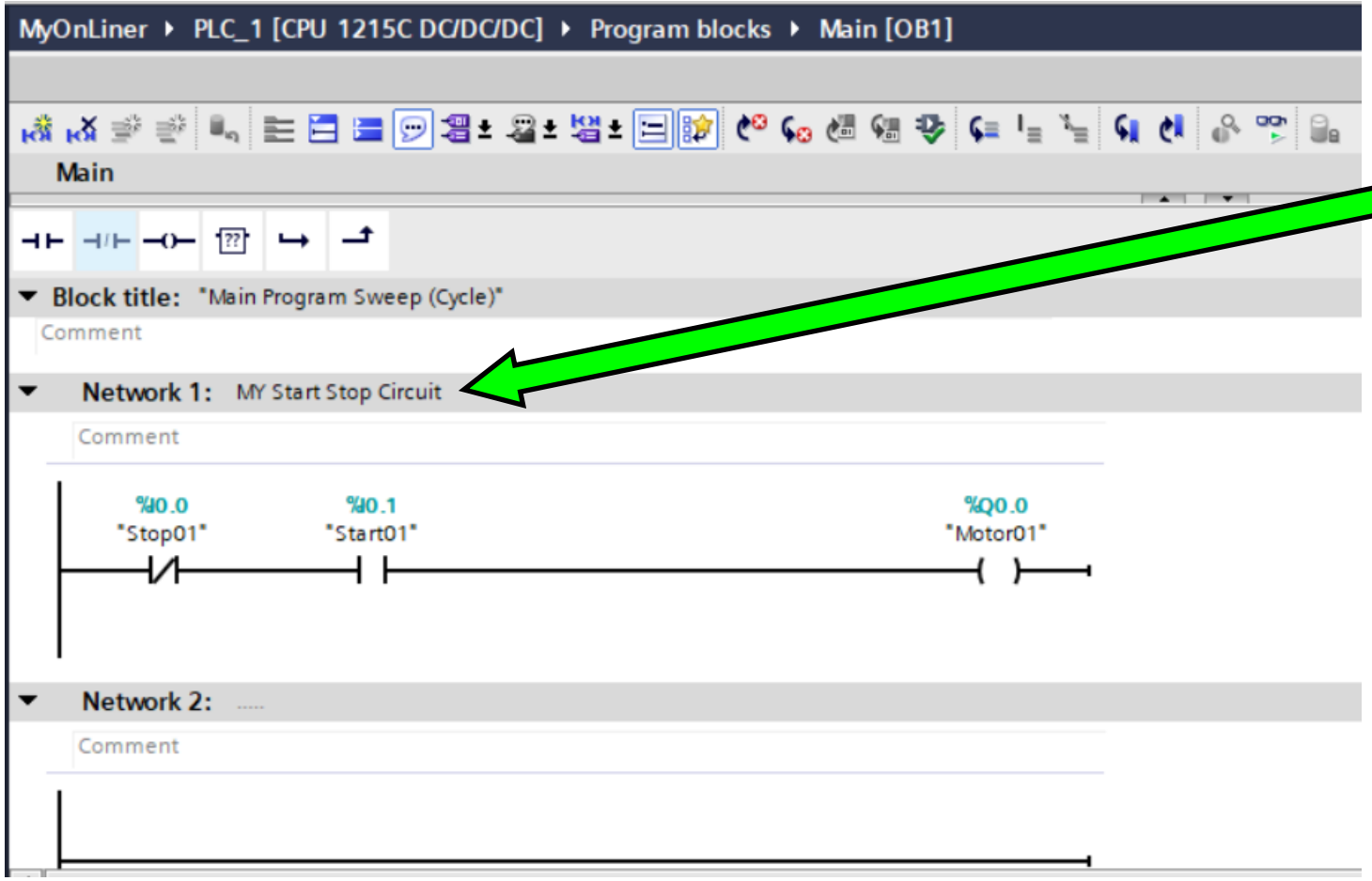
Programming Blocks

If everything went well, you have successfully downloaded your first project



Programming Blocks

Now give your network a description, then download again.



My Start Stop Circuit

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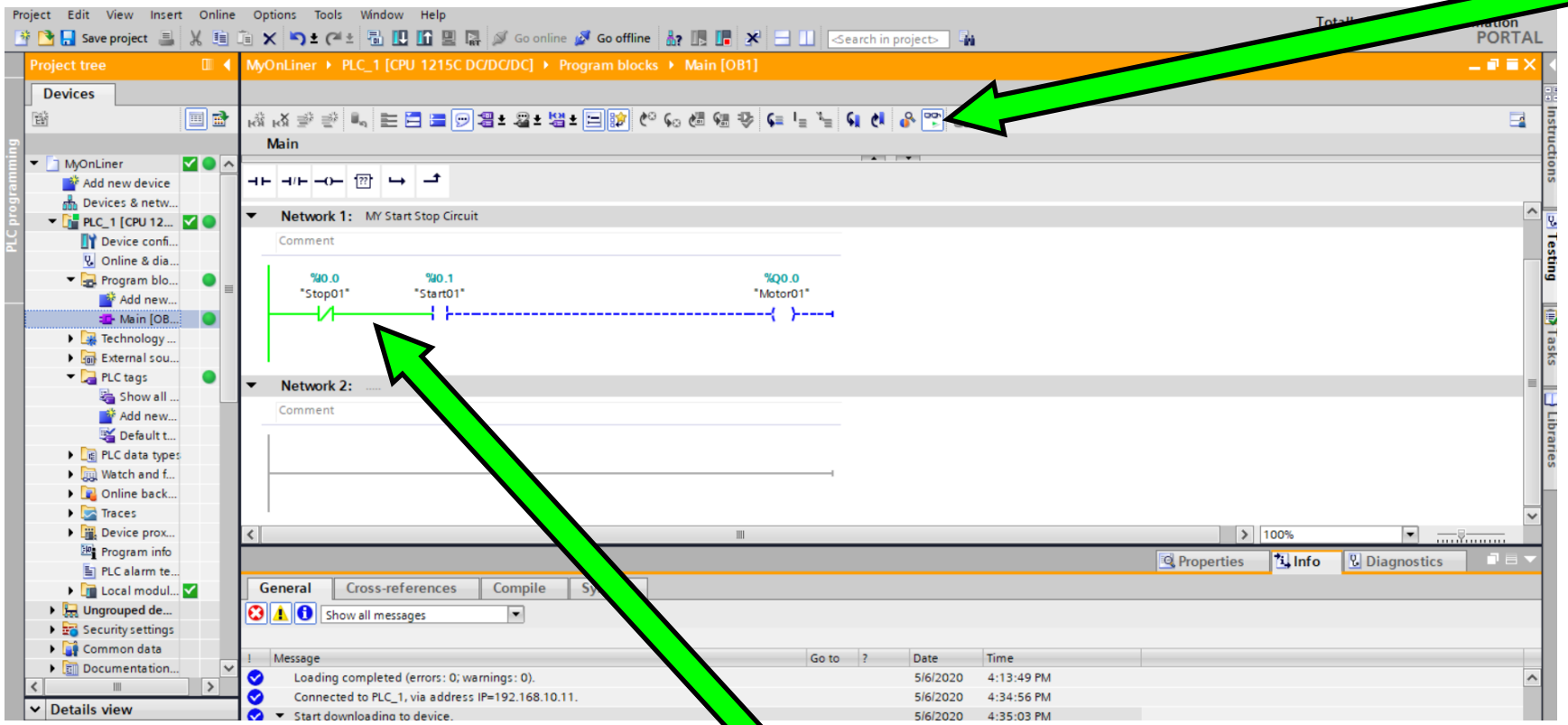
Programming Blocks

Now let's go on-line with the controller



On-Line Icon

Note … Green lines indicating power flow though the NC contact and stopping at the NO contact.

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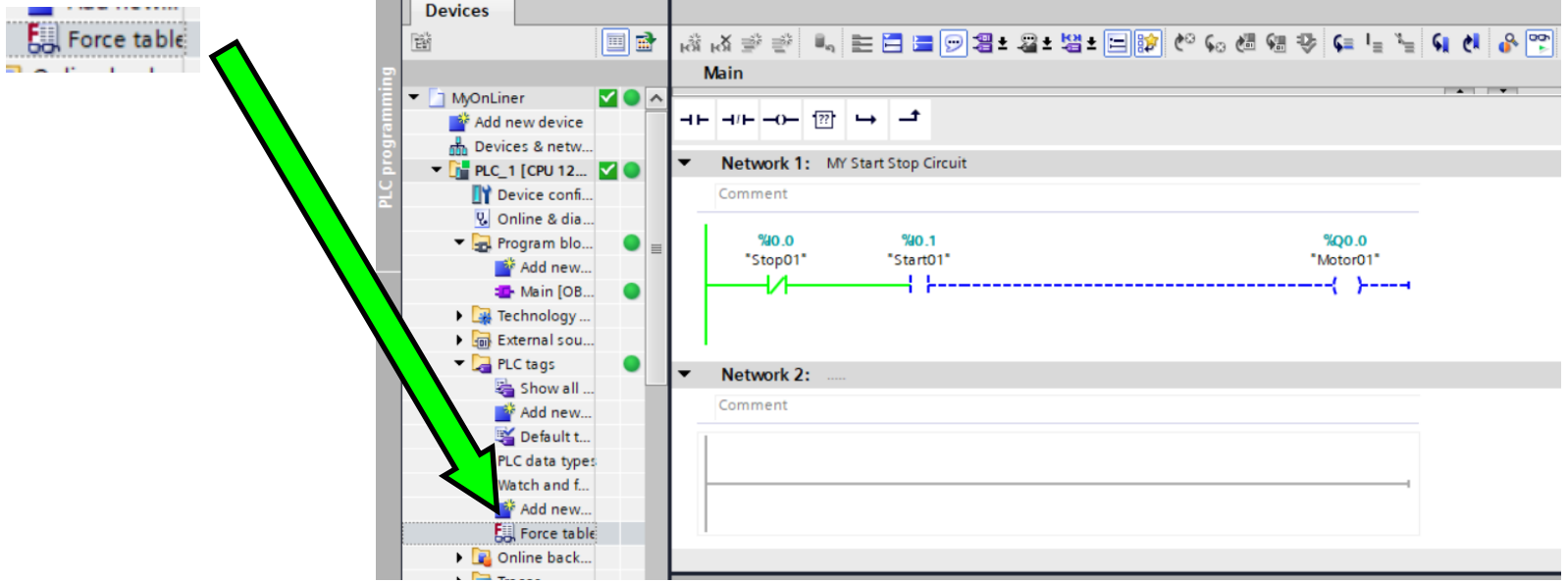
Programming Blocks

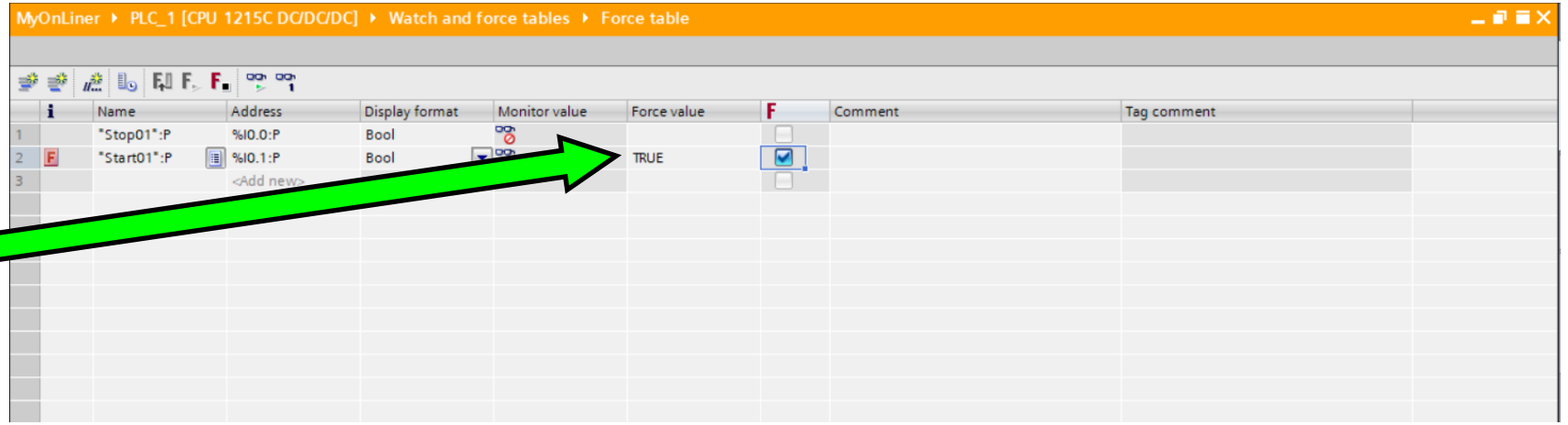
Now we must force
Because we are connected to the Real-World Inputs, which are designed to have push buttons connected to them. We can not turn them on because you are far away being remotely connected. We will use a command called force; this lets us override what the Real World Input is reading so we can test our program.
Go to Force table.



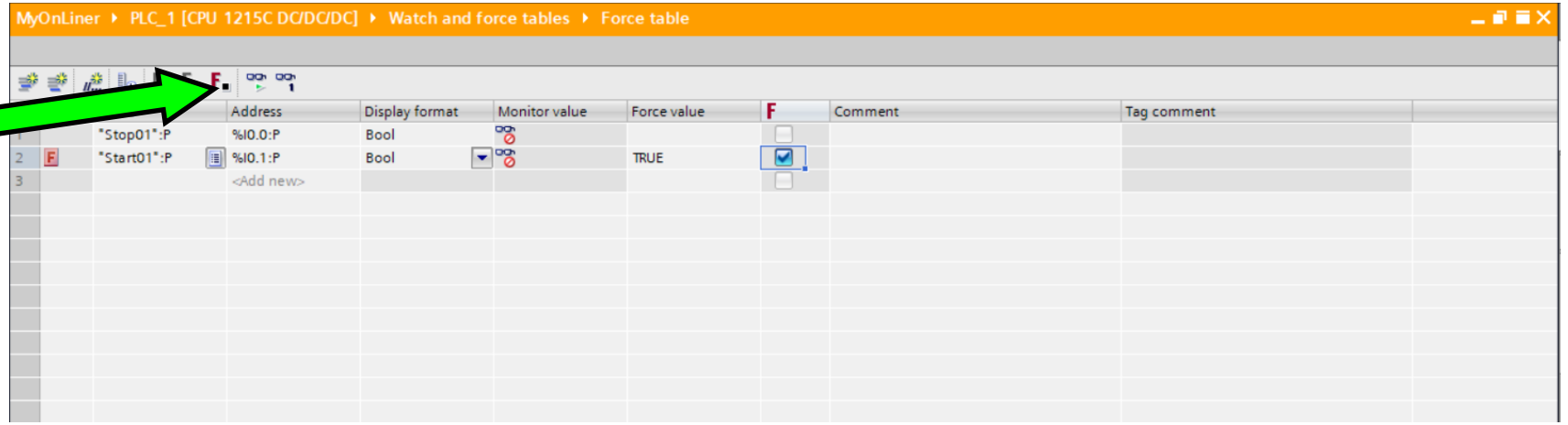
Programming Blocks

Type “True” under “Force value of your “Start01”

TRUE

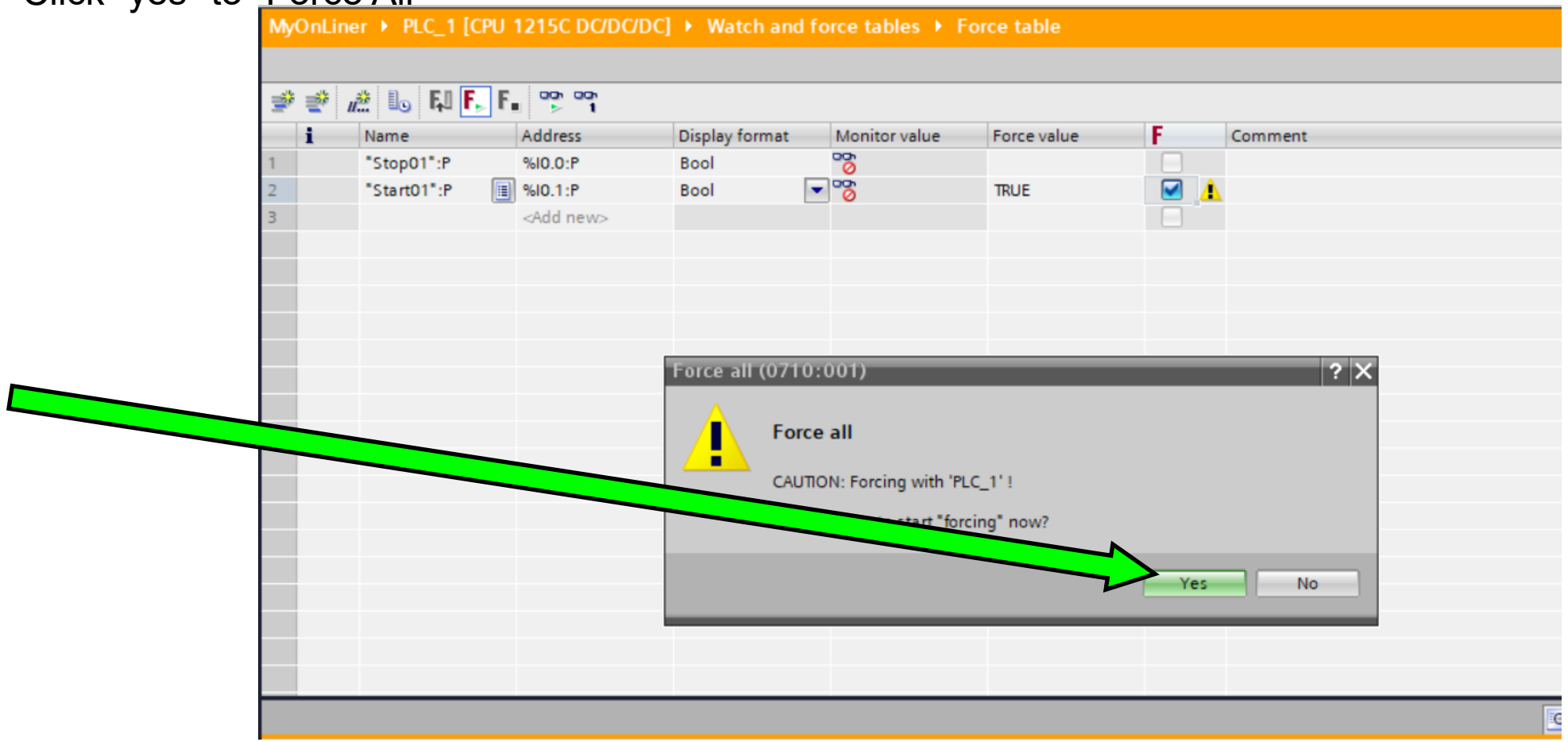


Click Icon to “Force All”



Programming Blocks

Click “yes” to “Force All”



