PLCnext Quick Start Guide

Contents

Introduction

This guide will go over the steps to setup a computer to be used with PLCnext Engineer, a programming software for PLCnext controllers. It will also go over the steps to setup communications, configure hardware and create a simple program for a PLCnext Controller.

Objectives

- Setup a computer to be used with PLCnext Engineer
- Configure hardware
- Create and debug a simple program

Requirements

The following hardware was used in the development of this procedure:

- Personal Computer (PC)
  - o Processor: Core i5 or better
  - o Ram:
    - Windows 7 or 8: minimum – 4 GB
    - Windows 10: minimum – 8 GB
  - o Must have an RJ45 Ethernet Port
- A PLCnext controller with Digital Input and Digital Output Module
  - o AXC F 2152 STARTERKIT (PN: 1046568) is used for this example which includes required controller hardware.

Procedure:

1 - Setup Personal Computer

This section will go over the steps to install the programming software, PLCnext Engineer, and setup the computer for communication to the controller.
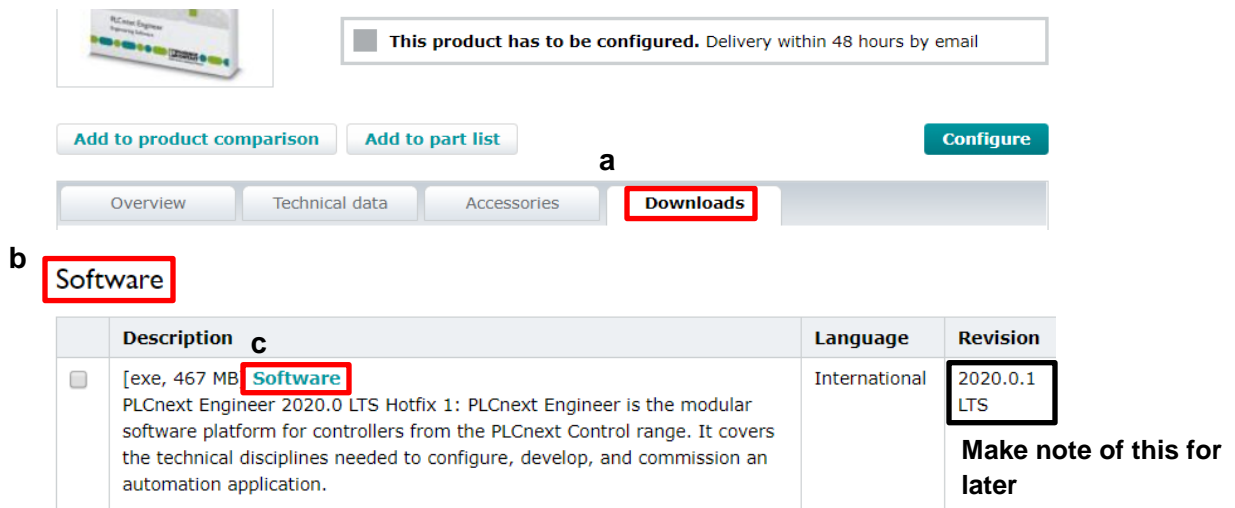
1.1 – Installing PLCnext Engineer

1. Click the link to download the software: https://www.phoenixcontact.com/online/portal/us?uri=pxc-oc-itemdetail:pid=1046008&library=usen&pcck=P-19-05-01&tab=5&selectedCategory=ALL

- Or go to www.phoenixcontact.com and search for "PLCnext Engineer" and select the first result.

2. Navigate to Downloads (a) > Software (b) and click the first "Software" link for the latest version (c). See figure 1.1-1. Read and accept the terms and the software will begin to download.

NOTE: Make note of the "Revision" this will be used to determine if the controller's firmware is up to date. (Year.Release.Hotfix)

Figure 1.1-1: Software Download

3. Once the file is downloaded "double-click" the "…exe" file. This should be located at the bottom of the browser or in the downloads folder.

In this example: PLCnext_Engineer_Setup_2020.0.1_LTS_(64bit).exe

4. Go through the setup wizard and leave everything at its default settings.

5. Restart your computer and use "search" (a) to confirm the software is installed (b). Figure 1.1-2.

Figure 1.1-2: Installed software confirmation

1.2 – Setup Computer's Communication

NOTES: You will need admin rights for this procedure. Use Wi-Fi for internet connection.

1. On your computer **right-click** on the window icon [⊞] and select "Network Connections"

2. Under "Status" section select "Change adapter options" – a new window will open

3. In this new window **right-click** on the "Ethernet.." or "Local Area Connection.." (a) and select properties (b). See figure 1.2-1.

Figure 1.2-1: Selecting the Ethernet Adapter
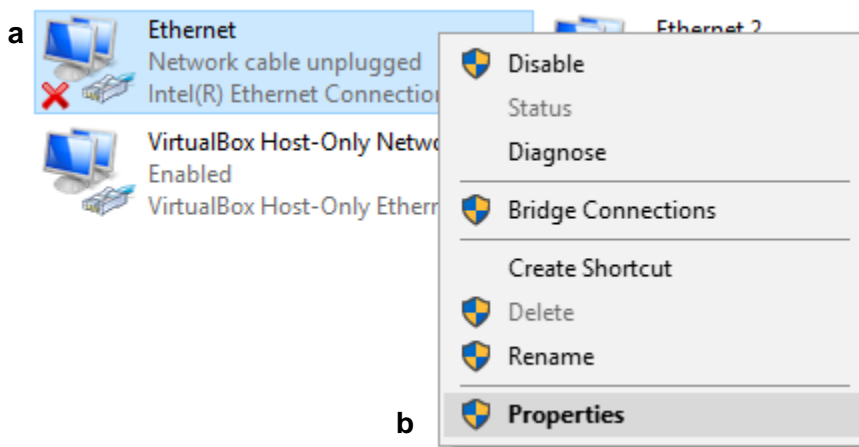
4. Select "Yes" in the pop-up window and an "Ethernet Properties" window will appear.

5. In the new window scroll down and **double-click** "Internet Protocol Version 4 (TCP/IPv4)", see figure 1.2-2. Then a new properties window will open.

Figure 1.2-2: Editing Ethernet Adapter
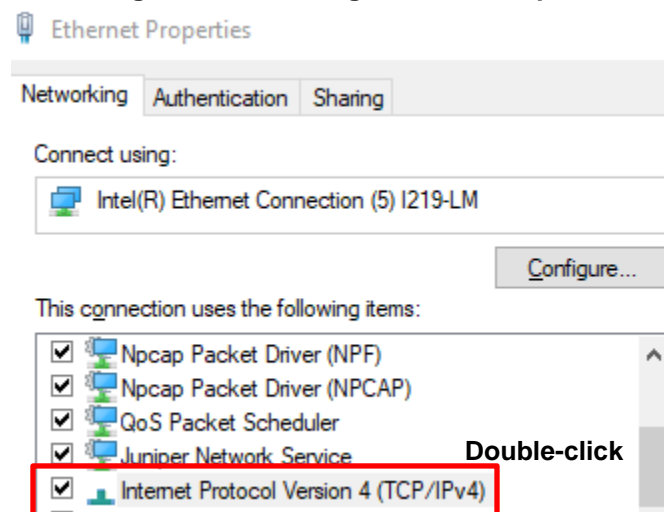
6. Now make the following changes in the properties window. See figure 1.2-3.

- Select "Use the following IP address" (a).
- Change "IP Address" (b)
    - If you are not familiar with networking, use the IP address in this example - 192.168.1.89
    - **NOTE:** In 192.168.1.X, X needs to be different for each device (i.e. PC) on the network.
- Change "Subnet mask" (c)
    - If you are not familiar with networking, use the subnet mask in this example – 255.255.255.0

7. After making the changes select "OK" and "OK" to close out of windows and save changes. (d, e). See figure 1.2-3

NOTE: If you want to revert to its original settings select "Obtain an IP address automatically" in the properties window then select "OK" and "OK" to save settings.

Figure 1.2-3: Edit fields
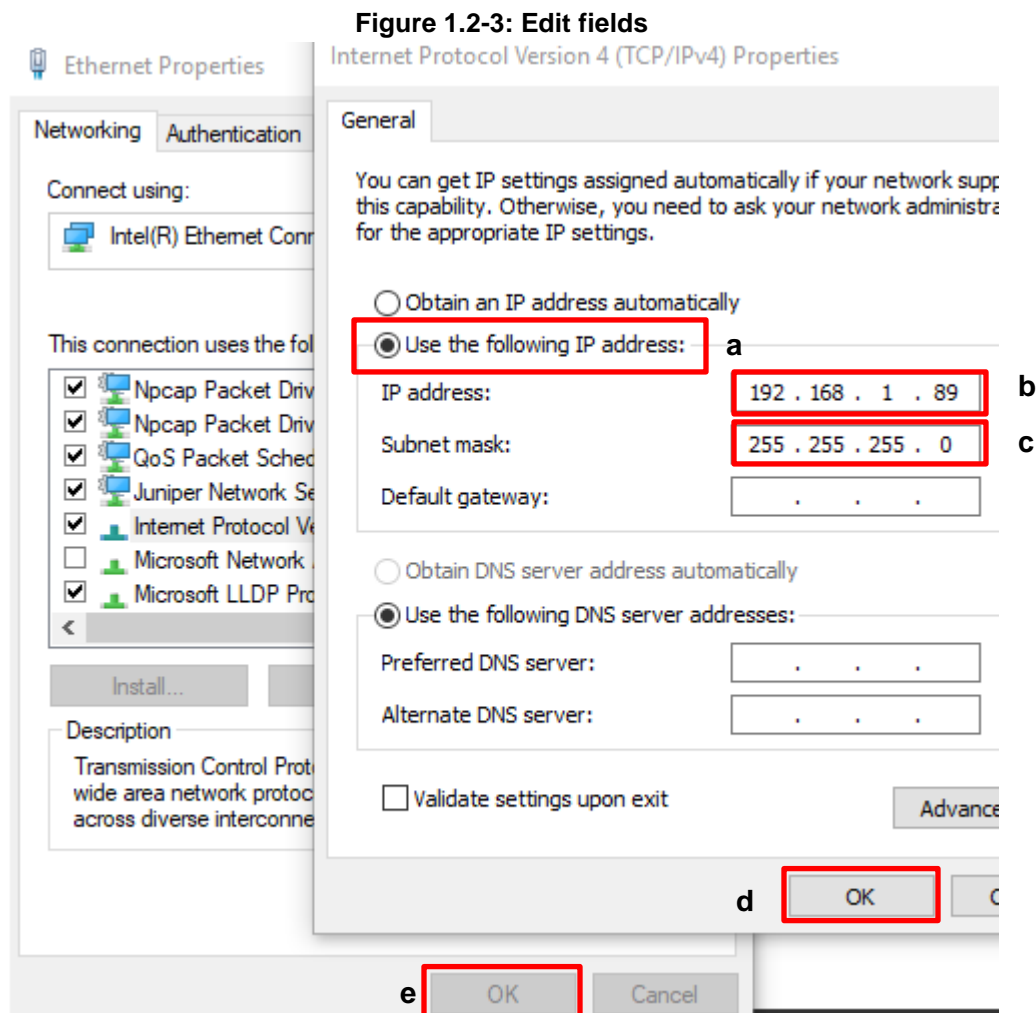
8. Close out of all other windows. Your computer is now set up and Procedure 1 is complete!

