fatbox G3
PROGRAMABLE
IIOT GATEWAY ROUTER

For MAC

EDITION2.1/JAN 2019

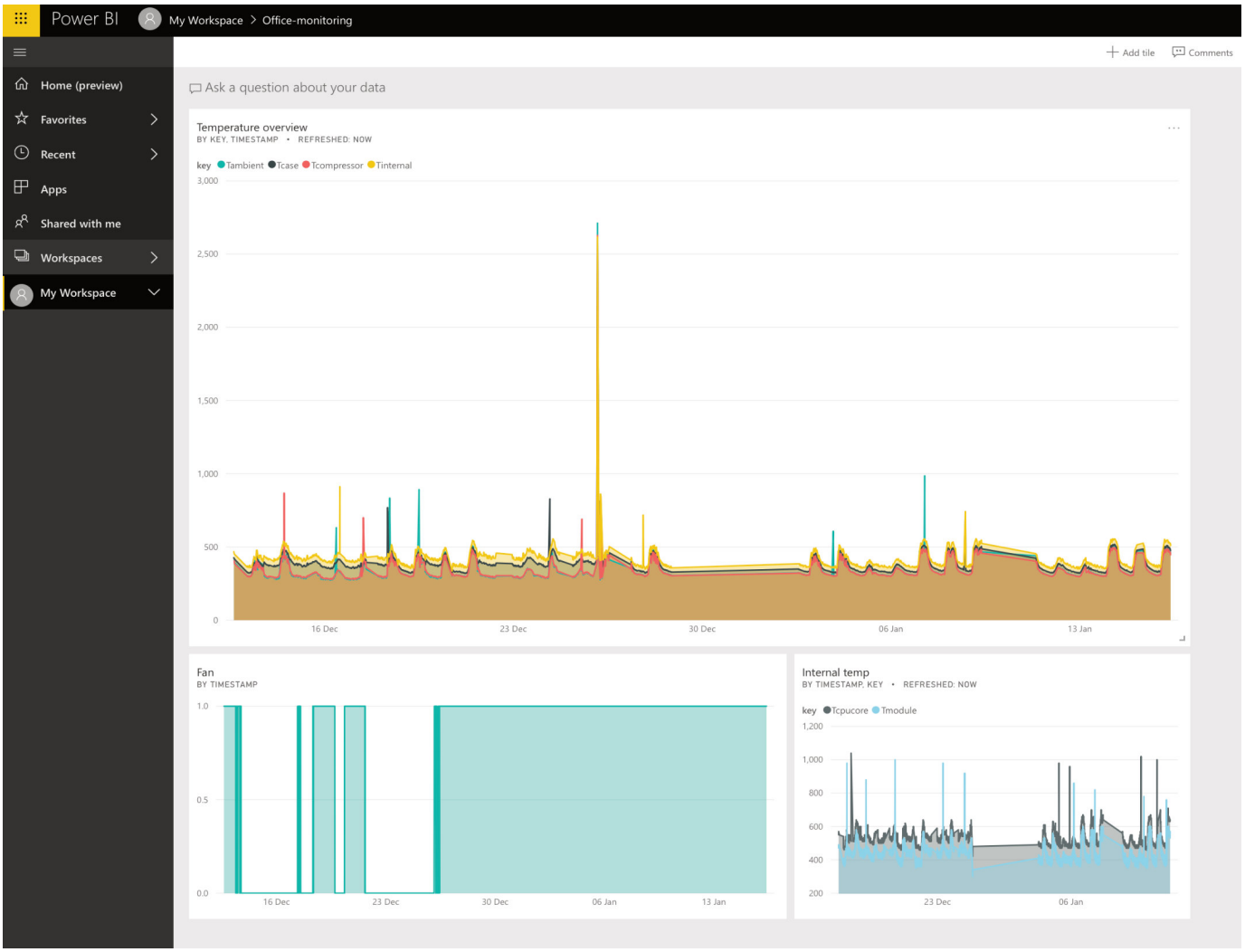
Microsoft Azure
Certified

AZURE IoT Quickstart Guide

Using Microsoft PowerBI, visualising data is straight-forward. It can be an end solution in itself or prove a concept for you to build your own custom web or app solution. With Azure IoT Hub client integrated on the FATBOX G3, you can easily collect data from remote industrial devices like power meters, PLCs or sensors.

