Welcome

PLCnext Technology
Part 2
Getting started with Proficloud

PHOENIX CONTACT
INSPIRING INNOVATIONS

PLCnext Technology

Part 2

Getting started with ProfiCloud

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ProfiCloud – Professional Cloud Solutions

- Cloud service hosted by Phoenix Contact
- Provides a convenient means of creating dashboards to show content generated from your PLCnext controller(s)
- Platform to conduct analytics on your data
- Trending, time series data

ProfiCloud – Professional Cloud Solutions

This training assumes you have completed Part 1 of this PLCnext training series. If so, you can follow this training almost verbatim. If you have not completed Part 1, but already have familiarity with PLCnext programming, you may still use this training, although you will need to adapt the examples to your existing program.

Thanks to Dave Hoysan – his Proficloud tutorial

Thanks to Liz Bertelson – Help with networking

Thanks to Loren Brown – Help with PLCnext Engineer

Topics

- Hardware and software used
- Preparing your PLCnext controller to communicate with ProfiCloud
  - Access the PLCnext controller’s web-based management to configure
  - Adapt your laptop and network to reach the internet
- PLCnext Engineer programming/configuration
  - Creating code and variables in PLCnext Engineer to interact with Proficloud
- ProfiCloud configuration
  - Time Series Data (TSD)
    - Adding your device
    - Creating dashboards

Hardware and software

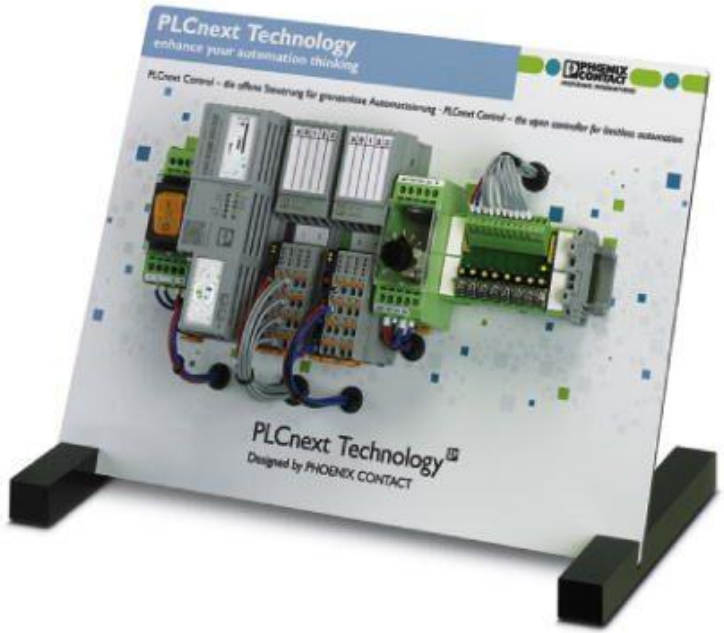
Hardware:

- AXC F 2152 STARTERKIT Order # **1046568**
- …or build your own:
  - Controller - AXC F 2152 - **2404267**
  - DI/DO Module – DI8 /1 DO8 /1 – **2701916**
  - AI/AO Module – AI2 AO2 – **2702072**
  - *I/O Exerciser - **5603026**
- *To follow the programming example in this training, a means of generating a 0-10vdc analog input signal and a 4-20mA analog input signal is needed.

Software:

- PLCnext Engineer – for PLCnext controller programming
- ProfiCloud

As this is follow-on training to the PLCnext training course, the same hardware and software are being used, with the addition now of the ProfiCloud application.



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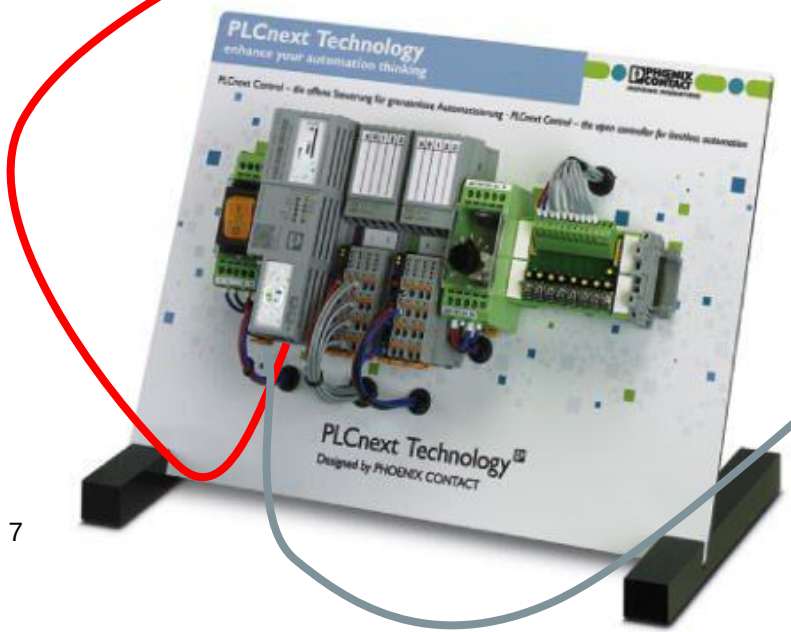
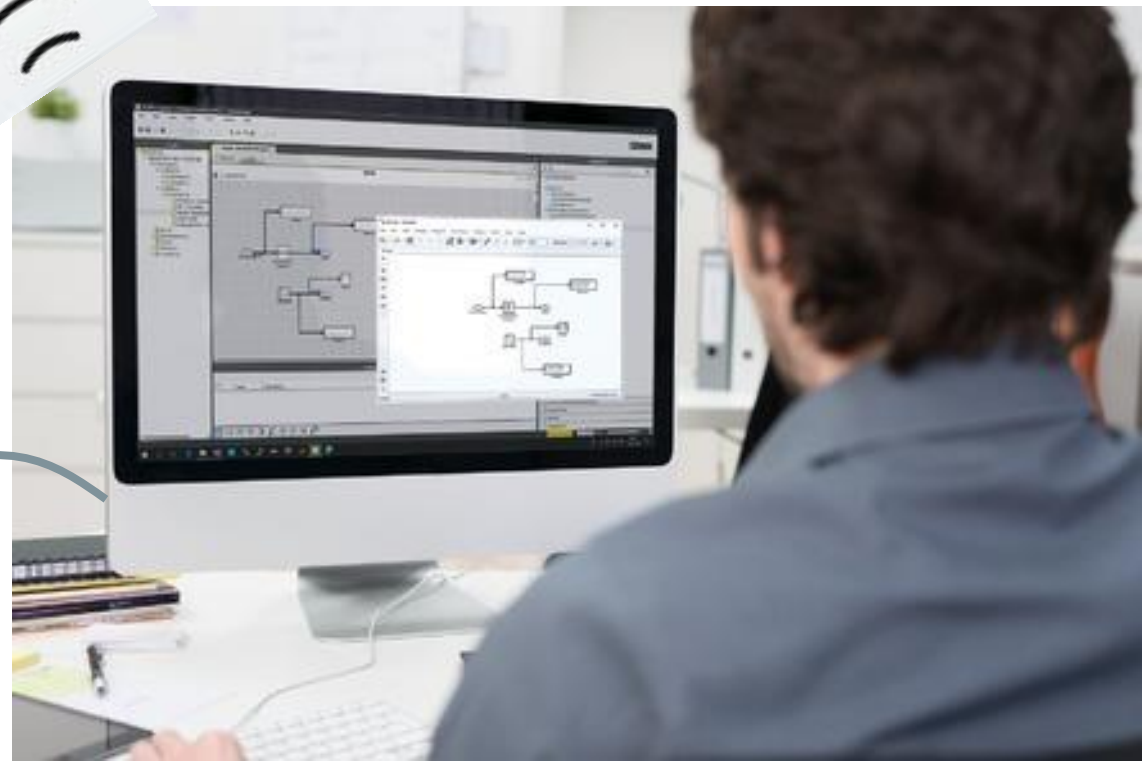
Connect the PLCnext controller to the internet, and simultaneously to your computer – via Ethernet

Modem – wired or cellular – to provide the PLCnext controller with internet access





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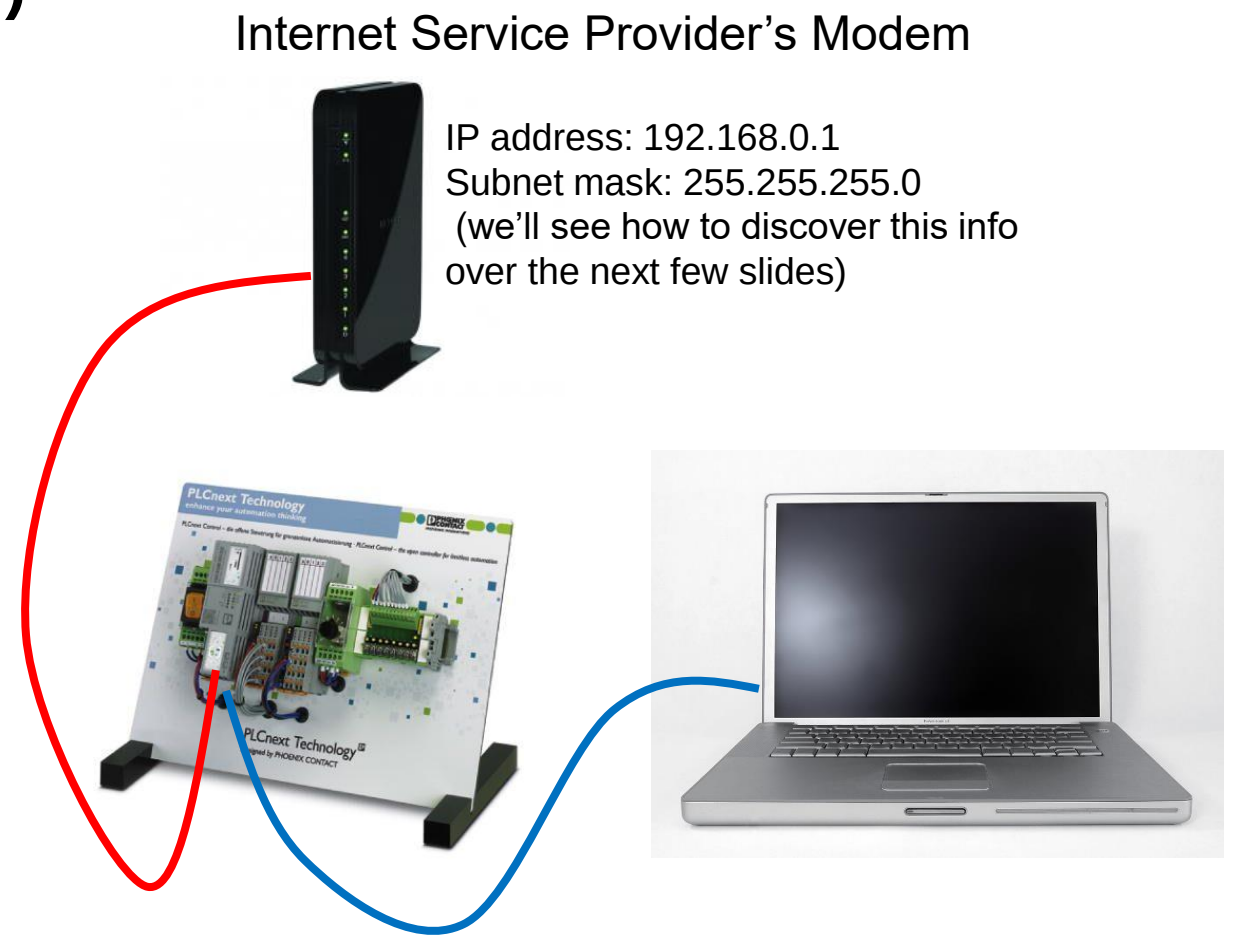
Connect the PLCnext controller to the internet, and simultaneously to your computer – via Ethernet

To work with Proficloud, the PLCnext controller requires simultaneous connection to both the programming PC and to the internet. This requires the use of an Ethernet switch. Fortunately a 2 port Ethernet switch is built into the AXC F 2152 (and other PLCnext models). Simply keep the existing Ethernet cable connected between the PLCnext controller and your programming PC. Plug a second Ethernet cable into the second Ethernet port on your PLCnext controller and plug the other end into a modem/router that has access to the internet. This could be cellular router, such as the one shown on the previous slide, or it could be for example, an Internet Service Provider's Router at your house, as shown on the following slide. In the case of this training session's development, the ISP's modem in the author's home office was used. This requires some reconfiguration of the IP address of the PLCnext controller, and some additional tweaks to the Ethernet network, which will be explained.

Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

In many cases you will not be able to change the IP address, subnet, or default gateway of the upstream router, so you must discover these, and adapt the PLCnext controller, and your laptop, to communicate with and through the router, to the internet.

We will use some Windows tools to discover the IP information of the upstream router and will adjust the IP address of the PLCnext controller accordingly.



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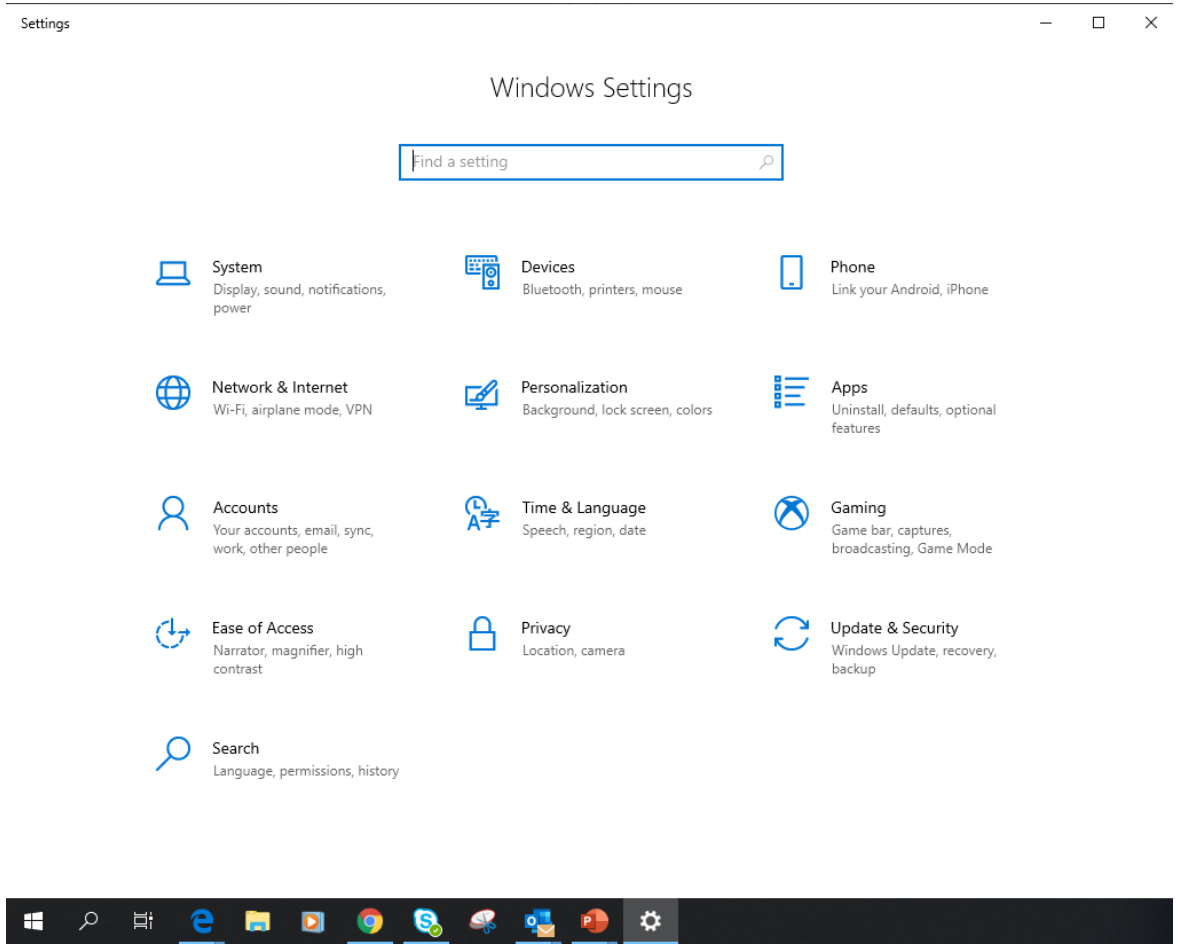
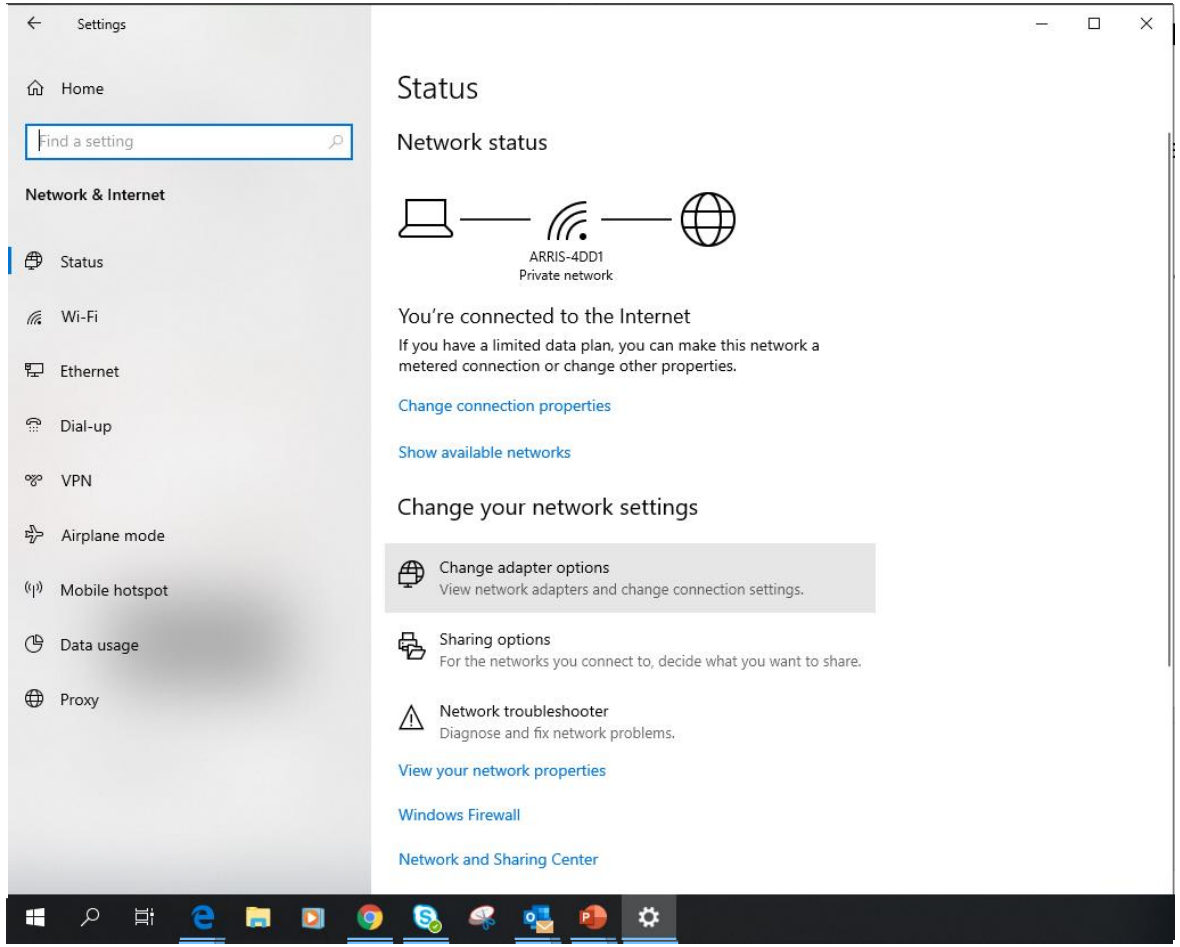
Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- Click on the Windows icon at the bottom-left of the screen
- Click on the "Settings" menu item
- When "Settings" opens, click on "Network & Internet"



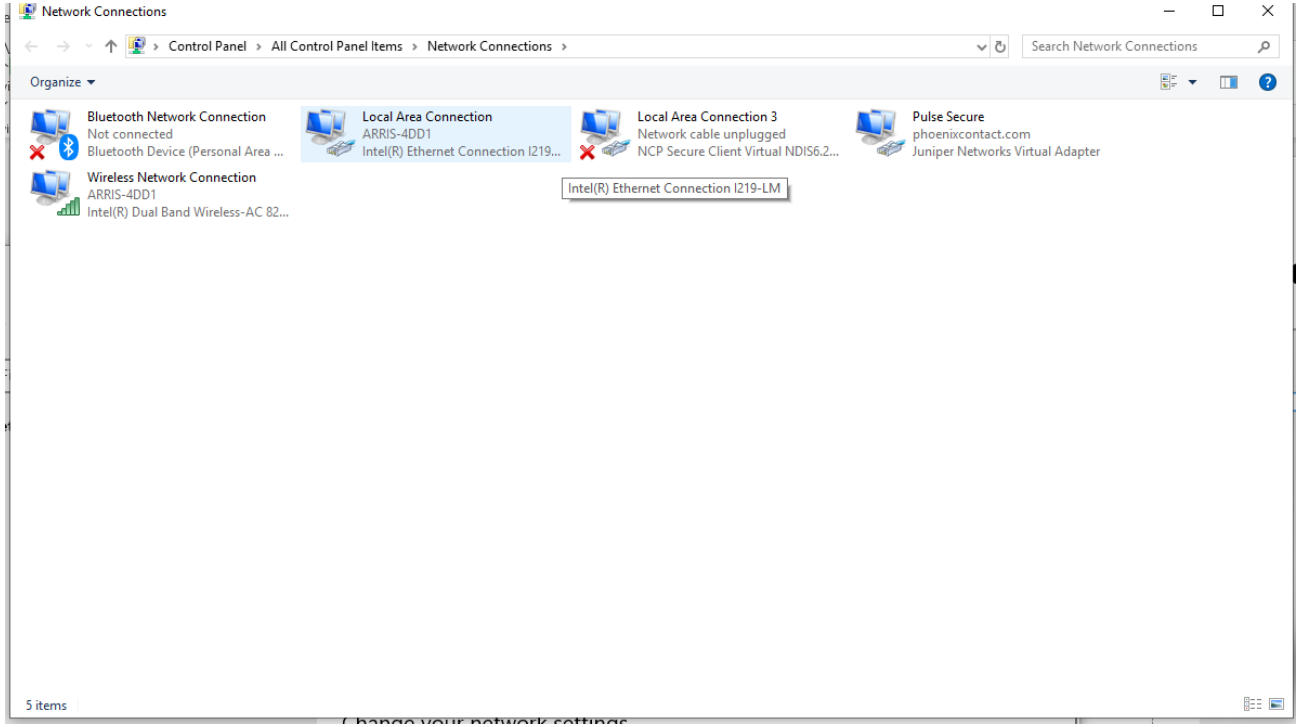
Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- Click on the Windows icon at the bottom-left of the screen
- Click on the "Settings" menu item
- When "Settings" opens, click on "Network & Internet"
- **Click on "Change adapter options"**



Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- **Right-Click on "Local Area Connection"**



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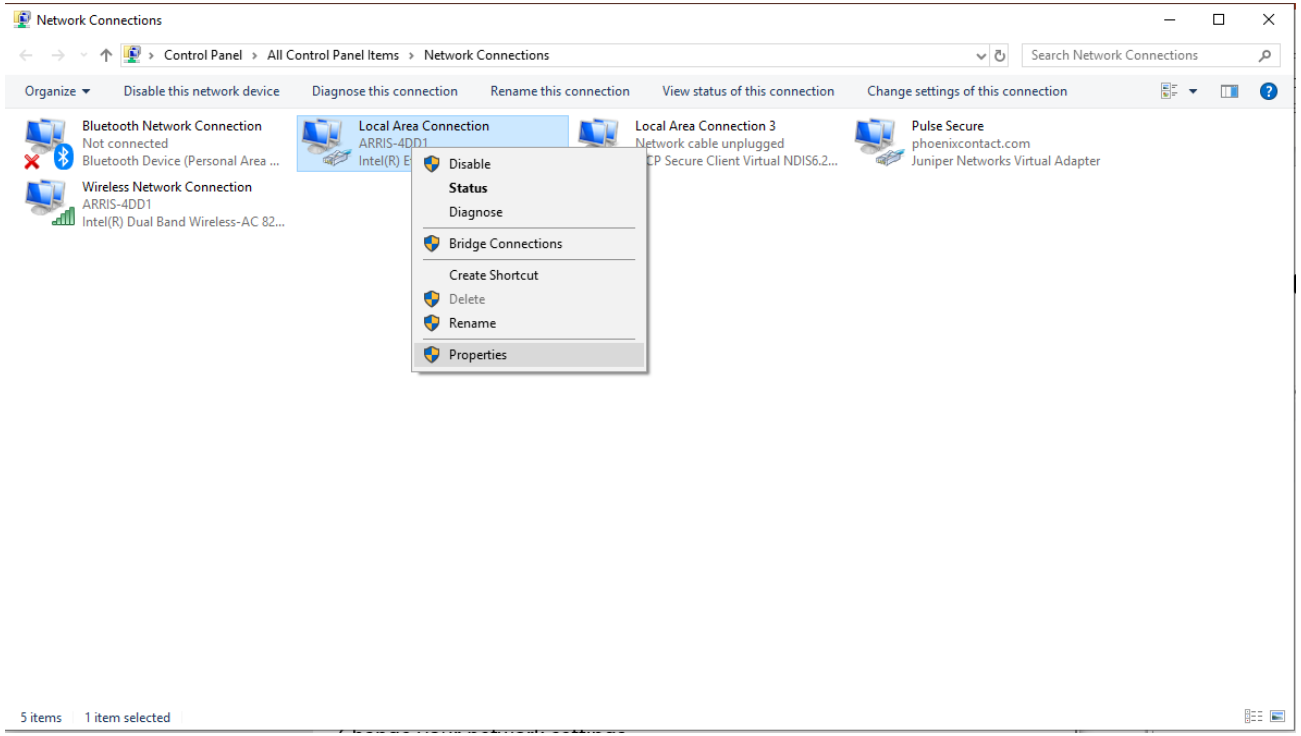
Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- Right-Click on "Local Area Connection"
- **Then click on "Properties" from the drop-down list**



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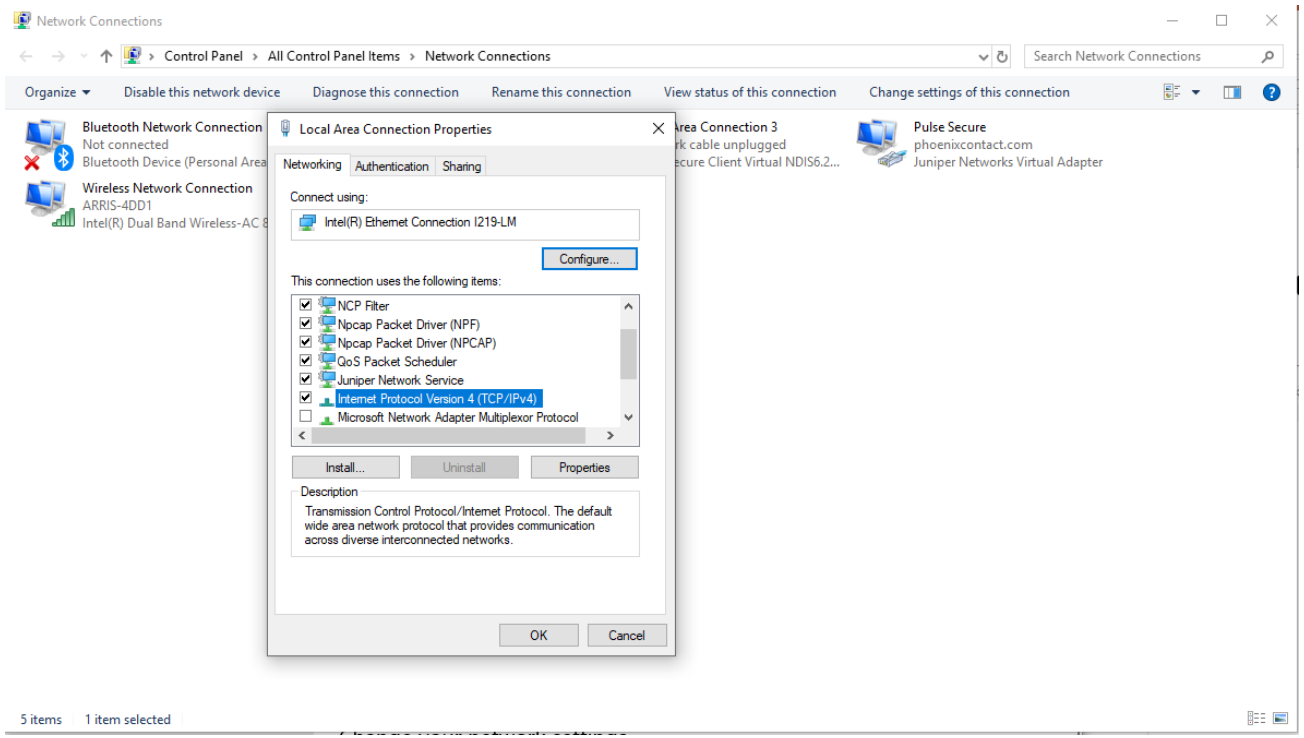
Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- Right-Click on "Local Area Connection"
- Then click on "Properties" from the drop-down list
- **Scroll down the list and double-click on "Internet Protocol Version 4 (TCP/IPv4)**



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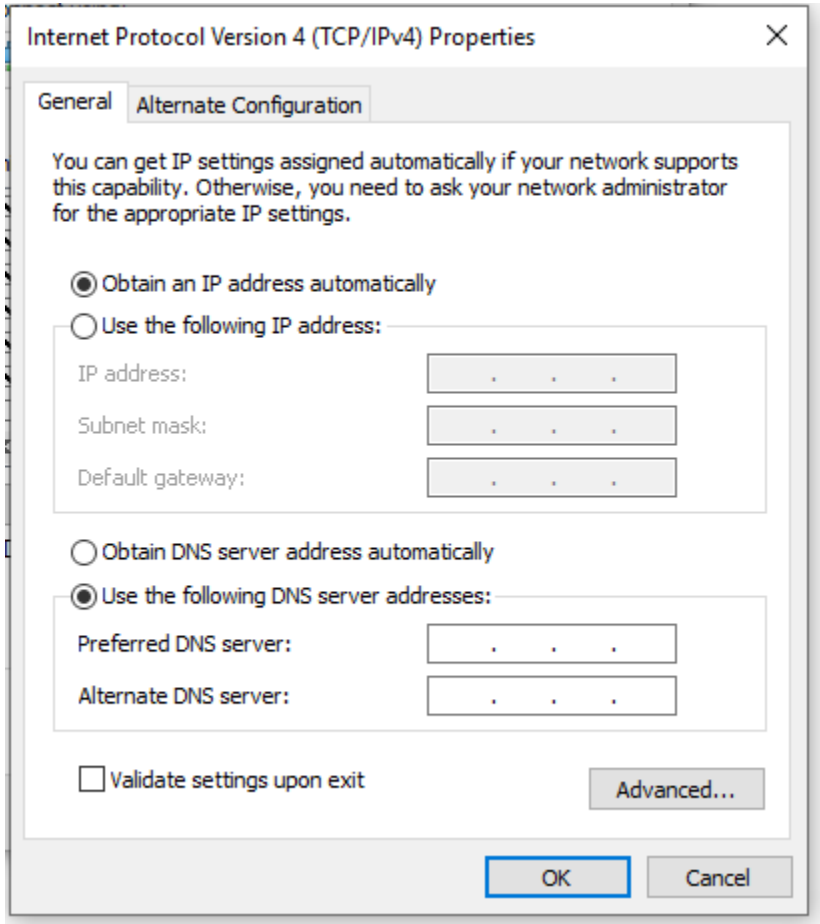
INSPIRING INNOVATIONS

Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- Right-Click on "Local Area Connection"
- Then click on "Properties" from the drop-down list
- Scroll down the list and double-click on "Internet Protocol Version 4 (TCP/IPv4)
- **Click on "Obtain an IP address automatically.**
- **Click "Ok" and "Ok" again**



This will force the Internet router to dynamically assign an IP address to your laptop and will give you insight into the internet router's configuration settings, so you can then change the PLCnext controller's IP information to interact with it and access the internet.

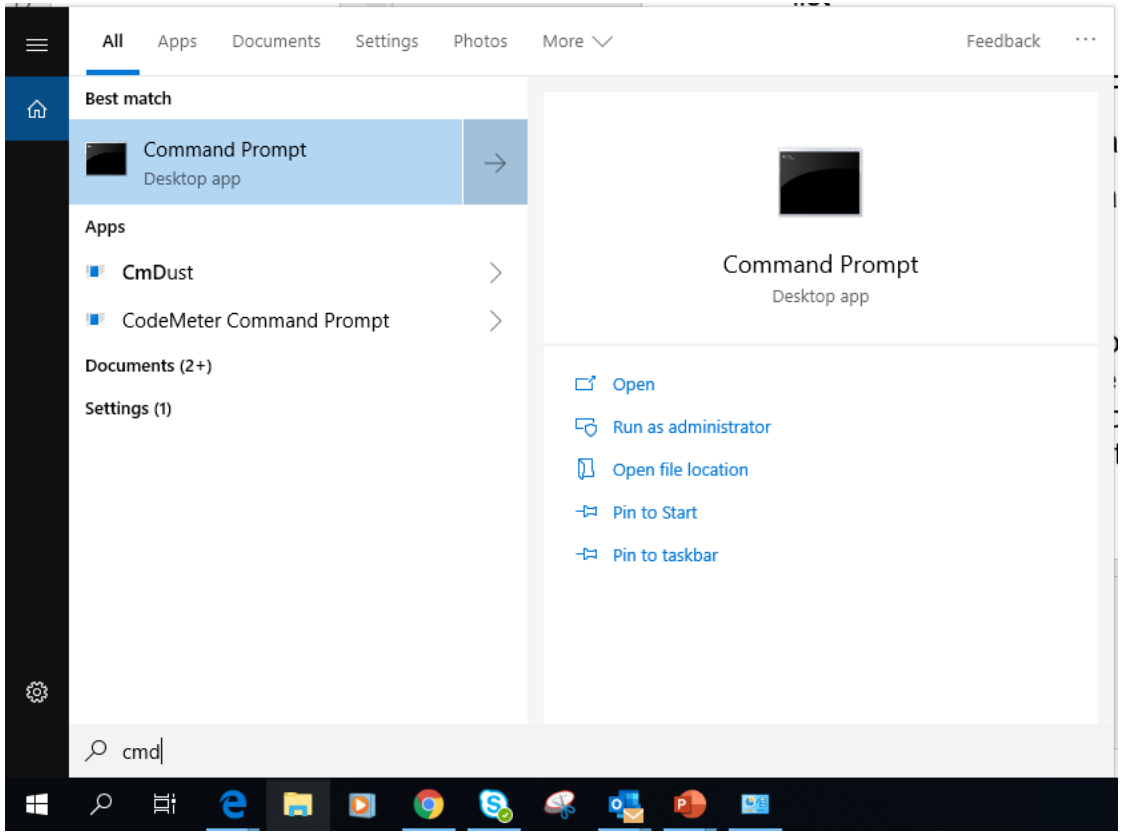
Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

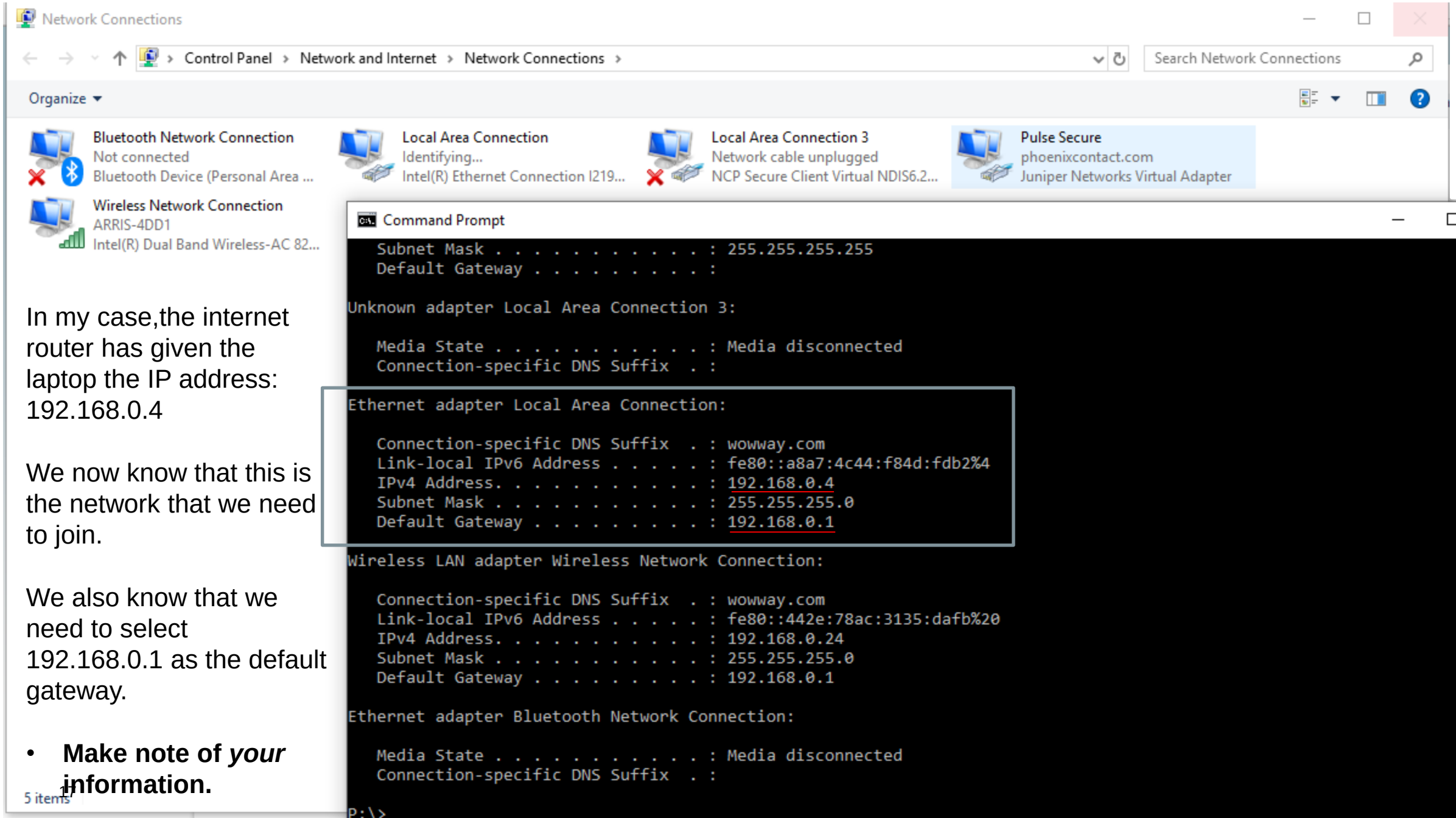
We will use another Windows tool to get insight on the Ethernet network that the Router is part of.

- Click on the magnifying glass next to the Windows icon at the bottom-left, and type in "CMD"
- This will find the "Command Prompt" program
- Click on the "Command Prompt" shortcut to open it.

This will pull open the Command Prompt program.

- Type in: "ipconfig" and hit the enter key. (don't use the quotation marks…just the contents between the quotation marks).





In my case,the internet router has given the laptop the IP address: 192.168.0.4

We now know that this is the network that we need to join.

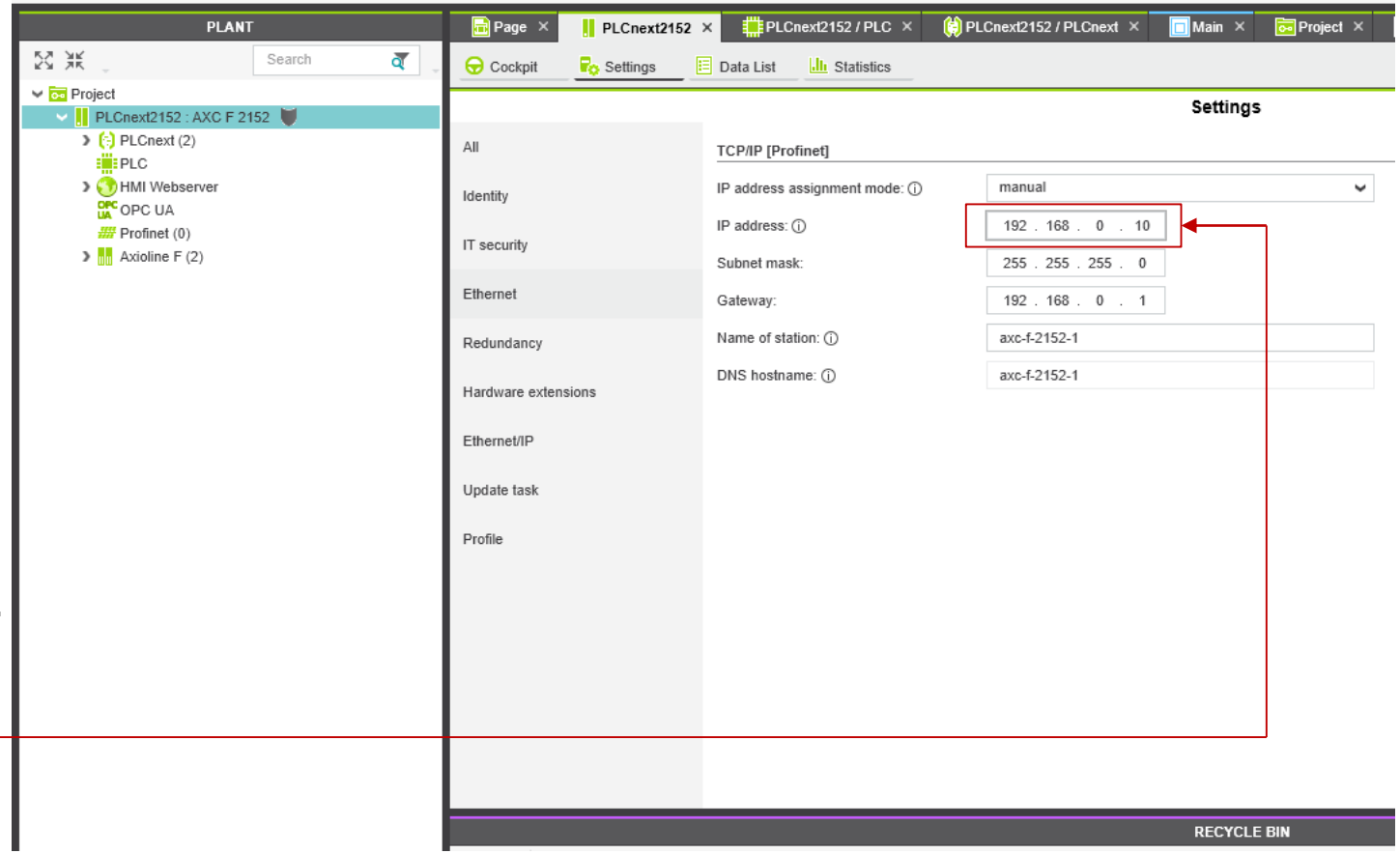
We also know that we need to select 192.168.0.1 as the default gateway.