2 – AXC F 2152 Starter Kit Overview/Setup

This procedure will go over the hardware, verifying communication to the controller and setting checking the firmware.

2.1 – Hardware Overview

1. Get familiar with the wiring. See figure 2.1-1

- (a) – 1 Controller: AXC F 2152 (PN# 1046568)
  - Click here for technical details
- (b) – 8 Digital Inputs & 8 Digital Outputs Module: AXL F DI8/1 DO8/1 1H (PN# 2701916)
  - Click here for technical details
- (c) – 2 Analog Inputs & 2 Analog Outputs Module: AXL F AI2 AO2 1H (PN# 2702072)
  - Click here for technical details
- (d) – Green Power Switch
- (e) – 1 Analog Input "Sensor" (0 – 10 VDC potentiometer)
- (f) – 8 Digital Input Switches (24 VDC switches)

Figure 2.1-1

Blue wire: +24 VDC

Red wire: 0 VDC

Black wire: Signal
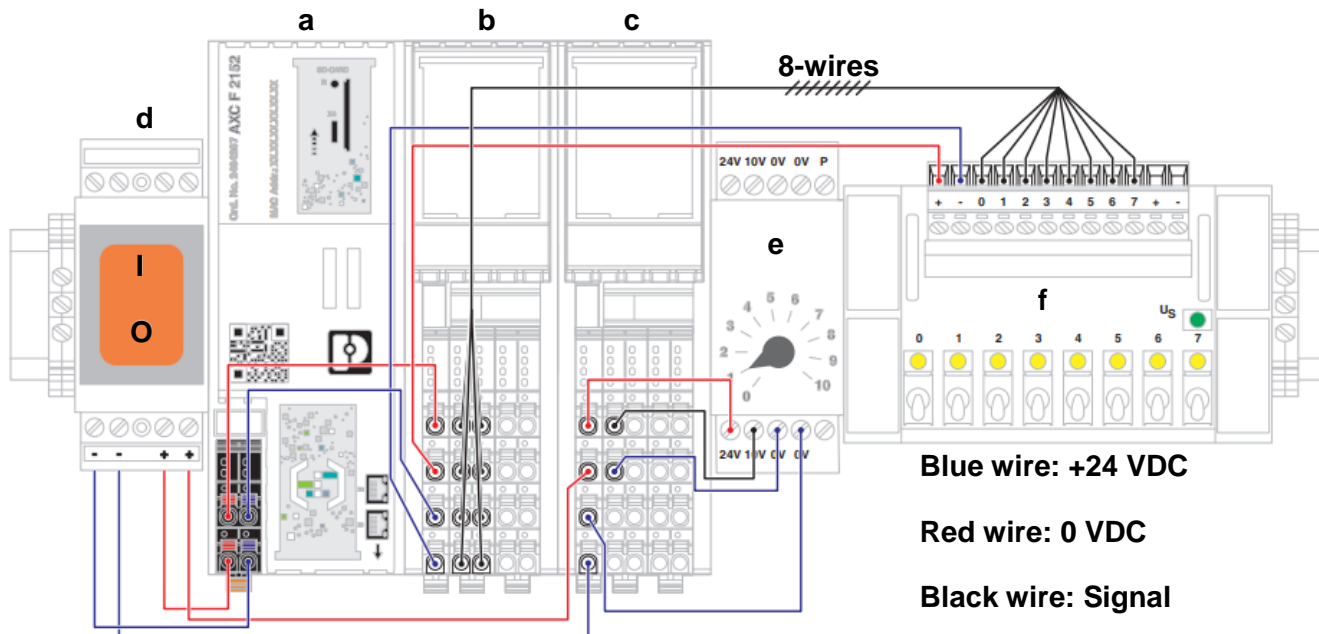
2.2 – Powering up the hardware

1. Using the power cable with the kit, plug it into the green switch and into a single-phase outlet in the wall.

2. Turn the switch from the off position "O" to the on position "|". See figure 2.1-1

3. The hardware will power up, once the "RUN" LED is blinking or solid green the controller is ready to use. Do not worry about any blinking red or yellow LED's once the green LED is lit.

2.3 – Checking communications and firmware

1. Using the Ethernet (patch) cable plug it into either port on the controller and into your computer. The port on the controller is located on the bottom side.

2. If your controller is new the default IP address is **192.168.1.10**. You will use this address to communicate to the device.

If the controller has been used and you are unsure of the IP address you can do one of the following:

- Option 1: Reset the device – See Appendix 1, Procedure 2 located at www.github.com/plcnextusa/quickstart/appendecies
- Option 2: Use PLCnext Engineer to change the IP Address. See 4.1 -4.3

3. Now connect to a webpage on the controller. Open an internet browser (preferred browser is chrome). Type https://**Controller IP address**/wbm (i.e. https://192.168.1.10/wbm) into the URL area and hit ENTER (a). See figure 2.3-1
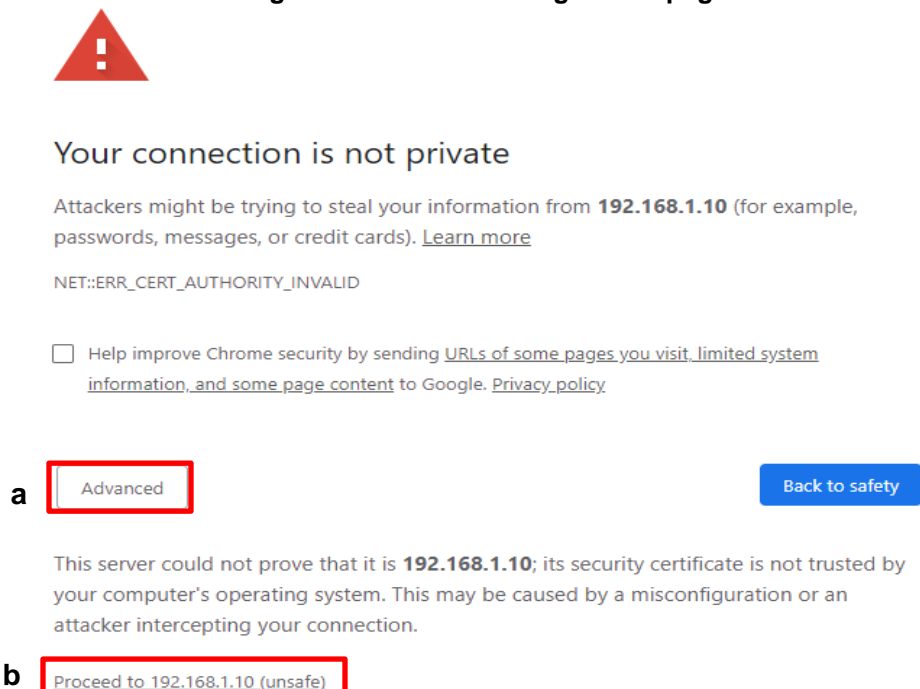
Figure 2.3-1 – Checking Connection
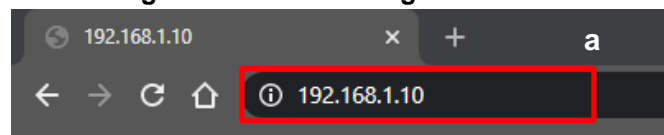
4. This connection will be unsecure. You will need to allow the browser to navigate to the controller's webpage. For Chrome click "Advanced" (a) and then click "Proceed to…(b)" See figure 2.3-2.

**NOTE:** Use chrome if you're unsure how to proceed with other browsers.

Figure 2.3-2 – Proceeding to Webpage

Your connection is not private

Attackers might be trying to steal your information from **192.168.1.10** (for example, passwords, messages, or credit cards). Learn more

NET::ERR_CERT_AUTHORITY_INVALID

☐ Help improve Chrome security by sending URLs of some pages you visit, limited system information, and some page content to Google. Privacy policy

a Advanced   Back to safety

This server could not prove that it is **192.168.1.10**; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.

b Proceed to 192.168.1.10 (unsafe)

5. If a PLCnext webpage appears (See figure 2.3-3) then you are **connected to the controller**! If not, please review previous steps from Procedures 1 & 2.