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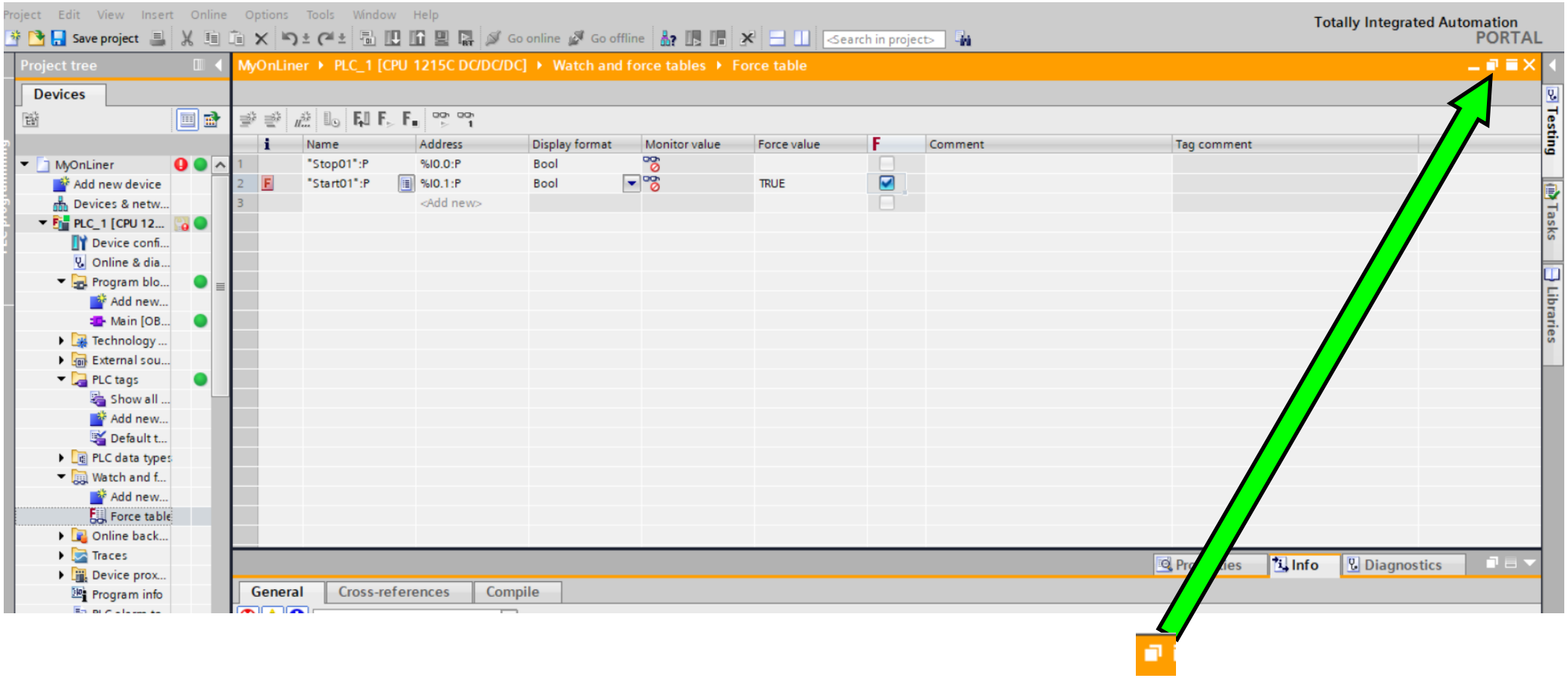
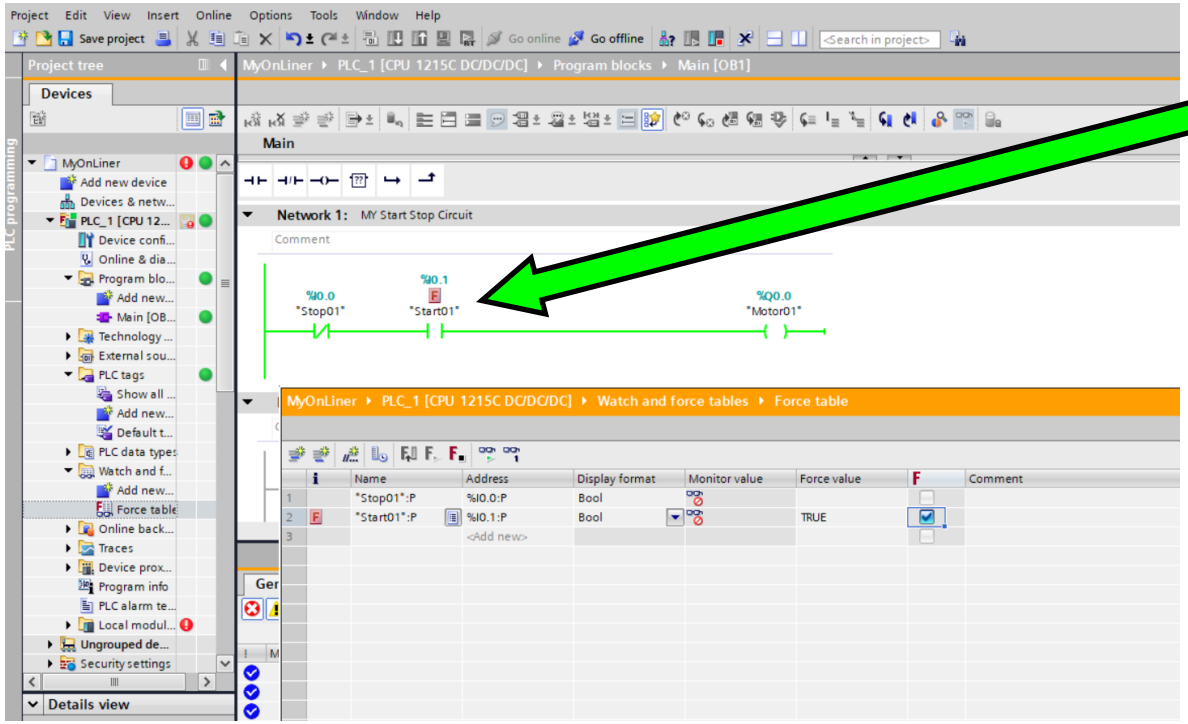
Programming Blocks

Now float again

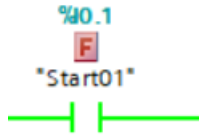


Programming Blocks

Move screen near bottom, now on your network you will see that I0.0 Start01 is Forced on and power flow now goes though and turn the coil on.



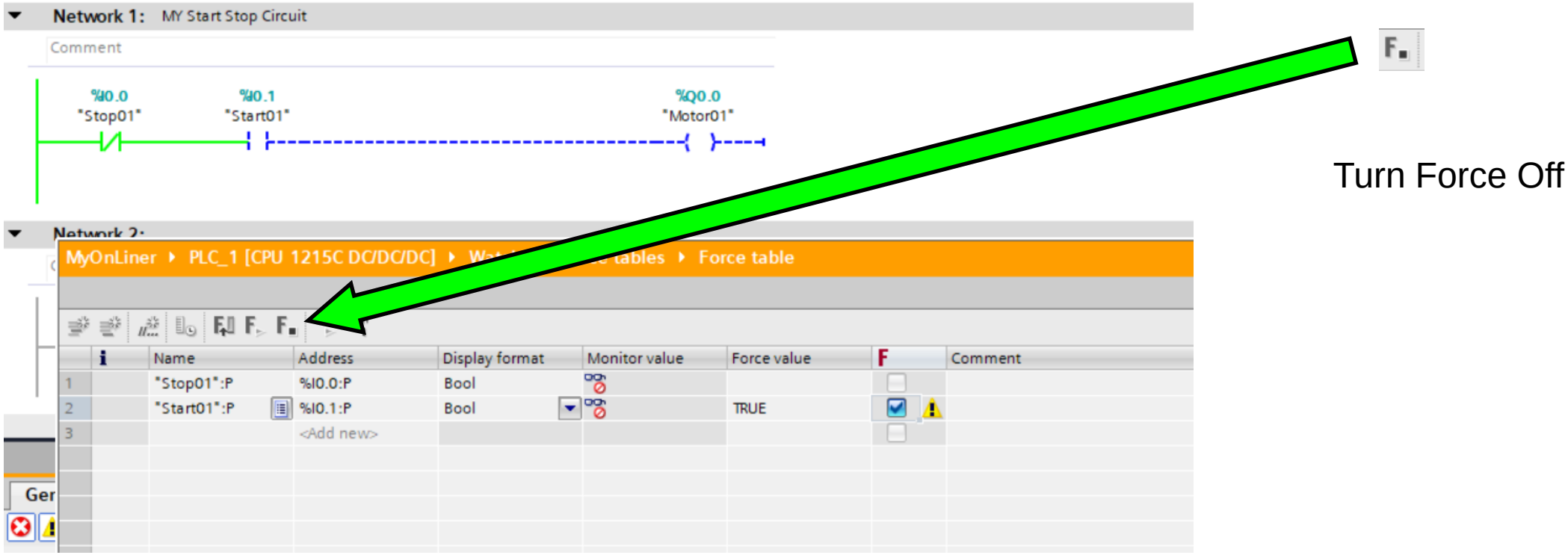
Force on contact



Now change Force value back to “False and see how the coil goes off.
This will be used through the rest of the training!

Programming Blocks

Now turn the “Force Off” and see how we lose power to the coil.



Turn Force Off

This will be used through the rest of the training!

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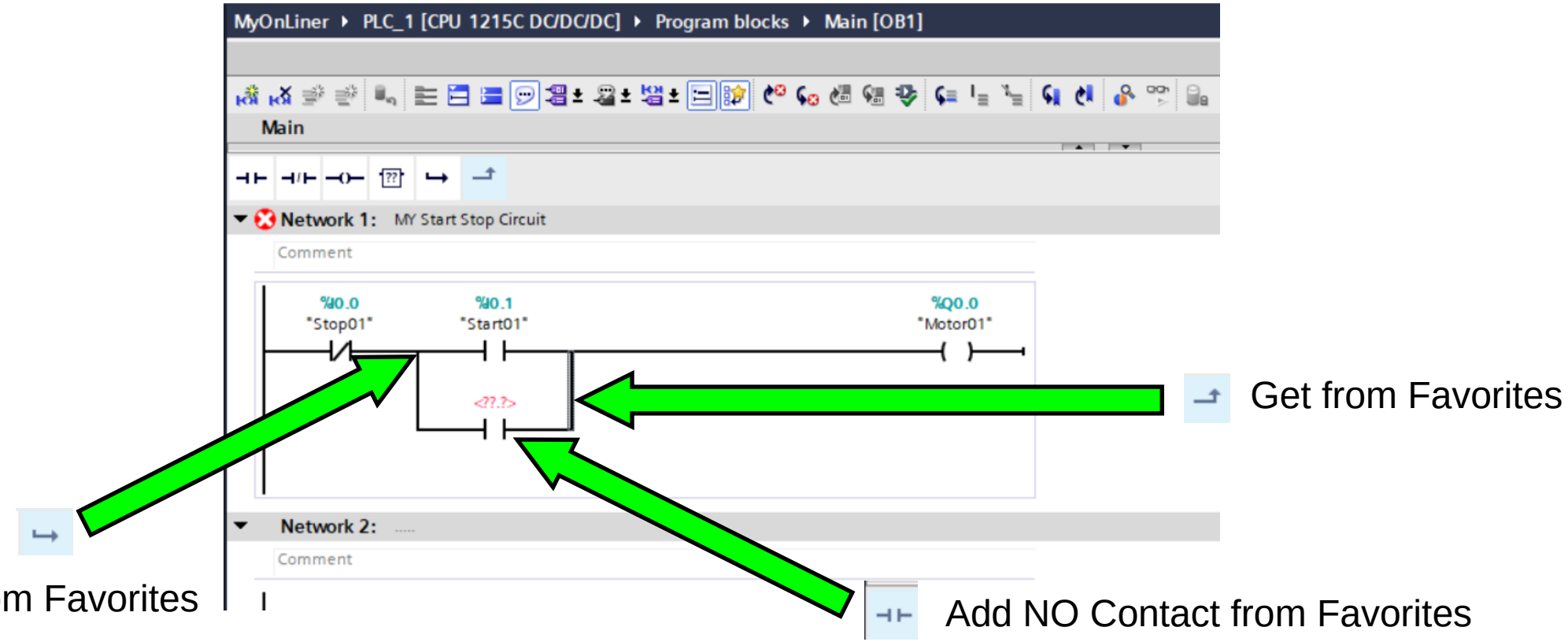
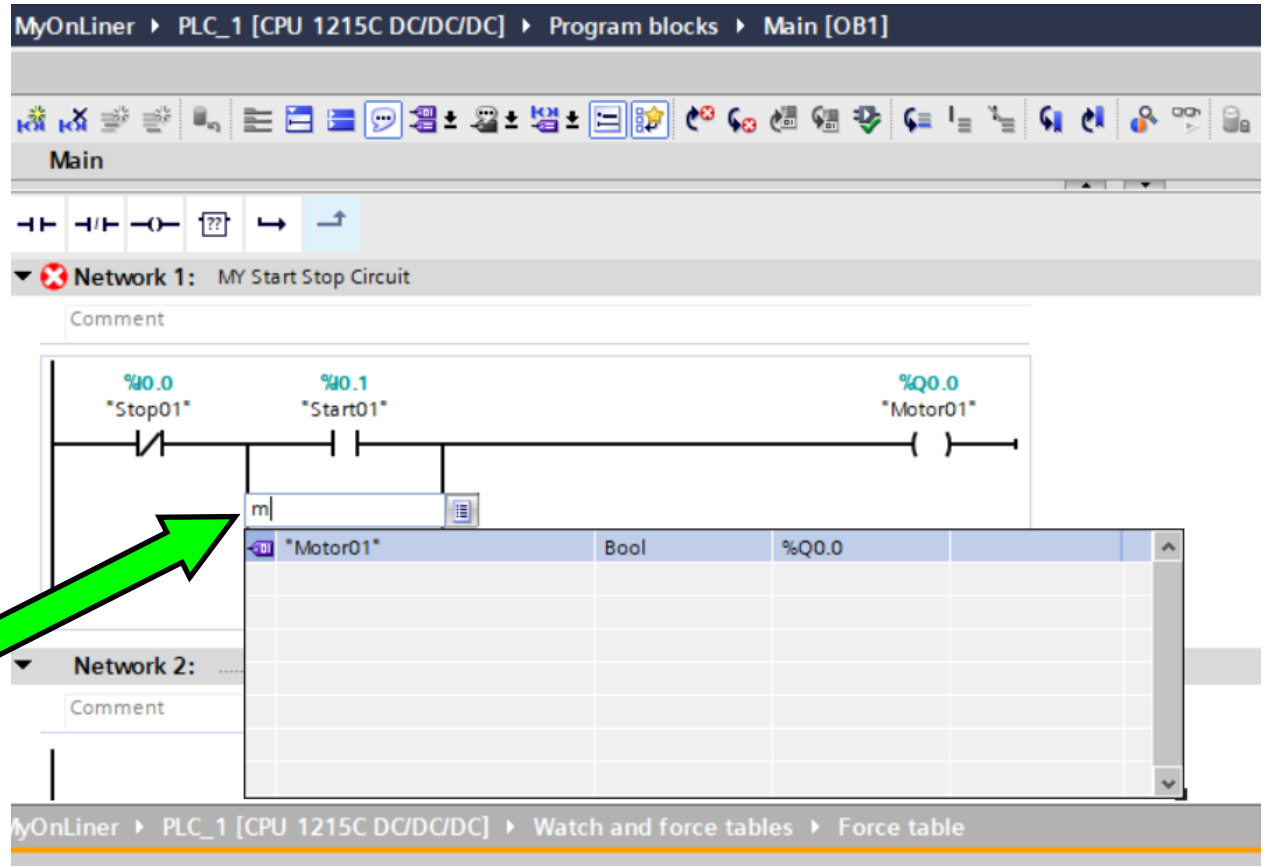
Programming Blocks

Creating a latch.



Programming Blocks

Add Motor01 Tag



Type “m”
Enter
Enter
Loads “Motor01” Tag

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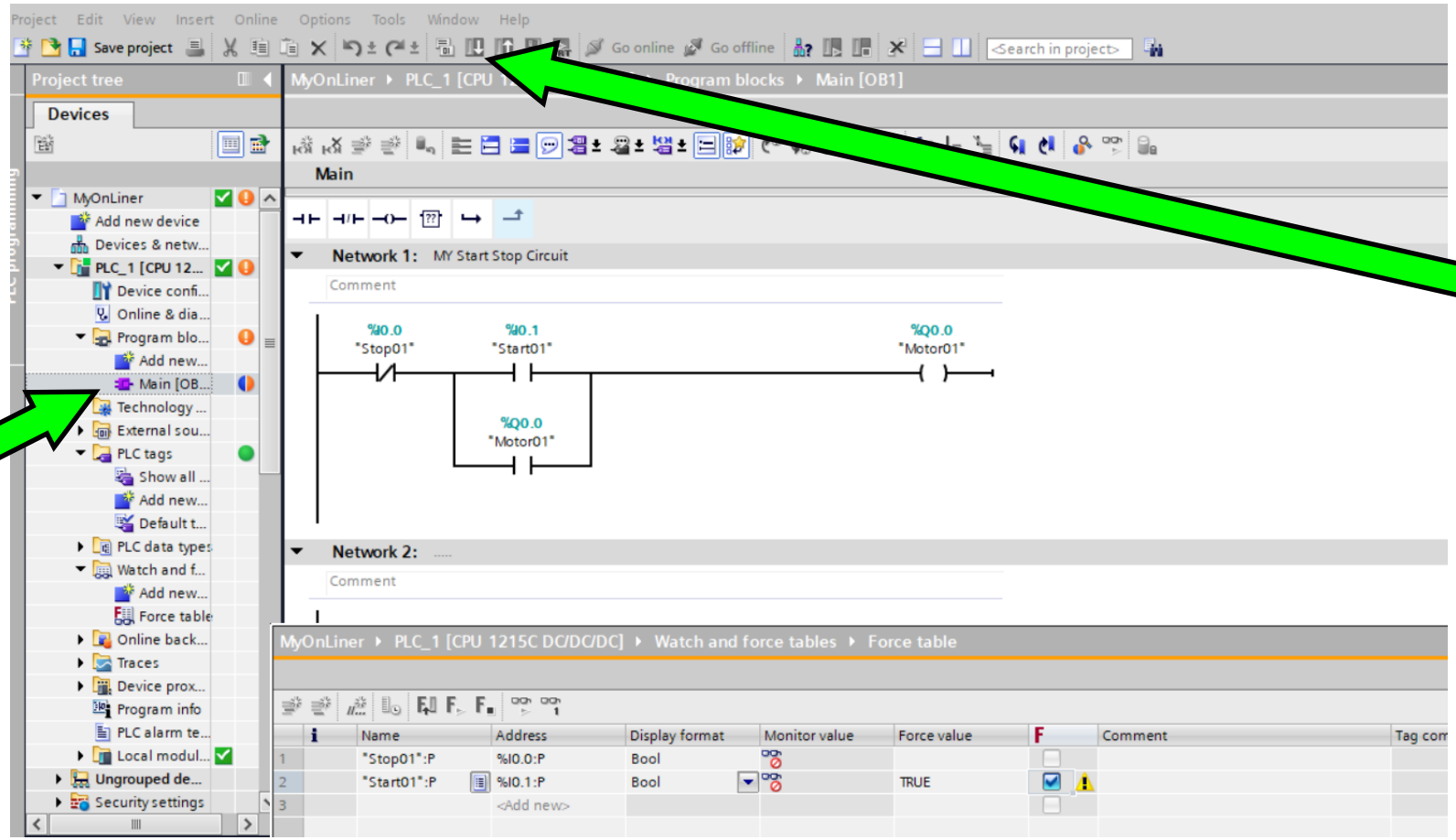
Programming Blocks