The programmable FATBOX G3, equipped with MODBUS (RTU and TCP), Serial RS-485/232, Ethernet, CAN Bus, ZigBee, WIFI and BLE is a robust IIoT device gateway for remote monitoring and analytics on Azure using a cellular (LTE/3G) backhaul or the existing ADSL/Fibre.

Here is a sample PowerBI dashboard from our demo kit.



In the following pages, we will show you step-by-step, how to get your own device data streamed on the Azure IOT Hub and displayed on the PowerBI dashboard

What You Need To Start

The Assembly

1. FATBOX G3 AZURE IOT STARTER KIT — Available at https://www.amplif ed.com.au/azure-iot-starter-kit

2. A SIM CARD — Get this from your local operator/Telco.
You will also need to get the SIM card's APN from them.

3. AN AZURE ACCOUNT — Create an Azure Account at https://azure.microsoft.com

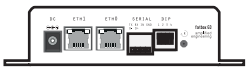
4. A POWER BI ACCOUNT — Create a Power BI account at https://powerbi.microsoft.com

Optional Downloads

5. IOTASSET.TXT — Your FATBOX comes with a working iotasset.txt f le installed.
If you have overwritten the f le, you can refer to step 3 of
our Azure Quickstart Guide on our website to obtain this f le.

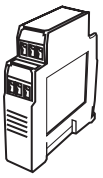
FATBOX G3 Azure IOT Starter Kit

1 x FATBOX G3



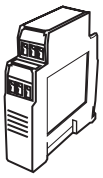
Industrial 3G Gateway
with Azure IOT Client &
MODBUS RTU/TCP server

1 x DIGITAL INPUT MODULE



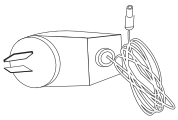
4 x digital inputs
(or switch contacts)
MODBUS RTU slave unit

1 x ANALOG INPUT MODULE



2 x analog input
MODBUS RTU
slave unit.