- **Make note of *your* information.**

Changing the PLCnext controller's IP address to match the subnet of the default gateway (upstream router)

- From PLCnext Engineer – open the project you created in the last training.
- Double click on the controller immediately under "Project" in the PLANT area.
- Open the "Settings" sub-tab
- Click on Ethernet from the menu
- Configure as shown to the right, using the information specific to your case, as discovered by following the previous slide.

Note: Match the network's first three octets exactly (e.g. 192.168.0)…For the 4th octet, use any integer between 2 and 254 that is not already in use on the network).



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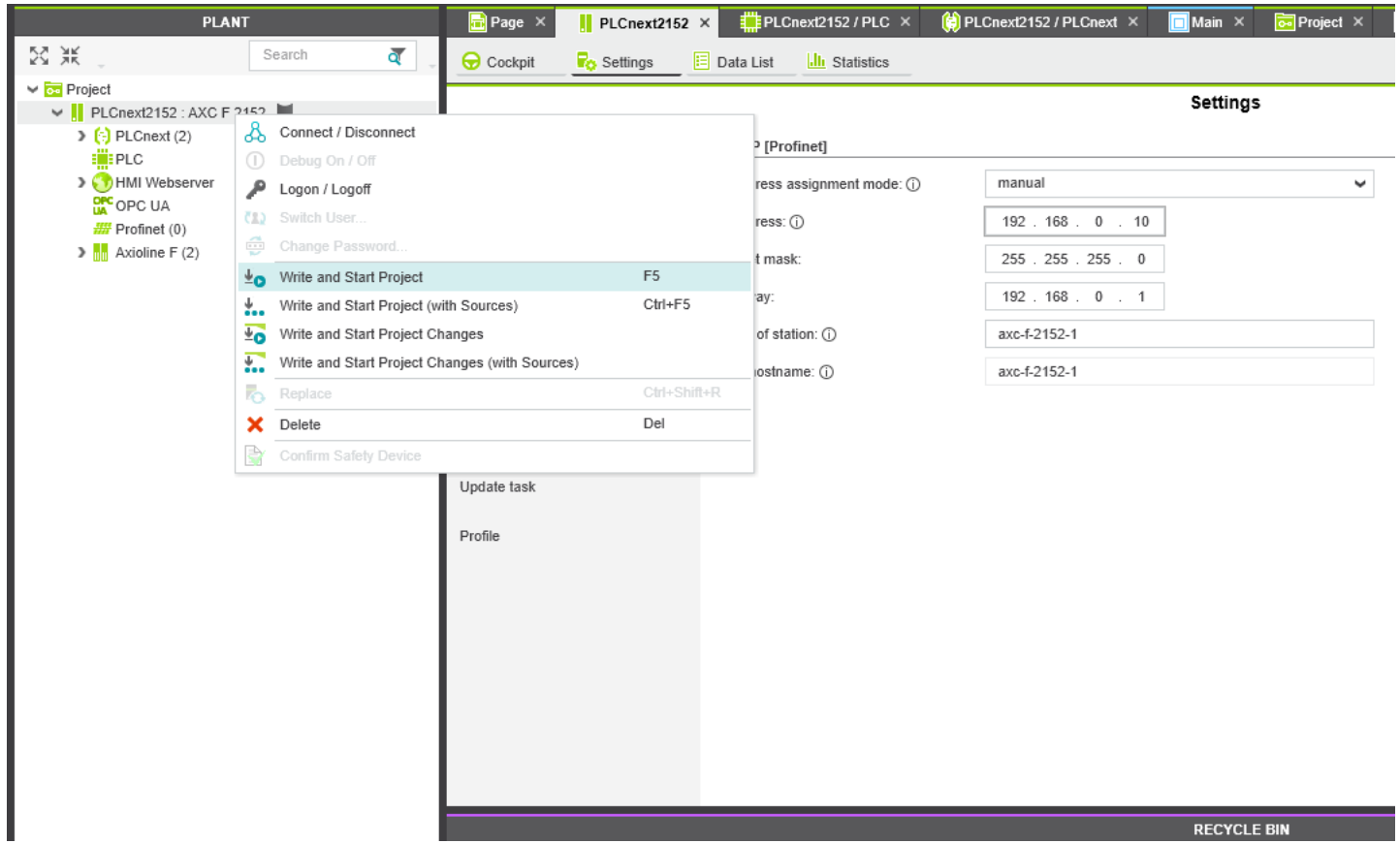
Changing the PLCnext controller’s IP address to match the subnet of the default gateway (upstream router)

(Note we are now on the same network as the internet router and using the internet router as the default gateway address).

Now, Write and Start the project on the PLCnext controller.



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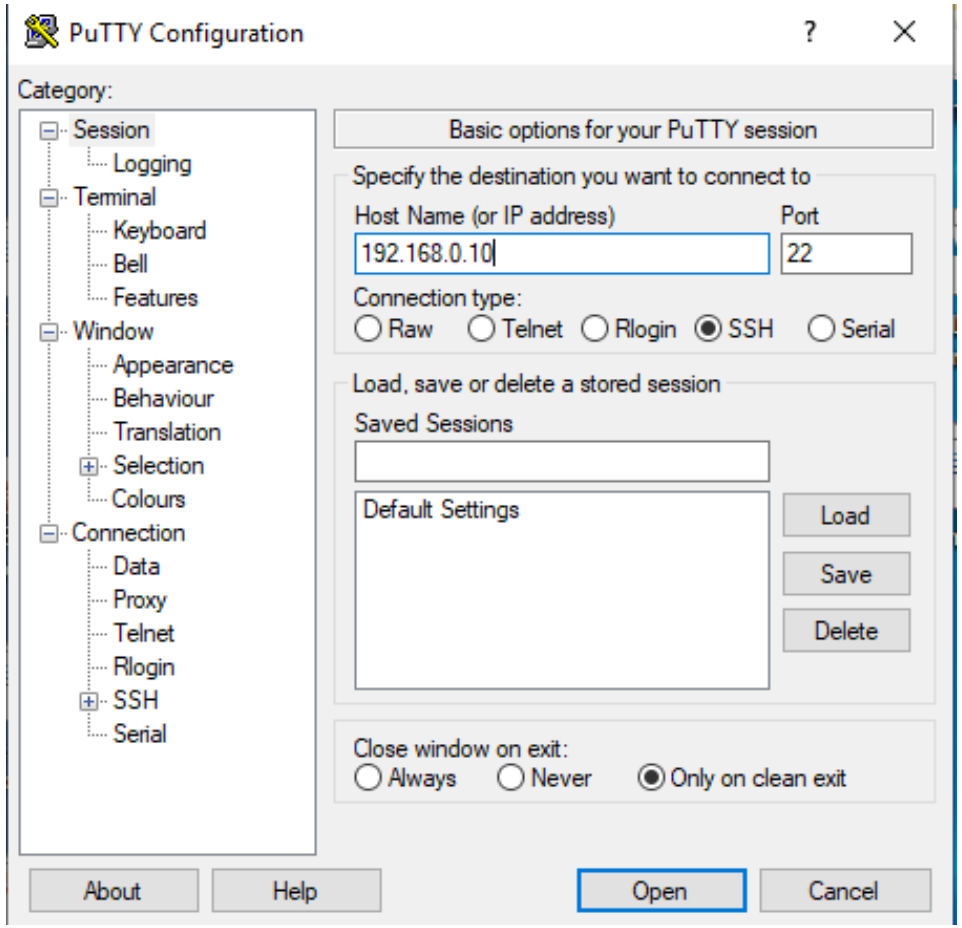
Testing to assure the PLCnext controller has internet access

We need a free 3rd party software package to test whether the PLCnext controller can access the internet through the modem.

- Download and install PuTTY:
  - https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html
- Open PuTTY
- Type in the PLCnext controller's IP address and set the Port to 22
- Click the "Open" button



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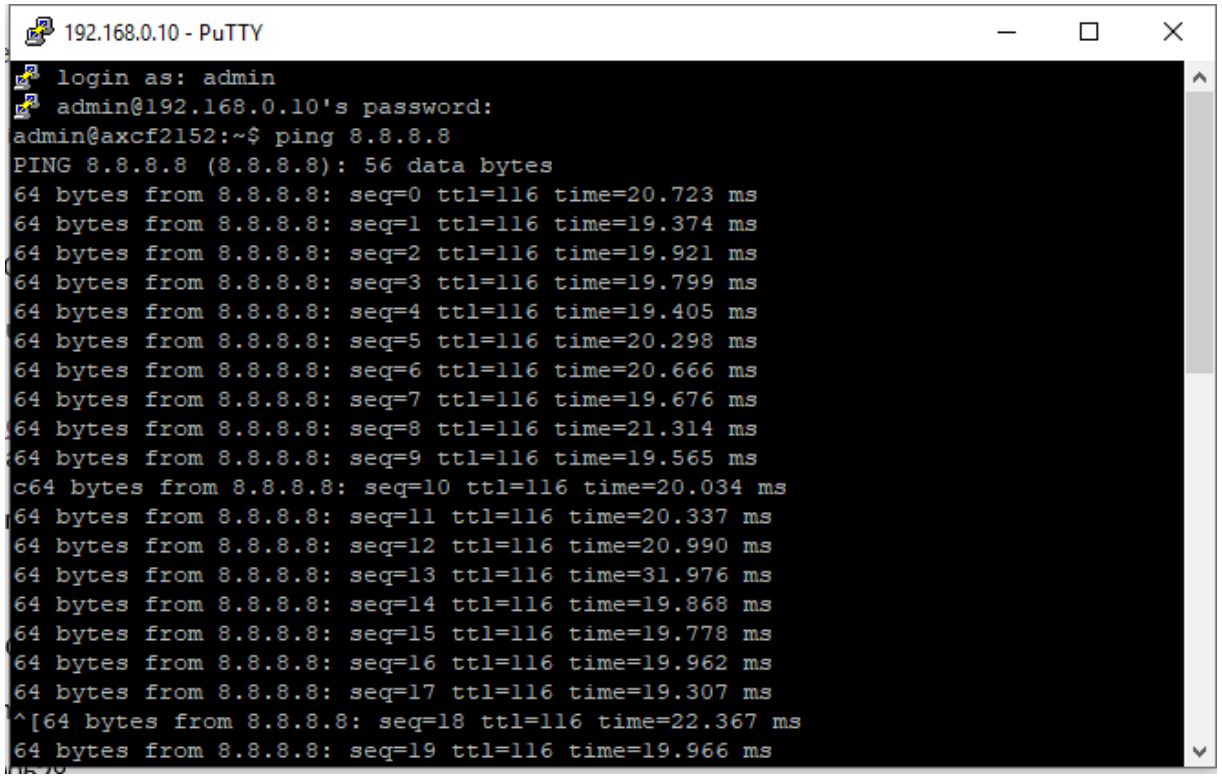
Testing to assure the PLCnext controller has internet access

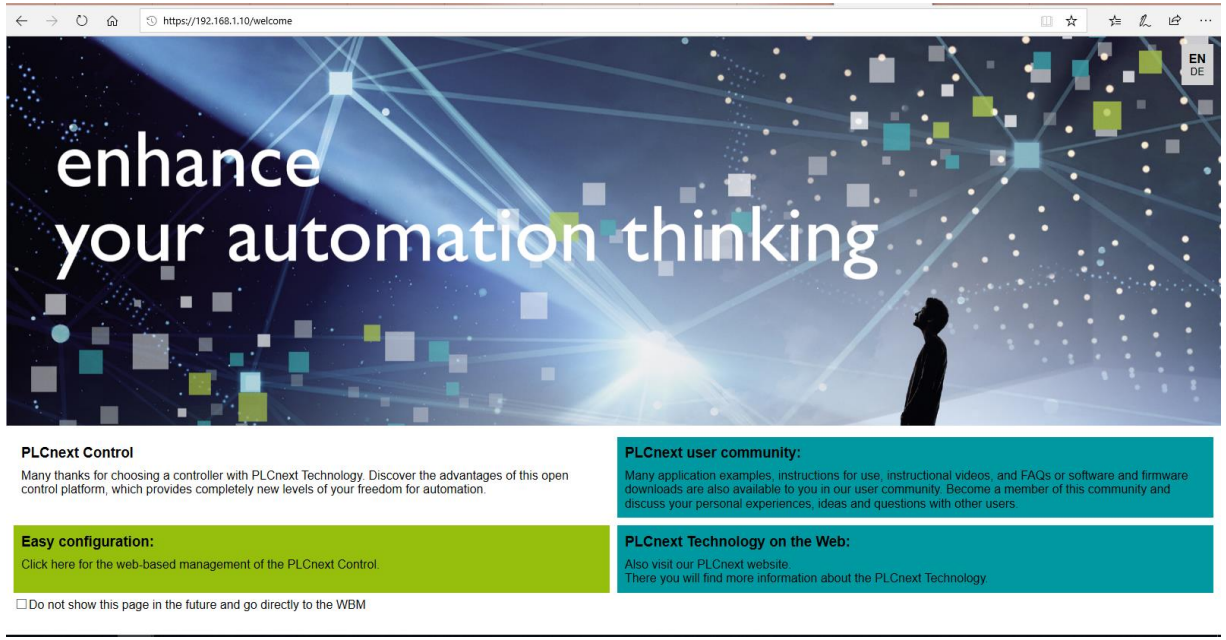
We will PING a known site on the internet – FROM THE PLCnext CONTROLLER to verify that it has a good connection to the internet

- Type in the username for the PLCnext controller (factory default is “admin”)
- Type in the password. (This is found on the face of the PLCnext controller)
- Type “Ping 8.8.8.8” then hit the enter key
  - (8.8.8.8 is the IP address for Google)
- You should see positive responses as shown to the right. To stop the Pinging, hit Ctrl C
- If that worked, close PuTTY. If it didn’t, the PLCnext controller does not have internet connectivity, and this must be fixed.



Preparing the PLCnext controller to work with Proficloud

- Ever since we developed the HMI in the PLCnext training, typing the PLCnext controller's IP address into a browser has pulled up the HMI page.
- We need to reach the web-based management page of the PLCnext controller to make some configuration changes.
- Use 192.168.0.10/admin
  - Log in if necessary



Once at this welcome screen, click on the "Easy configuration" block to access the PLCnext controller's web-based management to make the configuration changes. (Remember, admin = username and password is from the front of the PLCnext controller).

Preparing the PLCnext controller to work with Proficloud

- **Click on “Proficloud” under the “Configuration” menu**

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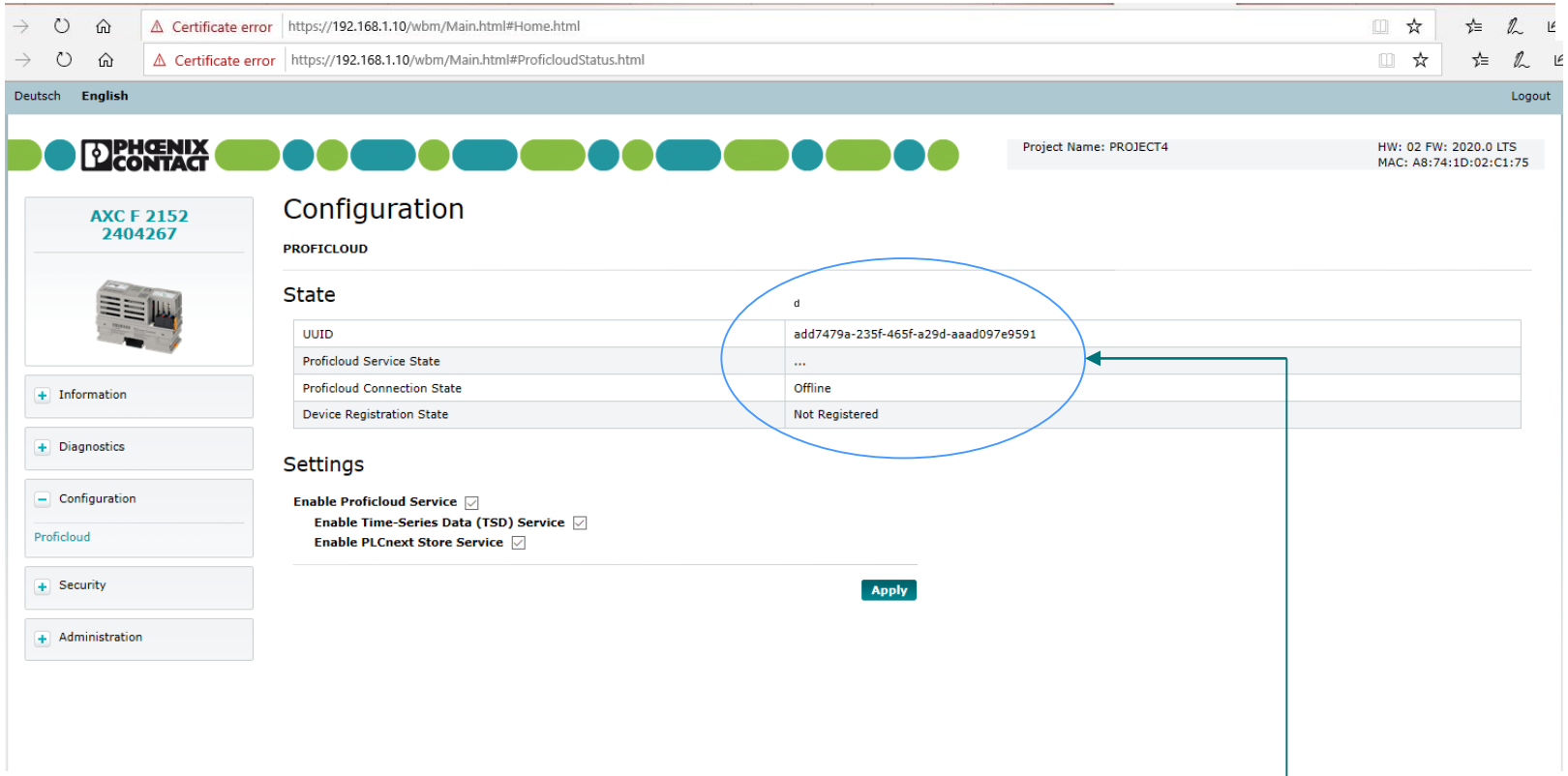
Preparing the PLCnext controller to work with Proficloud

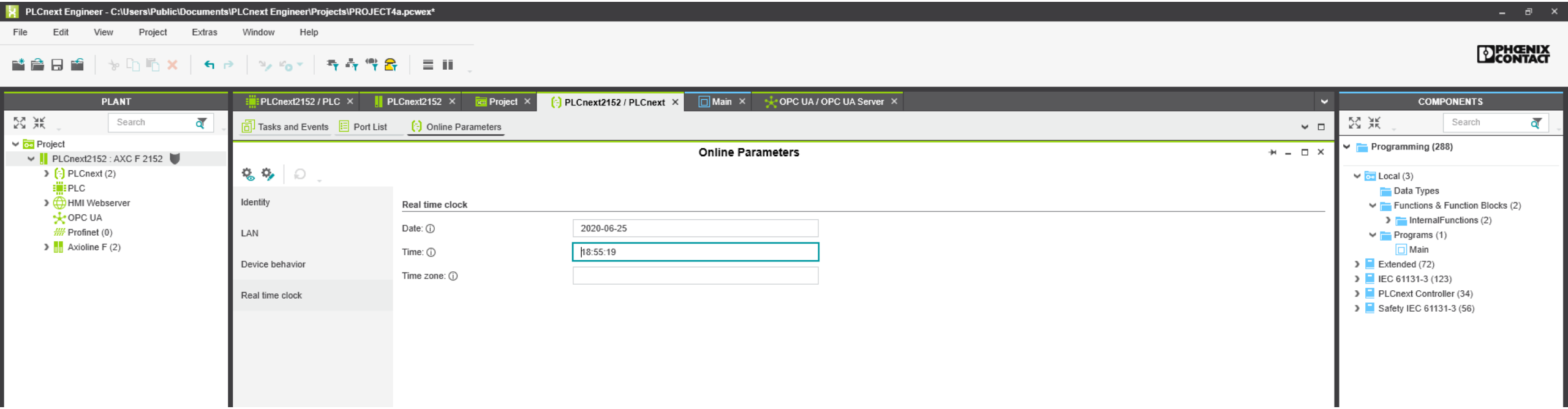
- Click on “Proficloud” under the “Configuration” menu
- **Check the following boxes:**
  - **Enable Proficloud services**
  - **Enable Time-Series Data (TSD) Service**
  - **Enable PLCnext Store Service**
- **Click “Apply”**



(Note: We are not yet connected)

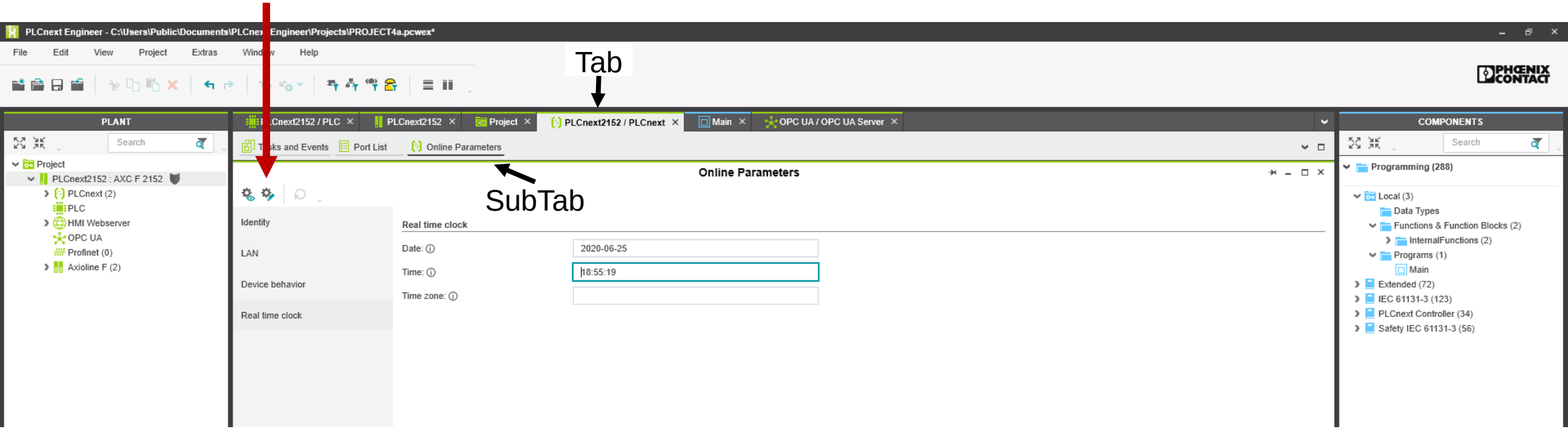
Preparing the PLCnext controller to work with Proficloud

The PLCnext controller's Realtime clock must be set to the same time as the Proficloud server (which is in Germany. Format should be in 24-hour format time, such as HH:MM:SS (the seconds are not critical. But try to match the hours and minutes). In my case, I needed to add six (6) hours to Eastern (US) time.