Add Motor01 Tag



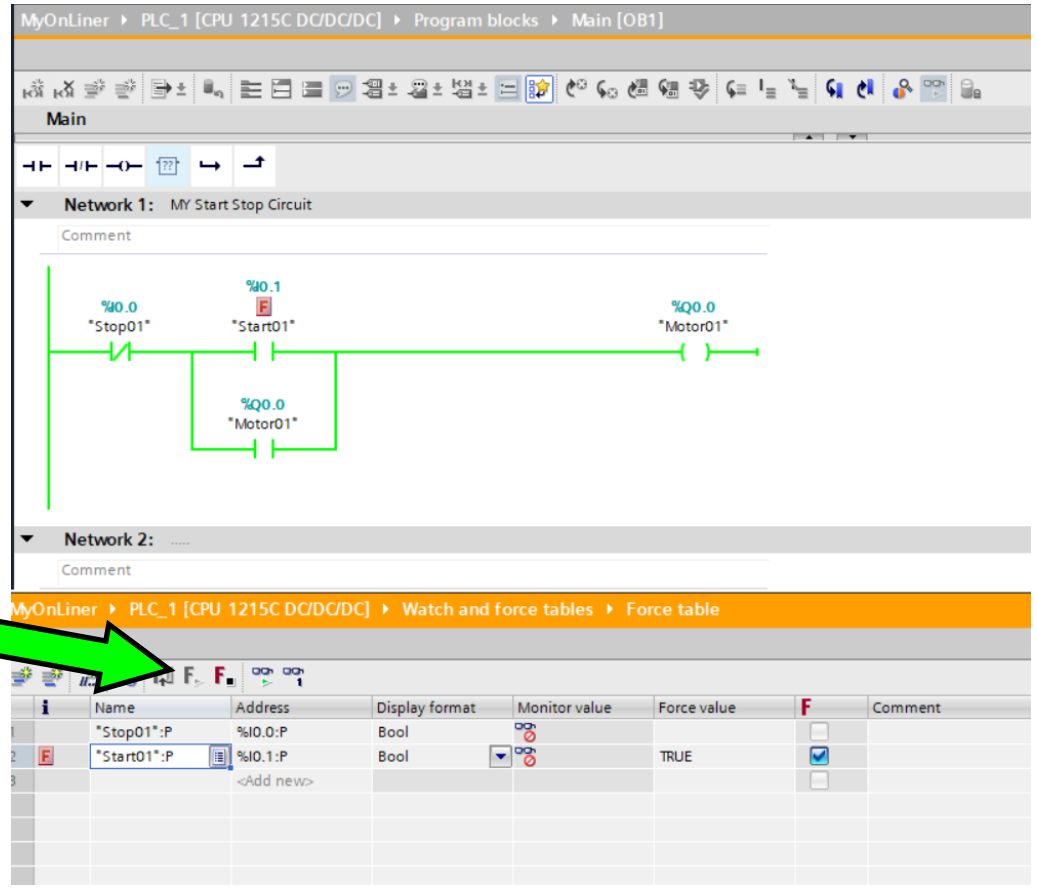
Download

Main [OB...

Click Main OB1

Programming Blocks

Force one more time



Click Force All

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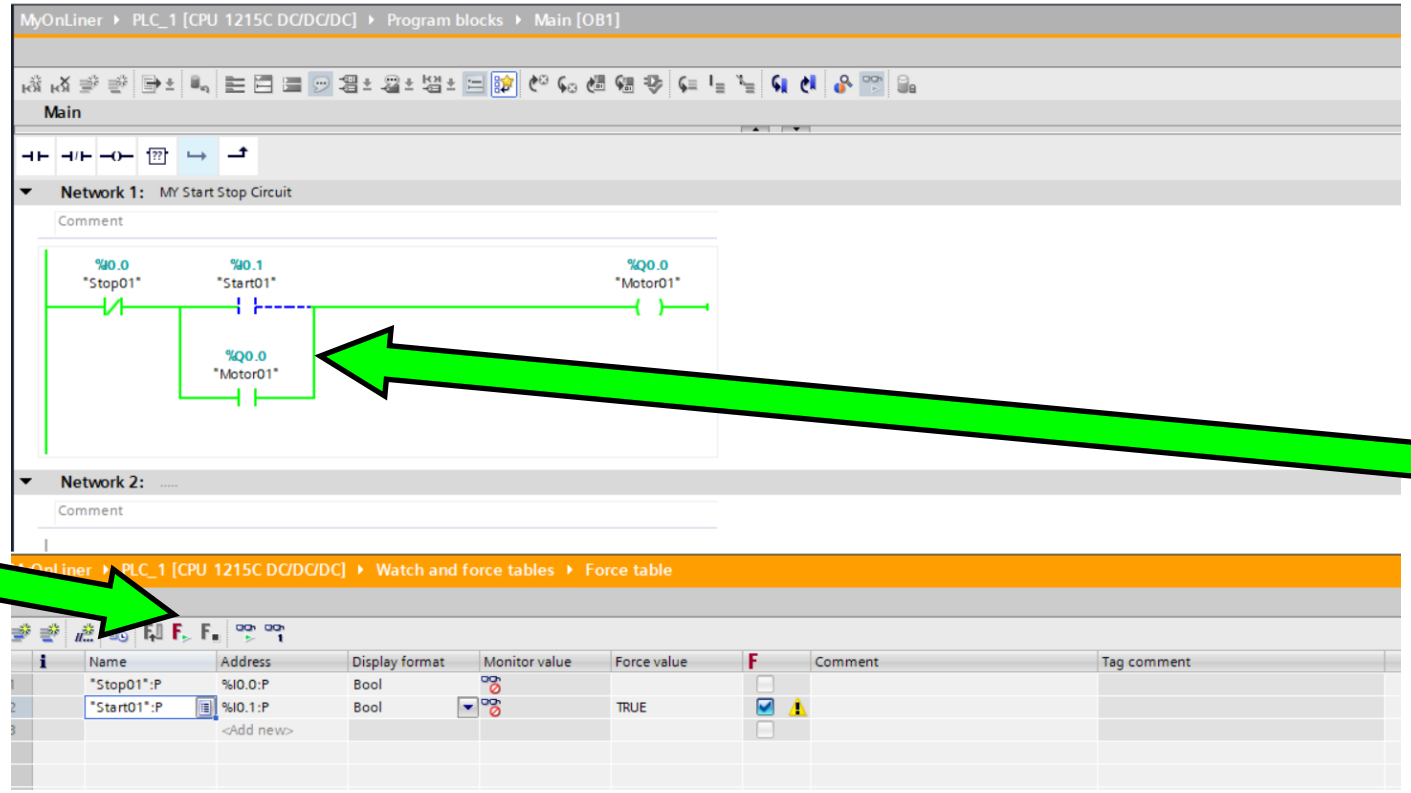
Programming Blocks

Unforce one more time



Click Unforce All

Note now that you have created what is called a Latch.

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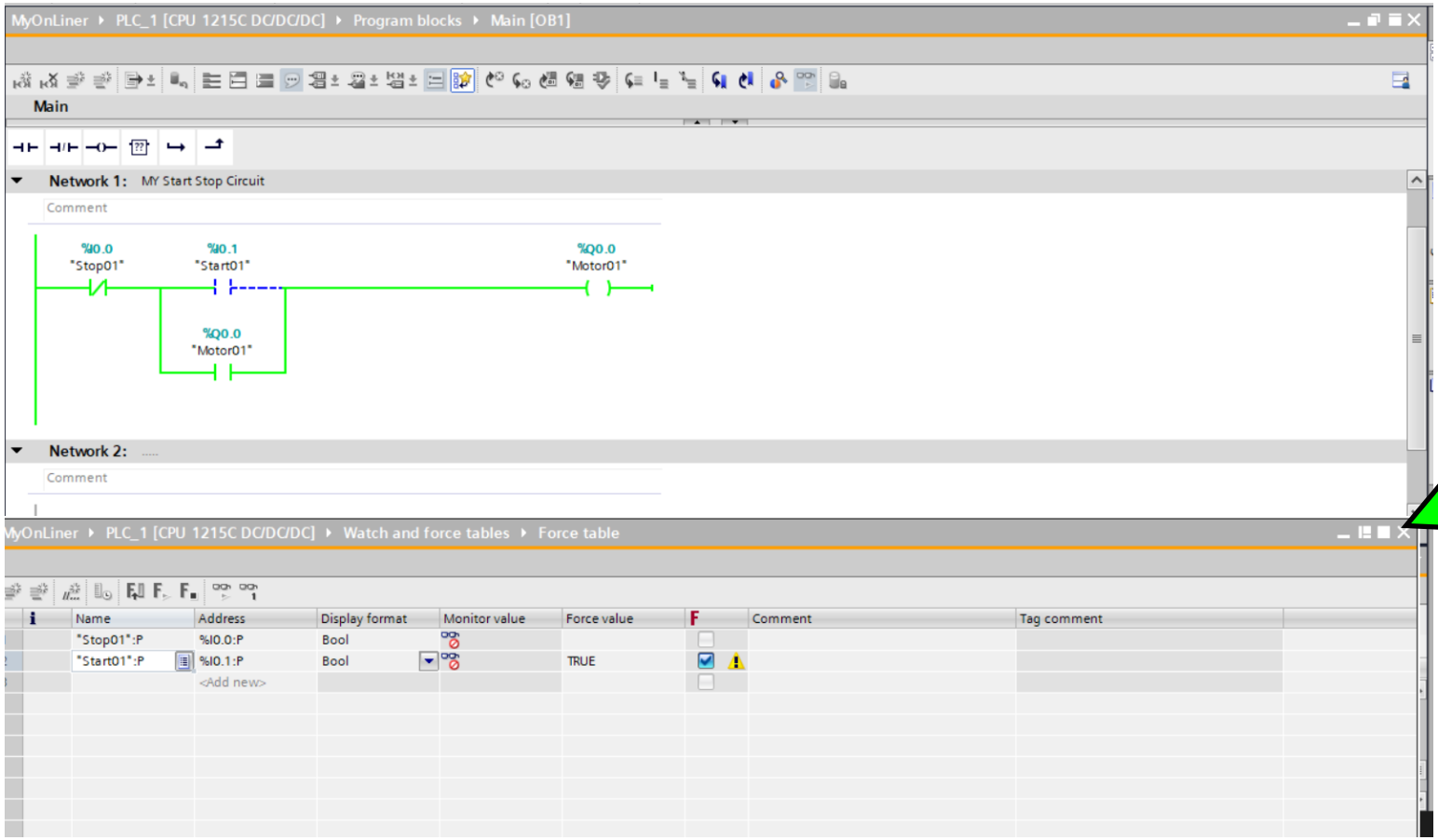
Programming Blocks

Close Force Window

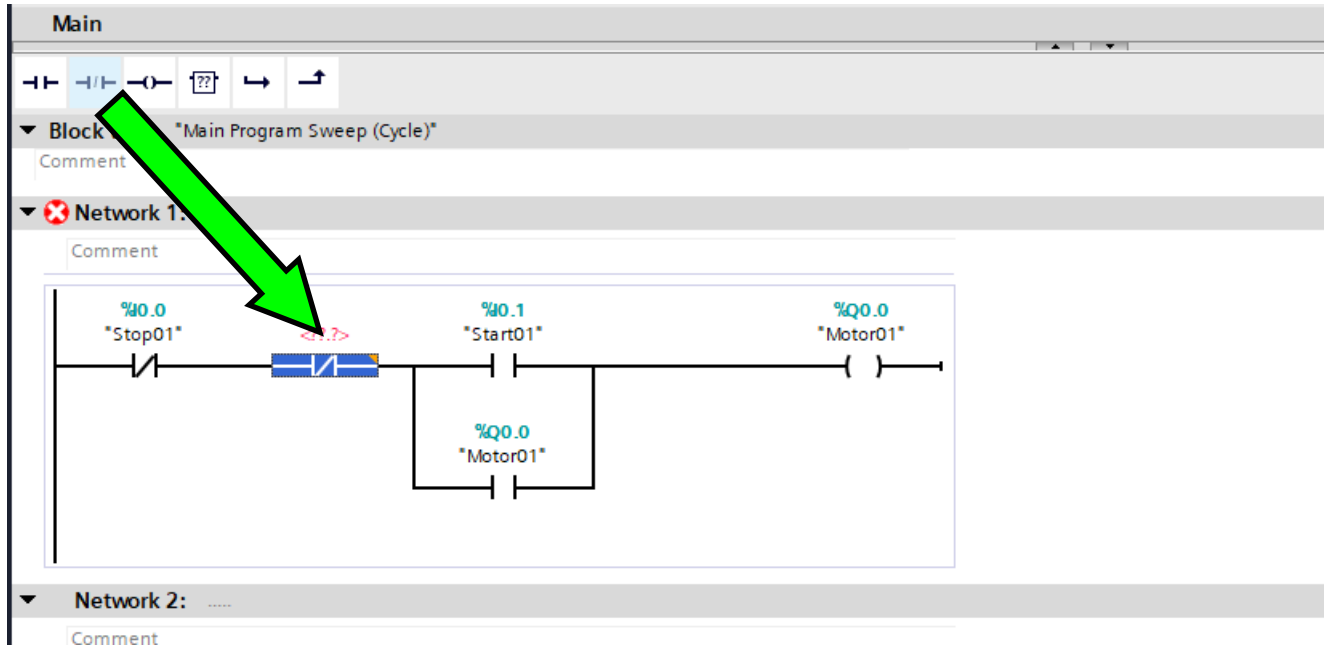


Click and Close Force window

Programming Blocks

Add two internal contacts

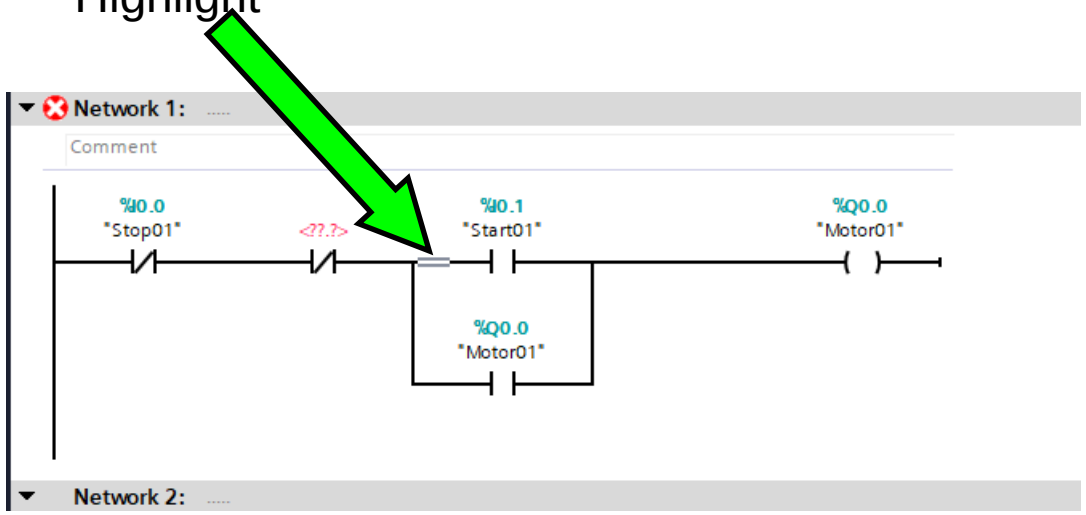
Click



Programming Blocks

Add two internal contacts

Highlight



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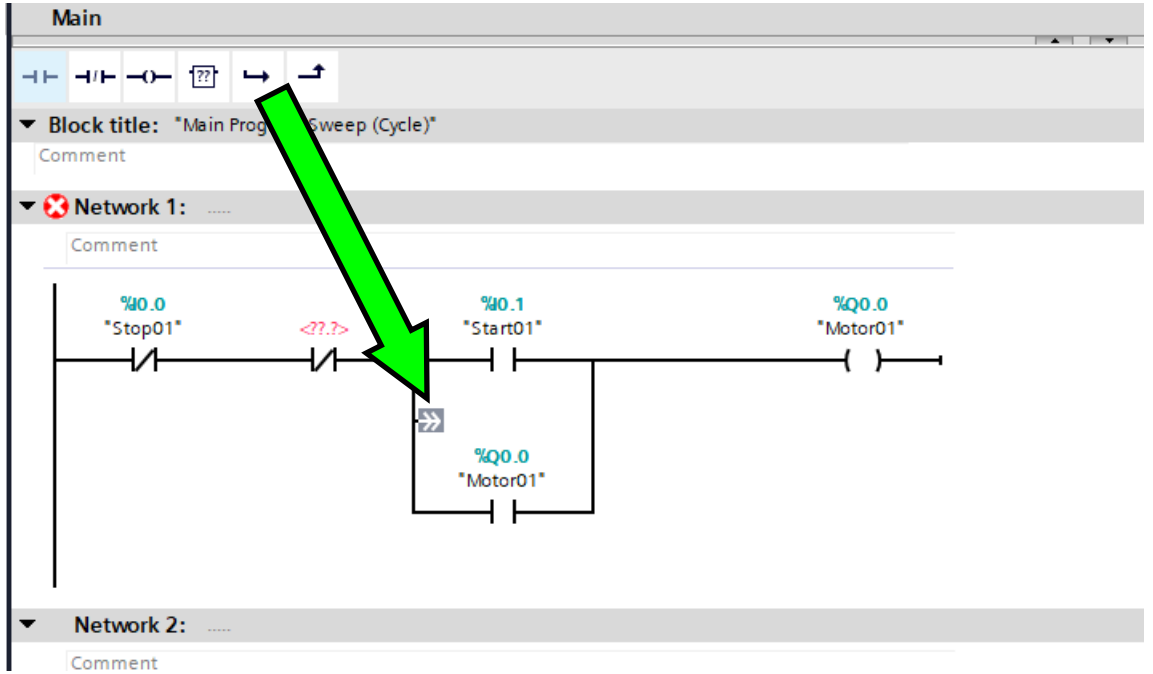
Programming Blocks