6. Now you can check the firmware version. Click "Easy Configuration" (a), see figure 2.3-3.

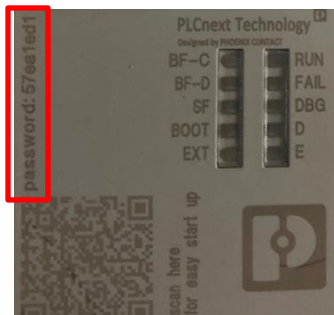**Figure 2.3-3 – PLCnext Controller Splash Page**
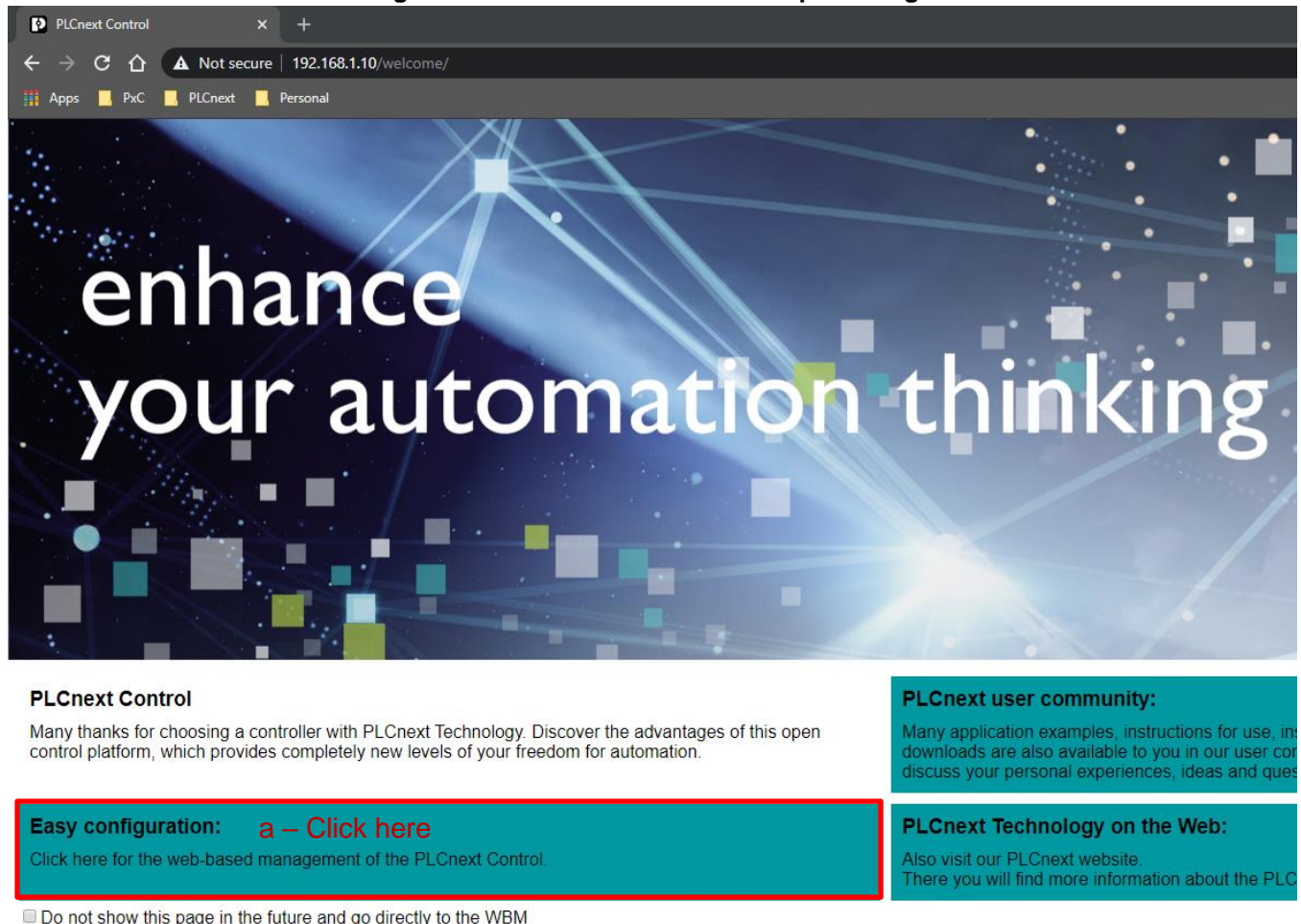
7. You will need to login in to get access. Default info:

- Username: admin
- Password: Located by QR code on controller

Please login with your username and password.

Username   admin

Password   ••••••••

Login

NOTE: Once logged in the password can be changed here: Security > User Authentication > Add User
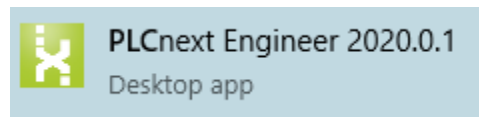
8. Once logged in you can check the firmware in the upper-right hand corner (a). Make note of the firmware and compare to the version of PLCnext Engineer downloaded (this was noted earlier). The software and hardware should both be from the same year (b). See figure 2.3-4.

Figure 2.3-4 – Software and Hardware Version Check

This was noted earlier:

= FW: 2020.0.1 LTS (Notice both are from 2020)

NOTE: If the firmware of the controller and version of PLCnext Engineer do not match the same year please update the controller's firmware – See Appendix 2 located at www.github.com/plcnextusa/quickstart/appendecies

o   Also, please be sure that you have the most recent version of PLCnext Engineer installed. See Procedure 1.1.

NOTE: You may use a controller with older firmware with the most recent version of PLCnext Engineer, but it is recommended to use the most recent firmware or the current year's LTS (Long Term Supported) version

9. Once the firmware is noted and/or updated, then you are ready to move on to the software procedures!
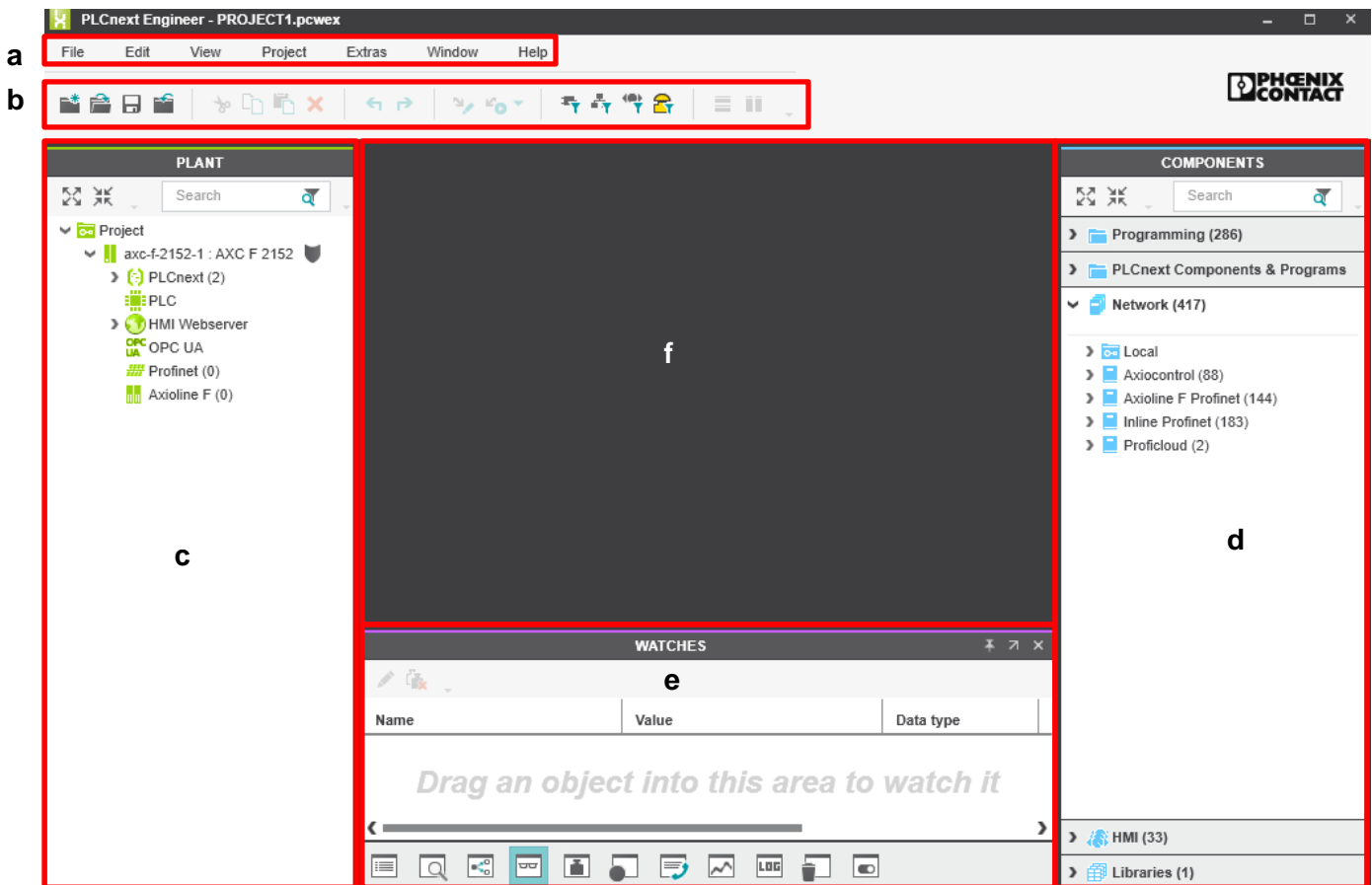
3 – PLCnext Engineer Setup

These procedures will go over the programming environment, how-to create a new project.