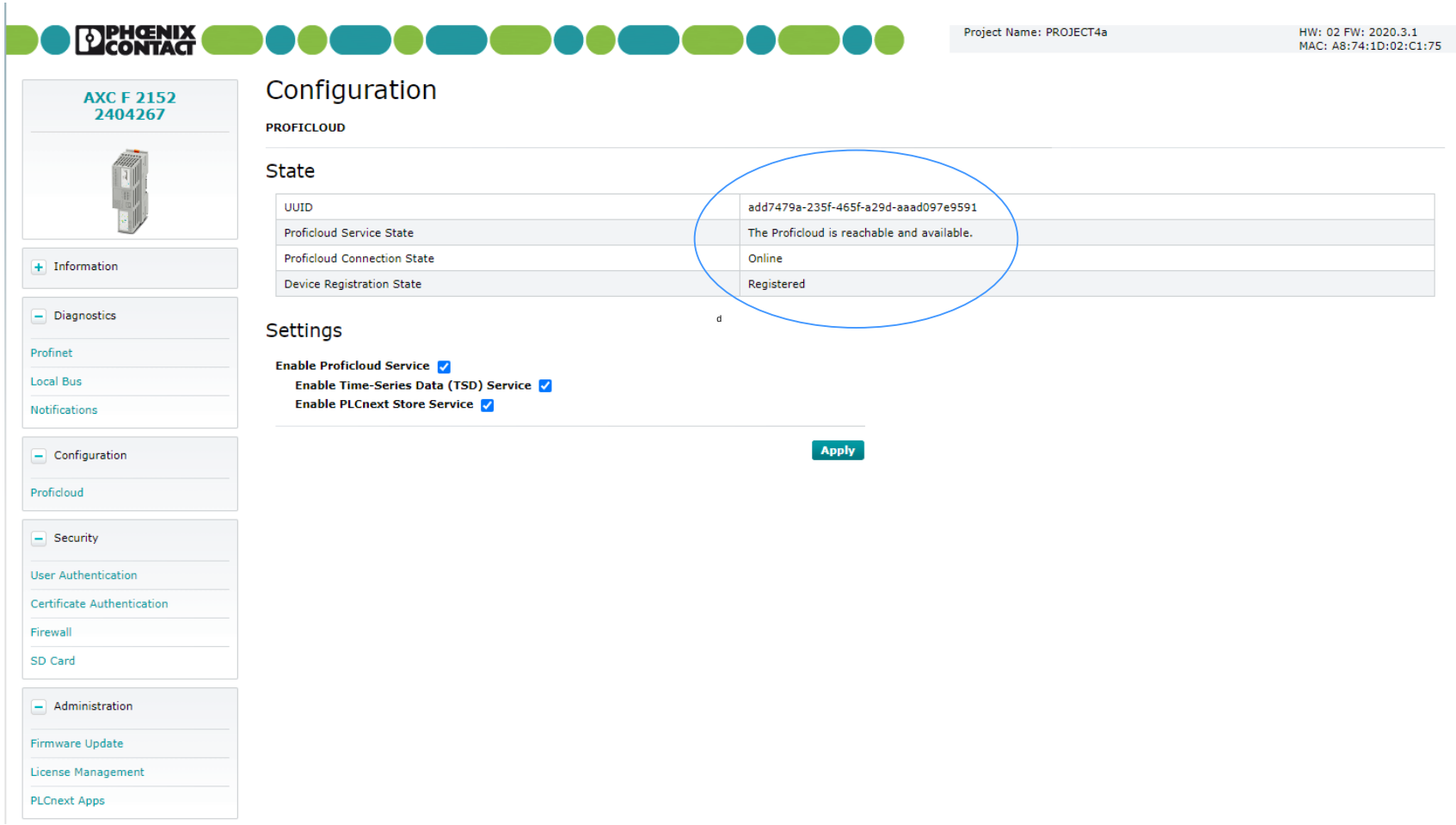
Preparing the PLCnext controller to work with Proficloud

From inside PLCnext Engineer, select the tab and subtab shown below to access the real time clock setting. Enter the time, being sure to match the hours and minutes to the current German time. Click the icon shown with the red arrow to write the time to the PLCnext controller.



Preparing the PLCnext controller to work with Proficloud

- Note the Proficloud Service State now reads:
  - The Proficloud is reachable and available



AXC F 2152
2404267

+ Information

− Diagnostics
Profinet
Local Bus
Notifications

− Configuration
Proficloud

− Security
User Authentication
Certificate Authentication
Firewall
SD Card

− Administration
Firmware Update
License Management
PLCnext Apps

Configuration

PROFICLOUD

State

UUID	add7479a-235f-465f-a29d-aaad097e9591
Proficloud Service State	The Proficloud is reachable and available.
Proficloud Connection State	Online
Device Registration State	Registered

Settings

Enable Proficloud Service ☑
Enable Time-Series Data (TSD) Service ☑
Enable PLCnext Store Service ☑

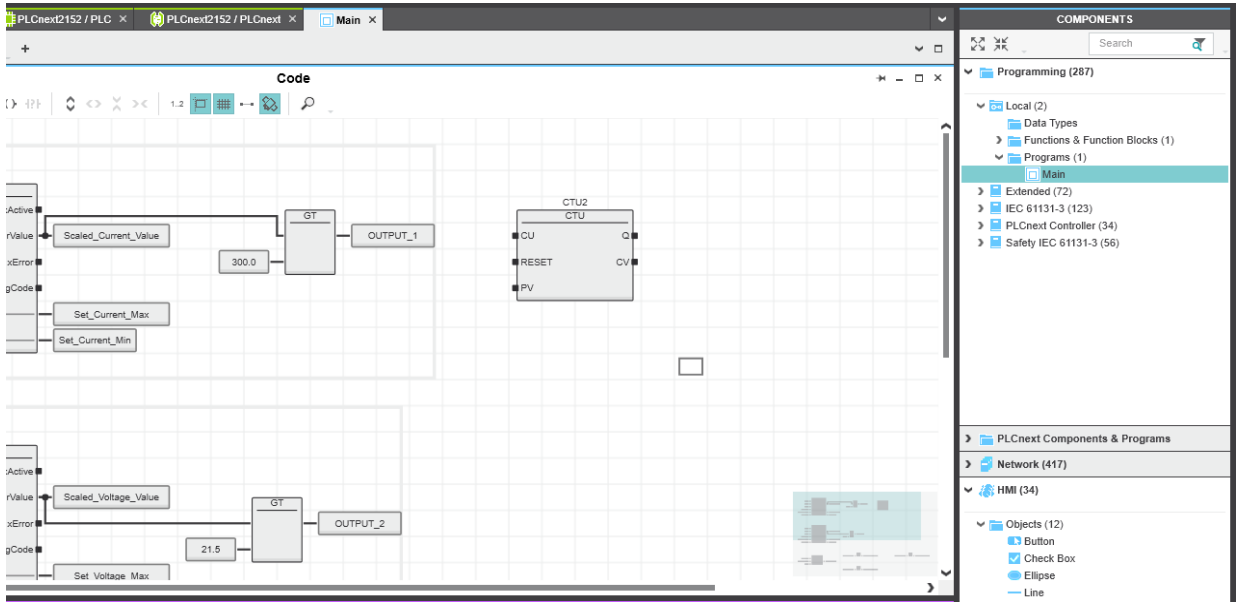
Apply

Preparing your program to communicate with Proficloud

- We will create some specific new variables in PLCnext Engineer to affect Proficloud communications
- We will create some code in PLCnext Engineer, making use of these new variables to affect Proficloud communications

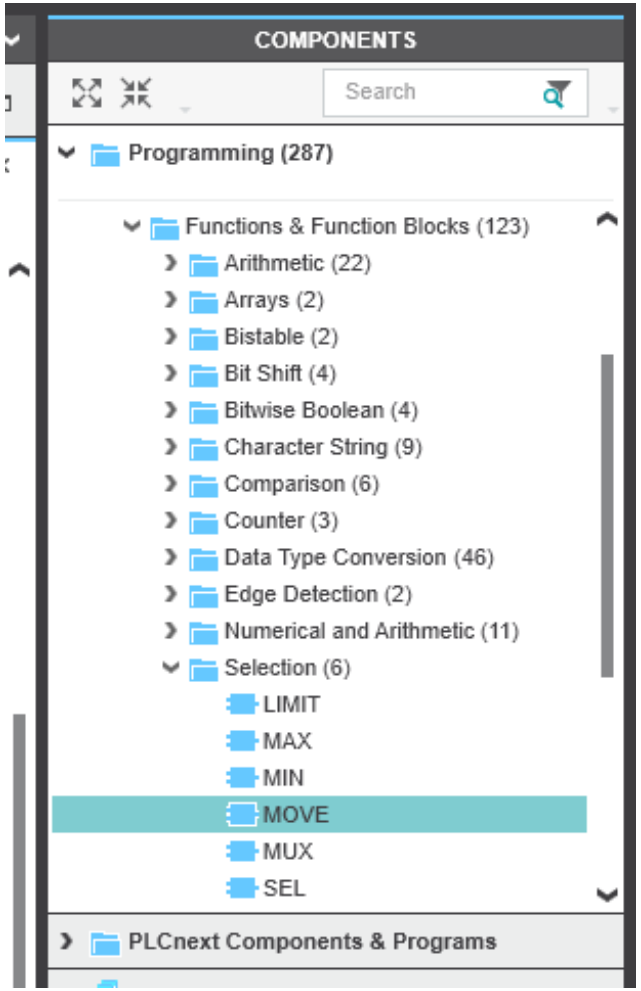
Creating code to enable Proficloud communications

- Select your program from the Programming/Local/Programs tree under the COMPONENTS area
- Make sure you have selected the “Code” sub-tab in the under “Main” in the top/middle section of the screen
- We have already created a program with plenty of interesting variables in Part 1 of this training. Rather than create any unique variables, we will simply adapt some existing variables for life in the Proficloud.
- To do this we will “move” some existing variables using a “MOVE” function block.



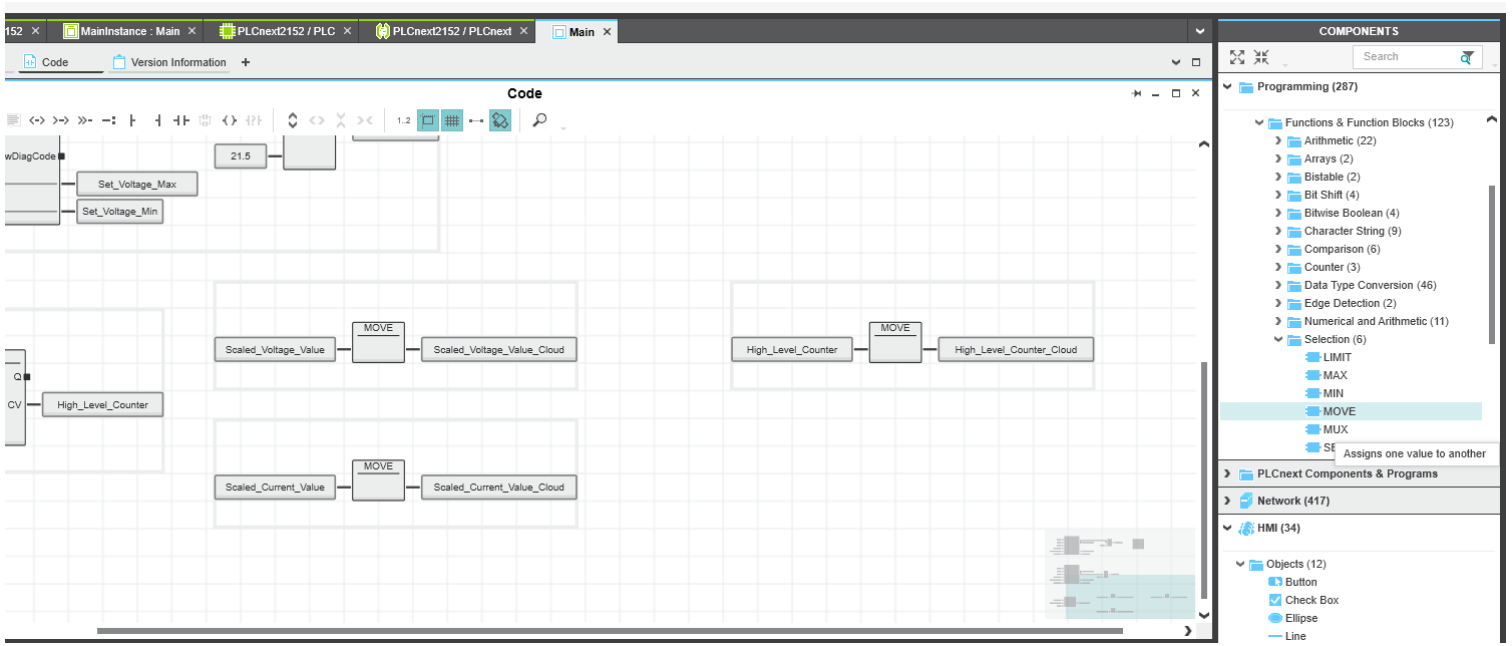
Creating code to enable Proficloud communications

- Choose a “MOVE” function block from the programming tree as seen to the far right.
- Drag and drop three instances of the “MOVE” block onto the Code work surface.



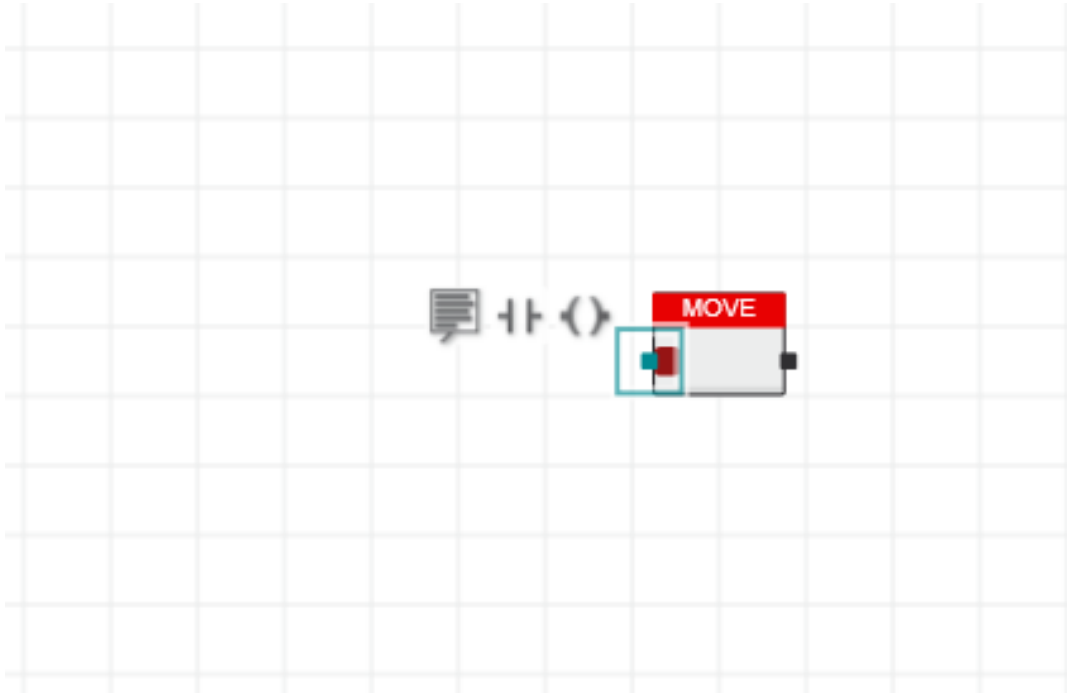
Creating code to enable Proficloud communications

- We will create three new variables, based on three existing variables, which essentially will allow those three original variables to be sent to the Proficloud
  - Scaled_Voltage_Value_Cloud
  - Scaled_Current_Value_Cloud
  - High_Level_Counter_Cloud



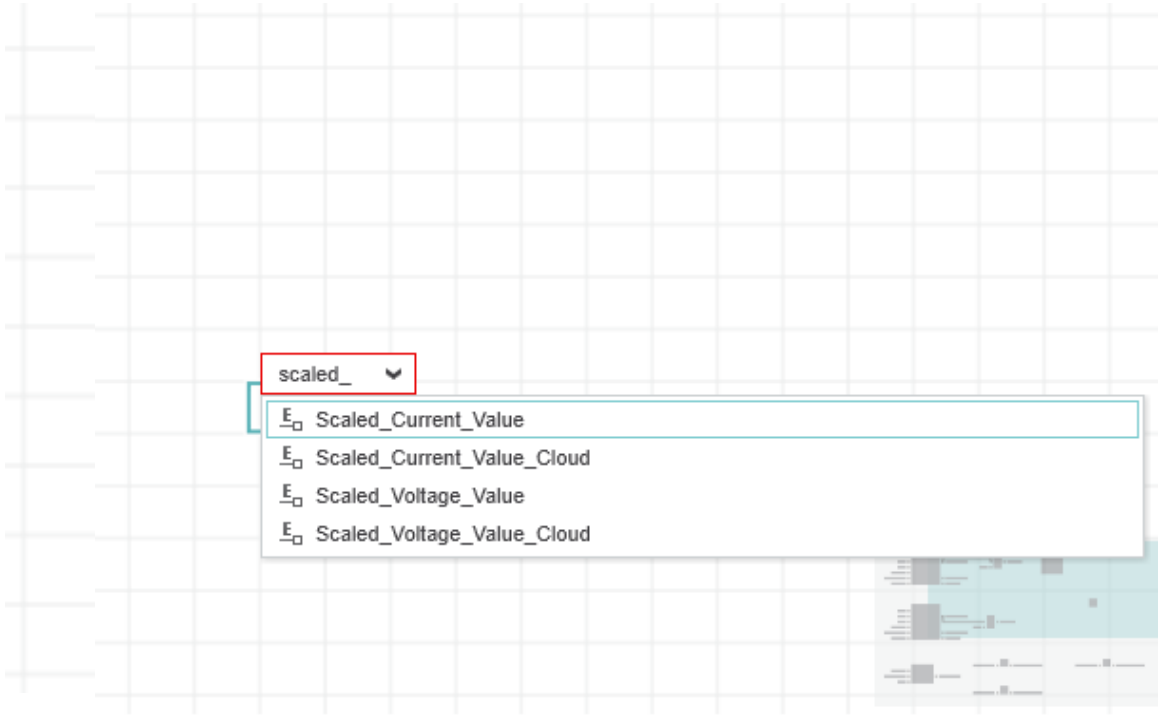
Creating code to enable Proficloud communications

- **Double-click on the node on the left of the “MOVE” function block**
- **Start typing in the name of one of the variables we want to send to the Proficloud**



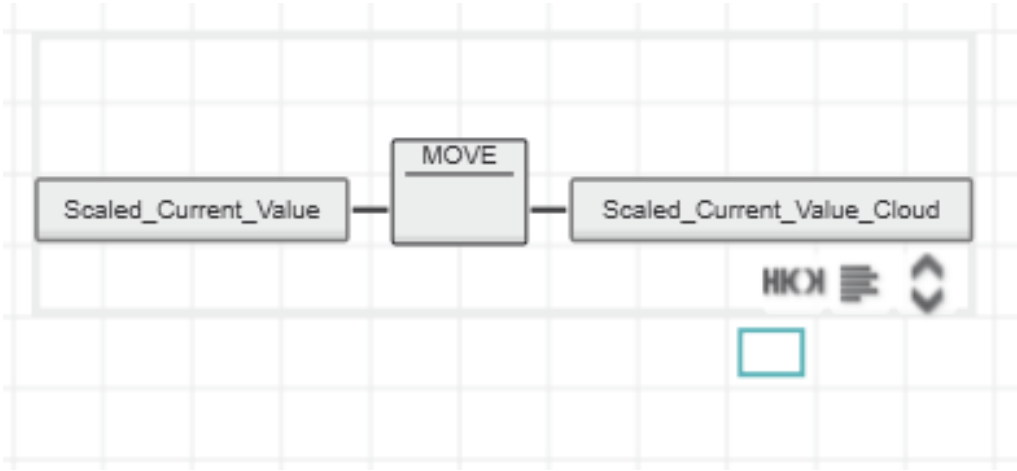
Creating code to enable Proficloud communications