Add two internal contacts

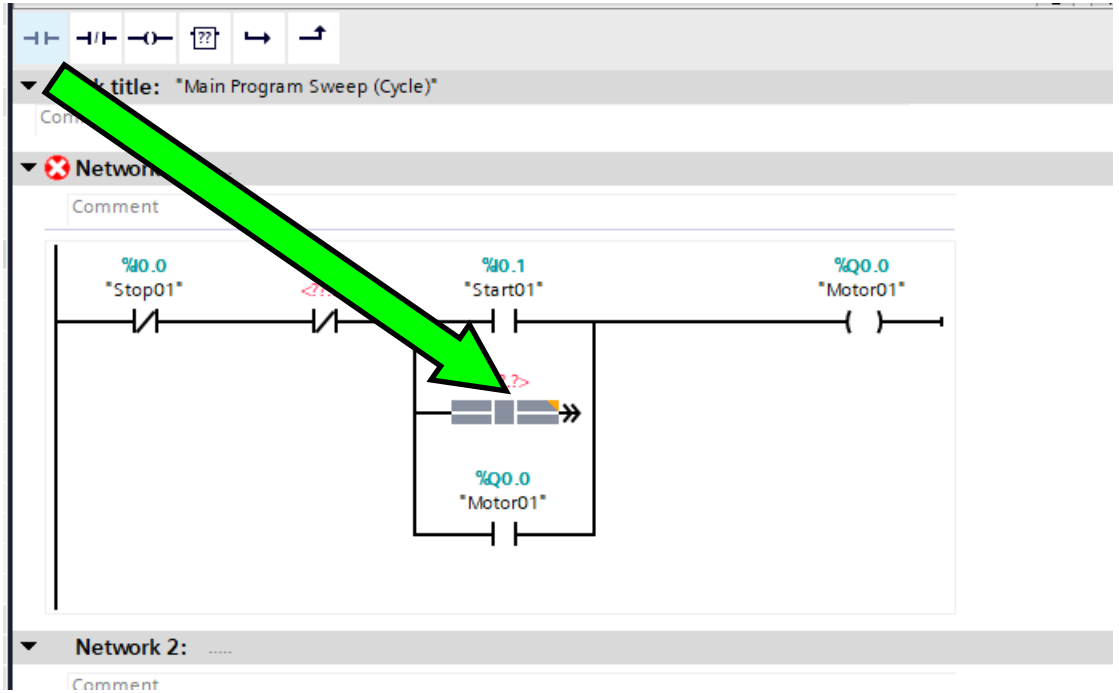
Click 



Programming Blocks

Add two internal contacts

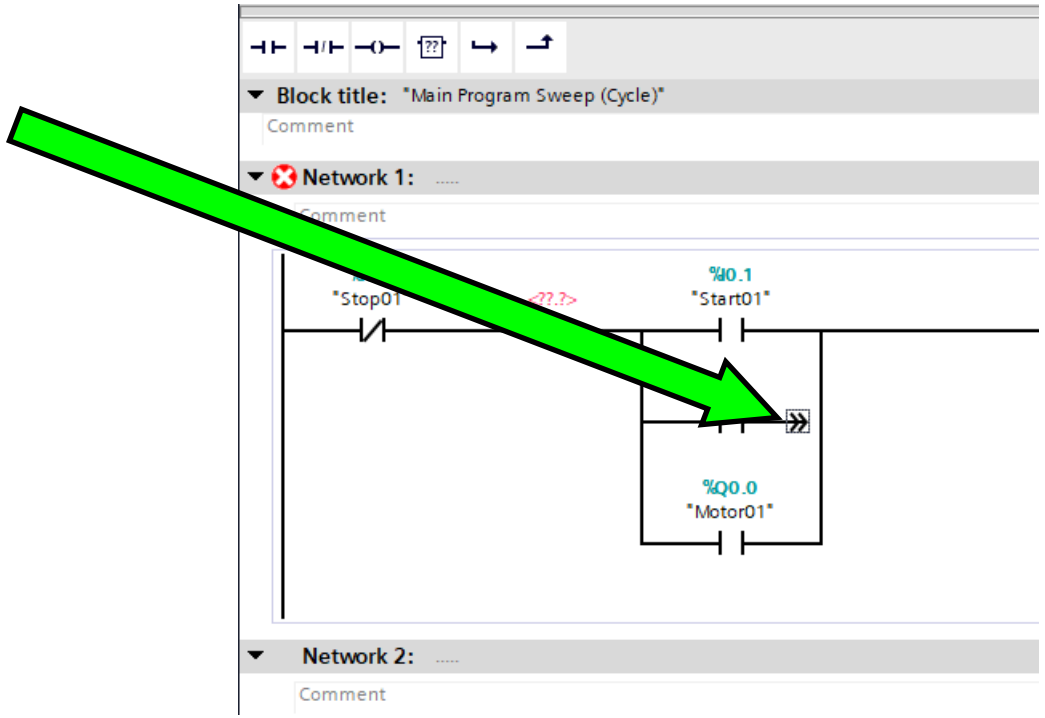
Click



Programming Blocks

Add two internal contacts

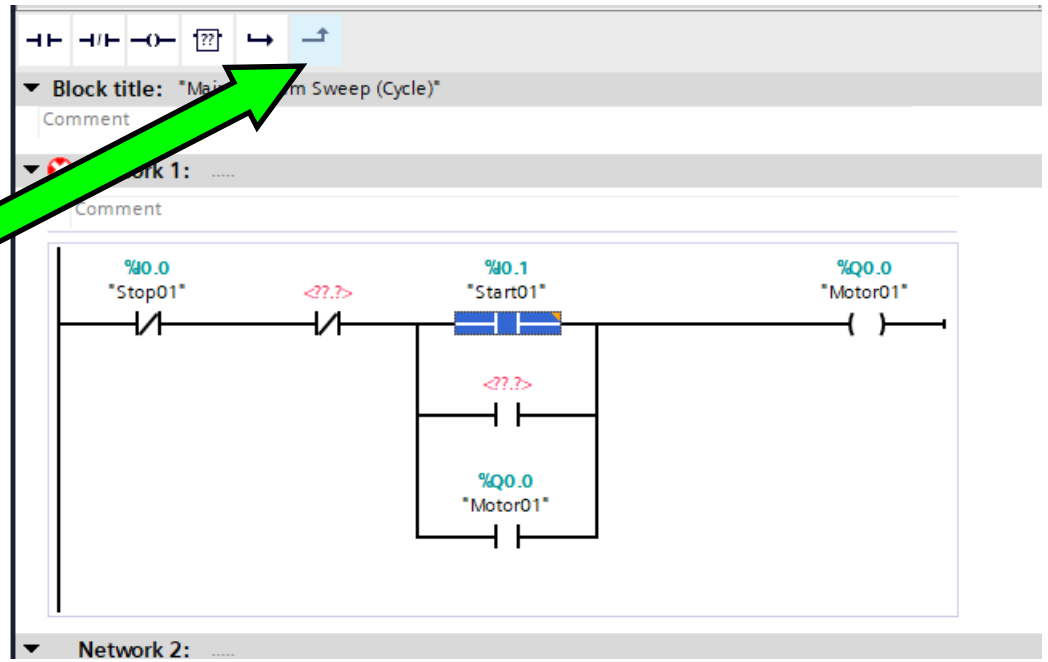
Highlight



Programming Blocks

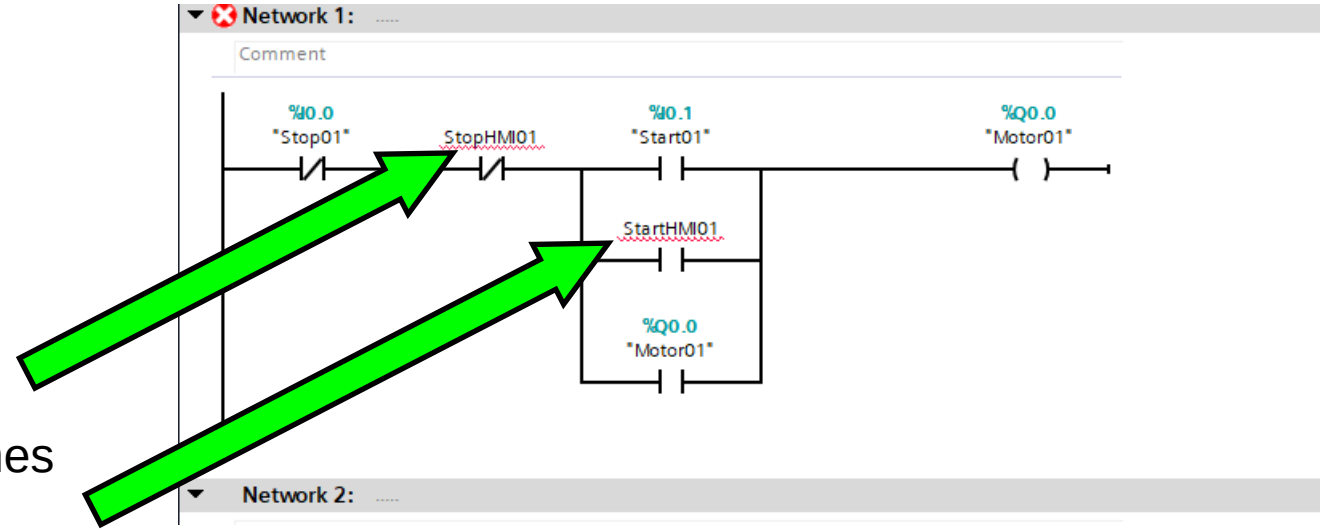
Add two internal contacts

Click 



Programming Blocks

Add two internal contacts



Add Tag Names

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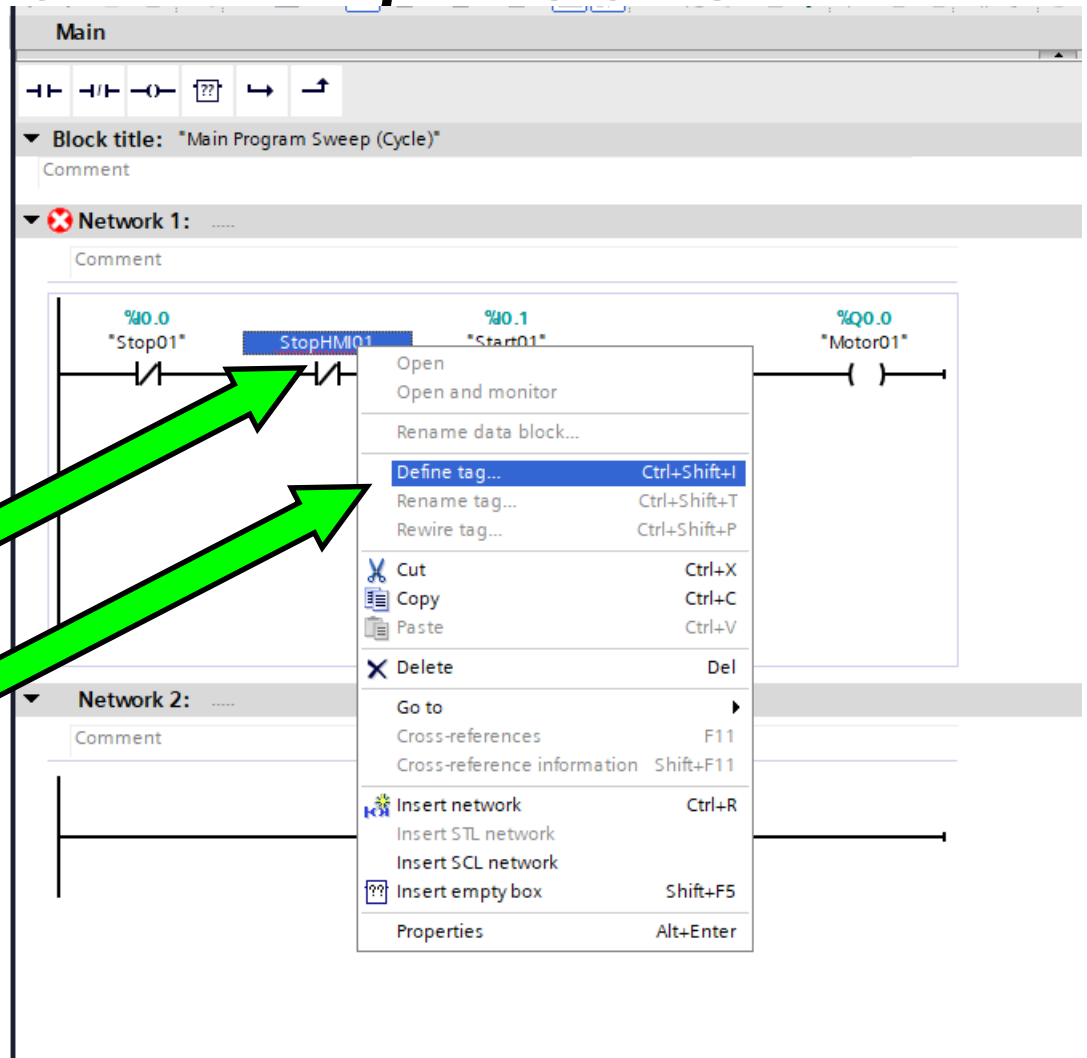
Programming Blocks

Add two internal contacts



Right Click on StopHMI01
Then Click Define tag

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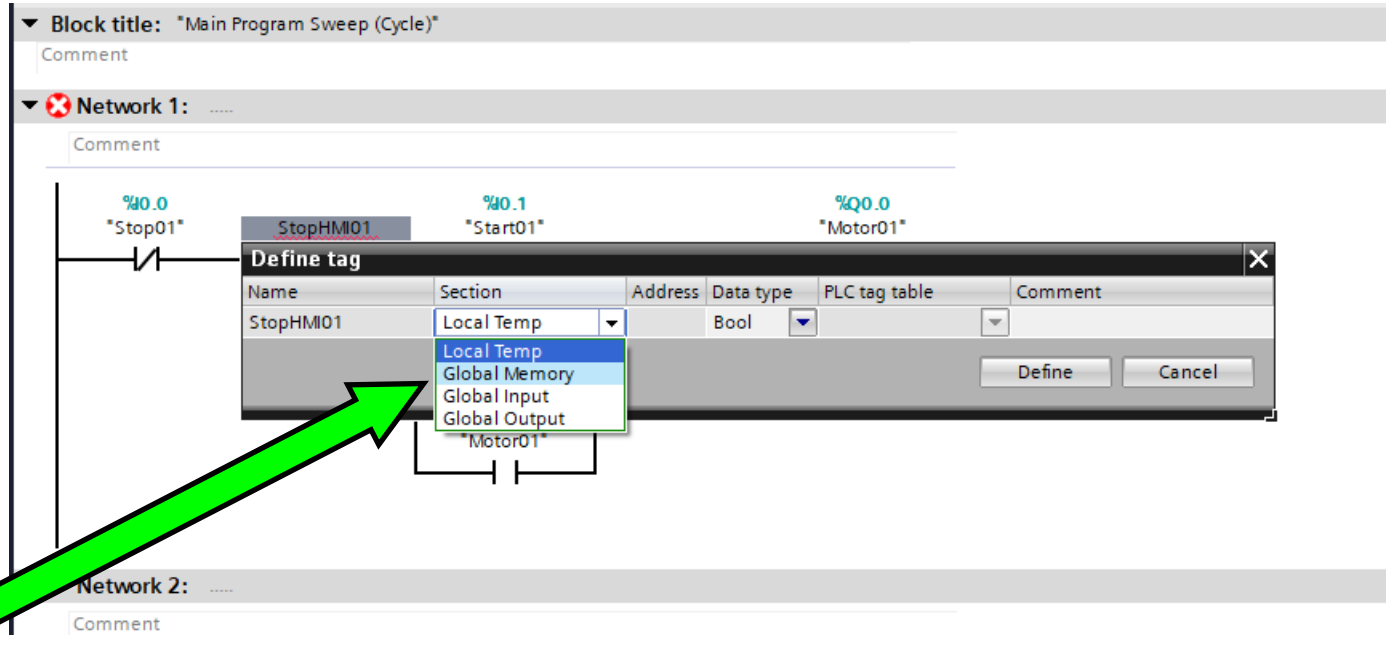
Programming Blocks