3.1 – Software Overview

This will go over the different areas in PLCnext Engineer. Section 3.2 will discuss how to create a new project.

a) Menu Bar – Save project, close project, change environment settings, etc.
b) Tool Bar – Save, open, close project. Toggle views, undo, etc.
c) PLANT – Window that contains your hardware and configuration options for each piece of hardware
d) COMPONENTS – Window that contains programming tools for developing code and screens. This window also contains the code for user programs, etc.
e) Cross Functional Area – Used to view errors/warnings, online values, logs, and more.
f) Editor – Windows are populated here for hardware configuration, programming and other details

3.2 – Create a New Project

1. Open the PLCnext Engineer software

2. Select File (a) > New Project (b). See figure 3.2-1

Figure 3.2-1: Creating a new project
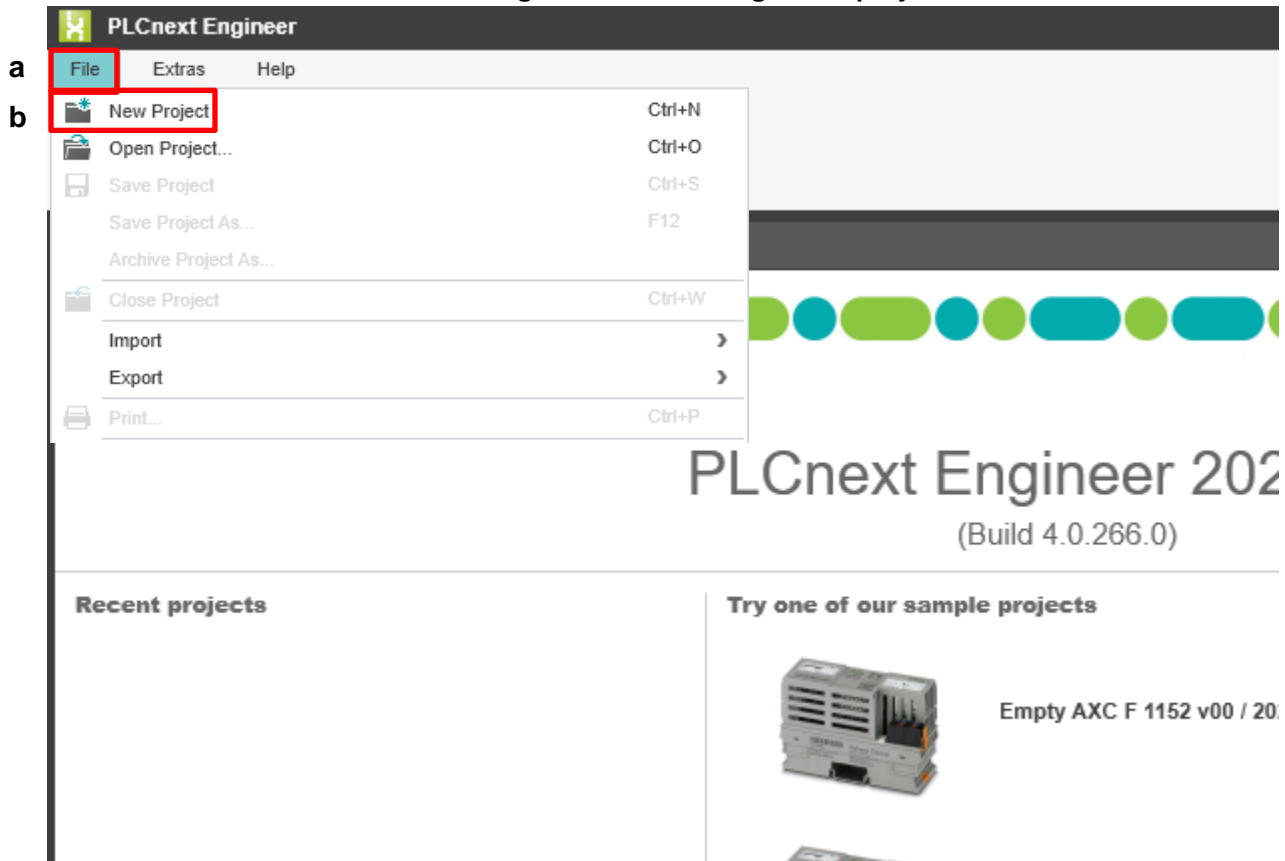


3. Now an empty project is created.

4. Add a controller. Go to Components (a) > Network (b)> AxioController (c)> Devices (d) > Controllers (e). See figure 3.2-2.

5. Find the controller that matches your controller & firmware (f), **right-click** and copy (g)

- **NOTE:** If your firmware version is greater than any listed use the latest version.
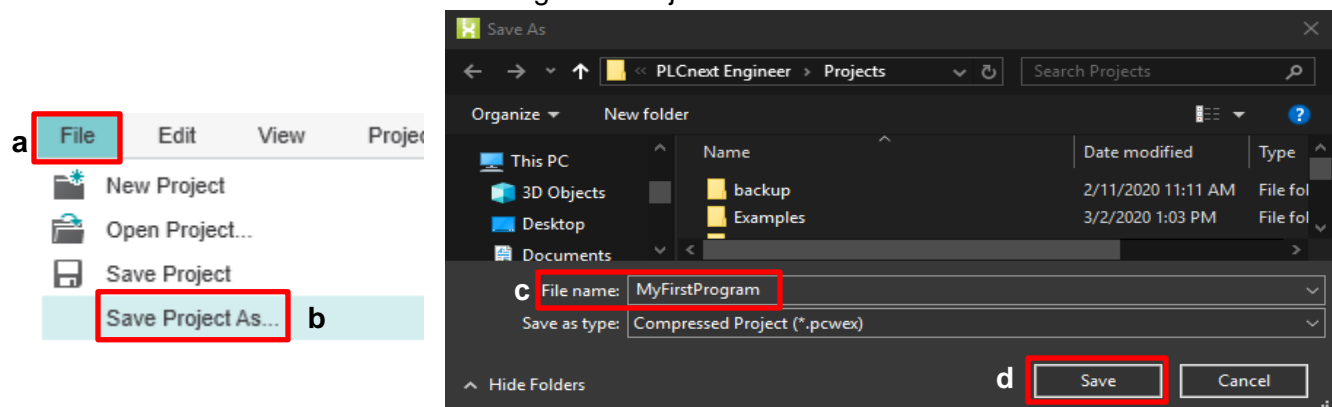 - i.e. 2020.0.1 > 2020.0.0 but if 2020.0.1 is not available 2020.0.0 may be used.

6. Add controller to Plant (h) > Project (i). **Right-click** and paste the controller (j). See figure 3.2-2

Figure 3.2-2: Adding a controller
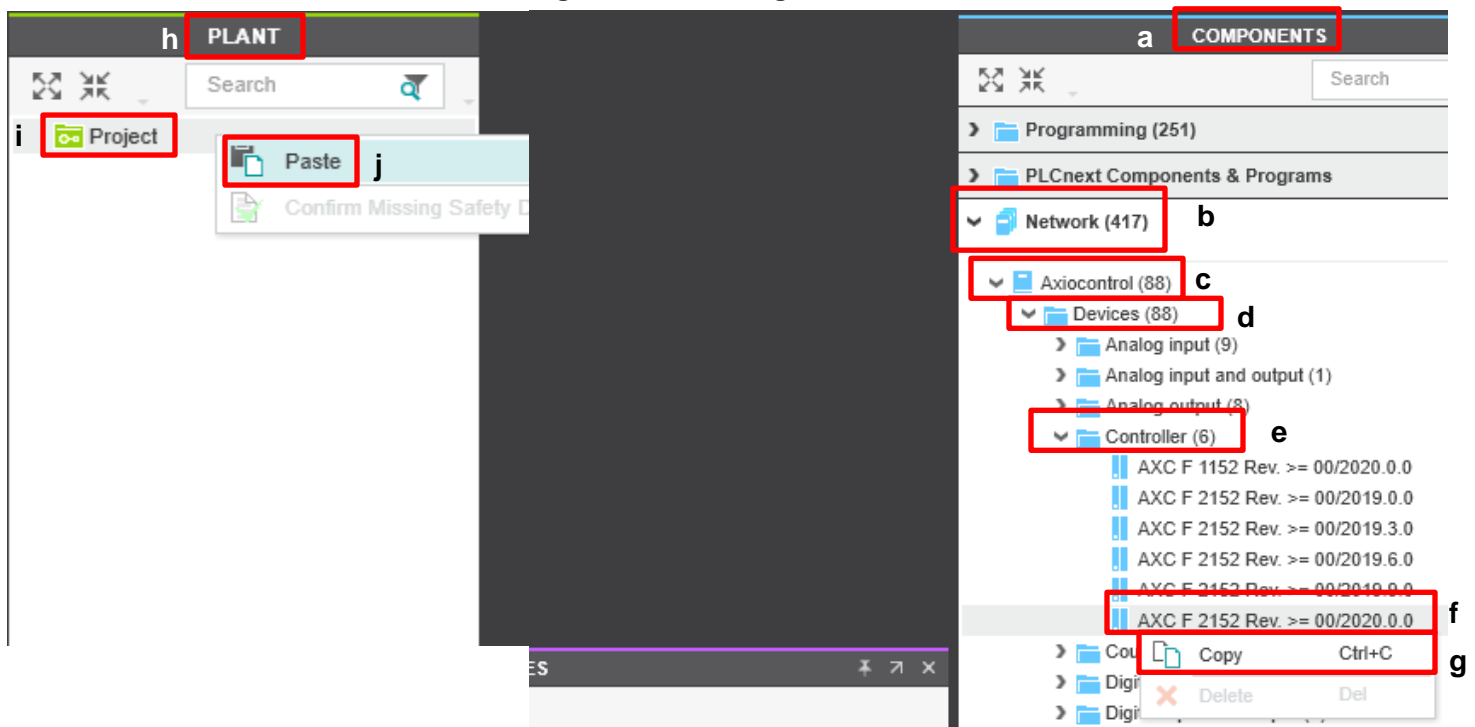
7. Now save your newly created project. File (a)> Save Project As... (b) and give it a unique name (c). For this example, "MyFirstProgram" and select Save (d) . Leave the default path: C:\Users\Public\Documents\PLCnext Engineer\Projects