- Double-click on the node on the left of the “MOVE” function block
- Start typing in the name of one of the variables we want to send to the Proficloud
- **Select the one you want, then repeat:**
  - **Scaled_Current_Value**
  - **Scaled_Voltage_Value**
  - **High_Level_Counter**



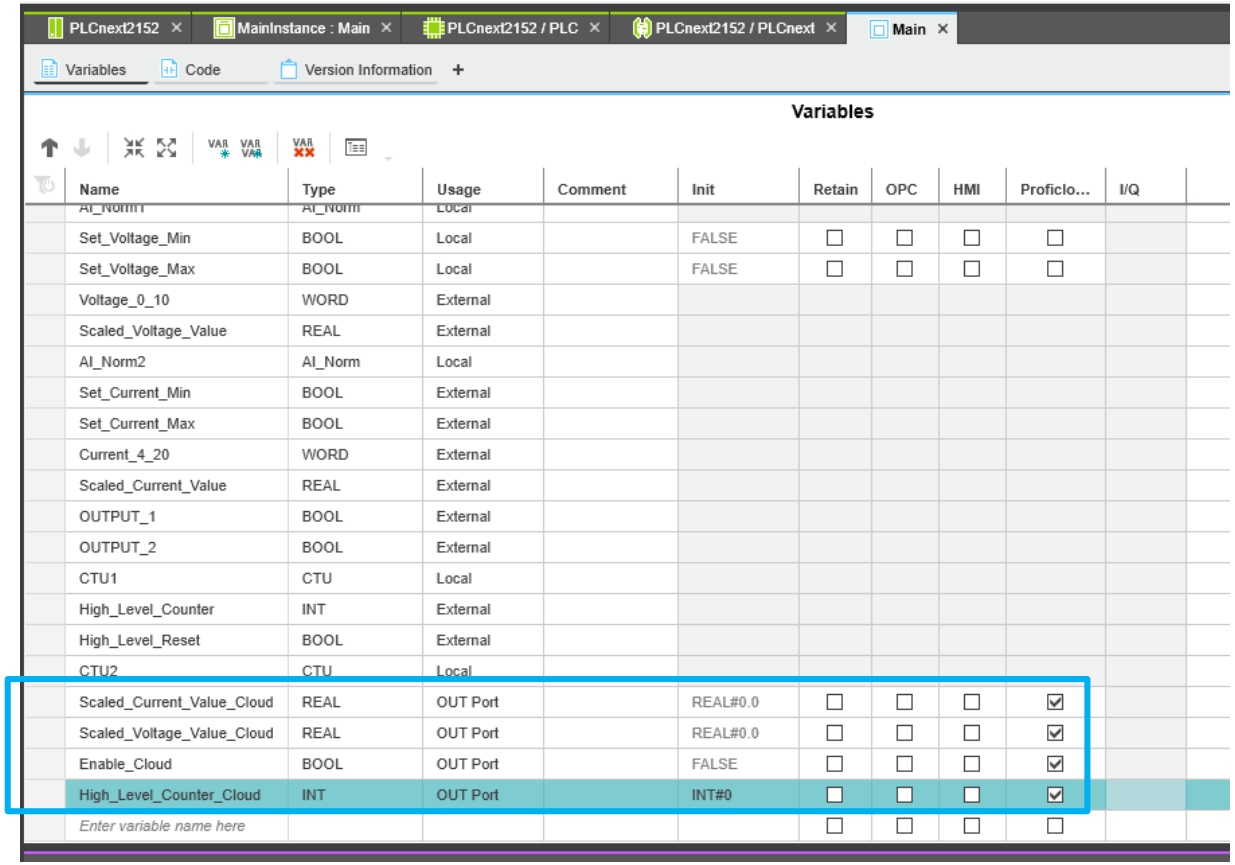
Creating code to enable Proficloud communications

- Double-click on the node on the left of the “MOVE” function block
- Start typing in the name of one of the variables we want to send to the Proficloud
- Select the one you want, then repeat:
  - Scaled_Current_Value
  - Scaled_Voltage_Value
  - High_Level_Counter
- **On the right side of the block, double-click and create new variables:**
  - **Scaled_Current_Value_Cloud**
  - **Scaled_Voltage_Value_Cloud**
  - **High_Level_Counter_Cloud**



Parameterizing the variables to enable Proficloud communication

- Still on the “Main” tab, click on the “Variables” sub-tab.
- Find the three new variables you have just created, and finish parameterizing them as shown to the right.
- It is critical that you check the “Proficloud” box for each new variable, and designate its usage as “OUT Port”
- The “Type” should match the “Type” of the original variable (i.e. REAL, INT, etc.)
- Note: the “Enable Cloud” variable is not necessary.

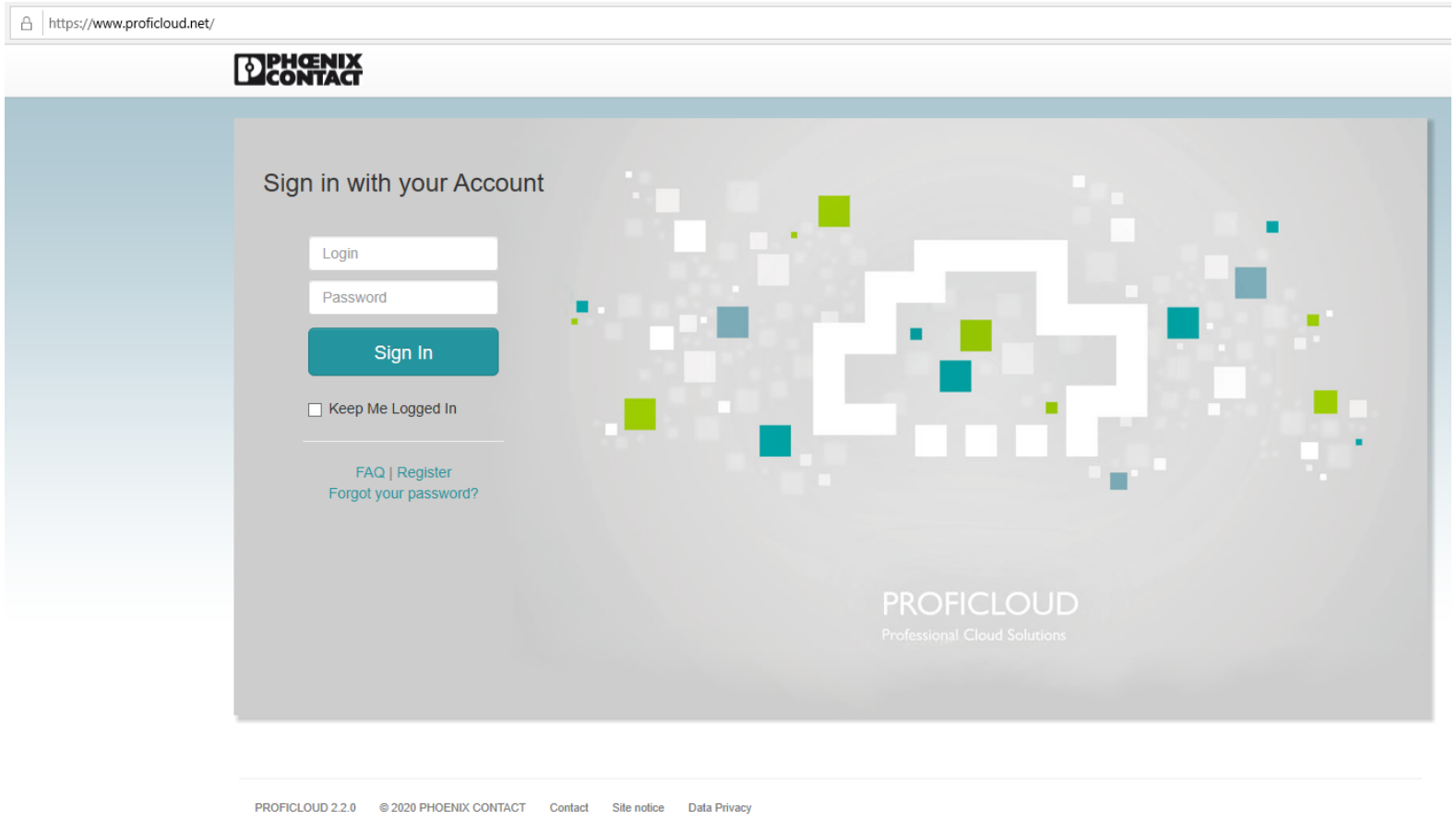


Name	Type	Usage	Comment	Init	Retain	OPC	HMI	Proficlo...	I/Q
Set_Voltage_Min	BOOL	Local		FALSE	☐	☐	☐	☐	
Set_Voltage_Max	BOOL	Local		FALSE	☐	☐	☐	☐	
Voltage_0_10	WORD	External							
Scaled_Voltage_Value	REAL	External							
AI_Norm2	AI_Norm	Local							
Set_Current_Min	BOOL	External							
Set_Current_Max	BOOL	External							
Current_4_20	WORD	External							
Scaled_Current_Value	REAL	External							
OUTPUT_1	BOOL	External							
OUTPUT_2	BOOL	External							
CTU1	CTU	Local							
High_Level_Counter	INT	External							
High_Level_Reset	BOOL	External							
CTU2	CTU	Local							
Scaled_Current_Value_Cloud	REAL	OUT Port		REAL#0.0	☐	☐	☐	☑	
Scaled_Voltage_Value_Cloud	REAL	OUT Port		REAL#0.0	☐	☐	☐	☑	
Enable_Cloud	BOOL	OUT Port		FALSE	☐	☐	☐	☑	
High_Level_Counter_Cloud	INT	OUT Port		INT#0	☐	☐	☐	☑	
Enter variable name here					☐	☐	☐	☐	

Working in Proficloud

Register and sign in

- Finally! We begin working in Proficloud…
- Visit www.proficloud.net
- Register for the site
- Then sign in



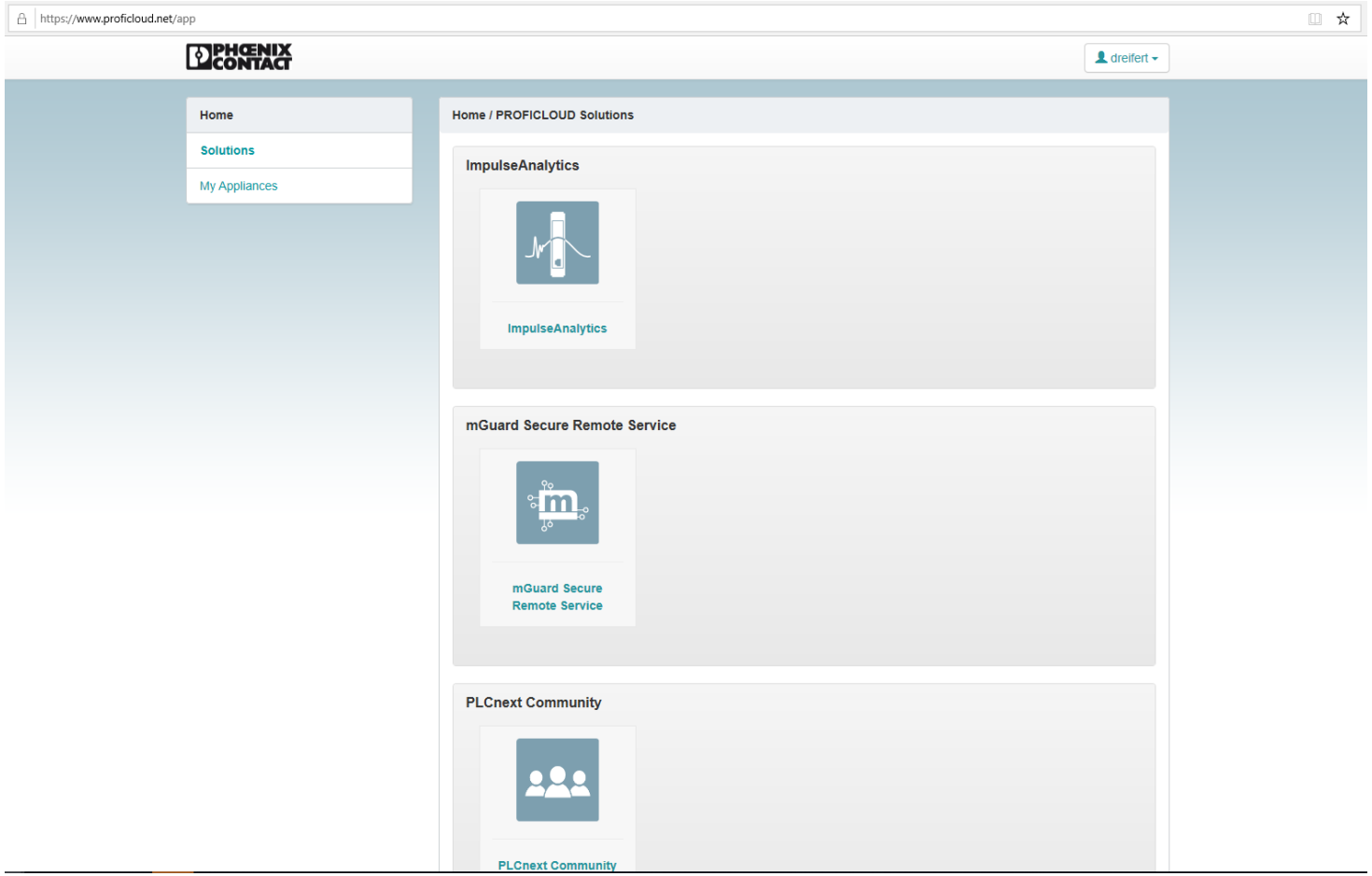
INSPIRING INNOVATIONS

Working in Proficloud

Time Series Data (TSD) Device Manager

Proficloud’s home screen

- Scroll to the bottom of this page

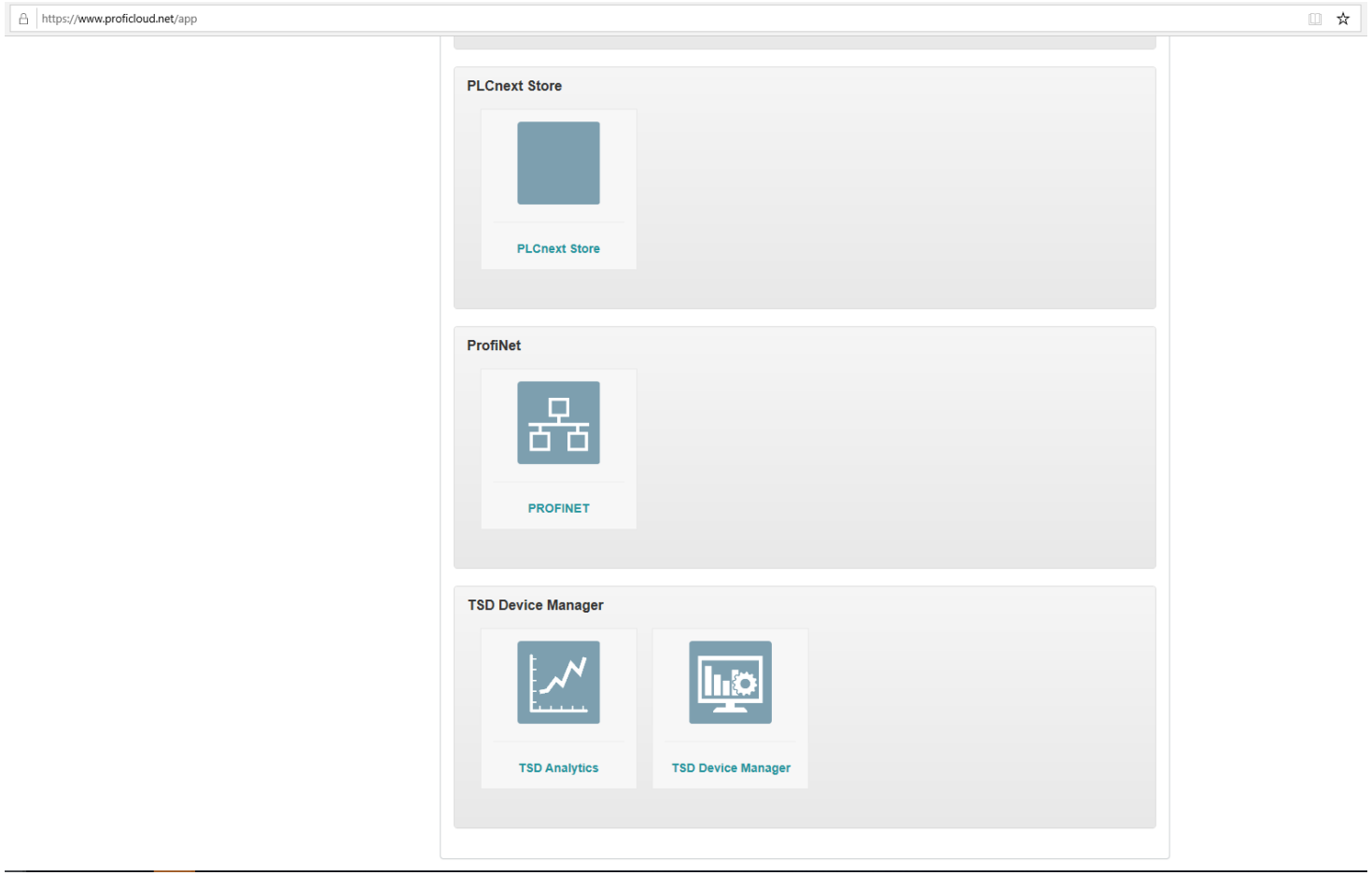


Working in Proficloud

Time Series Data (TSD) Device Manager

Proficloud’s home screen

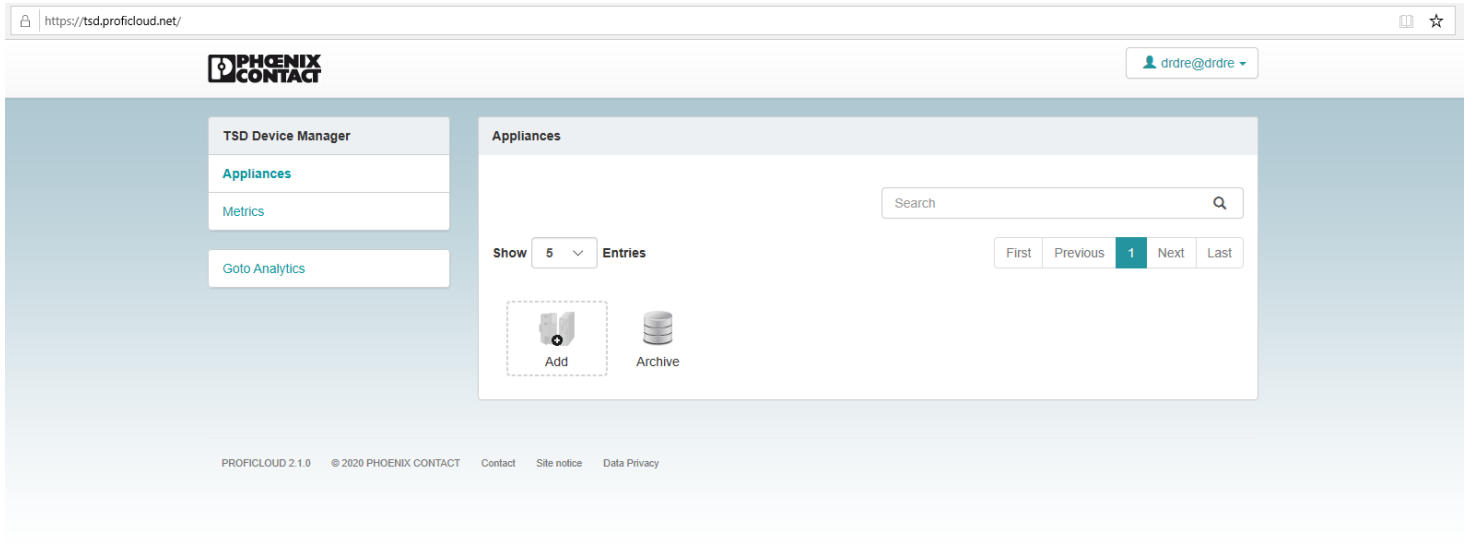
- Click on the “TSD Device Manager” icon in the TSD Device Manager section at the bottom of the screen