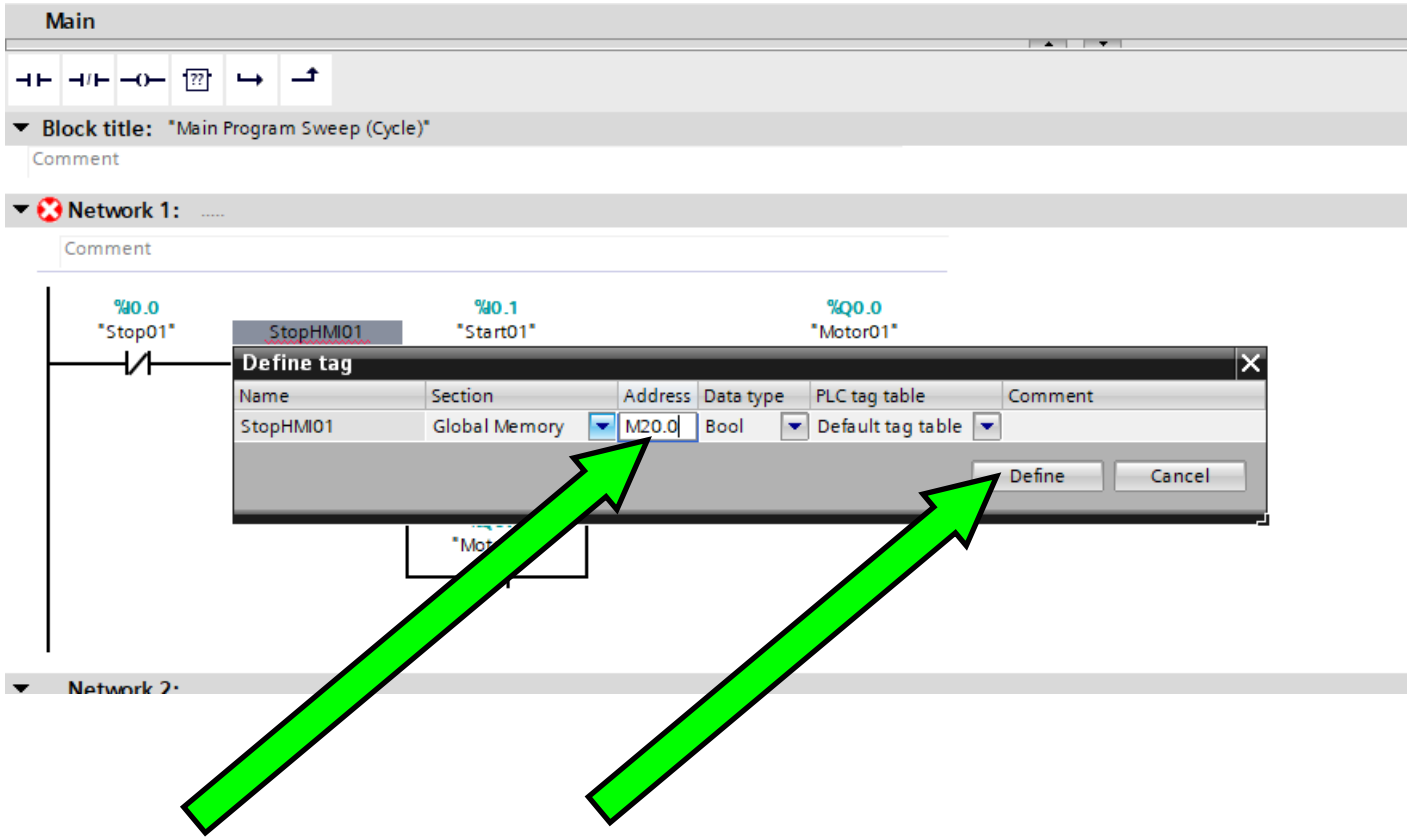
Add two internal contacts



Click Global Memory

Programming Blocks

Add two internal contacts

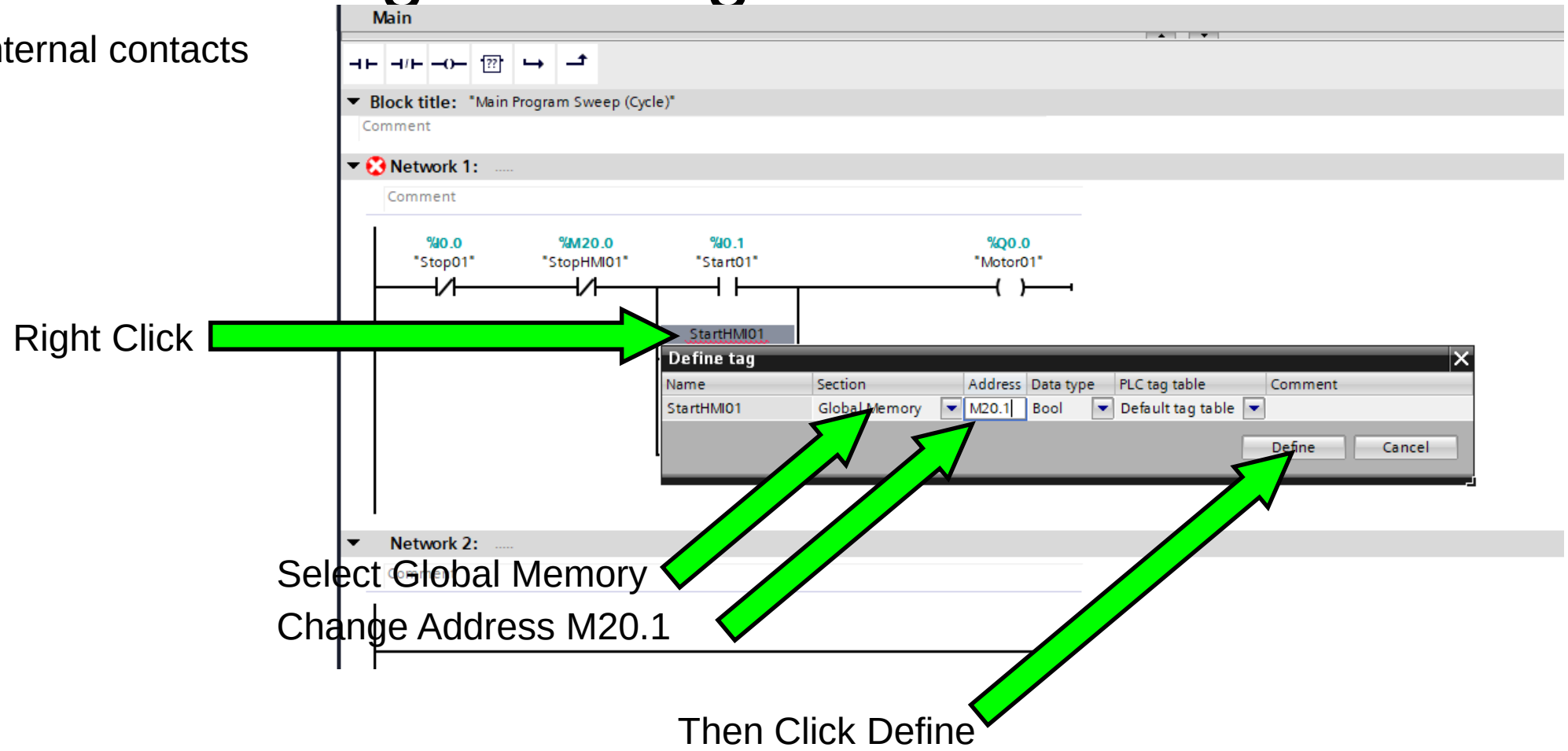


Change Address to: M20.0

Then Click Define

Programming Blocks

Add two internal contacts



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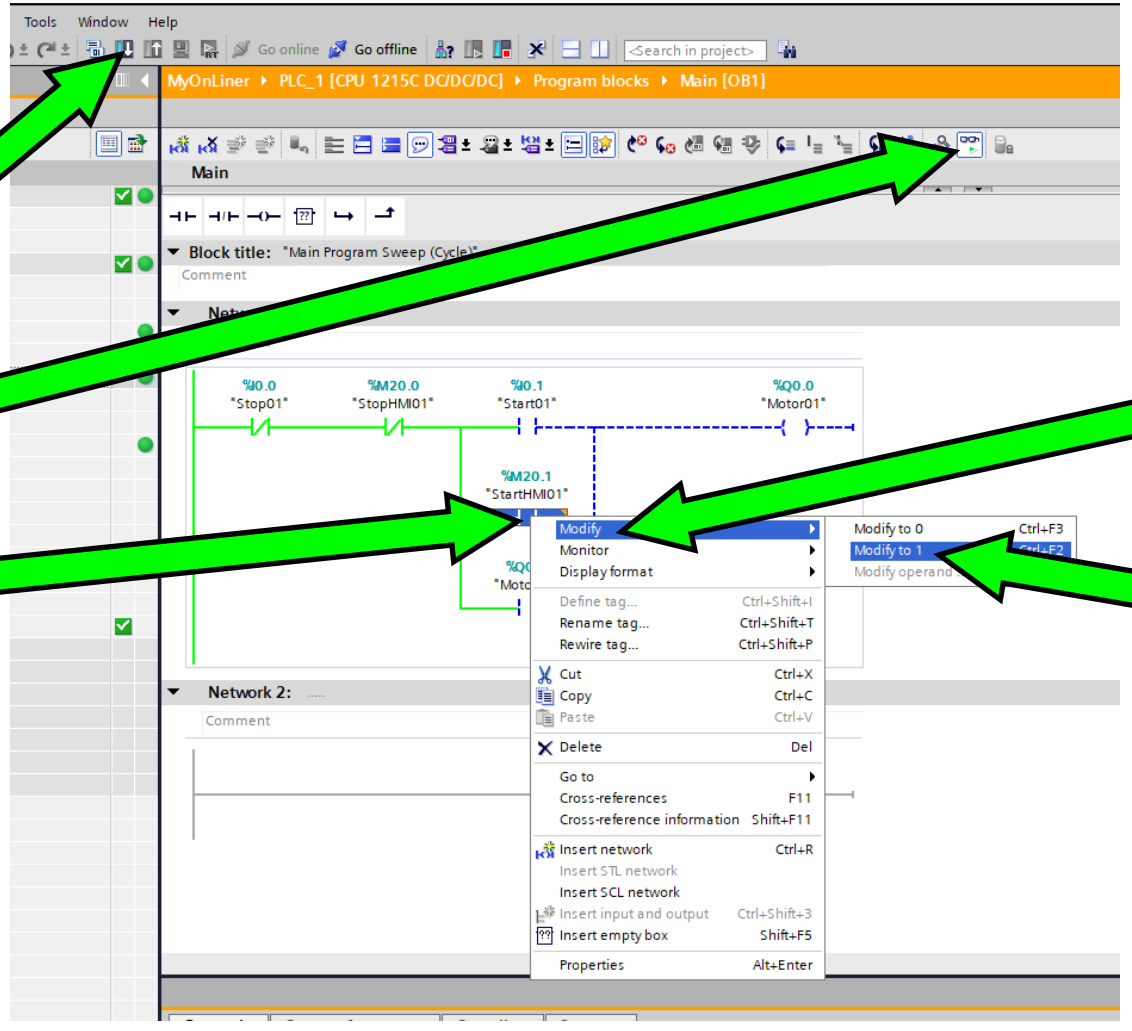
Programming Blocks

Add two internal contacts

Download

Motoring ON

Right Click



Modify

Modify to 1

Select Global Memory

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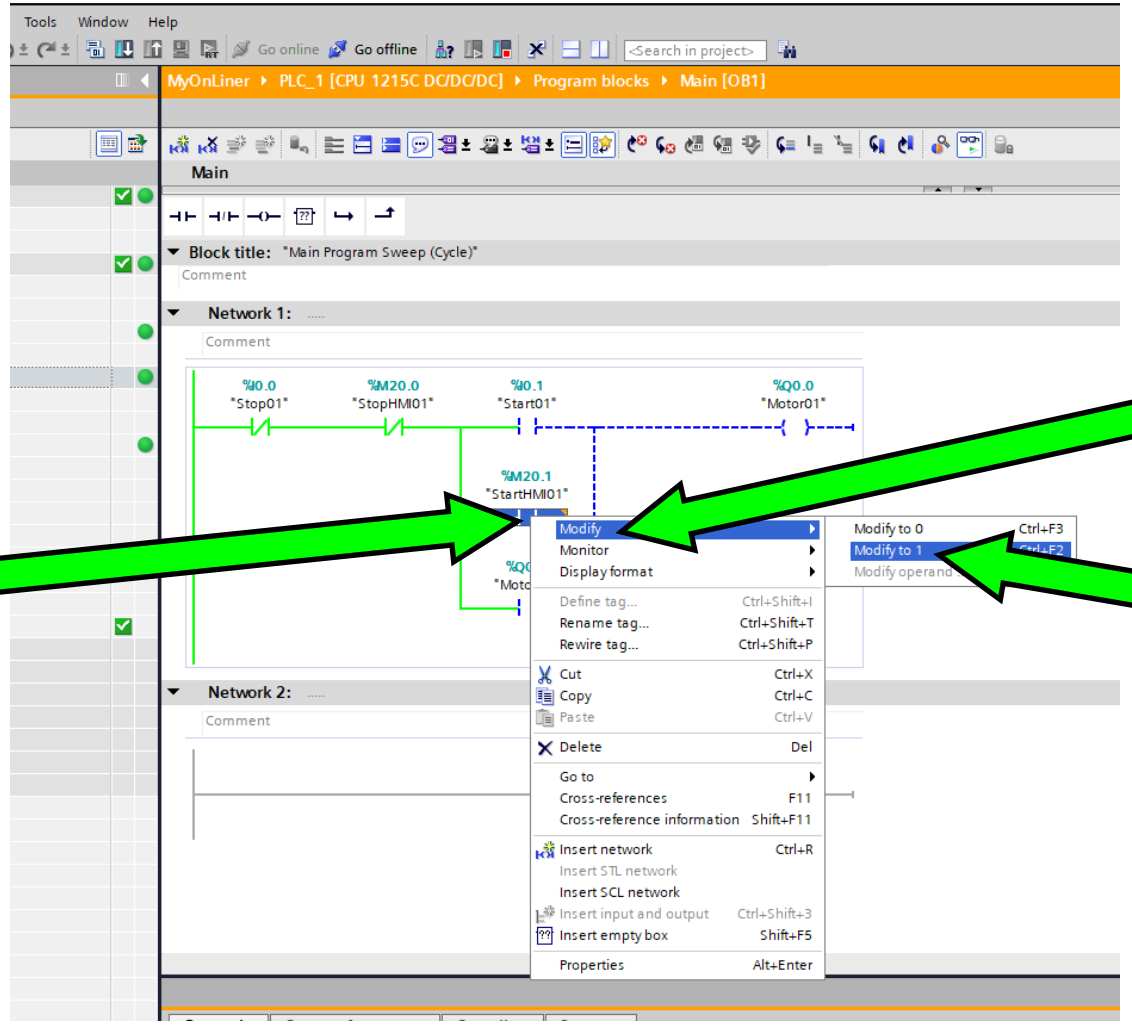
Programming Blocks

Add two internal contacts



Modify

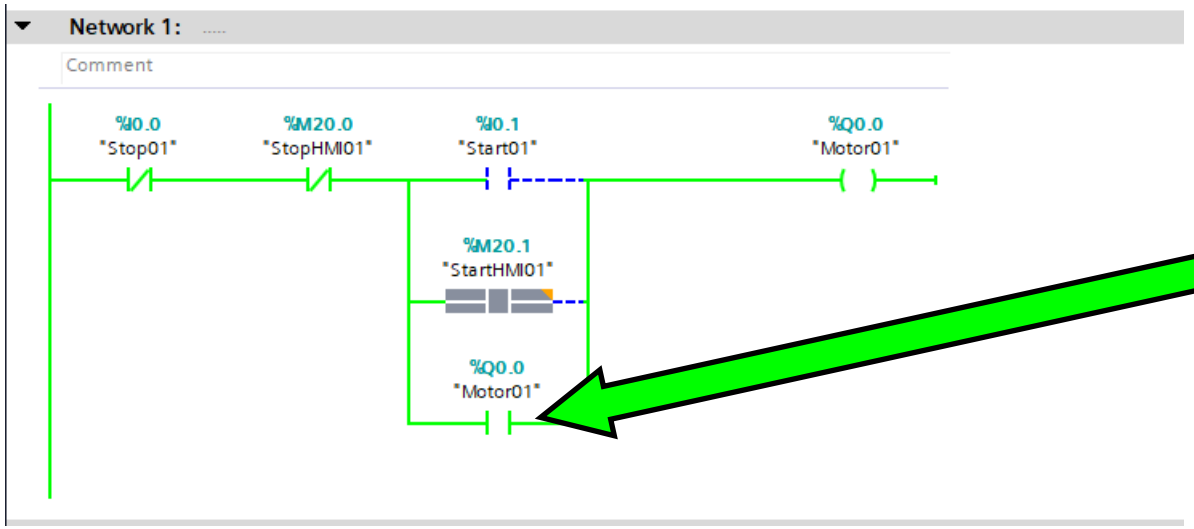
Right Click

Modify to 0

Select Global Memory

Programming Blocks

Add two internal contacts



Interlock on now
Power flow to motor

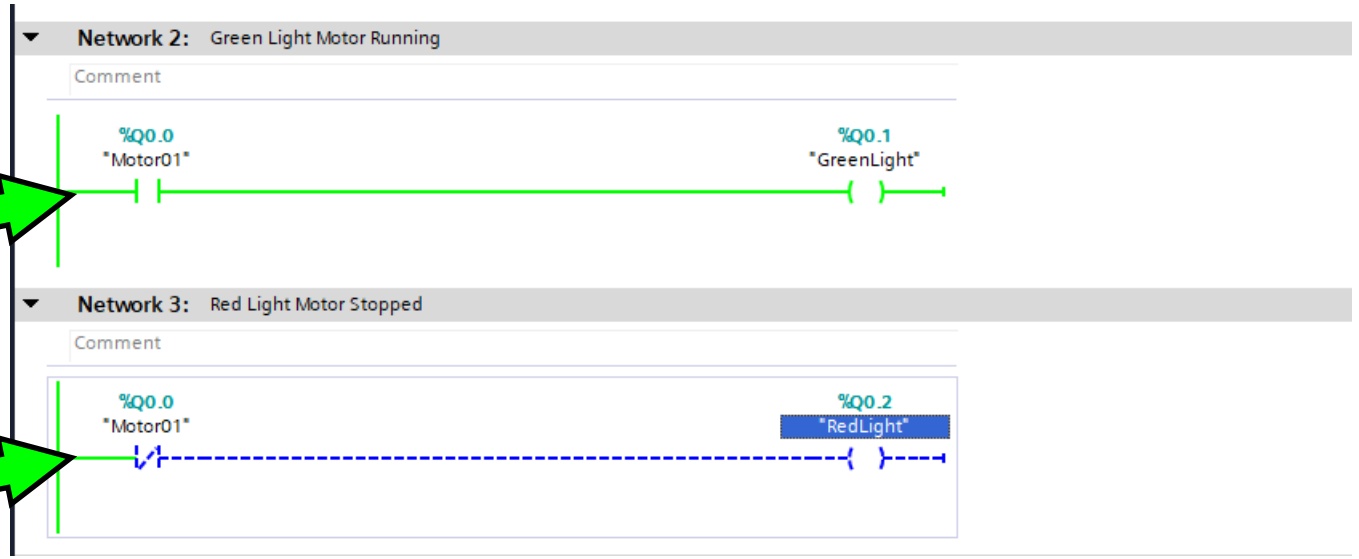
Select Global Memory

Programming Blocks

Create two new networks

Network 2
If Motor01 is on
Turn Q0.1 On
GreenLight

Network 3
If Motor01 is on
Turn Q0.2 On
RedLight



1. Download
2. Monitor
3. Test with Modify Value

Refer to Page 71
M20.0 turns motor OFF by modifying from a 1 the modify to a 0
M20.1 turns motor On by modifying from a 1 the modify to a 0

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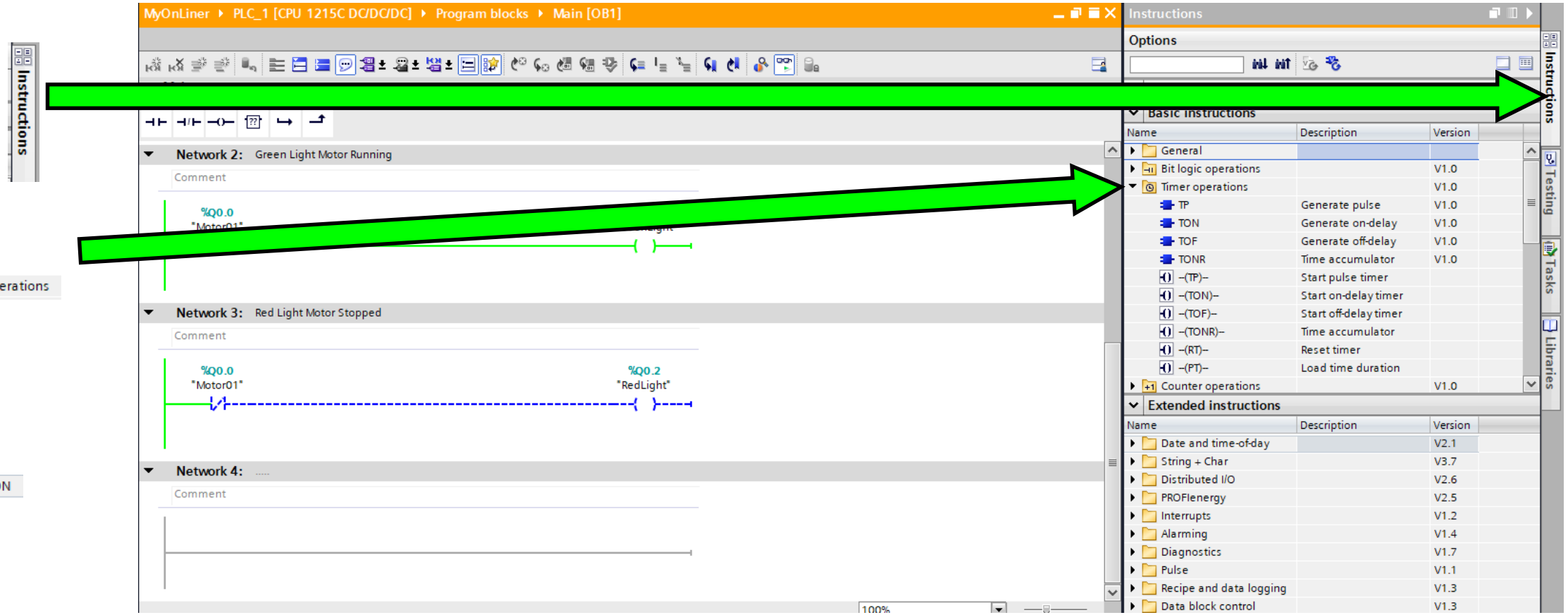
Programming Blocks