4 - PLCnext Engineer Communications

4.1 – Change the IP Address Range

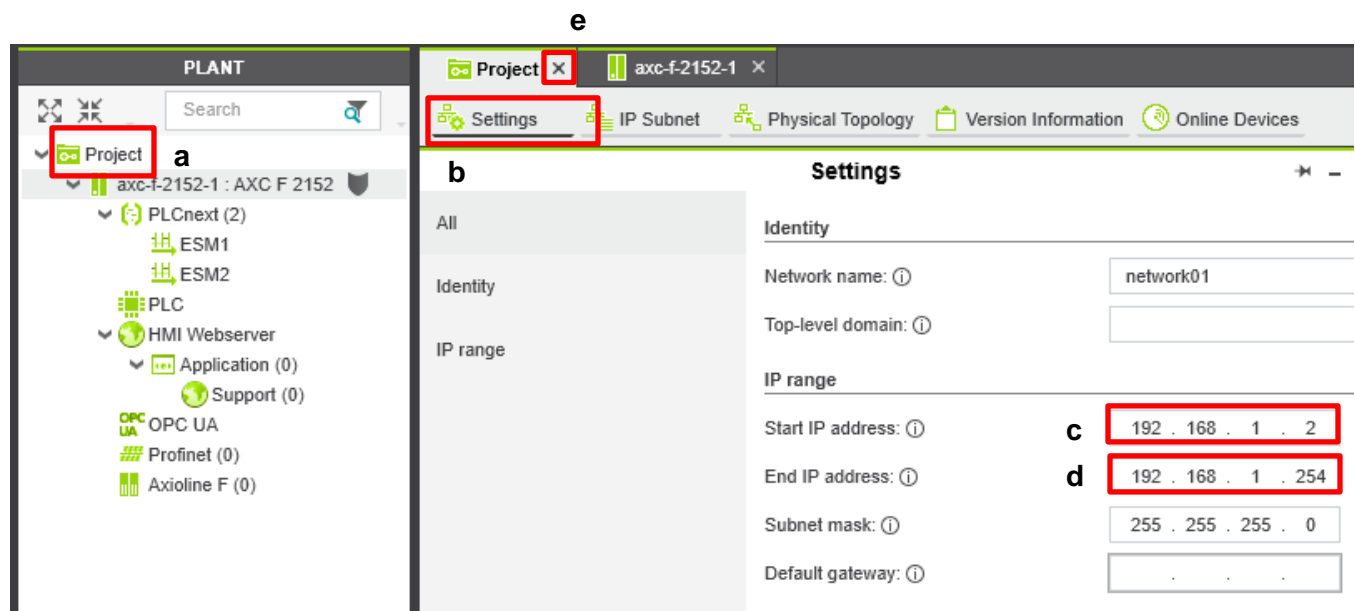1. Go to Plant and **double-click** Project (a). A new window will appear in the editor space. See figure 4.1 -1.

2. In the new window, go to Settings (b) and change the following: (See figure 4.1-1)

Start IP Address: 192.168.**1.**2 (c)

End IP Address: 192.168.**1.**254 (d)

3. The IP address range has been changed. Close "Project" window (e)

Figure 4.1-1: Changing the IP Range

4.2 – Change the Controller's IP Address

1. Go to Plant > Project and **double-click** axc-f-2152-1 (a). A new window will open in the editor space. See figure 4.2-1

2. In the new window ("axc-f-2152-1") (b), go to Settings (c) > Ethernet (d) and change the following: (See figure 4.2-1)

- IP assignment mode: Manual (e)
- IP address: 192.168.1.10 (f)

3. Close out of window (g). See figure 4.2-1.

**Figure 4.2-1: Changing the IP Address**
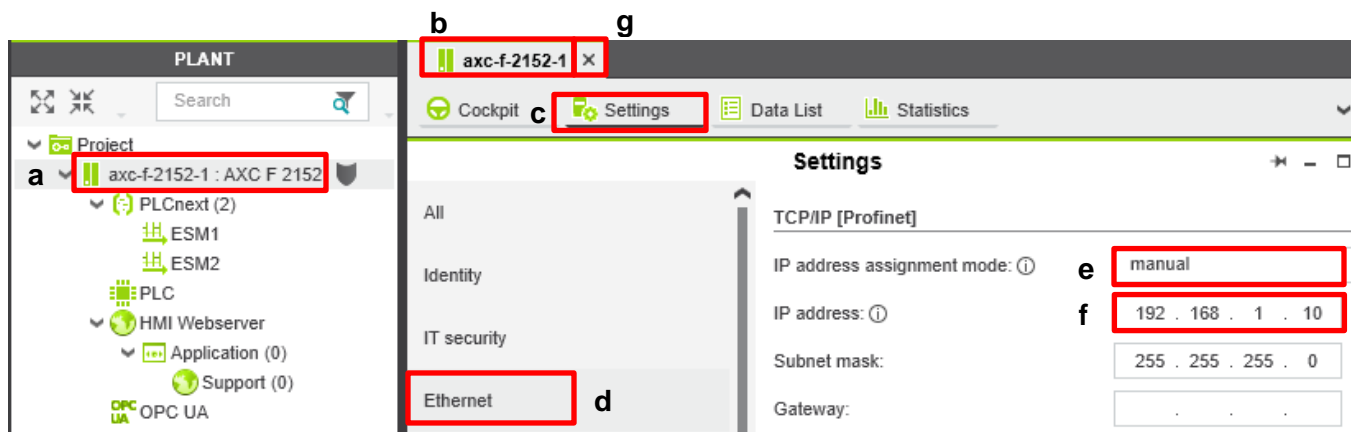
4. Go to Plant and **double-click** Project (a) to assign the IP address to the controller. See figure 4.2-2.

5. Go to Online Devices tab. (b) See figure 4.2-2.

6. Select the ethernet adapter (usually called "Ethernet.." or "Local Area Connection..") (c) See figure 4.2-2.

7. Scan network (d). See figure 4.2-2.

8. Select a controller in the "Select online device here" in the first row. (e) Once selected an hour glass will appear and then turn into a check mark.

9. Once the check mark appears the IP address has been successfully assigned to the controller. (f)

Figure 4.2-2
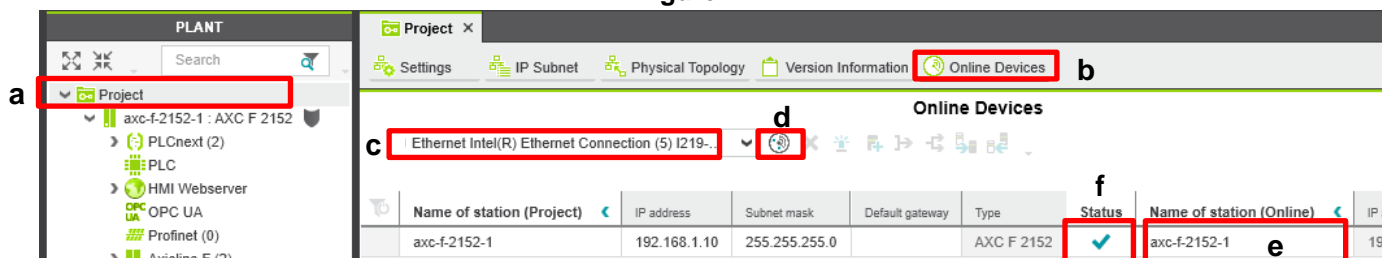
4.3 – Testing the Connection

1. Test the connection by going to Plant > Project and **right-clicking** on the controller ("axc-f-2152-1..") and selecting "Connect / Disconnect". If the connection is setup properly a login screen will appear.

2. Login into the controller using the username: "admin" and password. The default password is printed on the housing of the controller.

3. If you get any of the following icons you are connected and ready to move on to the next steps. Please right-click and select "Connect / Disconnect" to disconnect from the device.
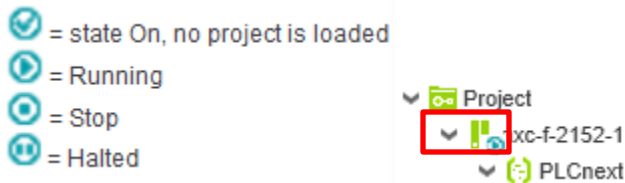

NOTE: If PLCnext Engineer is connected to the controller changes **cannot** be made!

5 – Adding I/O

The procedure will go over how to add I/O modules connected to the controller.