Time Series Data (TSD) Device Manager

The TSD Device Manager Page

- Click in “Appliances”
- Click on the “Add” icon

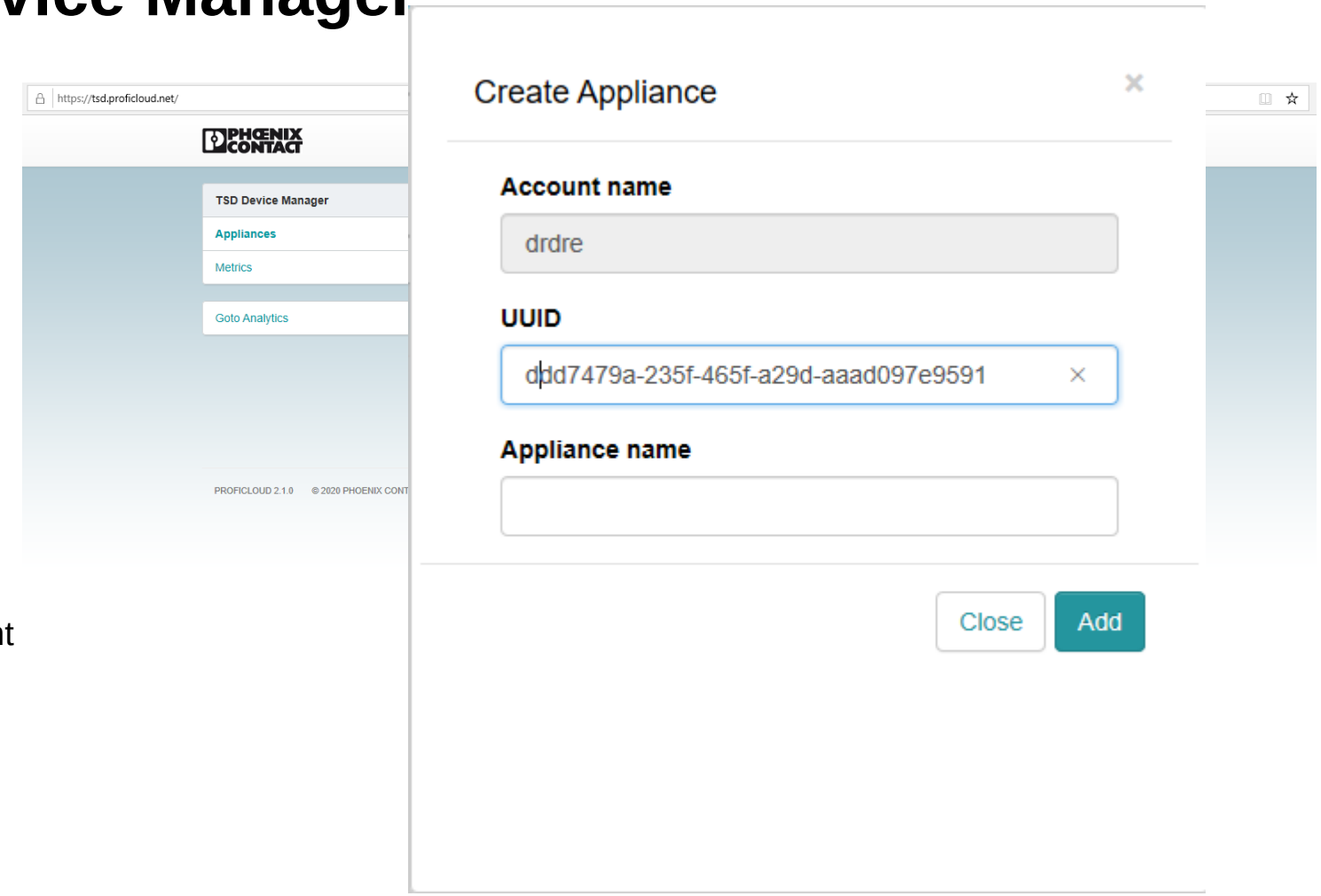


Time Series Data (TSD) Device Manager

The TSD Device Manager Page

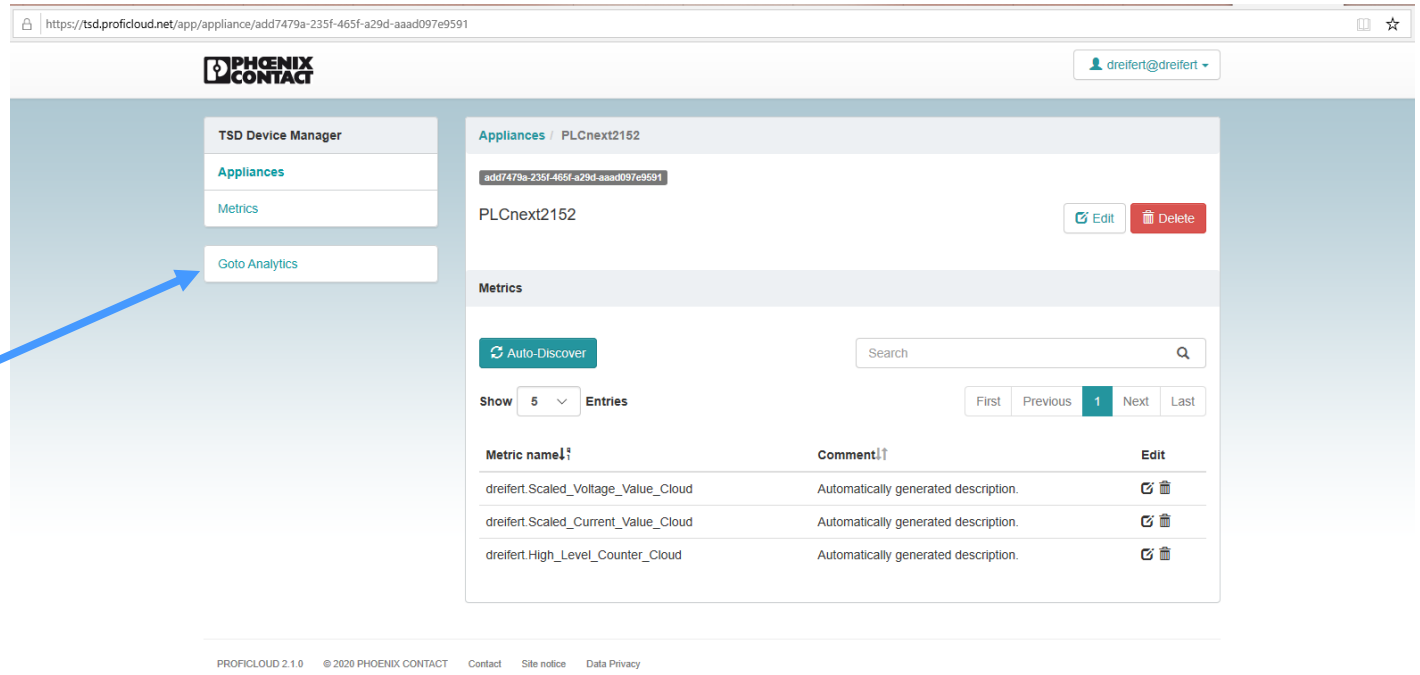
- Enter the UUID* of the PLCnext controller that you have programmed to communicate with Proficloud
- Enter a descriptive name for your PLCnext controller. It could be “4th street Pump Station”, or “PLCnext2152”, etc.
- Click “Add”

* This UUID can be found on the web-based management configuration page of your PLCnext controller, under “Proficloud”. See page 24 of this training.

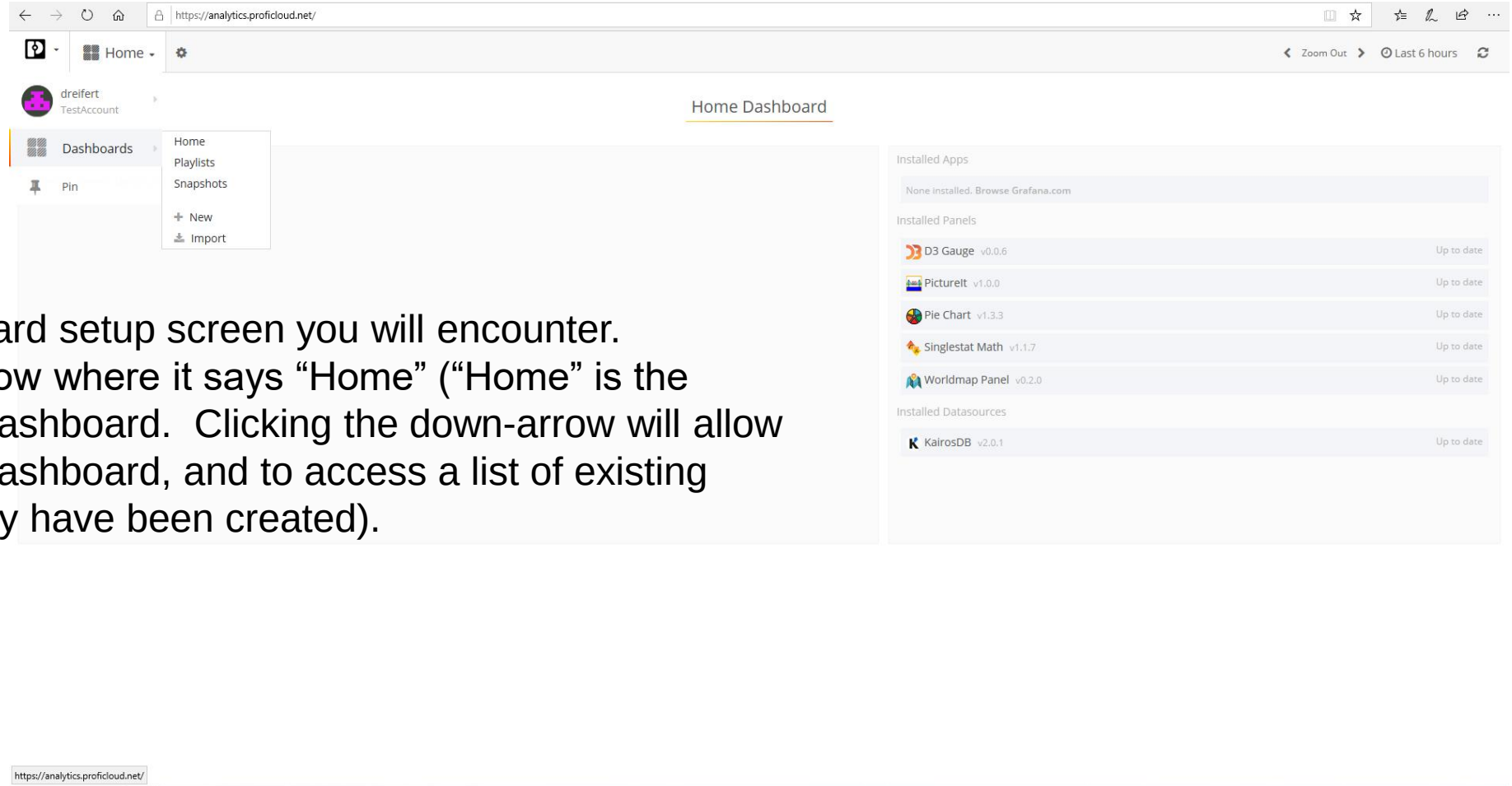


Time Series Data (TSD) Device Manager

- Your PLCnext controller should be successfully added to Proficloud
- The variables you set up in your PLCnext Engineer program should automatically be pulled in and will be displayed as seen to the right.
- Click the “Goto Analytics” button to start the process of building a dashboard



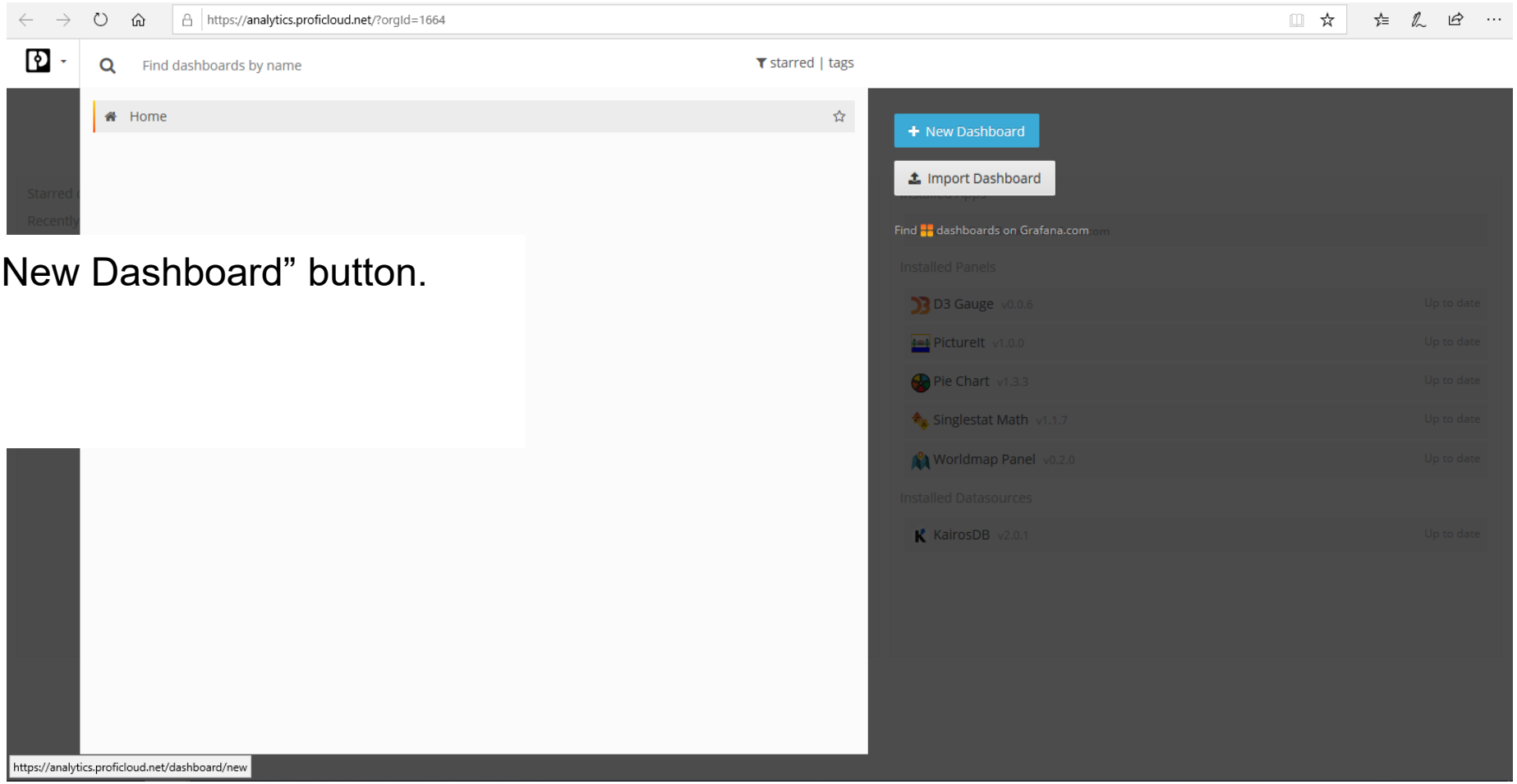
TSD Analytics – getting started building a dashboard



This is the initial dashboard setup screen you will encounter.

- Click on the down-arrow where it says “Home” (“Home” is the name of this default dashboard. Clicking the down-arrow will allow you to create a new dashboard, and to access a list of existing dashboards, once they have been created).

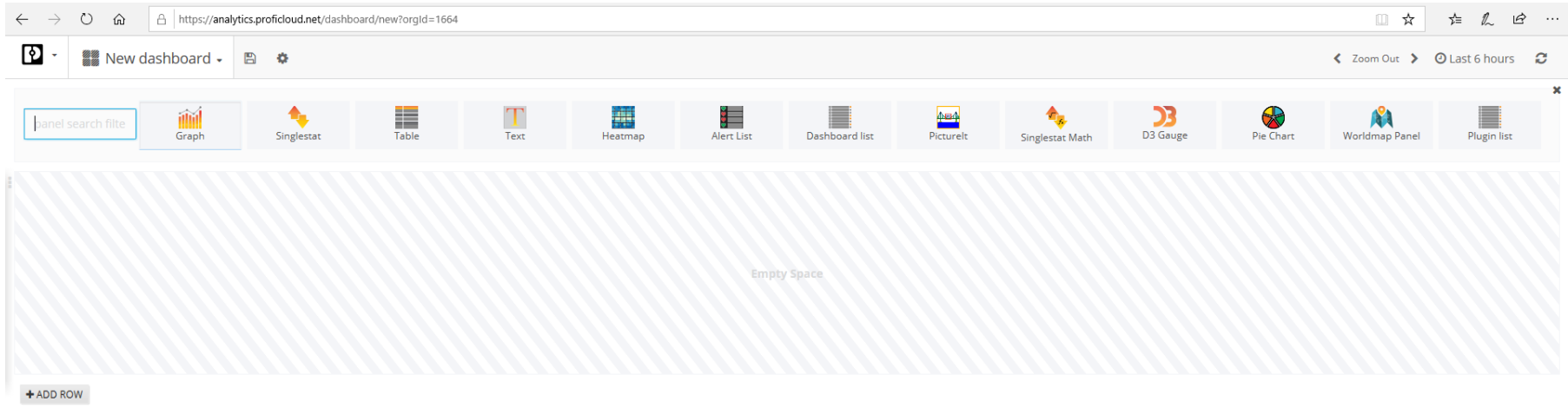
TSD Analytics – Getting started building a dashboard



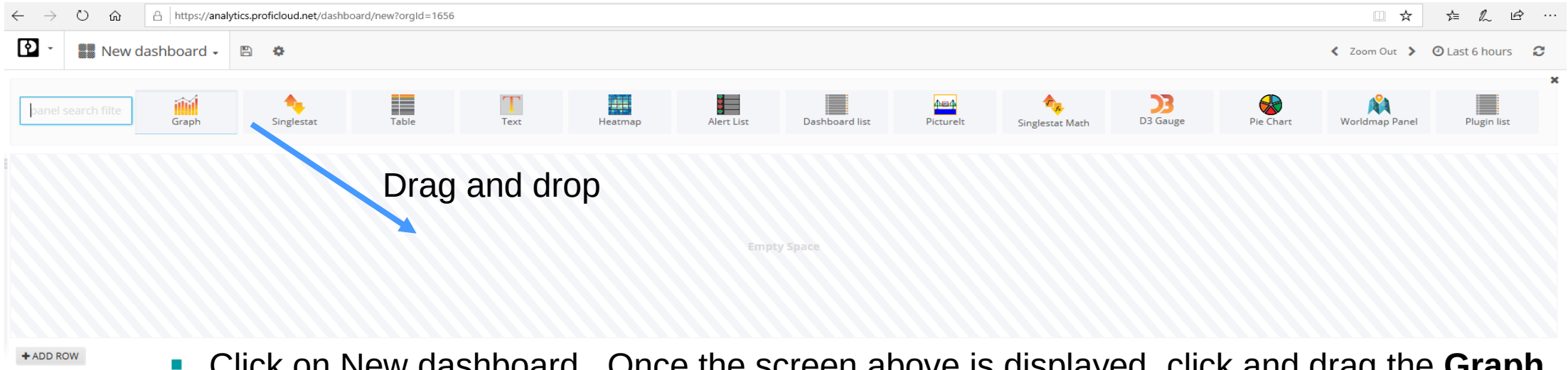
- Click on the blue “+ New Dashboard” button.

TSD Analytics – Getting started building a dashboard

- You will be brought to this dashboard configuration screen. You can click and drag any of the elements you see. You can then click “+Add row” to add a row and drop other elements onto the dashboard.
- Start with a Graph



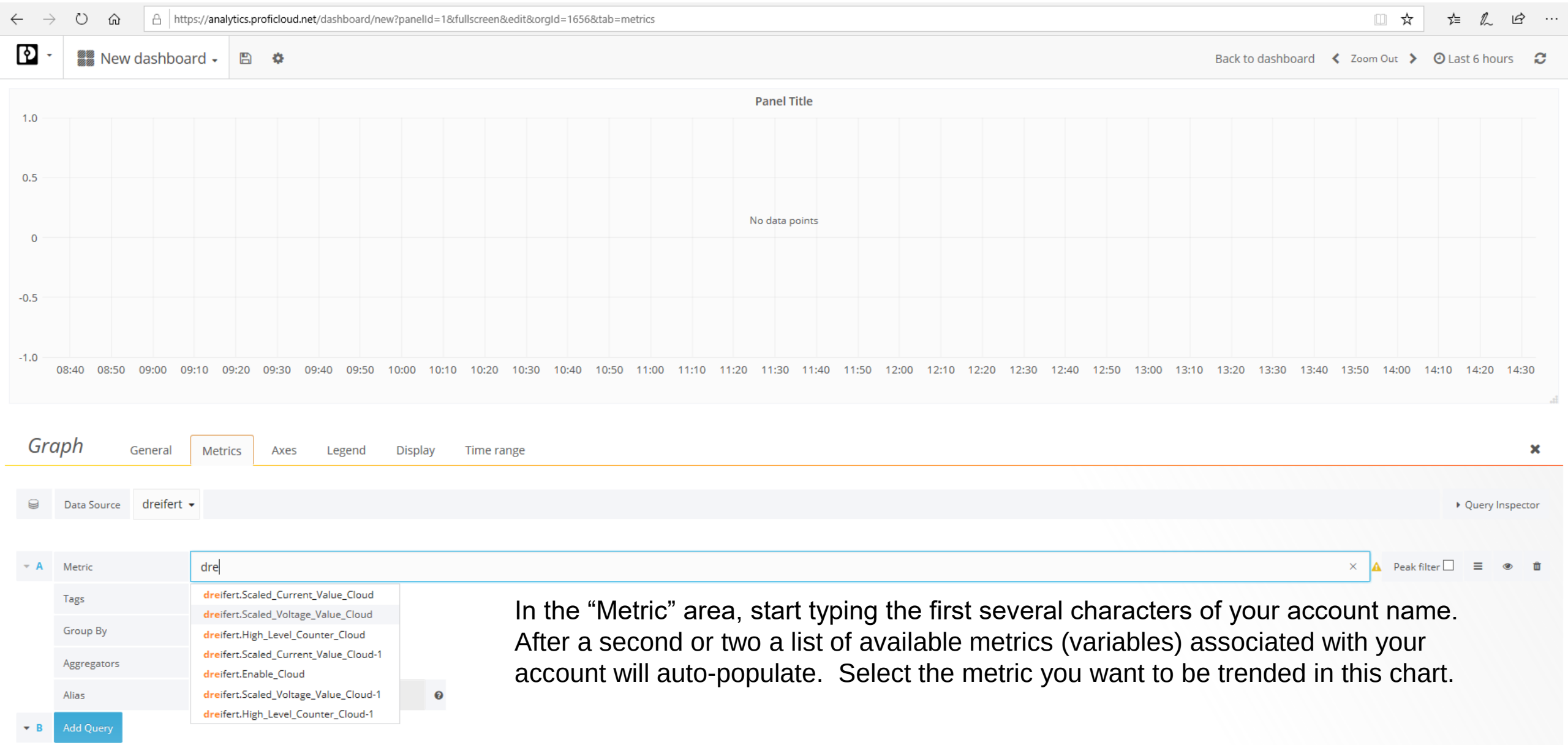
TSD Analytics – Getting started building a dashboard