Create Timer

Click

Click



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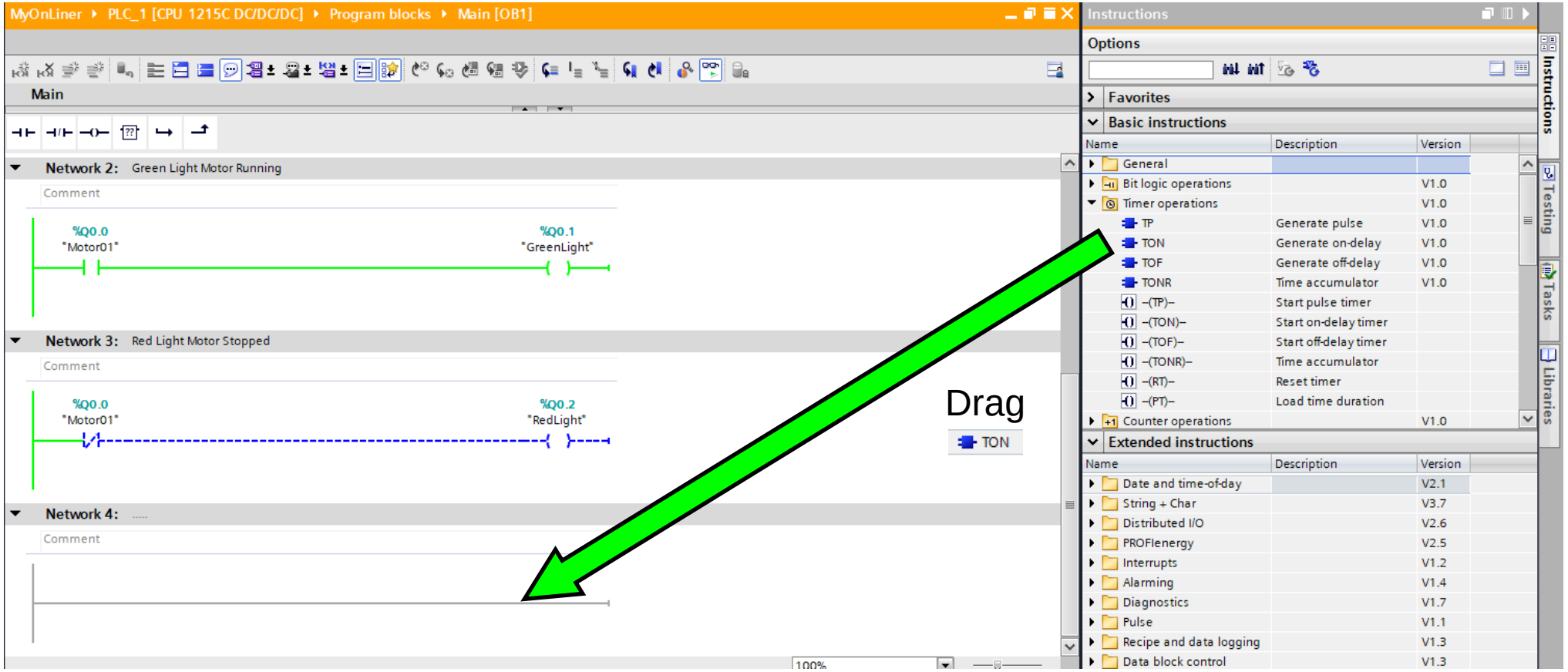
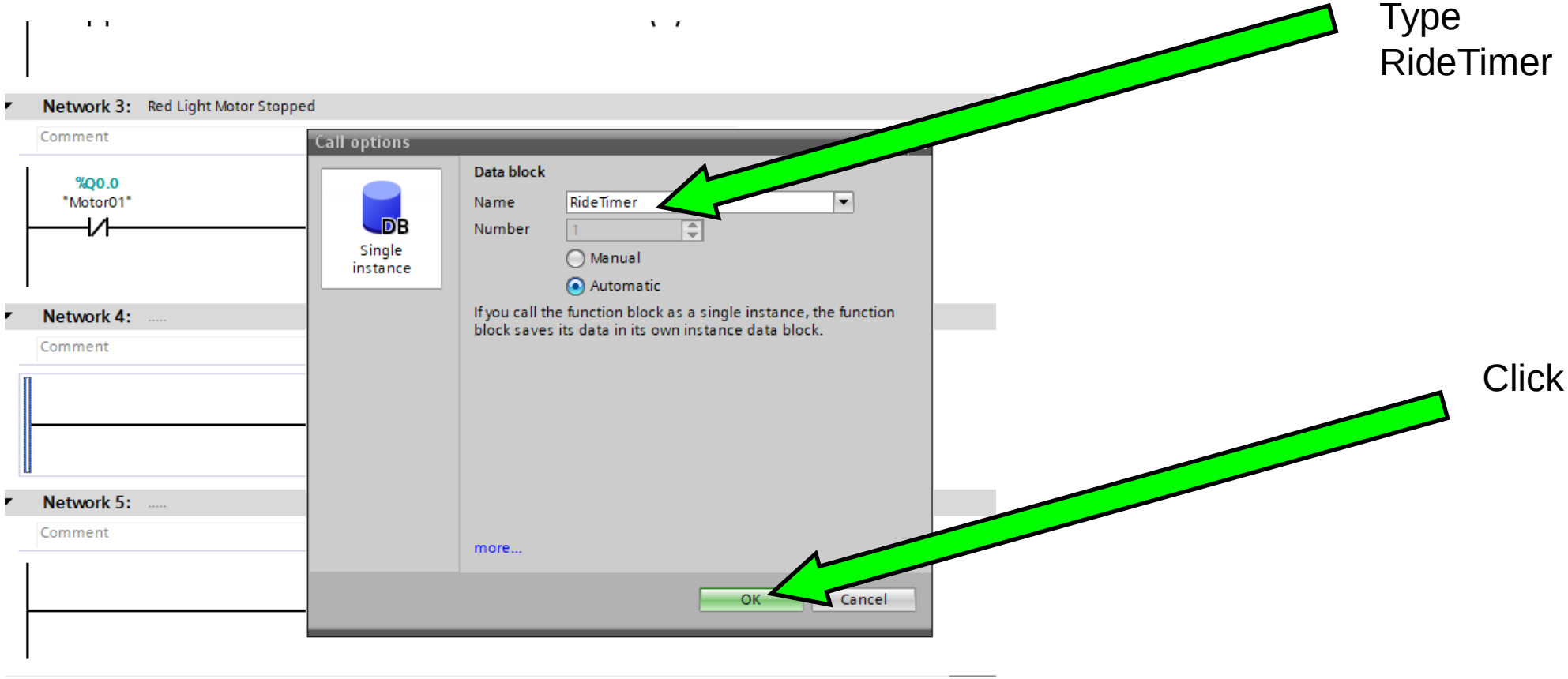
Programming Blocks

Create Timer



Programming Blocks

Create Timer

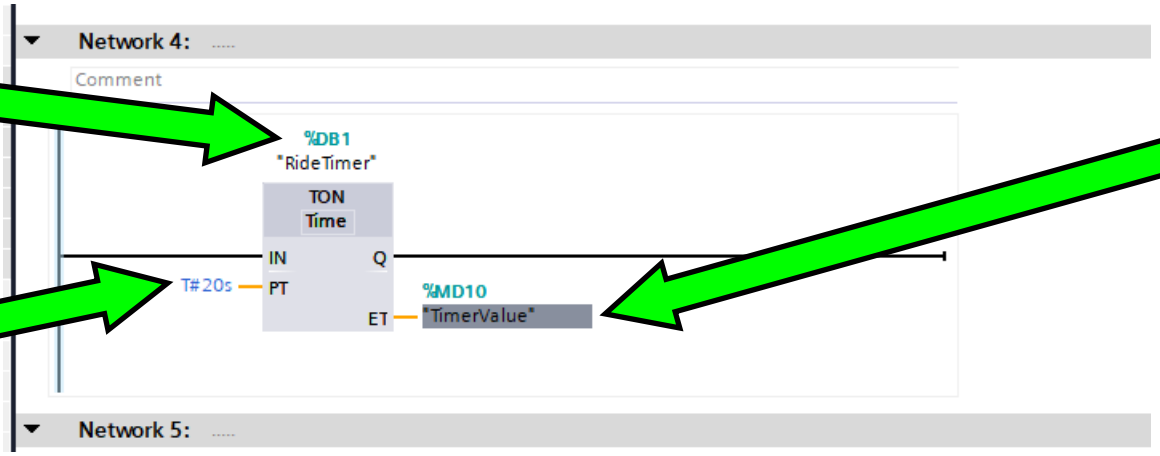


Programming Blocks

Create Timer

Added
New Timer

Type:
20s

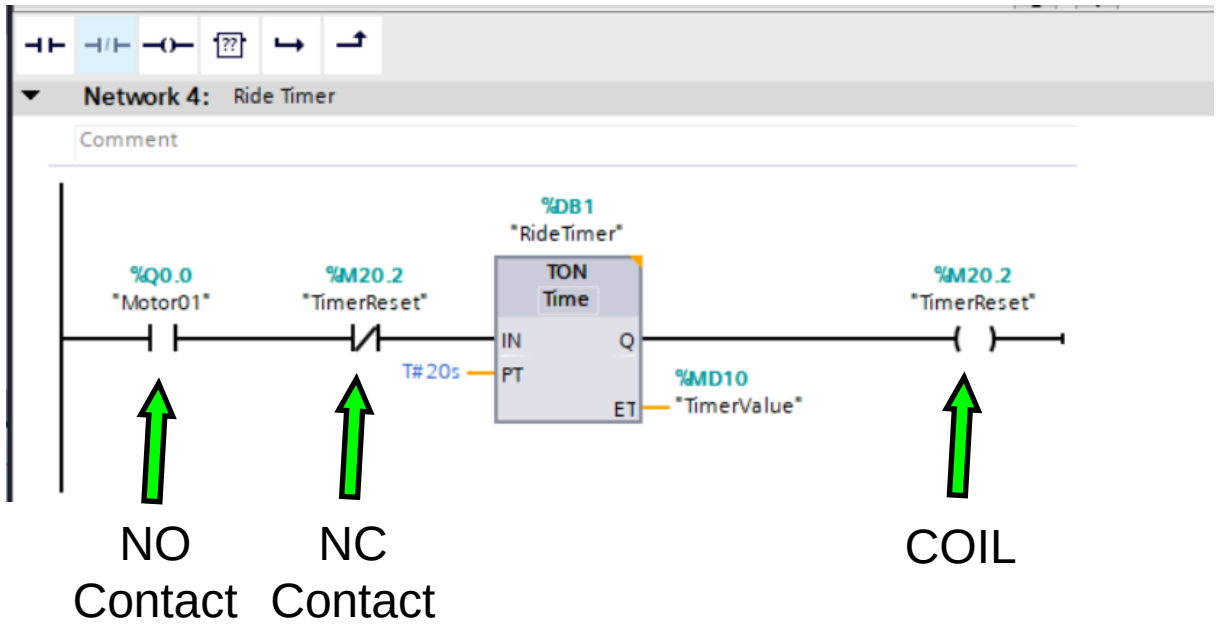


Add MD10
Rename Tag to:
TimerValue

Programming Blocks

Create Timer

Add contacts and coils



Note: Follow slide 66 to 69 for defining the tag name “TimerReset”

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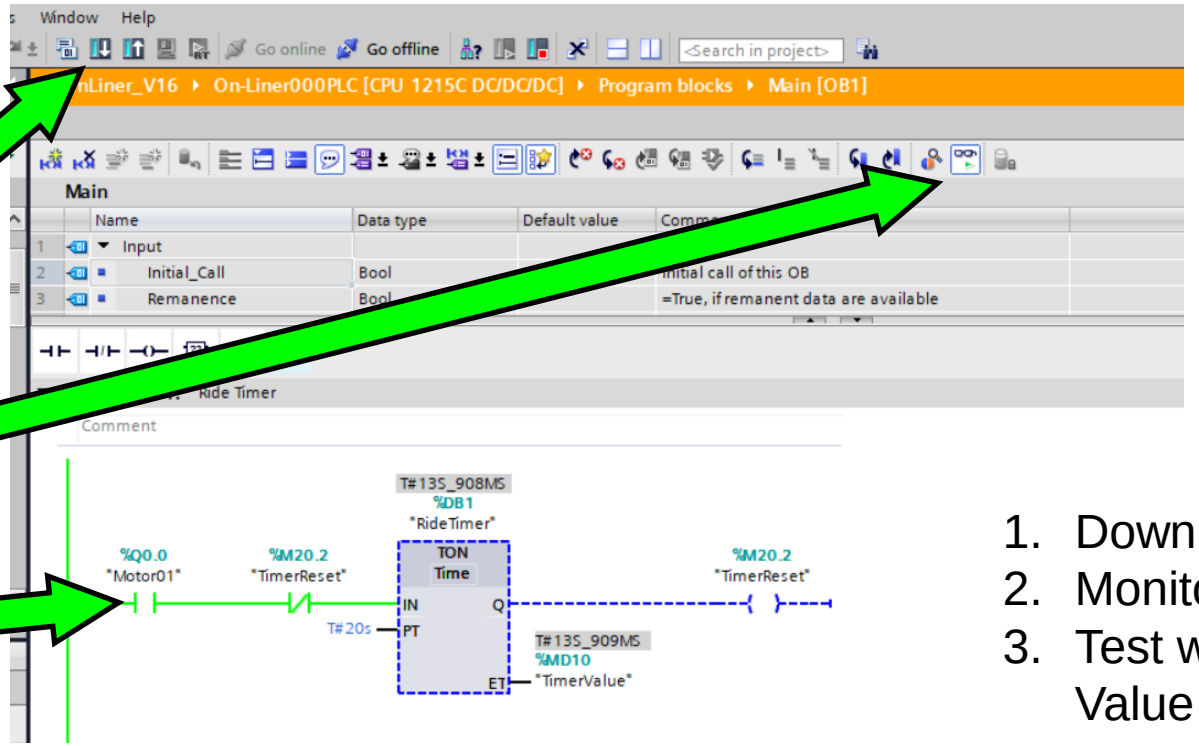
Programming Blocks

Create Timer



Download

Monitoring
ON

Right Click
Modify
Modify to 1

1. Download
2. Monitor
3. Test with Modify Value

“Motor01 Q0.0” turns RideTimer ON by modifying from 0 to 1

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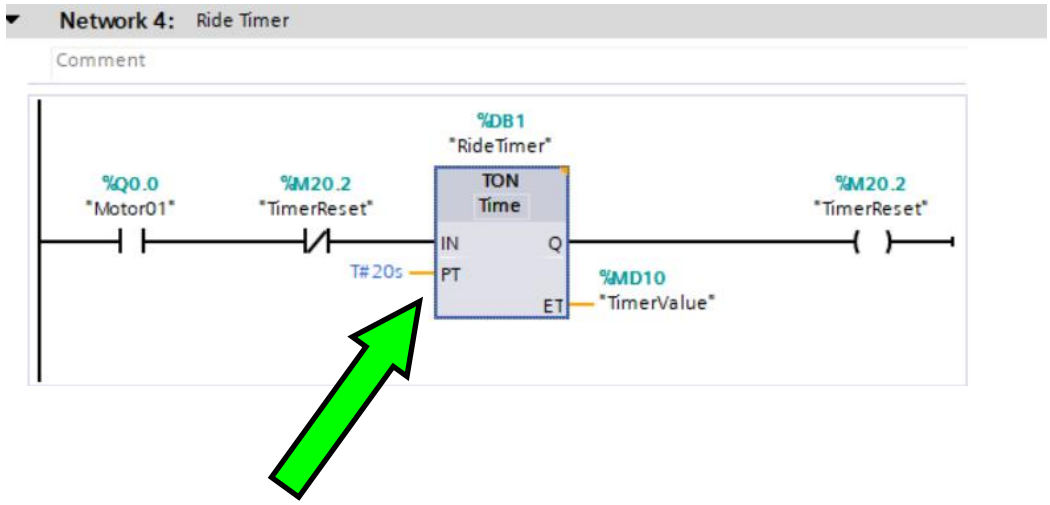
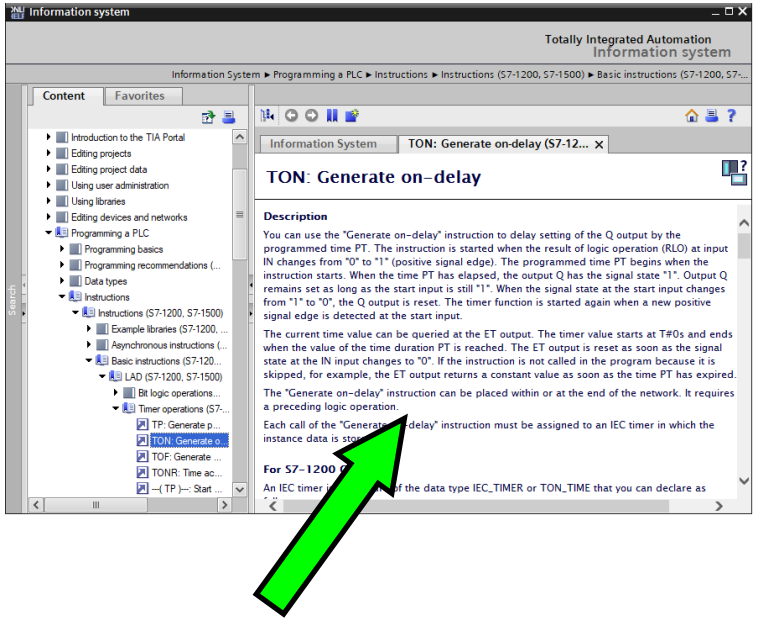
Programming Blocks

Create Timer



To know more about TON (Timer ON Delay) select the TON block and press F1 on the keyboard



Information window pops up

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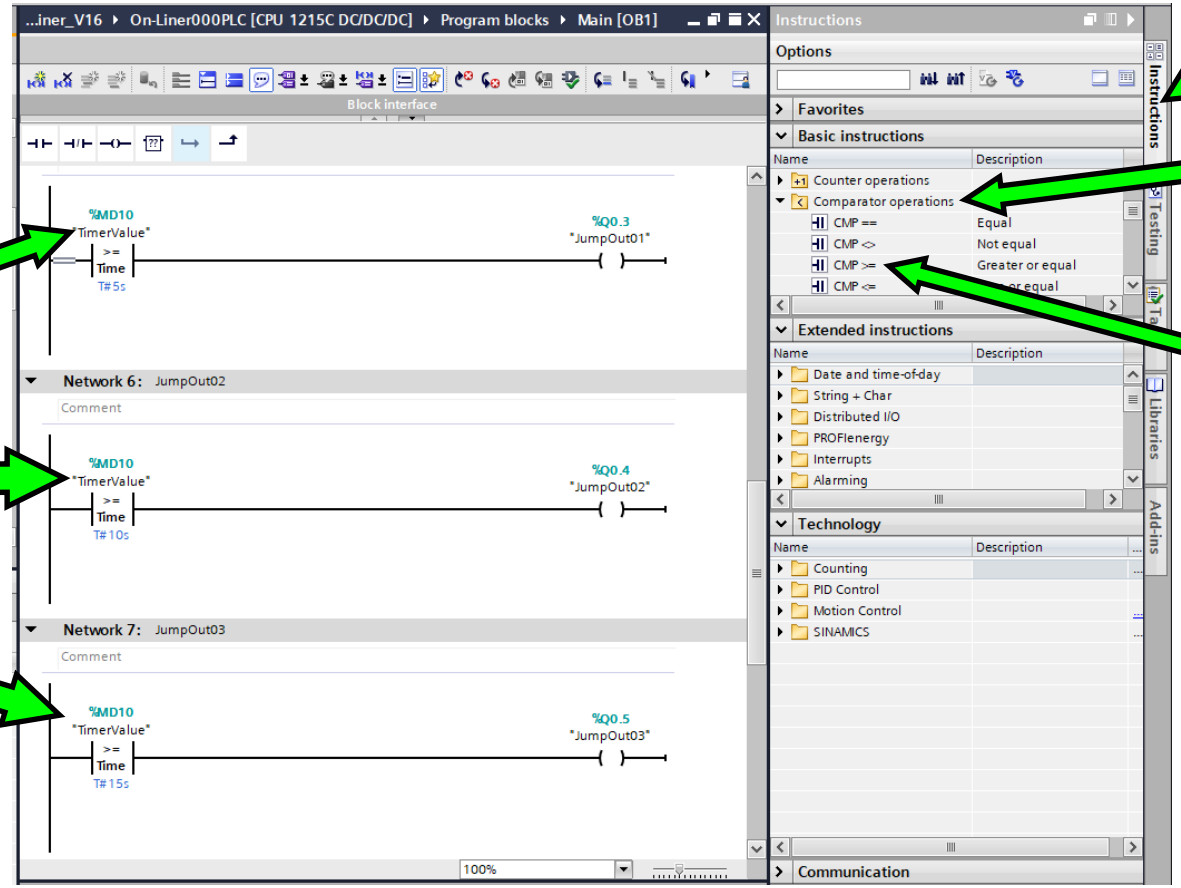
Programming Blocks