1. Go to Plant > Project > "axc-f-2152.."(a) and **double-click** Axioline F – a new window will open

2. In the new window, go to the Device List tab (b). See figure 5.1-1.

3. In the order the modules are connected to the controller (left to right) add them to the table in the Device List.

4. Click "Select Type Here" and a list of available I/O modules will appear (c). See figure 5.1-1.

5. First, add the Digital Input/Output Module (AXL F DI8/1 DO8/1 H) (d, e). See figure 5.1-1.
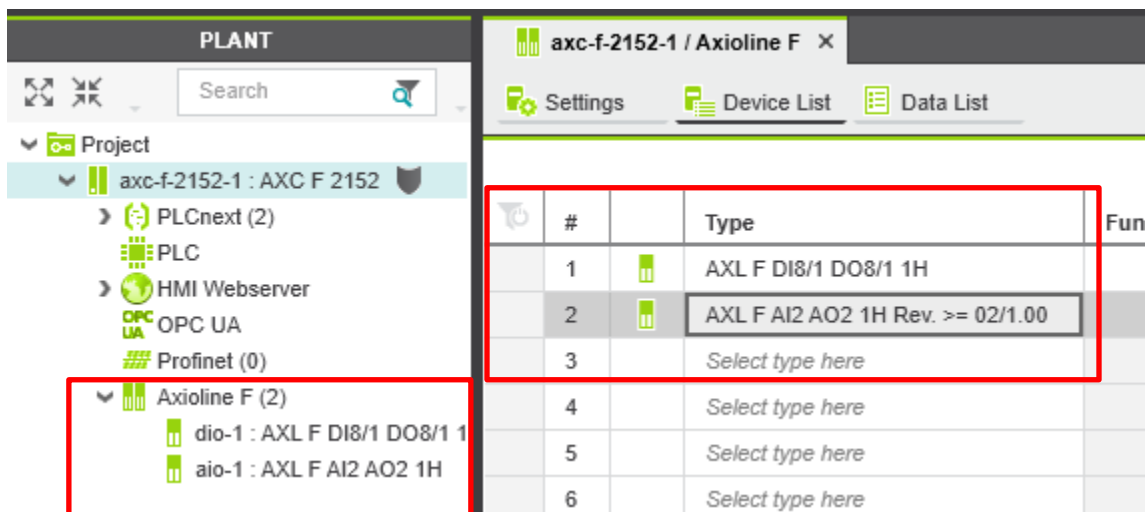
Figure 5.1-1
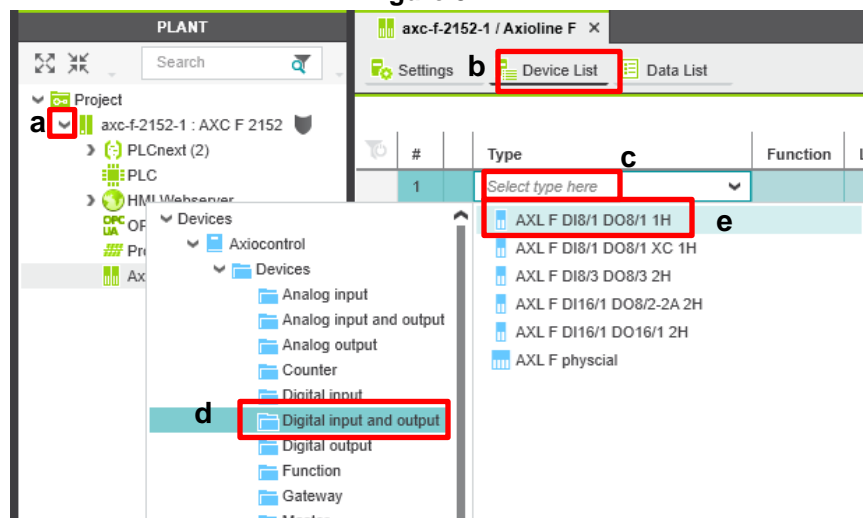
6. Now add the Analog Input Module (a, b). Figure 5.1-2

Figure 5.1-2
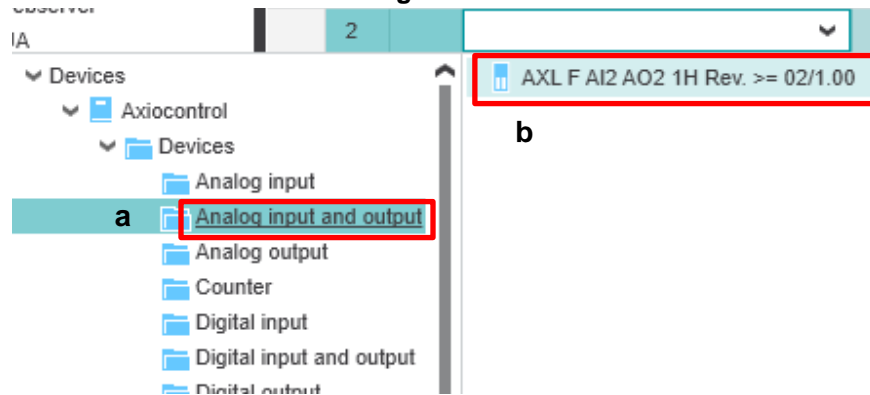
7. The result should be two additional modules in the Project tree under "Axioline F". If your setup matches the image below close out of the window.


NOTE: To configure the analog module see Appendix 9. This is not necessary for this example.

6 – Mapping I/O

This procedure will describe how to create "Global Variables" that are assigned to the inputs & outputs (I/O) attached to the controller. The "Global Variables" can then be used in a program to monitor and control I/O.

1. Go to Plant > Project > "axc-f-2152.." and **double-click** PLC (a). – This will open a new window. See figure 6.1-1.

2. In the new window, go to "Data List" (b) you will see a list of global variables. Create a new group and call it "I/O" by selecting the icon in the toolbar (c). See figure 6.1-1.

Figure 6.1-1: Global Variable Table
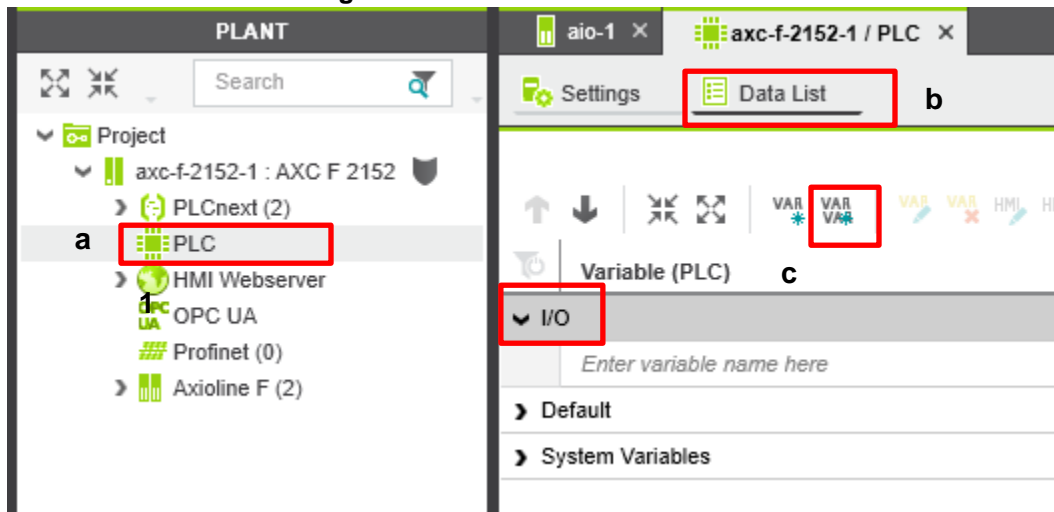
3. Create global variables. There are two parameters of the variable that will need created/configured.

- Name: Can be any name. Preferably, a name that describes the value associate with it.
- Process Data Item – The Input or Output channel to be mapped to the variable

4. Click the field that says, "Enter variable name here" and type in the name of our first Digital Input, "DI_0" and select ENTER.

5. Map to the appropriate Digital Input by clicking in the Process Data Item field (a). Then select the module (b) and channel (c) to be mapped. See figure 6.1-2.

Figure 6.1-2: Creating a Global Variable
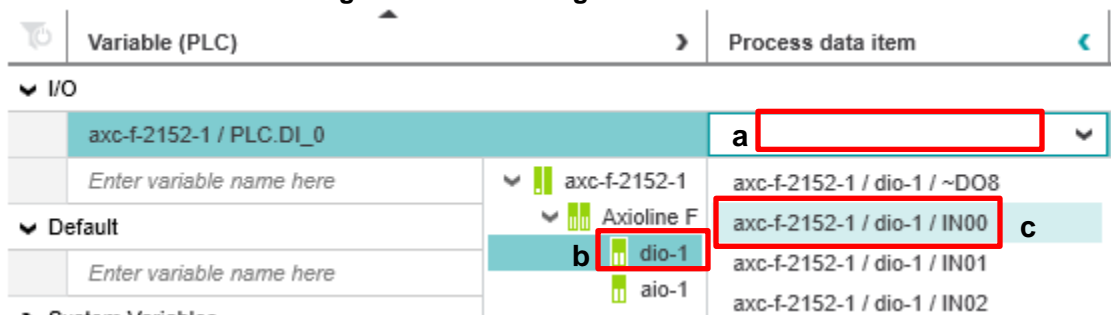
6. Do this for each digital input and output channel. Below shows the number of variables and recommended naming convention. After this is complete digital I/O has been successfully added and ready to use in a program! See figure 6.1-3 for reference.

- 8 Digital Inputs – DI_x (a)
- 8 Digital Outputs – DO_x (b)
- See Appendix 9 for mapping analog I/O. NOT needed for this example.