2 X 24VDC POWER SUPPLY
100-240 VAC



1 for the FATBOX G3
1 for the MODBUS Slave units

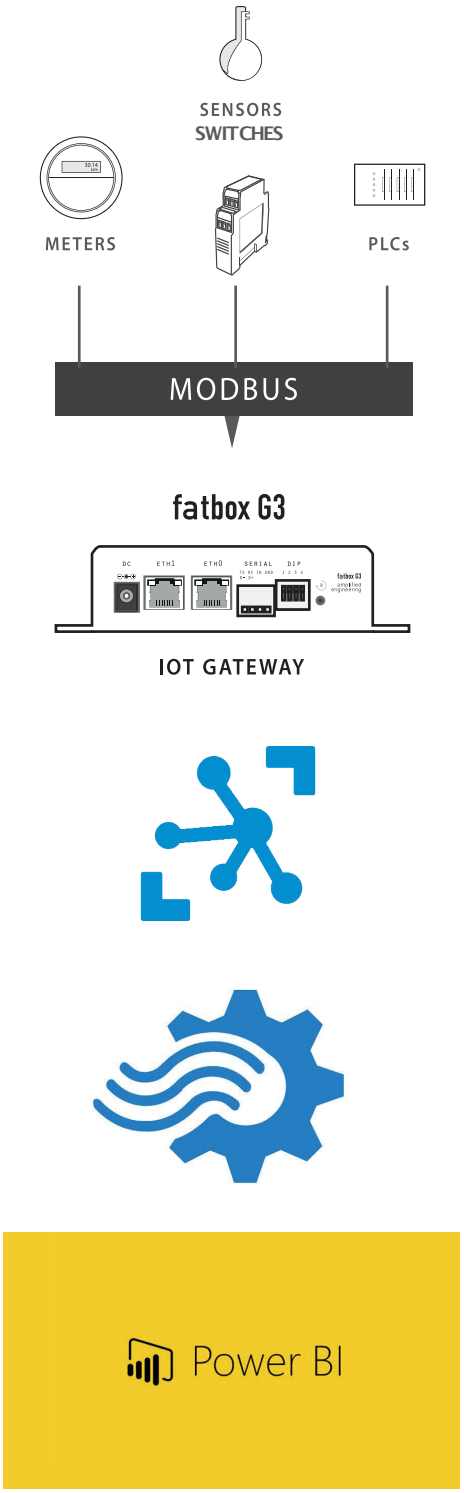
1 X CELLULAR ANTENNA

Cellular antenna with
2m wire

1 X TEMPERATURE SENSOR

Temperature sensor probe
(0c - 400c) with 1m wire

Set Up An Overview



1 Wiring Inputs to the NOVUS Modules

To collect data from industrial MODBUS RTU/TCP Power meters, PLCs or Sensors

[pg. 4]

2 Setting Up the FATBOX G3

Conf gure your FATBOX G3 to stream data to AZURE over a 3G network

[pg. 5-6]

3 Setting Up AZURE IoT Hub

Register your FATBOX G3 as a new device with AZURE IoT Hub

[pg. 7-10]

4 Setting Up Stream Analytics

Set up Stream Analytics to deliver your data readings to Power BI

[pg. 11-14]

5 Setting Up Power BI

Create a visualised report of your data on Power BI

[pg. 15-17]

approx. set up time: 3 hours

1. Wiring Inputs To The NOVUS Modules

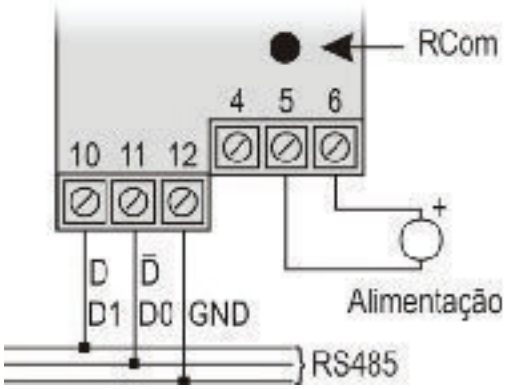
This section describes how to wire up the MODBUS RS485 I/O modules included in the starter kit to the FATBOX G3 and also to its 24VDC power supply. It will also show you how to wire up the temperature sensor to the analog MODBUS module. The following are simplif ed wiring diagrams for the NOVUS Automation I/O modules. For detailed instructions please refer to the instruction manual. ◢

Instruction Manual Links:

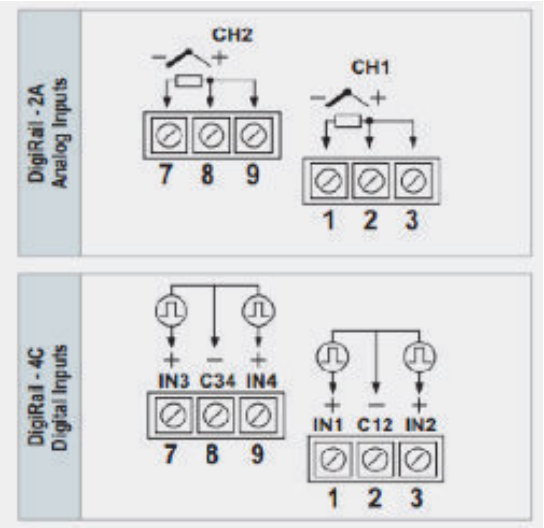
Analog Input Modules
https://www.novusautomation.co.uk/digirail2a