Create Comparator



1.Click

2.Click

3.Select and Drop Greater or equal in network 5, 6 and 7

4.Tag Name: TimerValue
Type: Time
Address: MD10

Note: Ignore adding coils

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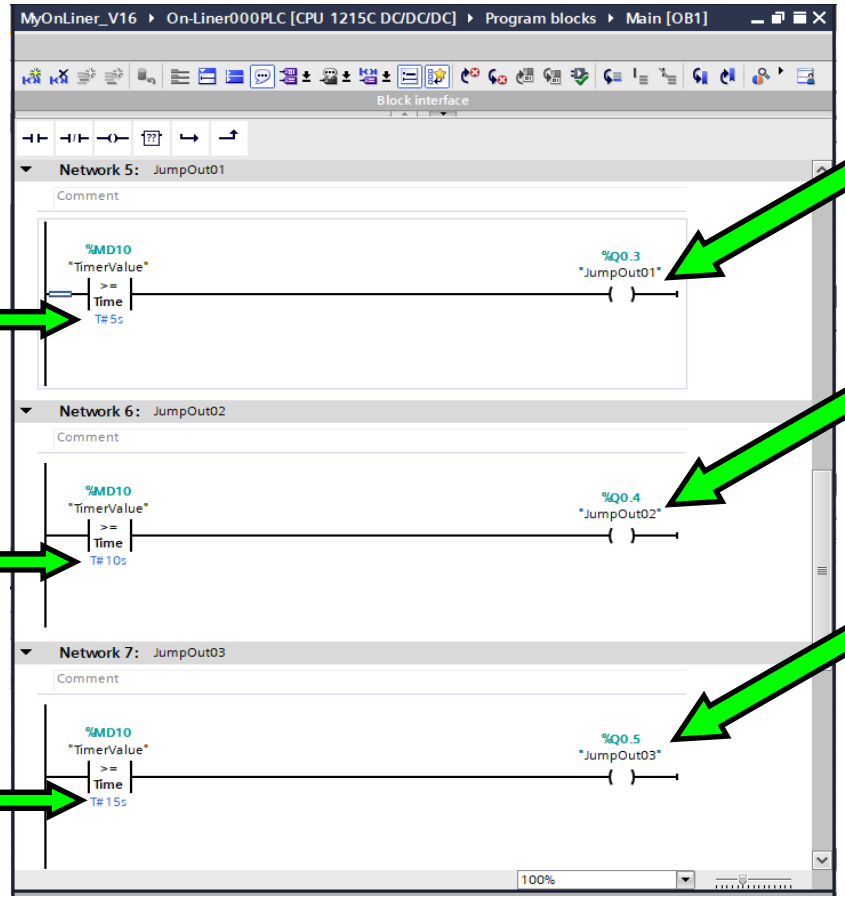
Programming Blocks

Create Comparator



5.Type: T#5s

6.Type: T#10s

7.Type: T#15s

8.Add Coil and Define global output tag name: “JumpOut01”; Address: Q0.3, Type: BOOL

9.Add Coil and Define global output tag name: “JumpOut02”; Address: Q0.4, Type: BOOL

10.Add Coil and Define global output tag name: “JumpOut03”; Address: Q0.5, Type: BOOL

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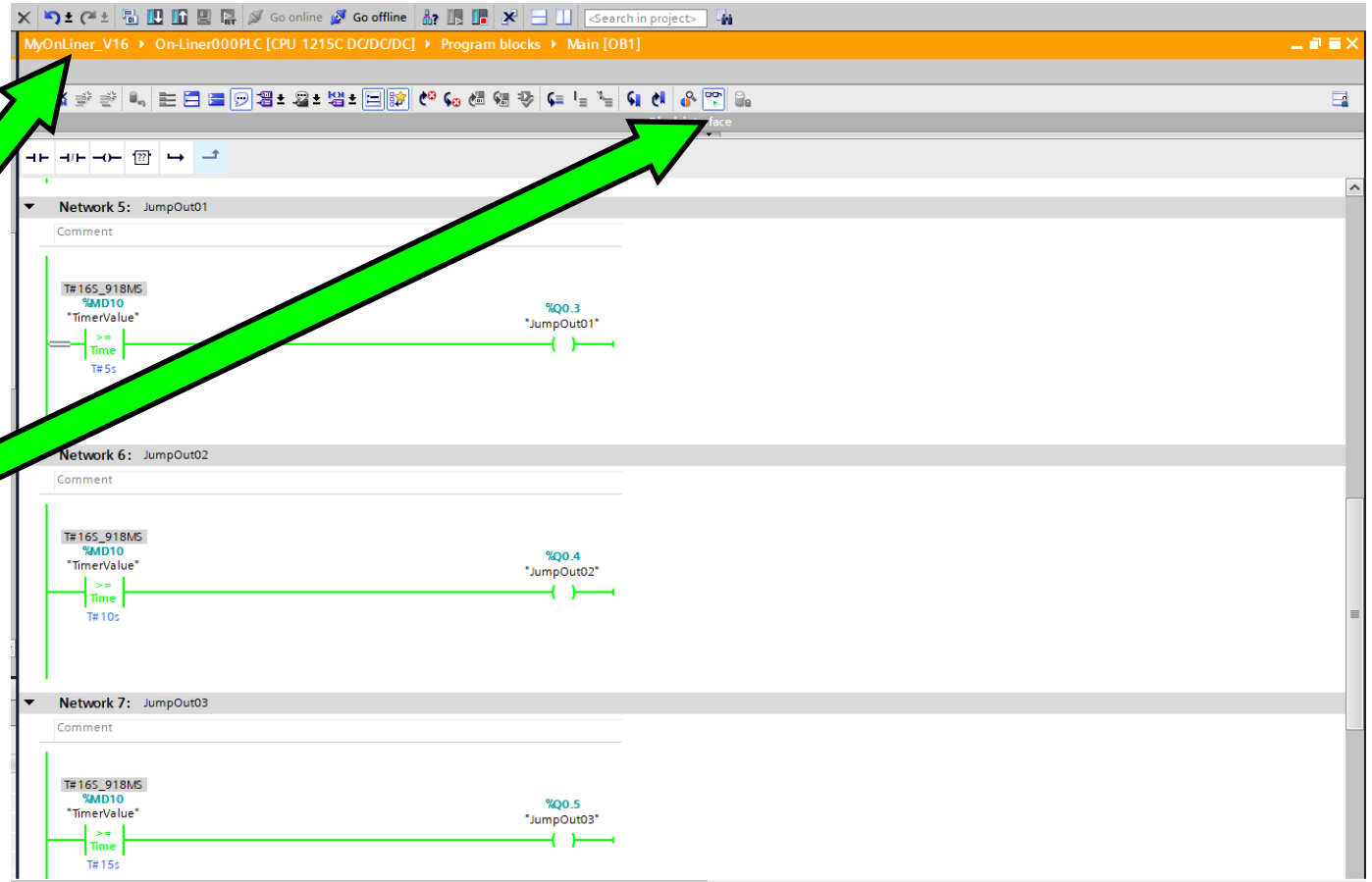
Programming Blocks

Create Comparator

Download

Monitoring ON



1. Download
2. Monitor
3. Test with Modify Value for “Motor01”

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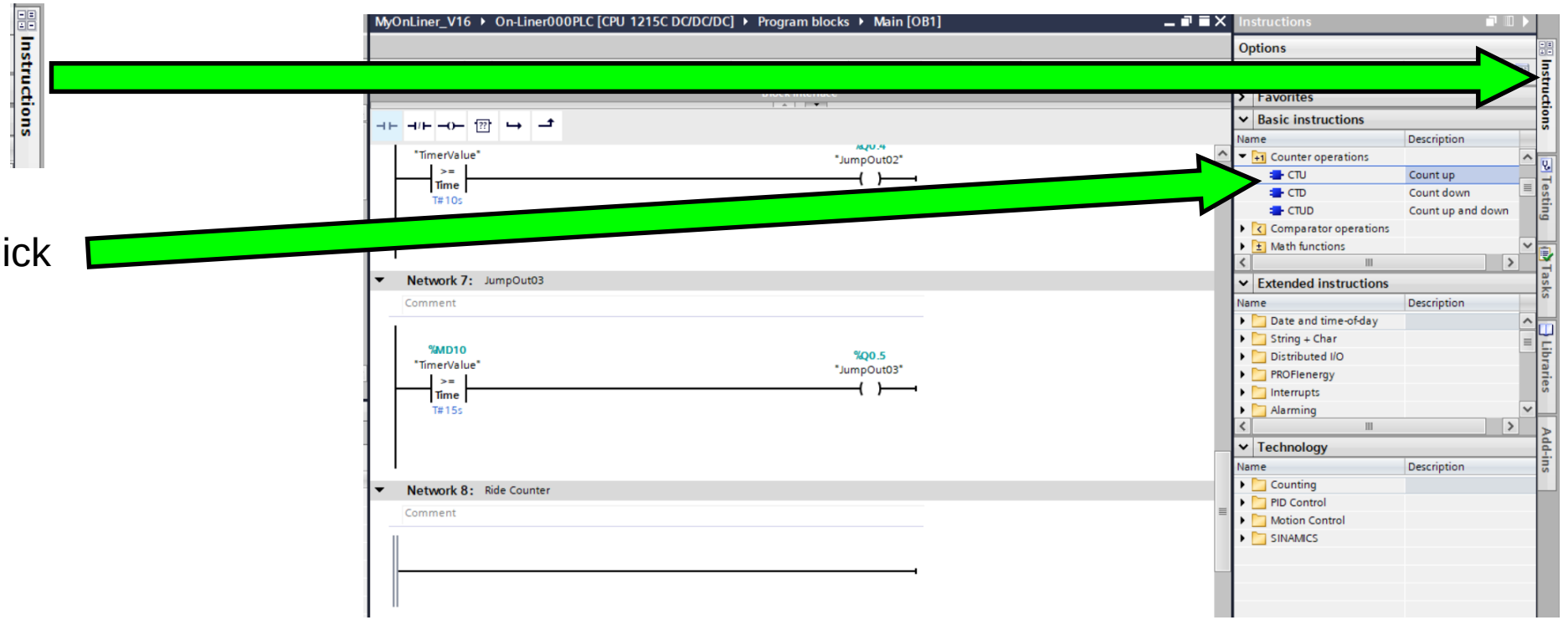
Programming Blocks

Create Counter

Click

Click



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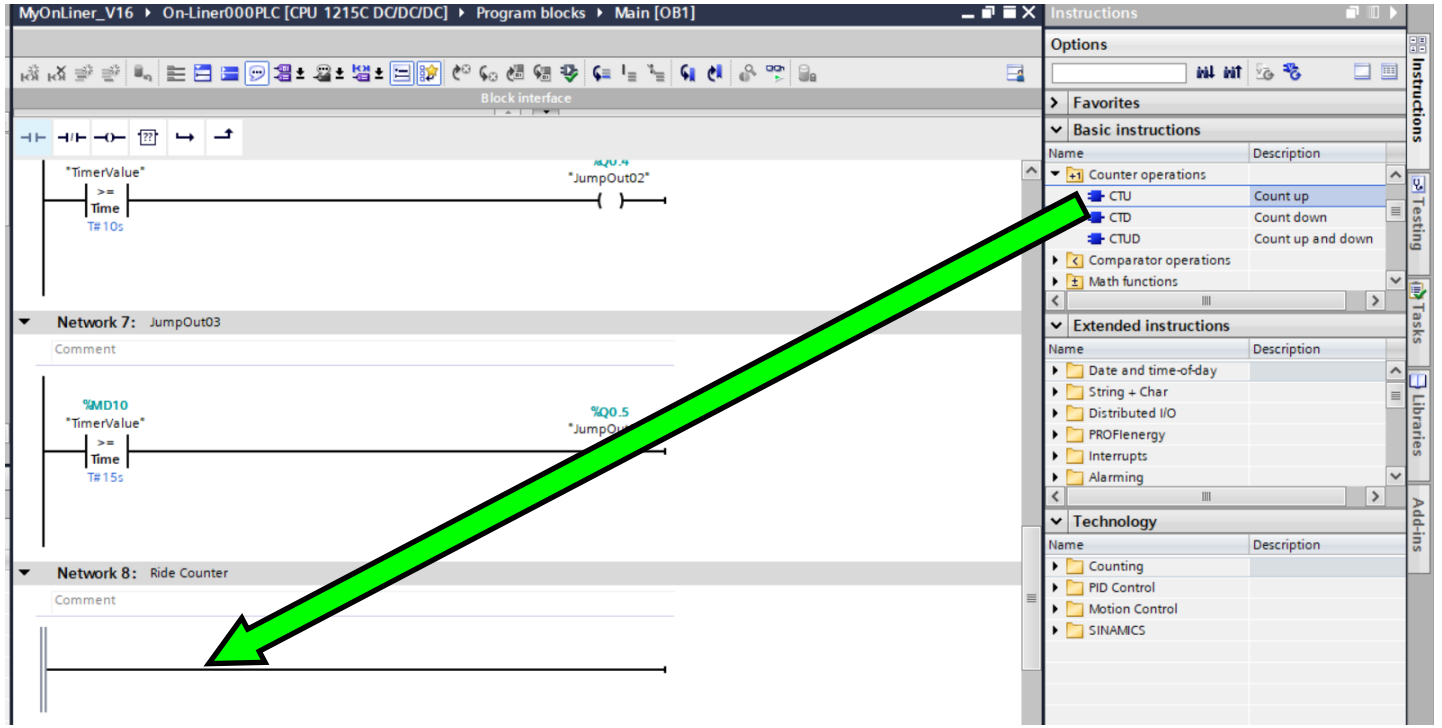

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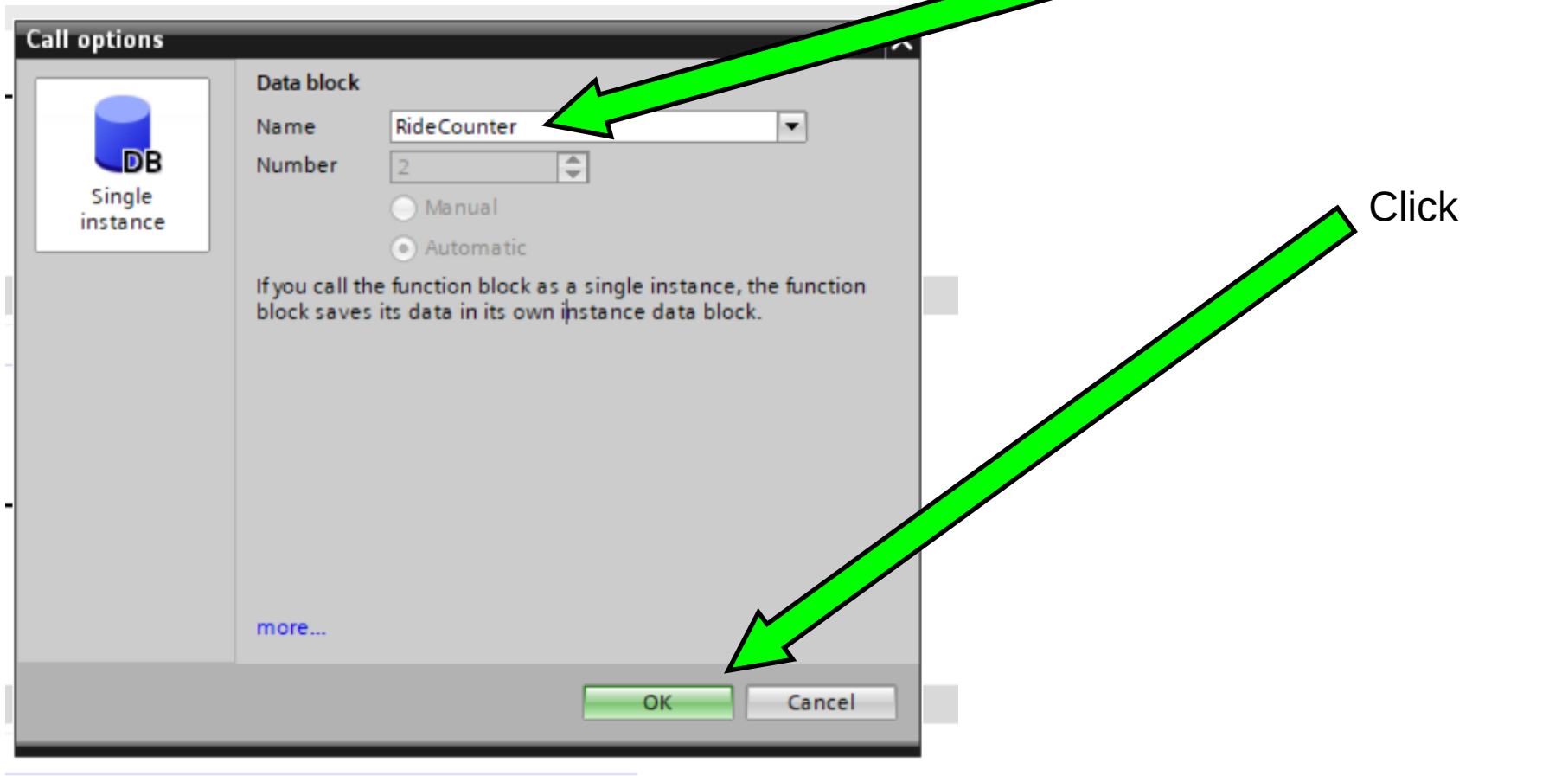

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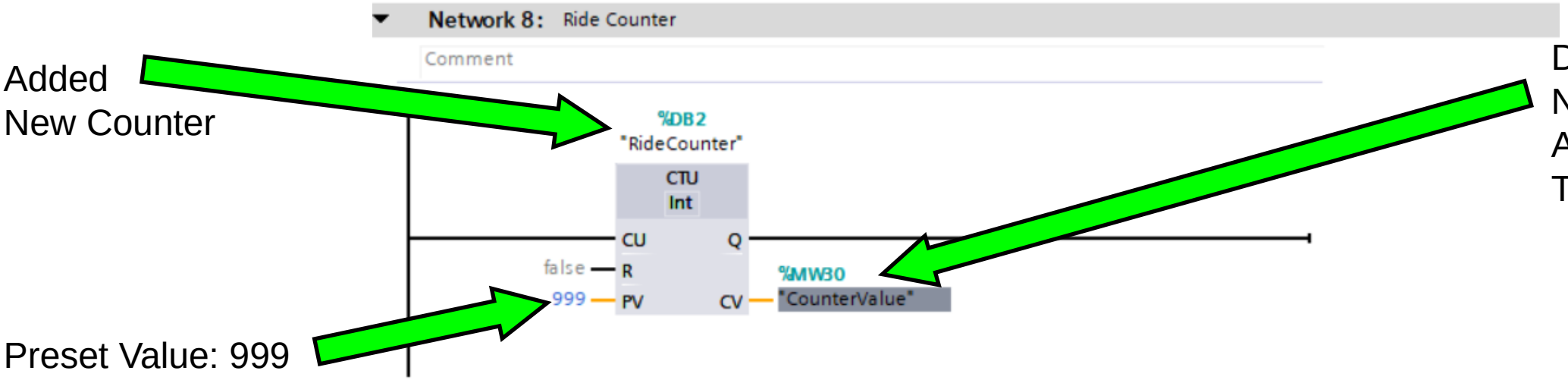