Figure 6.1-3

Variable (PLC)	›	Process data item	›	HMI tag	›
⌄ I/O					
axc-f-2152-1 / PLC.DI_7		axc-f-2152-1 / dio-1 / IN07			
axc-f-2152-1 / PLC.DI_6		axc-f-2152-1 / dio-1 / IN06			
axc-f-2152-1 / PLC.DI_5		axc-f-2152-1 / dio-1 / IN05			
axc-f-2152-1 / PLC.DI_4		axc-f-2152-1 / dio-1 / IN04			
axc-f-2152-1 / PLC.DI_3		axc-f-2152-1 / dio-1 / IN03			
axc-f-2152-1 / PLC.DI_2		axc-f-2152-1 / dio-1 / IN02			
axc-f-2152-1 / PLC.DI_1		axc-f-2152-1 / dio-1 / IN01			
axc-f-2152-1 / PLC.DI_0		axc-f-2152-1 / dio-1 / IN00			
axc-f-2152-1 / PLC.DO_7		axc-f-2152-1 / dio-1 / OUT07			
axc-f-2152-1 / PLC.DO_6		axc-f-2152-1 / dio-1 / OUT06			
axc-f-2152-1 / PLC.DO_5		axc-f-2152-1 / dio-1 / OUT05			
axc-f-2152-1 / PLC.DO_4		axc-f-2152-1 / dio-1 / OUT04			
axc-f-2152-1 / PLC.DO_3		axc-f-2152-1 / dio-1 / OUT03			
axc-f-2152-1 / PLC.DO_2		axc-f-2152-1 / dio-1 / OUT02			
axc-f-2152-1 / PLC.DO_1		axc-f-2152-1 / dio-1 / OUT01			
axc-f-2152-1 / PLC.DO_0		axc-f-2152-1 / dio-1 / OUT00			
Enter variable name here					

a

b

7 – Creating a New Program

This procedure will go over how to create a new program and assign to be executed on the controller.

1. Go to Components (a) > Programming (b) > Local (c) and **right-click** on Programs and click "Add Program"(4). See figure 7.1-1.

Figure 7.1-1: Creating a new program
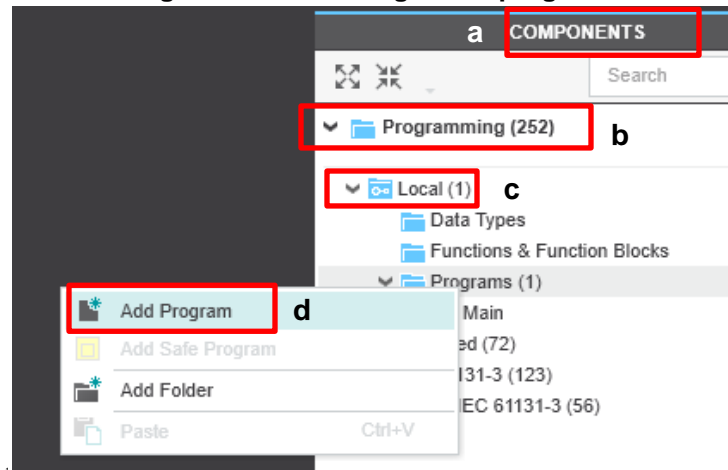
2. Once created change the name from "New Program". In this example, it will be called "Main". You can do so by typing after adding the program or right-click and choose "rename".

3. Now go to Plant > Project > axc-f-2152... and **double-click** PLCnext (a). Here you will create a task to tell the controller how to execute the program. See figure 7.1-2

4. Go to the "Tasks and Events" tab (b) and create a task by typing a new task name in the field that says "Enter task name here" under ESM1 (c). In this example, the task is called "Task01". See figure 7.1-2.

5. Change the Task type field from Cyclic task to Idle task (d). Idle task will run the program as fast as possible at the lowest priority. See figure 7.1-2

Figure 7.1-2: Creating a task
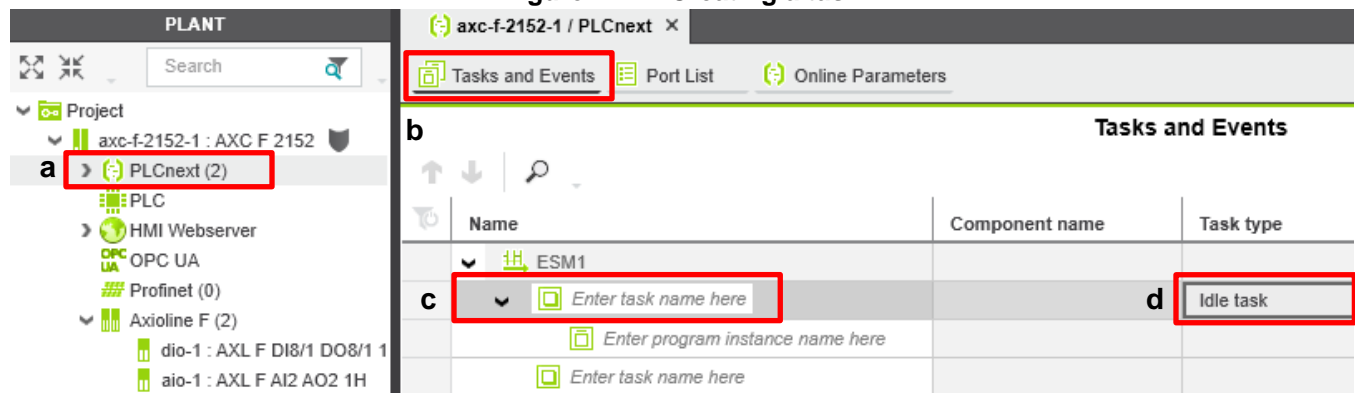
6. Now the newly created program can be assigned to the task "Task01". Go to the "Program Type" field (a) and click "Select program type here" then add the program (b). In this example, "Main". See figure 7.1-3.

Figure 7.1-3: Adding a Program to a Task

7. An instance name "Main1" will be created automatically.

8. The program is now assigned to execute on the controller. Close out of all windows.

8 – Developing Code

This procedure will cover selecting a programming language, creating variables, and developing code in Function Block Diagram (FBD). The code will control and blink an output on the controller.

1. Go to Components > Programming > Local > Programs and double click on your Program. In this example, "Main" (a). See figure 8.1-1.

2. A new window will open in the editor space. Here a programming language can be selected. For this example, select "Add LD Code Worksheet" (b) this will allow for FBD programming. See figure 8.1-1.

Figure 8.1-1: Selecting a programming language
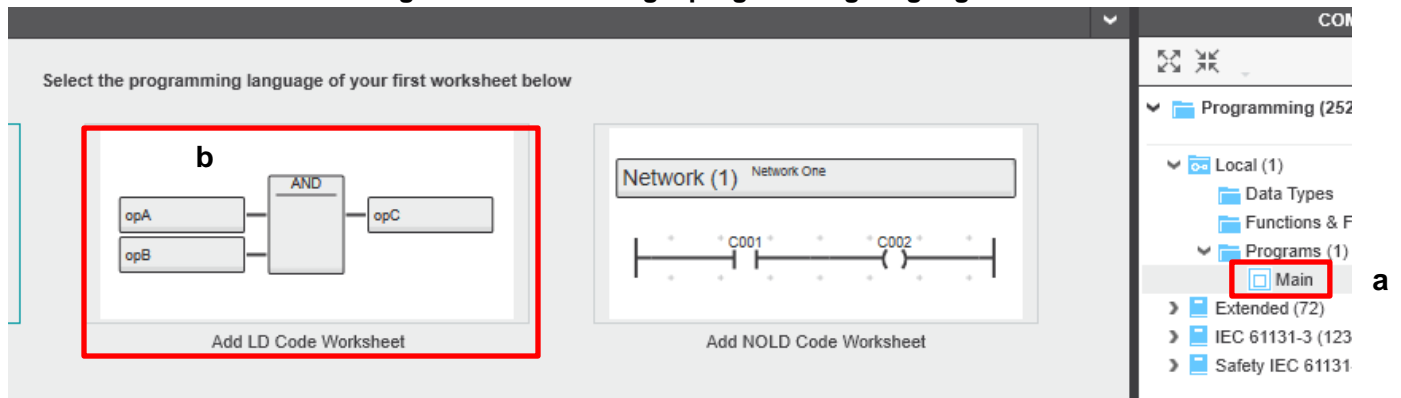
3. Now the window will change to the code sheet where code can be written.

4. First, let's add a variable for the first input mapped to the Digital I/O module.

5. Click in the code sheet (a) and start typing the name of the variable mapped to the first Digital Input. (b). In this example, "DI_0" and click the variable when it appears (c). See figure 8.1-2.

Figure 8.1-2: Adding a New Variable
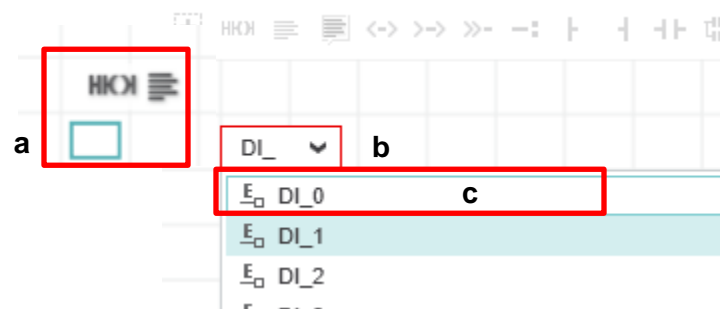
6. Declare the variable by selecting the variable and choosing the external variable icon (a). This will create an external variable which points to the global variable table where the I/O is mapped. See figure 8.1-3.

NOTE: PLCnext version ≥2020.3 automatically creates the external variable once added so this step will not be necessary.

Figure 8.1-3: Declaring an External Variable

7. Adding functions and function blocks to the program. These will allow for special functionality including adding, timing, counting, and more. They can be viewed here: Components > Programming > IEC61131-3 OR Extended.