Digital Input Module
https://www.novusautomation.co.uk/digirail4c

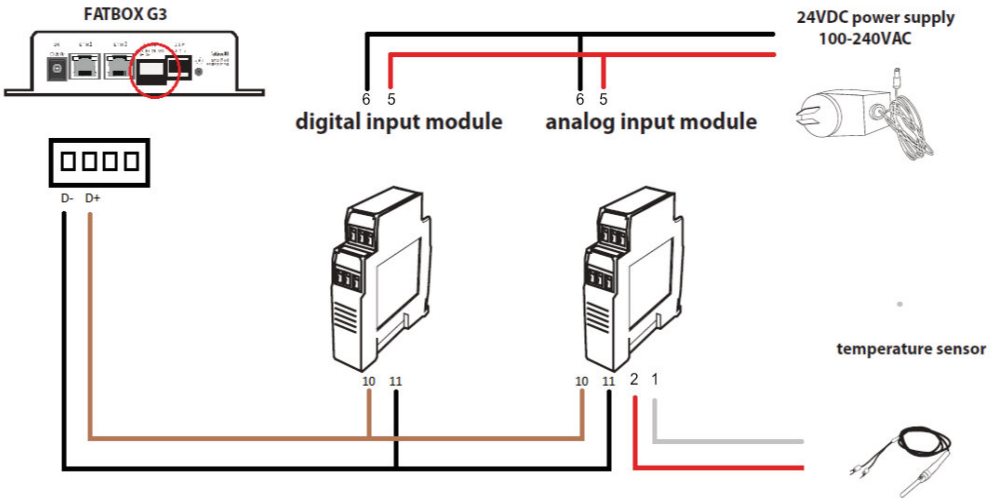
Please ensure a valid SIM card is inserted in the G3 before you begin wiring.



The communications/power are the same for both modules



Input connections for individual modules are shown here



2. Setting Up The FATBOX G3

2A. Log into the FATBOX web console

When you have connected up the FATBOX [ETH0 port], log into the web console [192.168.1.1]. By default the username is **admin** and password is **fatbox12345**

2B. Conf guring the cellular (3G) settings

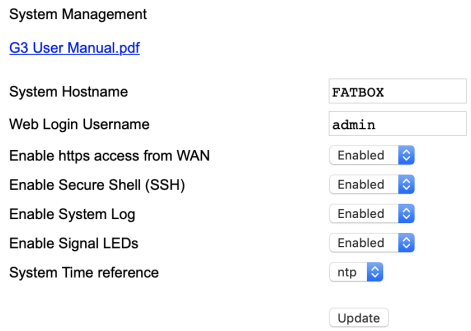
> Enter in the APN details you got from your SIM card operator.
> To conf rm the settings, click the UPDATE button.

2C. Conf guring the Serial Port settings

Got to <Port Settings>. Conf gure your serial port parameters as follows:
Remember to conf rm the settings by clicking the UPDATE button.

2D. Enable SSH to be used for managing the FATBOX

Click on the <MANAGEMENT> tab and enable the SSH option.
Remember to conf rm the settings by clicking the UPDATE button.

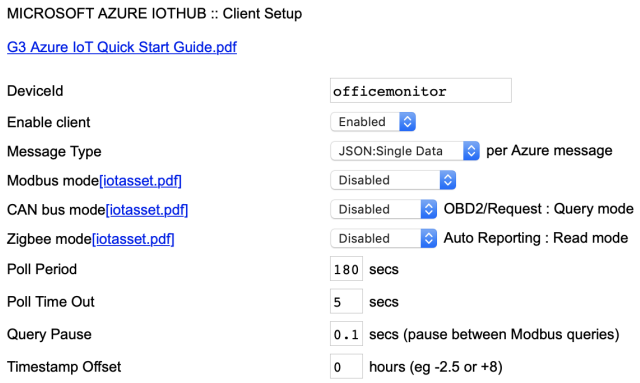


2E. Ensure you have iotasset.txt

The FATBOX G3 has iotasset.txt preconf gured. If it is overwritten, you have to copy iotasset.txt to the FATBOX's /user directory via SCP. [See the instructions on pg.19.]

2F. Set up the FATBOX Azure IoT Hub Client

> Click the <AZURE IOT> tab and create a DeviceID for this FATBOX. How you name this ID is up to you but make it distinct so you can identify it easily later.
> Select the ENABLE option and conf rm your settings by clicking the UPDATE button.



2G. Reboot the FATBOX to save your settings

You can reboot the box by powering it down and up again. ◢

Testing your settings

Let's test that the FATBOX G3 is getting readings from the NOVUS modules.