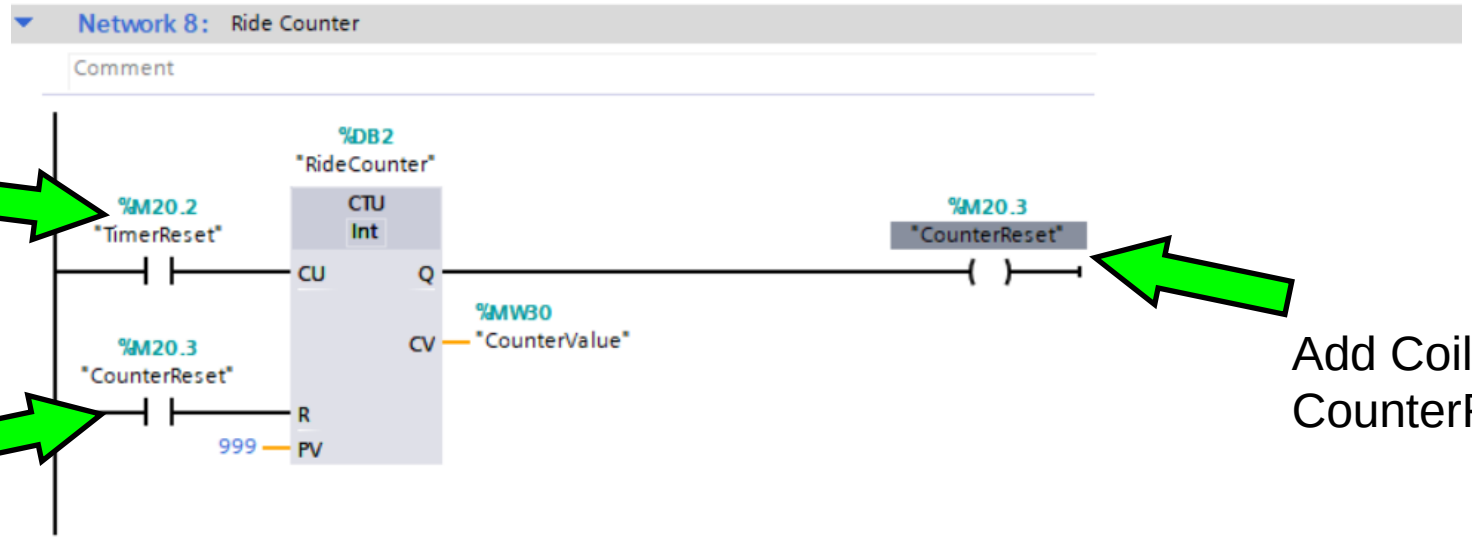
Added
New Counter

Define a tag with
Name: CounterValue
Address: MW30
Type: Int

Preset Value: 999

Programming Blocks

Create Counter



Add NO contact with name “TimerReset”

Add NO contact
Name:“CounterReset”
Address:M20.3
Type:Bool

Add Coil with name CounterReset

Note: To know more about CTU(Count Up), select the CTU block and press F1 on the keyboard

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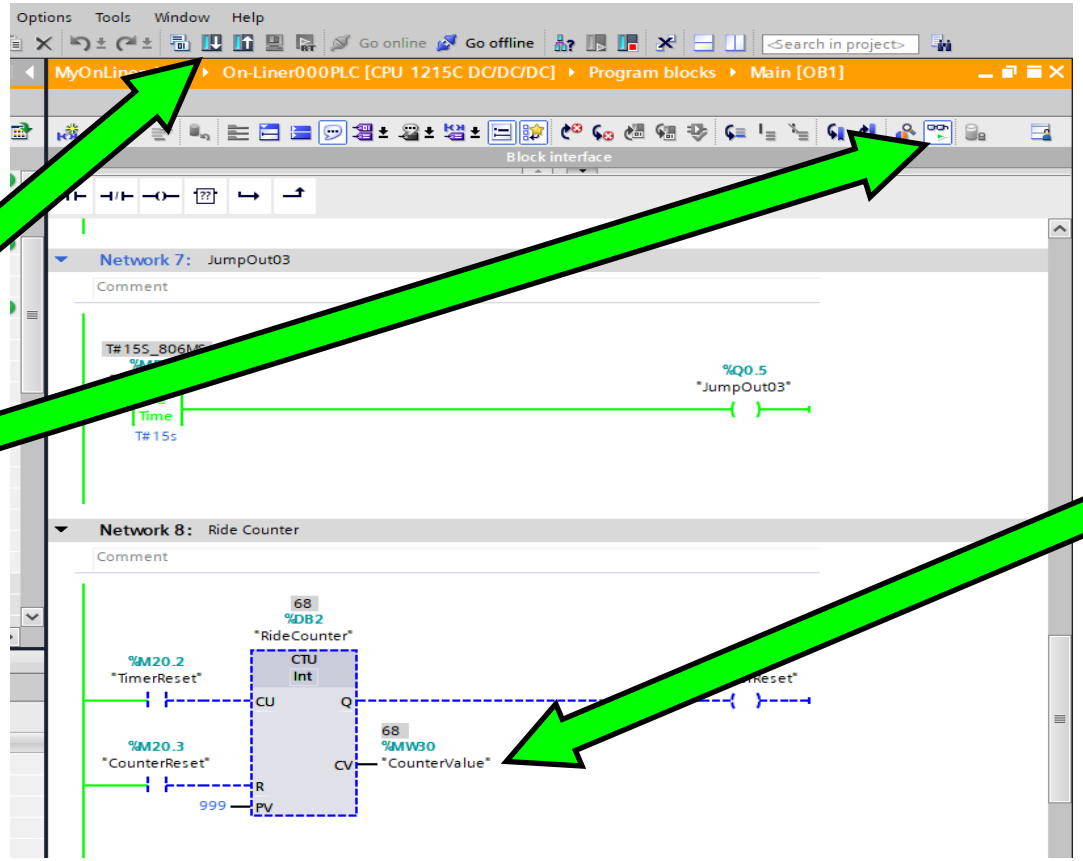
Create Counter



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Monitoring ON

1. Download
2. Monitor
3. See “CounterValue” that gets update after every 20sec

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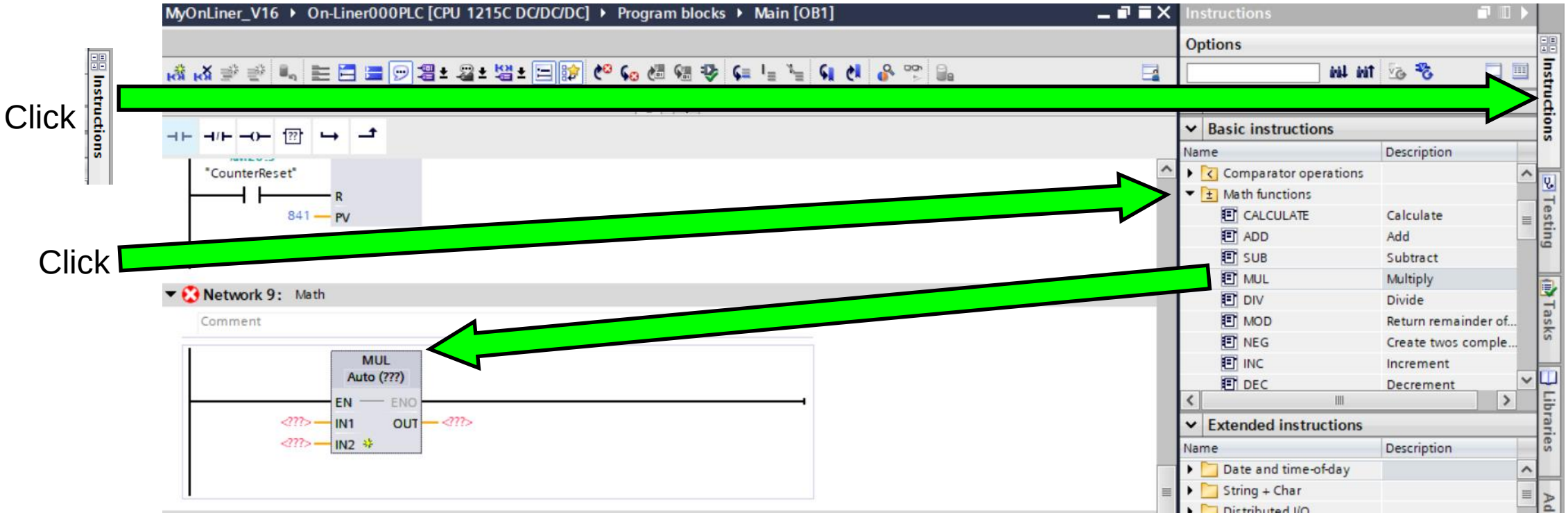
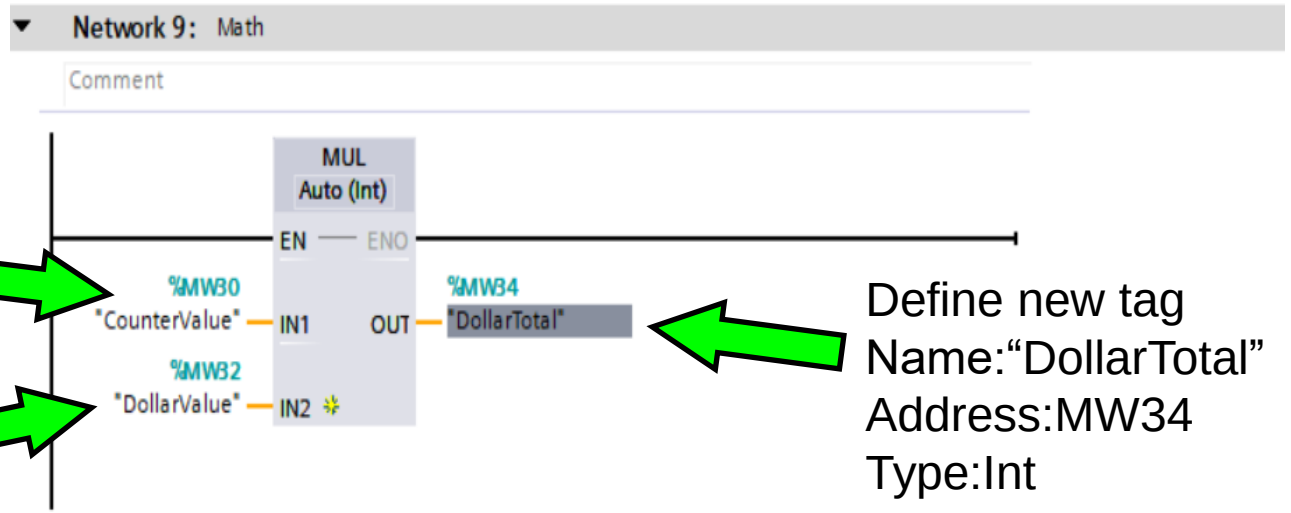
Create Math Functions



Programming Blocks

Create Math Functions



“CounterValue”

Define new tag
Name:“DollarValue”
Address:MW32
Type:Int

Define new tag
Name:“DollarTotal”
Address:MW34
Type:Int

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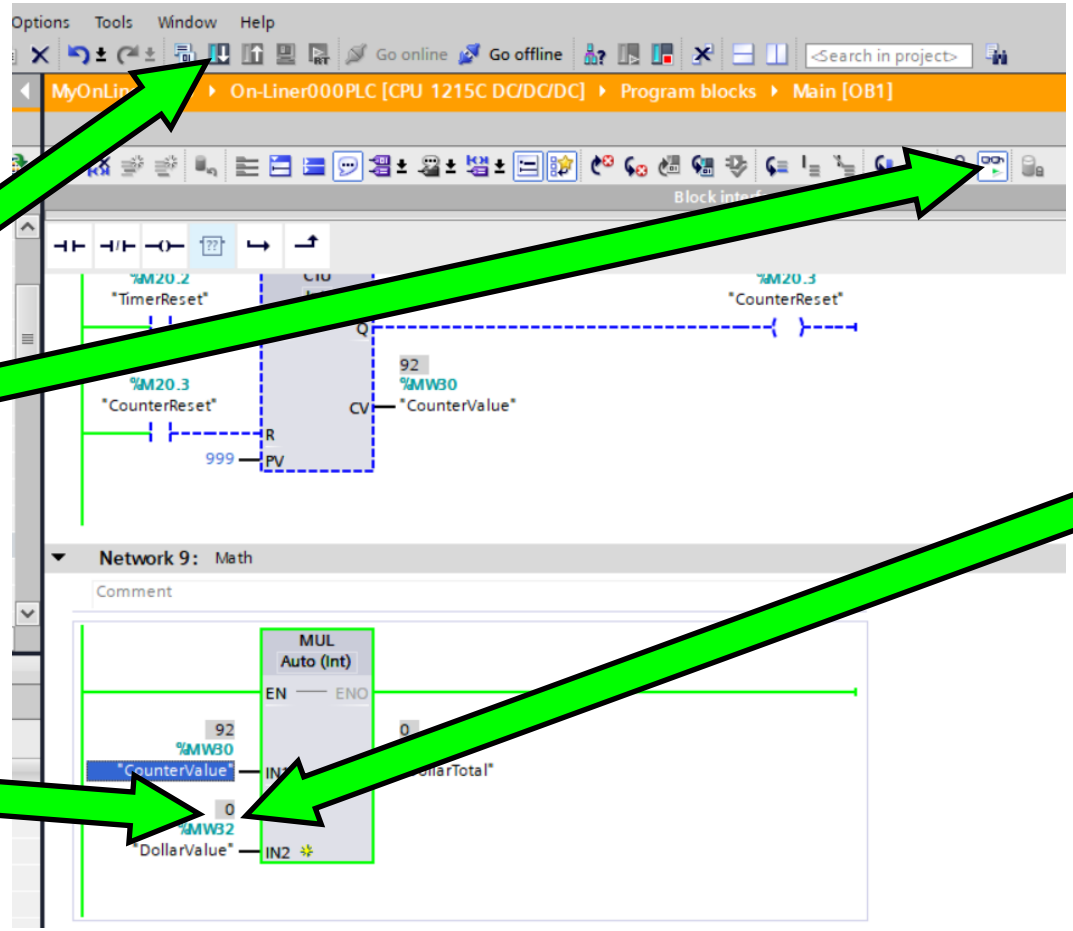
Create Math Functions



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Default “DollarValue” will be 0

1. Download
2. Monitor
3. See “CounterValue” that gets update after every 20sec
4. Modify “DollarValue” to 2 by double click

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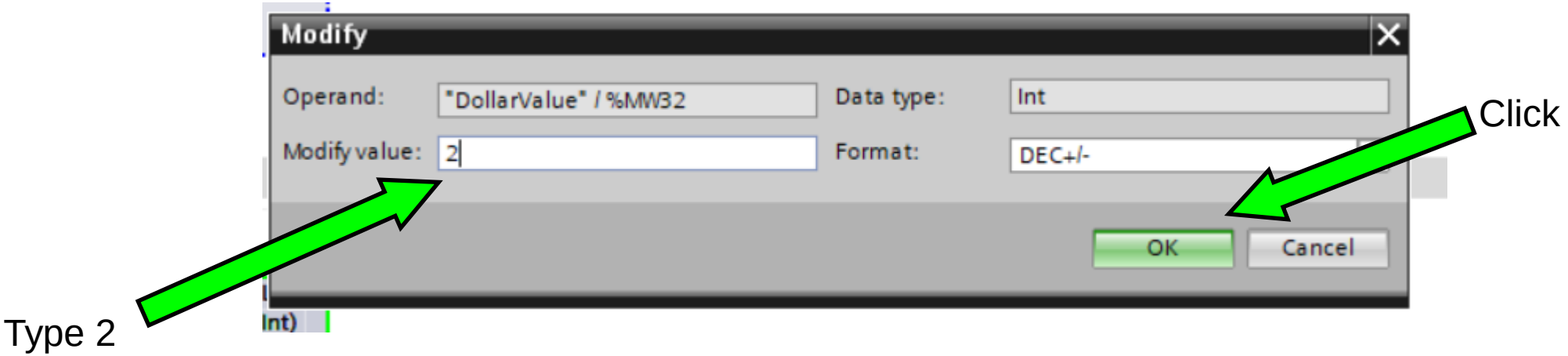
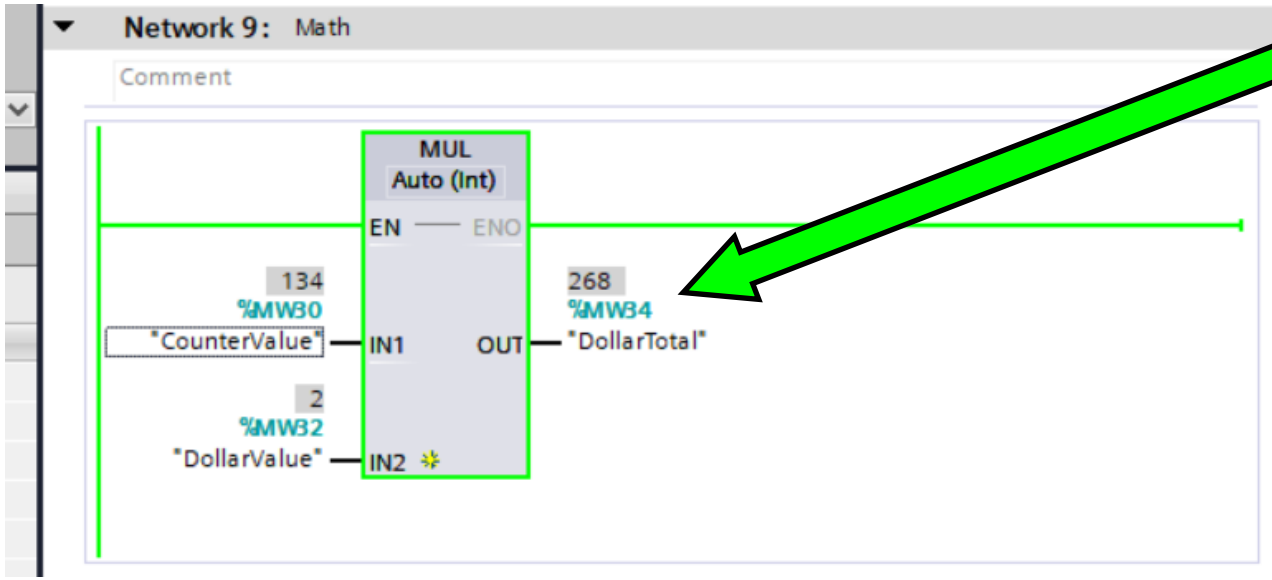
Create Math Functions



Programming Blocks

Create Math Functions



"DollarTotal": 268
134*2=268

Note: To know more about different Math Functions, drag and drop different math functions on the network and press F1

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Thank You