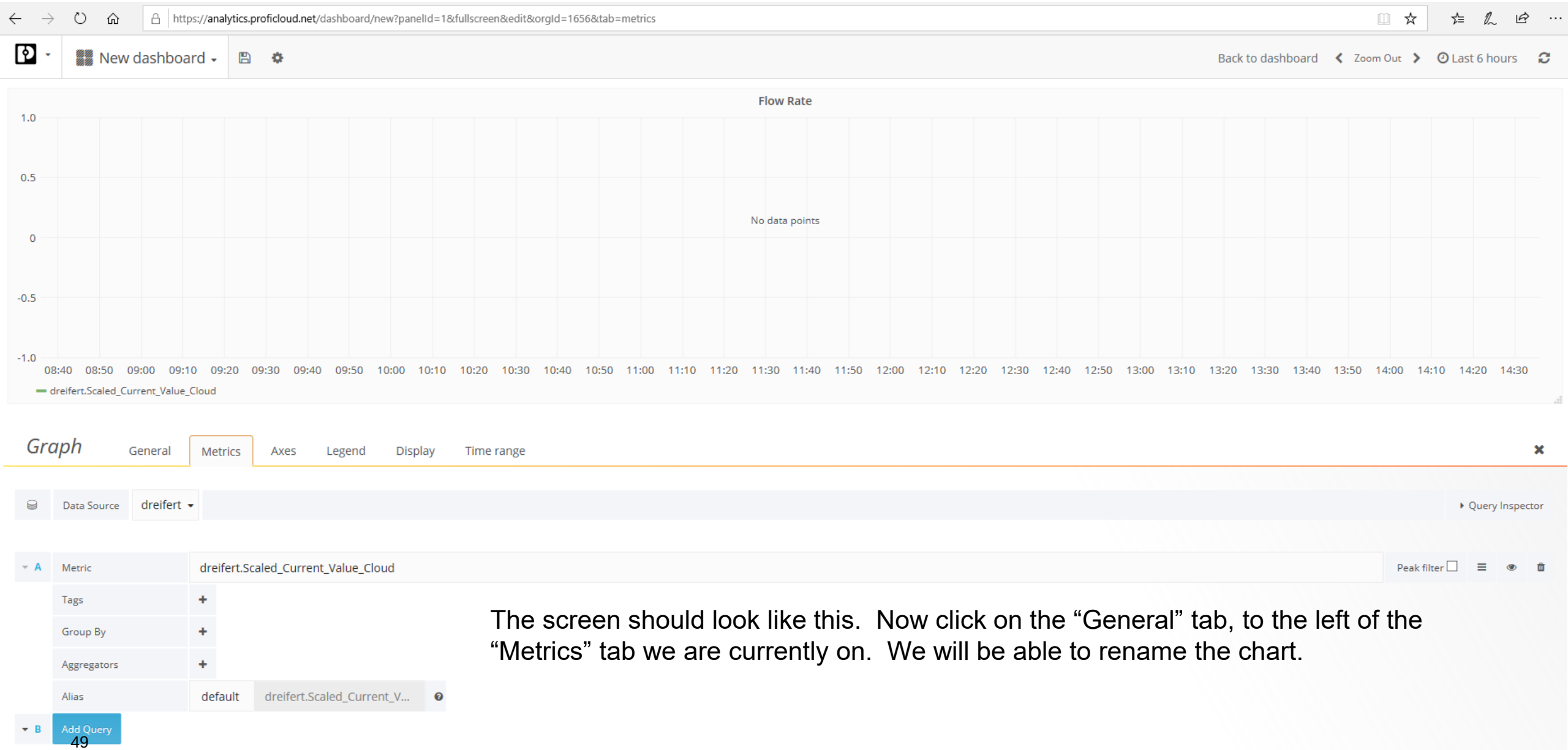
- Click on New dashboard. Once the screen above is displayed, click and drag the **Graph** element onto the shaded empty space. This will automatically create a chart. It will look like it has been trending real data, but it is not yet linked to any data source.
- On the next screen we will see how we can link a data source (a variable from our PLCnext program…which is called a metric in Proficloud)

Click on “Panel Title” at the top of the page. This will expose a menu. Choose “Edit” from the menu.

From the “Data Source” box (currently showing “Default”), click on your account (“dreifert” in this case).



In the “Metric” area, start typing the first several characters of your account name. After a second or two a list of available metrics (variables) associated with your account will auto-populate. Select the metric you want to be trended in this chart.

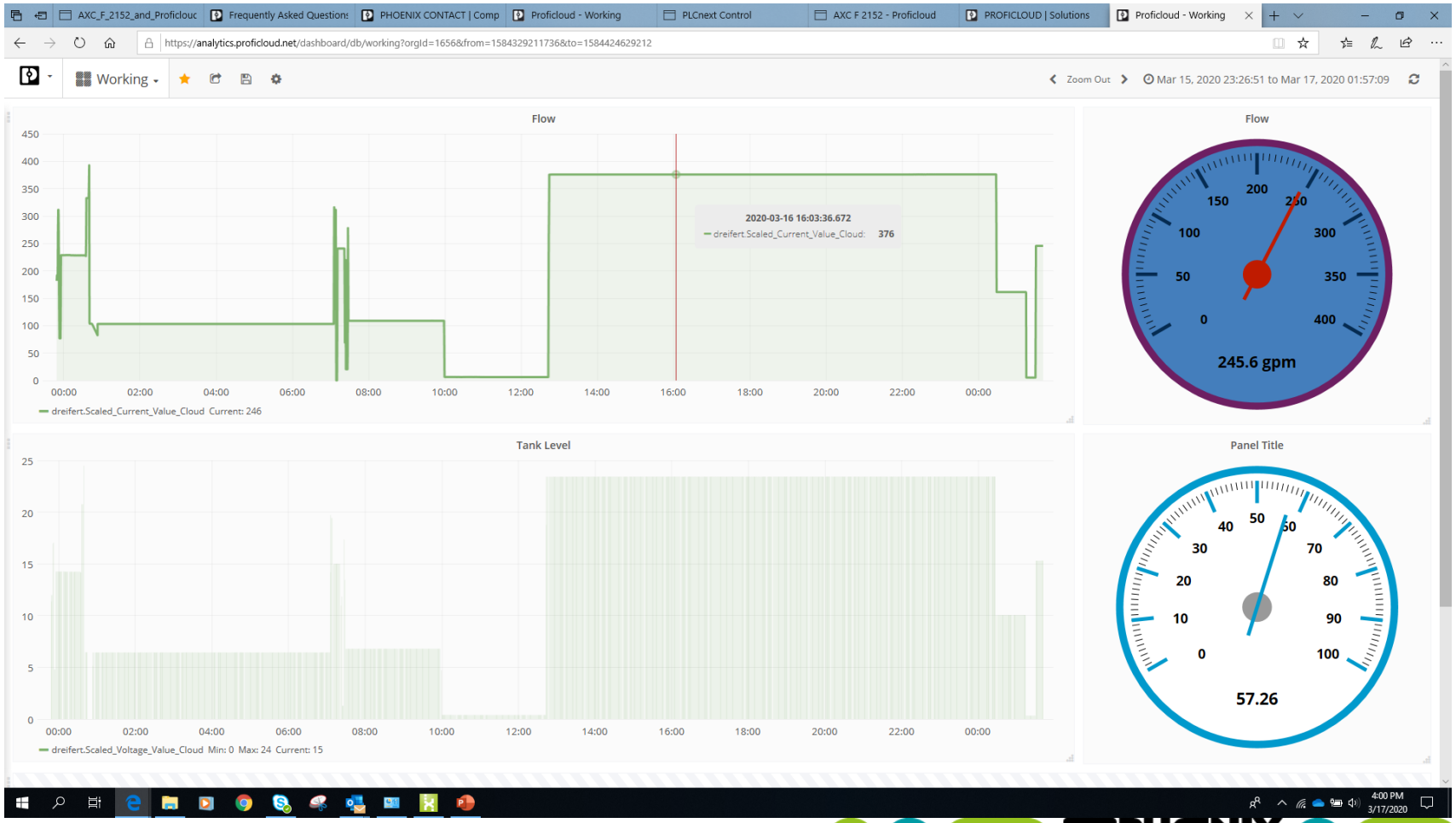


The screen should look like this. Now click on the “General” tab, to the left of the “Metrics” tab we are currently on. We will be able to rename the chart.

Note – the title of the chart has changed at the top pf the page, and you can see directly under the chart, the metric (variable) that is trended.
Click the x below the chart to leave Configuration mode.

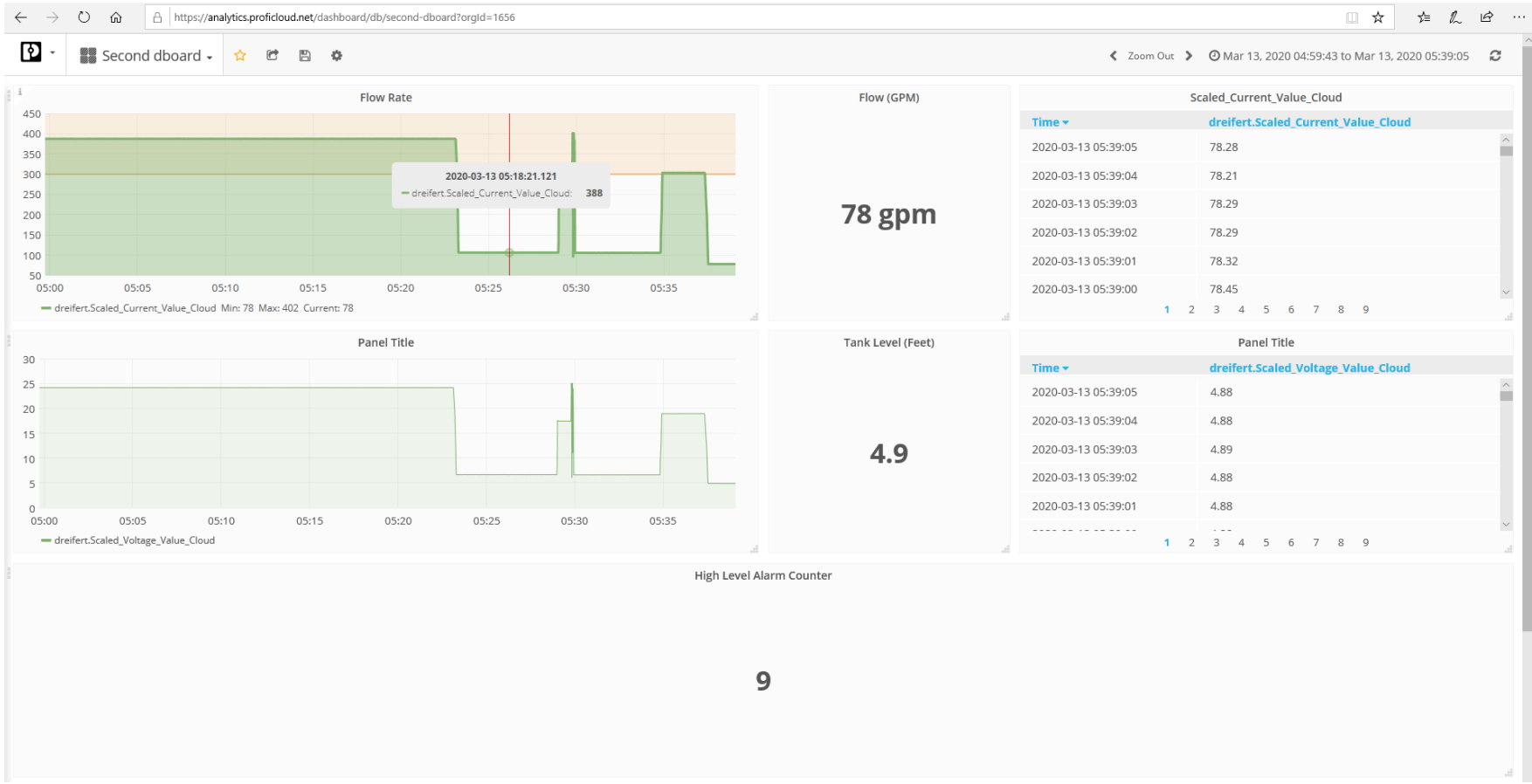
Configuring a dashboard

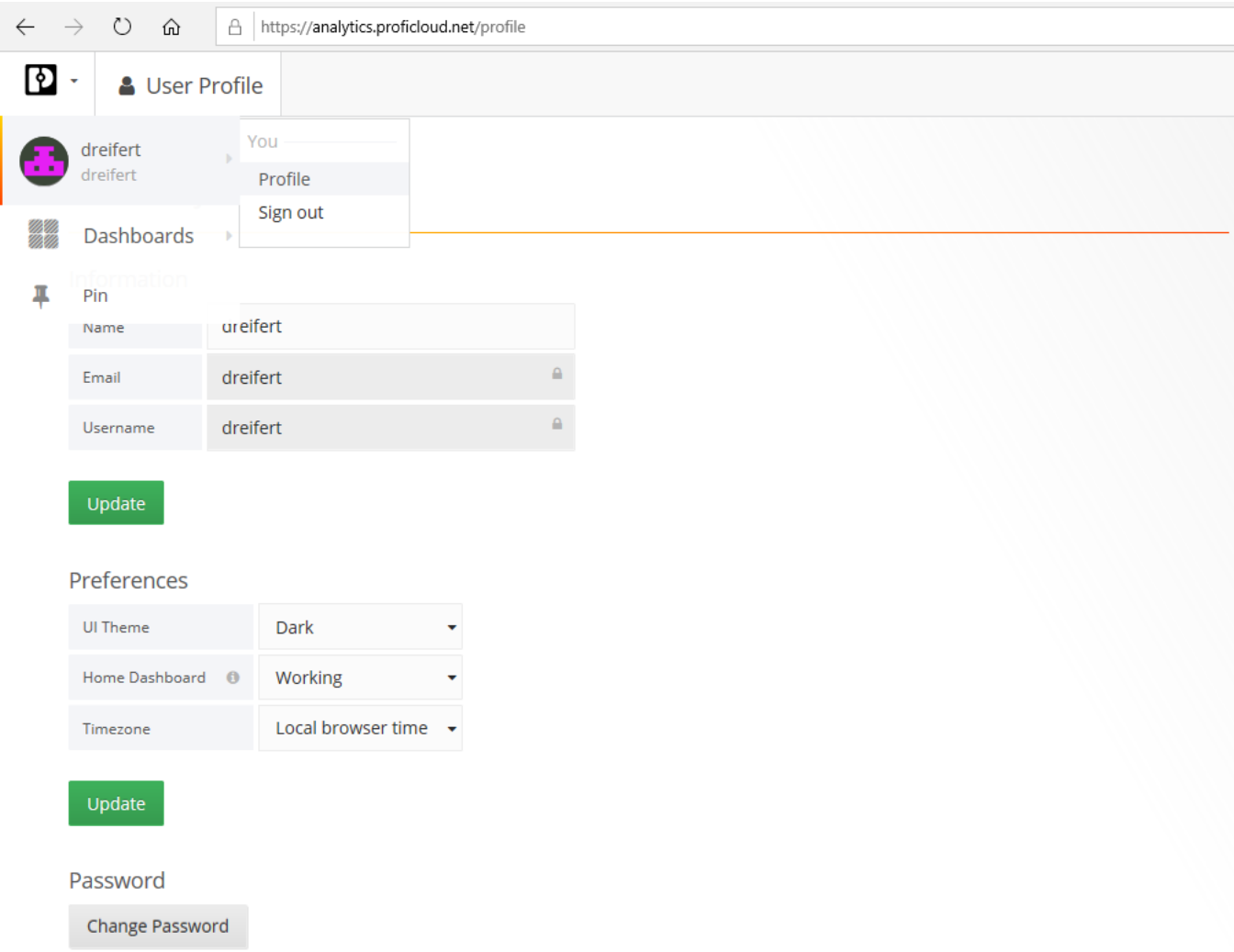
- “Add row” and drop in another chart. Follow the procedures to link another metric (like Scaled_Voltage_Value_Cloud and, label it with “Tank Level”
- At the very bottom/right of the chart area is a faint triangular “handle”. Click on it and drag to re-size the chart.
- When the cursor is placed at the top/right of the chart area, the cursor turns from an arrow to a hand. This enables you to grab and move that element to another part of the dashboard



Configuring a dashboard

- Keep experimenting. You can add dashboards, which can reference the same metrics (variables).
- Note the inclusion of a high-alarm threshold on the top chart (pink shaded area).
- Note it is possible to show values as numbers, rather than gauges
- Note – you can display time series data in tables
- In a huge waste of space, I am using the screen's entire width to show a counter value.

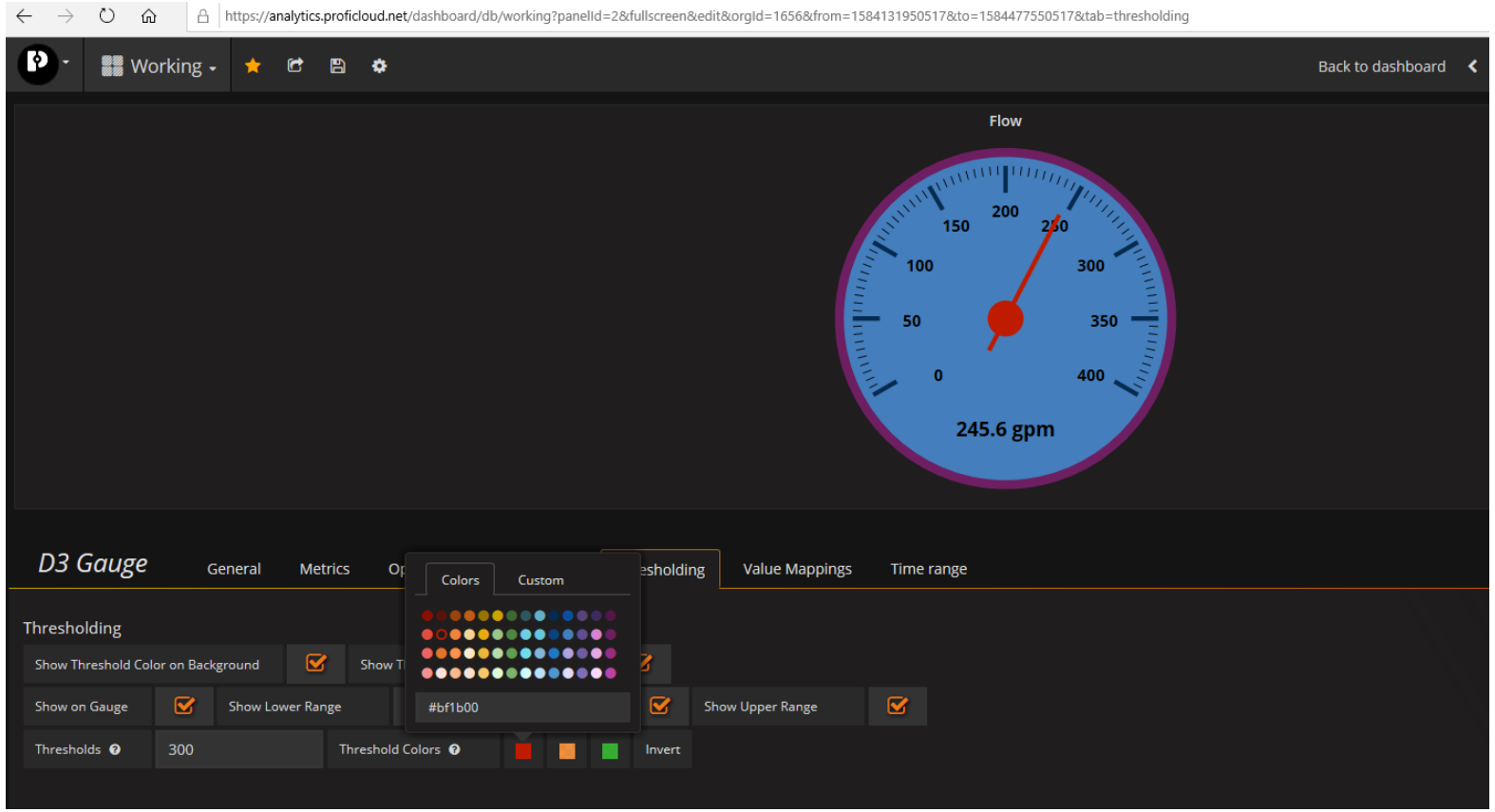




- Click on the Phoenix Contact logo at the top/left of the screen and click on your user, Select “Profile” from the drop-down list.
- You can change the UI (User Interface) theme from default to dark, as I will do.
- You can adjust time to reflect local browser time, UTC, or some other time.
- Click “Update” to save changes

Configuring a dashboard

- Then experiment with other elements, like D3 gauges. They are configured similarly.
- Trial and error is the best bet to become familiar with dashboarding.