8. Start by adding an AND function. Go to Components > Programming > IEC61131-3 > Functions & Function Blocks > Bitwise Boolean > AND (a). Drag'n Drop AND onto the code sheet close to the variable previously added (b).
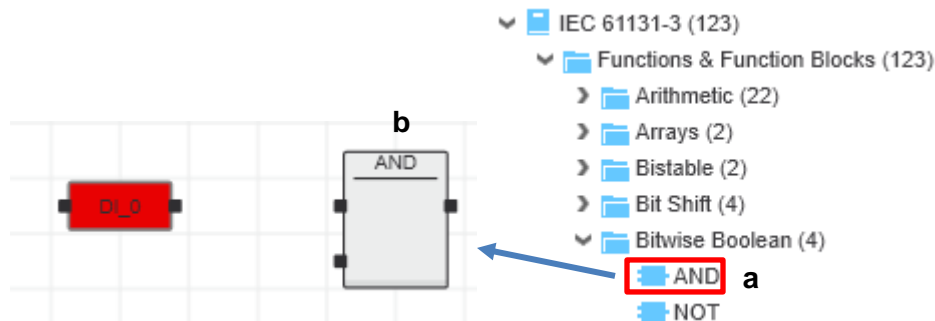
NOTE: By right-clicking on a functions or function blocks you can open a help file to see how the code works.

9. Now connect the variable "DI_0" to the top input of the "AND" block. You can add a line from both points.

10. The result should look like the following:
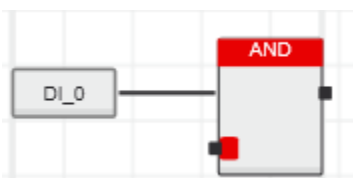
NOTE: To delete a connection click the connection line (wire) and select the red 'X' that appears

12. Add a Timer On Delay (TON). Go to Components > Programming > IEC61131-3 > Functions & Function Blocks > Timer > TON. Drag and Drop "TON" onto the code sheet by the output of the AND block (a). See figure 8.1-4.

13. Connect the output of the AND block to the "IN" of the TON block (b). See figure 8.1-4.

14. Add a Timer Off Delay (TOF). Go to Components > Programming > IEC61131-3 > Functions & Function Blocks > Timer > TOF. Drag and Drop "TOF" onto the code sheet by the output of the TON block (c). See figure 8.1-4.

15. Connect TON's output (Q) to TOF's input (IN) (d). See figure 8.1-4

16. Click "PT" on both the TON and TOF blocks and type "t#3s" (e,f). This is how often and long the light will blink. See figure 8.1-4

Figure 8.1-4: Adding timers
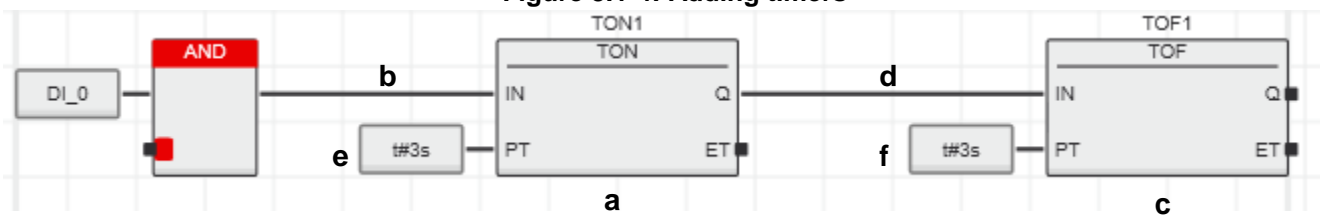
15. Assign the first Digital Output "DO_0" to "Q" on the TOF (a). See figure 8.1-5.

16. Add a NOT function to the second input of the AND block. (b) Go to Components > Programming > IEC61131-3 > Functions & Function Blocks > Bitwise Boolean > NOT. See figure 8.1-5.

17. Assign the first Digital Output "DO_O" to the input of the NOT block (c). See figure 8.1-5.

17. Once complete and no errors exist the program has been completed! (d)

NOTE: Warnings are okay!

**Figure 8.1-5: Final Code!**
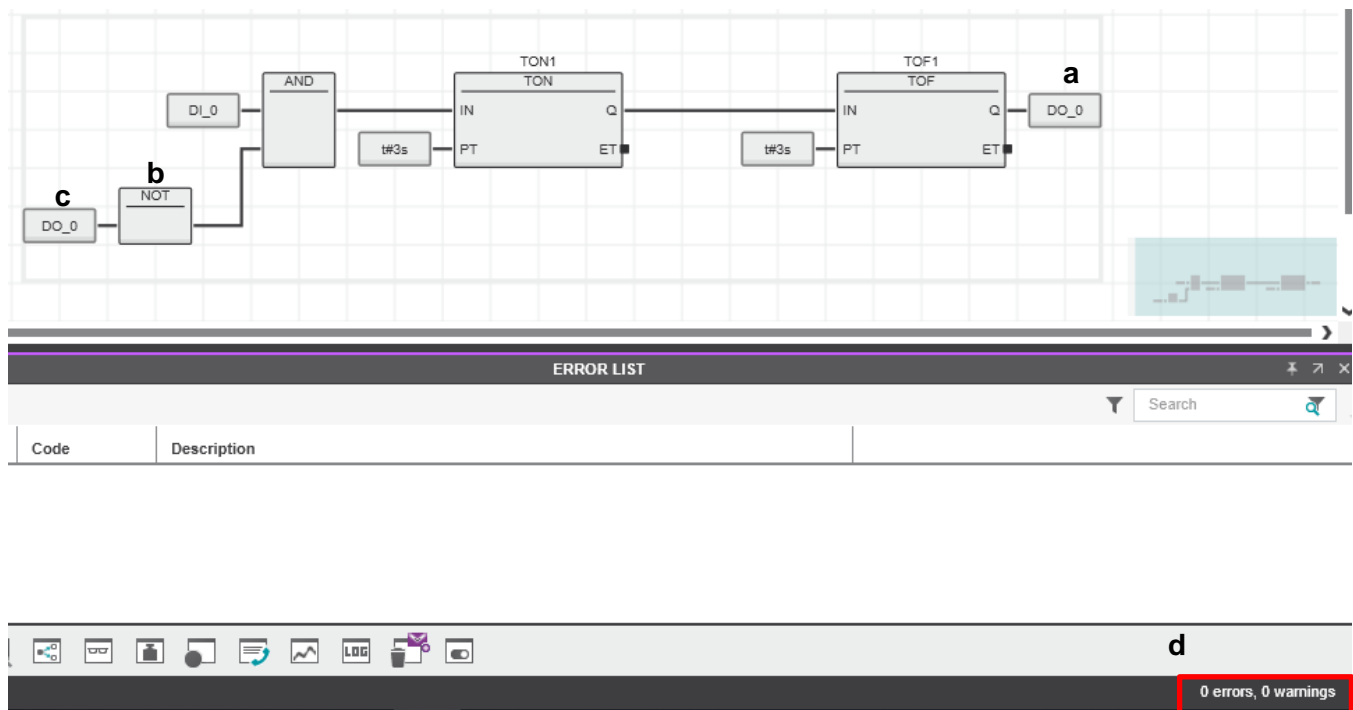
The result of this code will be once the switch is turned on and 3 seconds have expired an LED will turn on for 3 seconds and off for 3 seconds until the switch is turned off. View the help files for the blocks to see how they function.

9 – Downloading to the Controller

The procedure will go over downloading code to the controller and viewing the values online.

1. Now that the code is complete it is ready to be downloaded and ran on the controller.

2. Go to PLANT > Project and **right-click** on "axc-f-2152.." (a) and select "Write and Start Project" (b). See figure 9.1-1. This will connect to the controller, download the project, and start running the code.

Figure 10.1-1
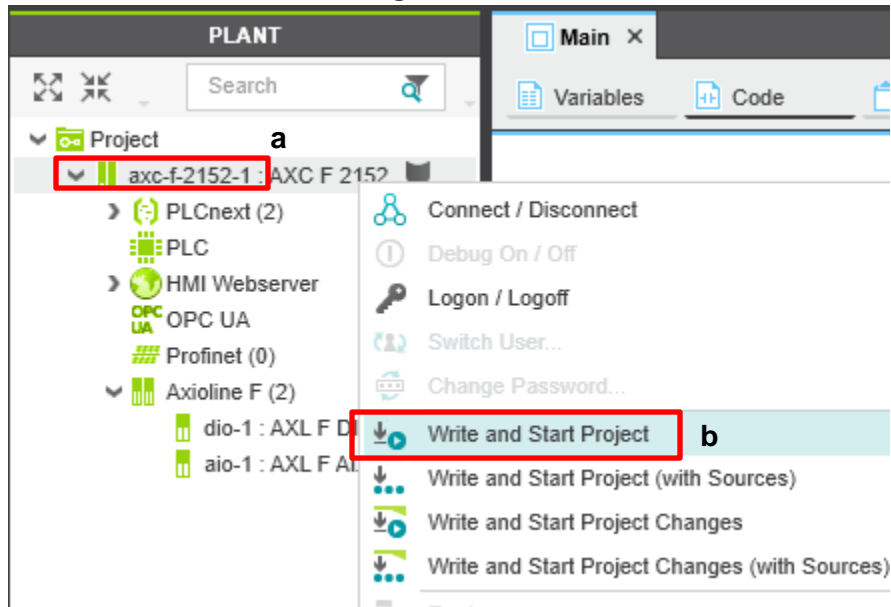
3. You may be prompted to login. If so, login as "admin".

4. Once the project is running the icon below will appear by the controller:

 = Running

5. Now that the program is running, turn the first toggle switch on and the output LED on the Digital I/O module will turn on and off every 3s.

6. You can also open the program "Main" > Code (a), click in the code sheet and select the arrow (b) to view online values. See figure 9.1-2. For all other debugging features checkout Appendix 12.

Figure 9.1 -2: Viewing online values