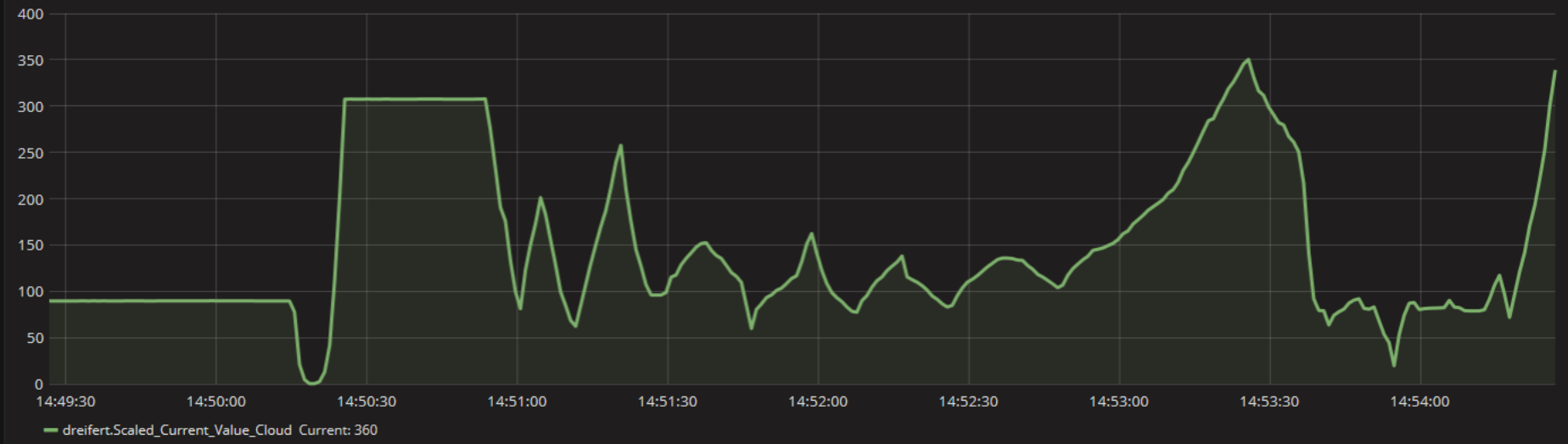


https://analytics.proficloud.net/dashboard/db/working?refresh=1s&orgId=1656

Working

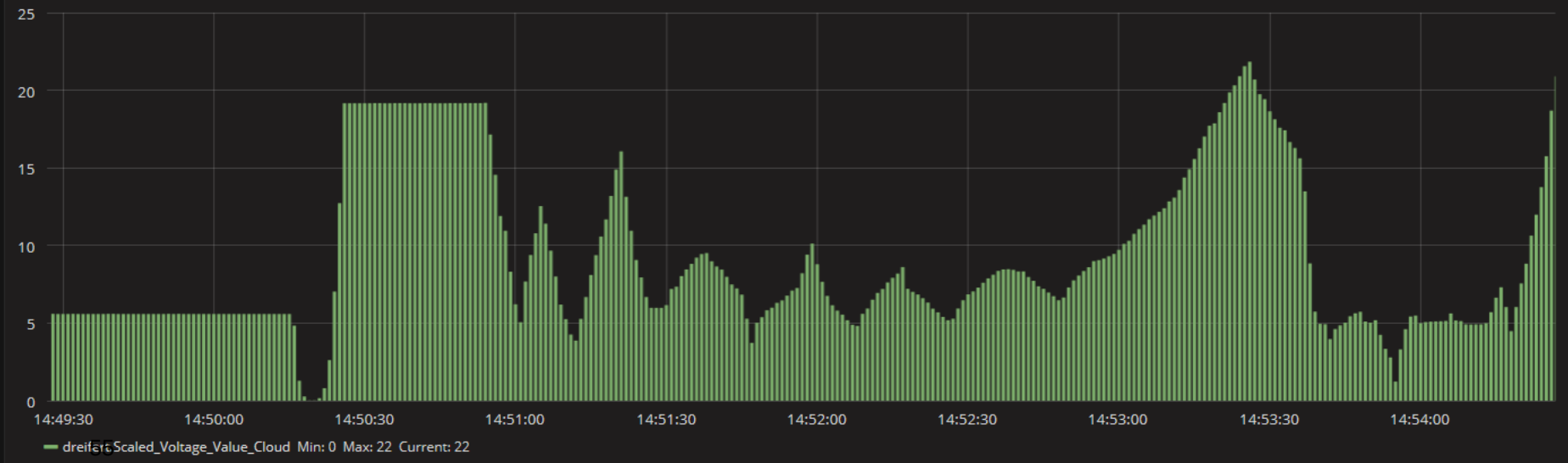
Last 5 minutes Refresh every 1s

Flow

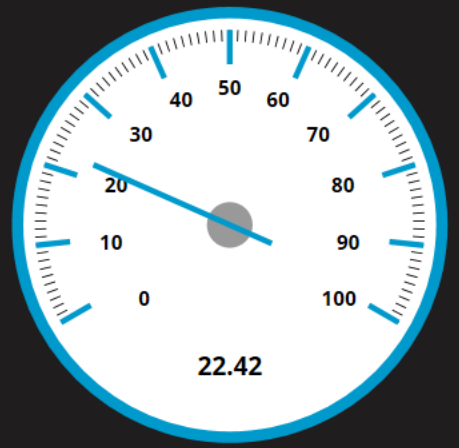


Flow

Tank Level



Tank Level (Feet)

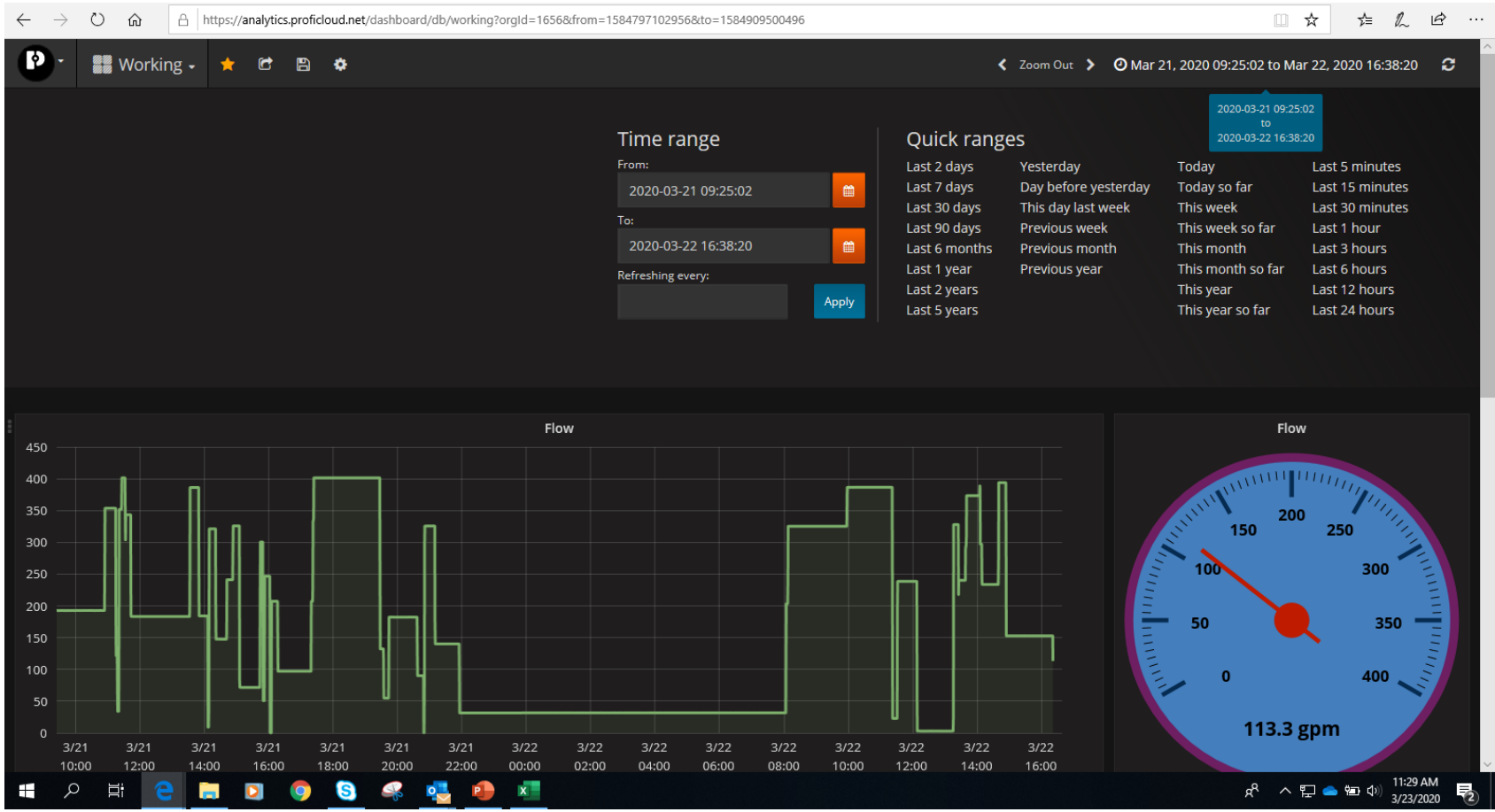


2:54 PM
3/18/2020

Dashboarding – changing the time range, update rates

At the top/right of any dashboard is an indication of the time range.

- Click on the time range to open the interface seen in this graphic.
- Choose “Quick range” or enter your own custom range.
- Also click in the “Refreshing every” box, and select a refresh rate
- Click enter



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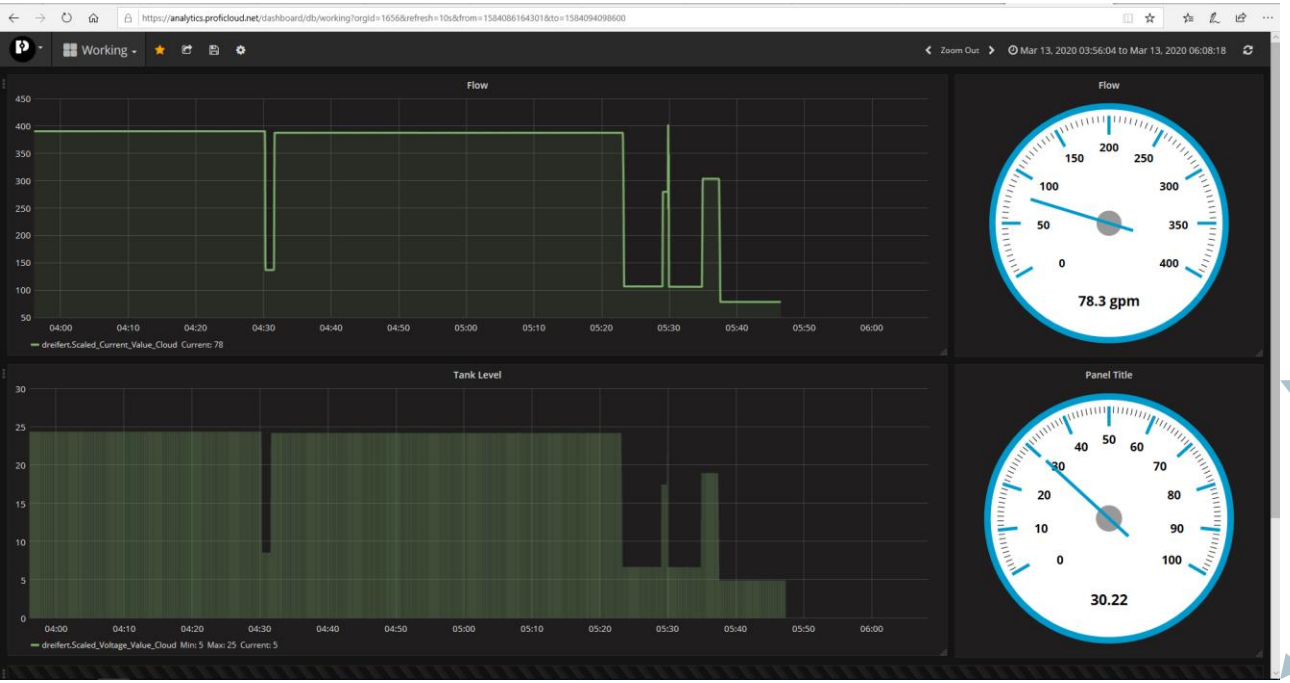
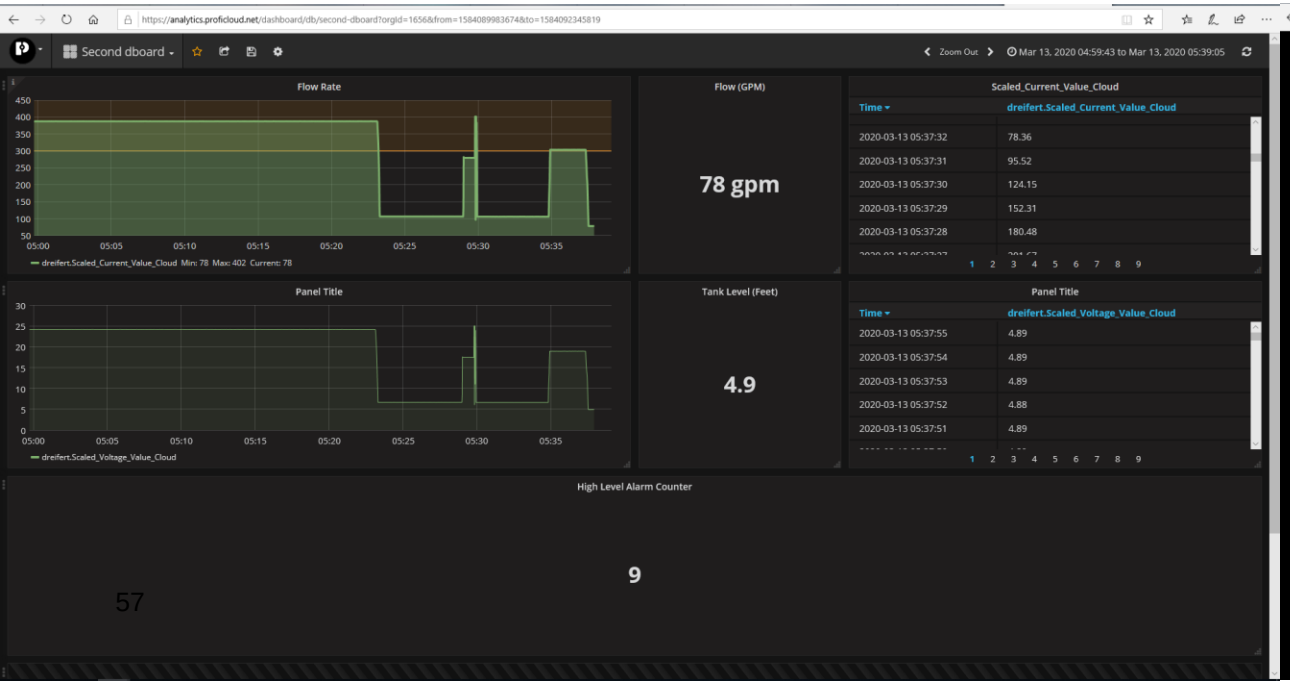
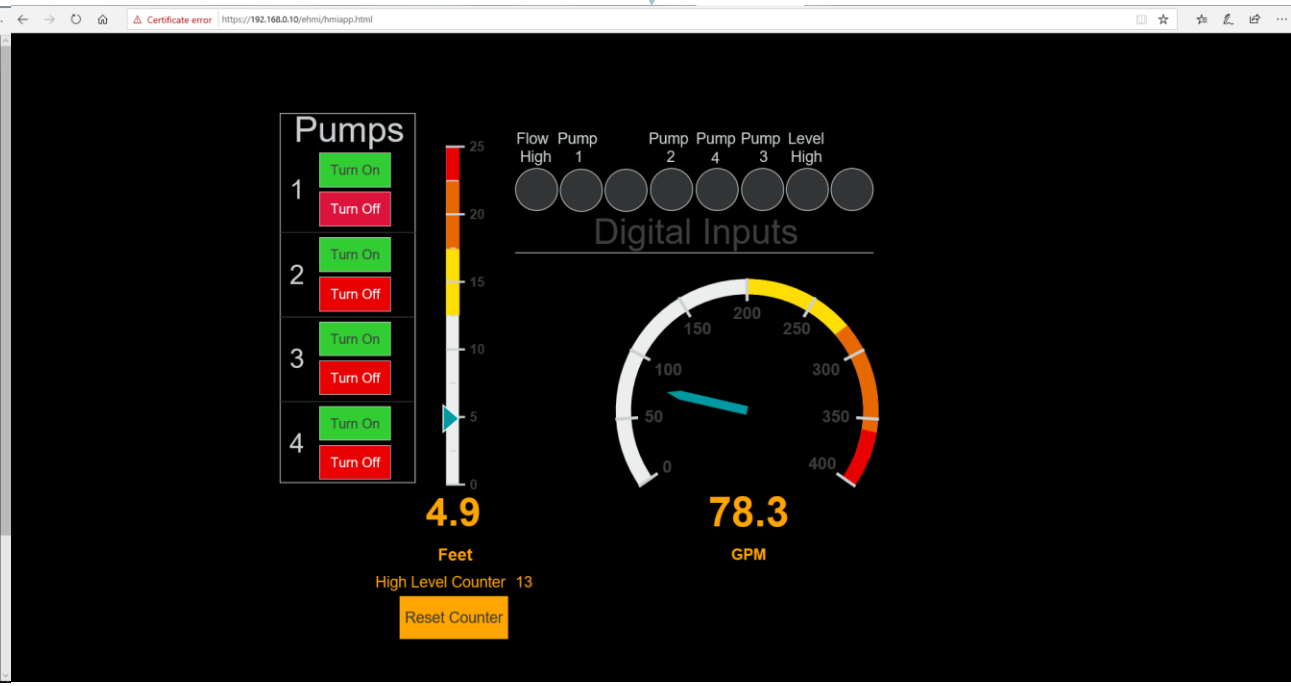
Examples of Graphical User Interfaces, all displaying the same information from the PLCnext controller

ProfiCloud dashboards

PLCnext's internal HMI





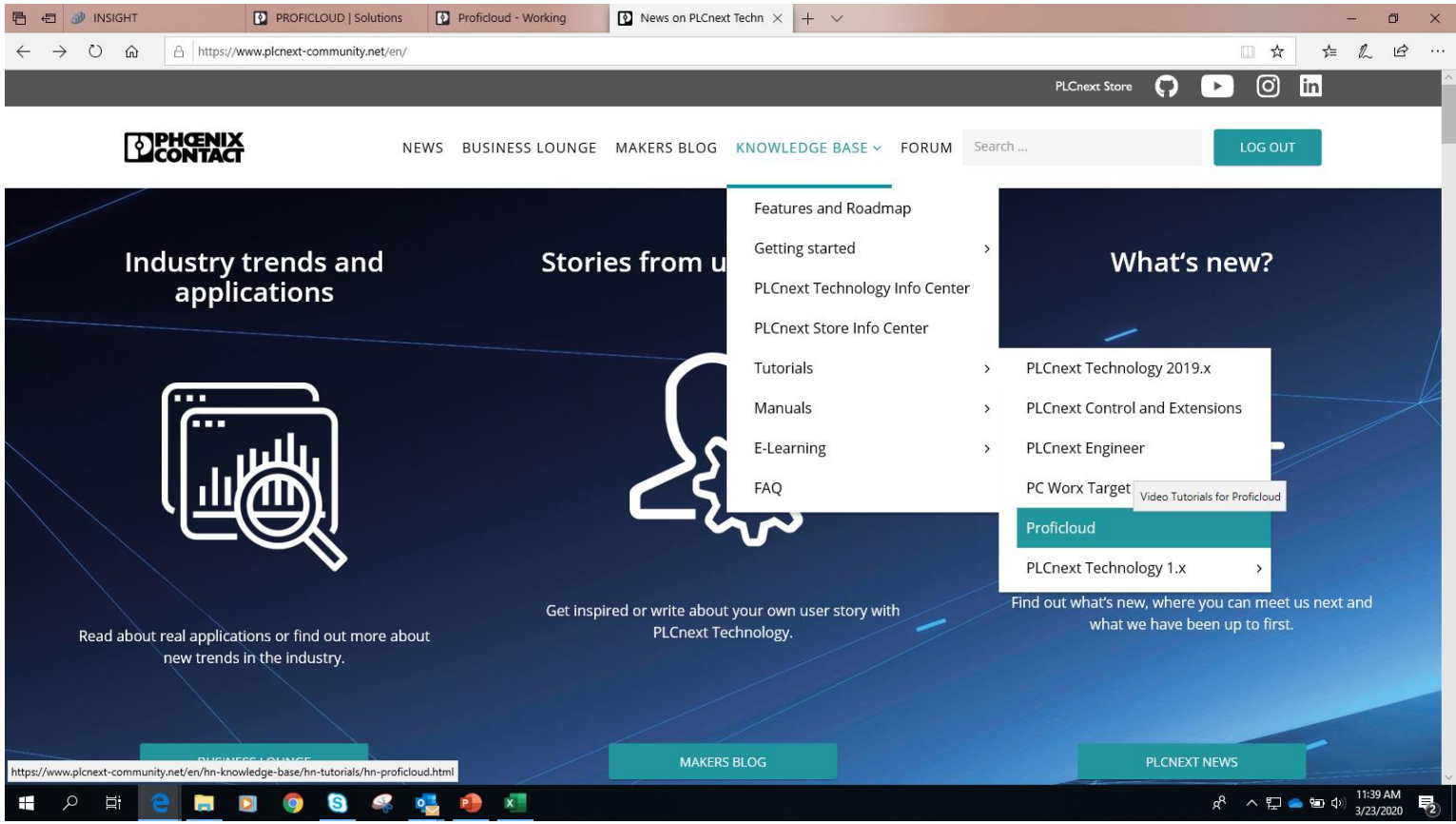


Proficloud – other training resources

The PLCnext Community is a great place to check for help and training on any PLCnext topic, including Proficloud

- Navigate as shown

- Also go to FAQ section
  - Look for “How do I create dashboards on Proficloud by Dave Hoysan
    - Link



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Part 2

Getting started with ProfiCloud

End

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