Open a session on Terminal and log into the box using the command:
'ssh root@192.168.1.1'

Once you are prompted for the password:

> Enter the password as: **fatbox12345**

> Enter the command '**cd /tmp**' to the console

> Enter the command '**cat dataq.txt**' to the console

You should see an output similar to the following:

```
Last login: Thu Jan 24 15:14:17 on
[        -MacBook-Pro:~              ssh root@pmtemperature.dyndns.org                    ]
[root@pmtemperature.dyndns.org's password:                                                 ]


BusyBox v1.23.2 (2018-11-27 19:30:18 +08) built-in shell (ash)

fw_G3_2_4_16pmtemperature 3.0.35

FATBOX G3 Cellular Gateway Router

Developed in Australia www.amplified.com.au


[root@FATBOX:~# cd /tmp                                                                    ]
[root@FATBOX:/tmp# cat dataq.txt                                                           ]
[{"DeviceId":"officemonitor","Key":"Tcpucore","RecOn":"2019-01-24T04:16:28Z","Val":610}]
[{"DeviceId":"officemonitor","Key":"Tmodule","RecOn":"2019-01-24T04:16:28Z","Val":530}]
[{"DeviceId":"officemonitor","Key":"Tcase","RecOn":"2019-01-24T04:16:34Z","Val":459}]
[{"DeviceId":"officemonitor","Key":"Tinternal","RecOn":"2019-01-24T04:16:34Z","Val":501}]
[{"DeviceId":"officemonitor","Key":"Tcompressor","RecOn":"2019-01-24T04:16:34Z","Val":437}]
[{"DeviceId":"officemonitor","Key":"Tambient","RecOn":"2019-01-24T04:16:34Z","Val":448}]
[{"DeviceId":"officemonitor","Key":"FanState","RecOn":"2019-01-24T04:16:34Z","Val":1}]
root@FATBOX:/tmp#
```

end test

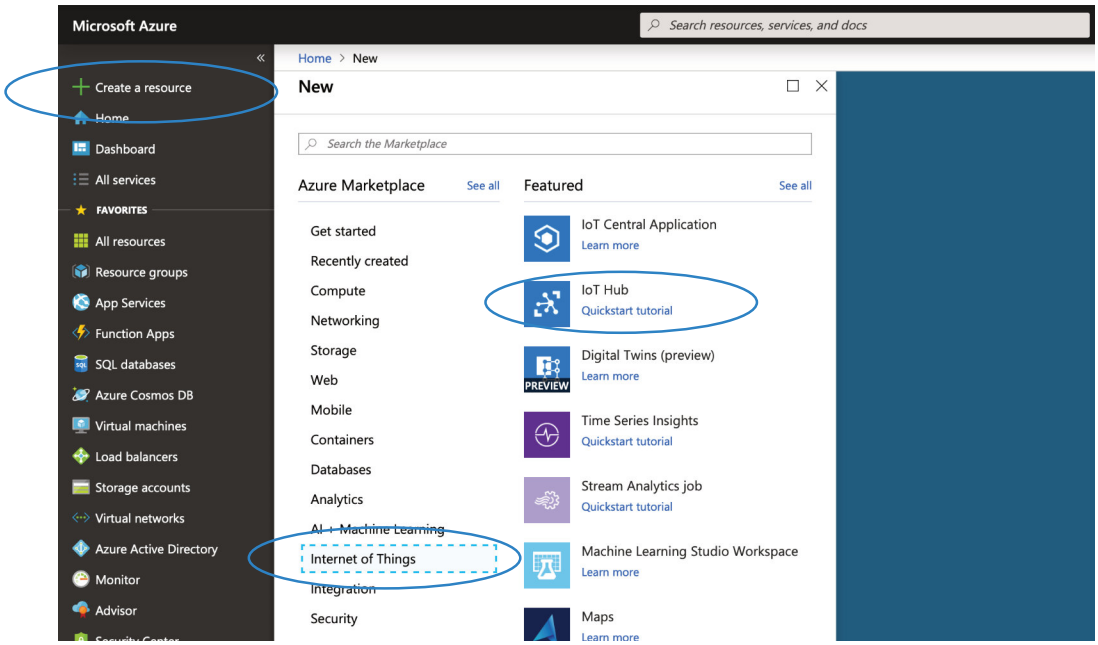
3. Setting Up AZURE IoT Hub

3A. Log into AZURE

Log into AZURE (https://portal.azure.com) using your account settings.

3B. Create a new IOT HUB

In the dashboard select > Create a resource > Internet Of Things > IoT Hub



Create a distinct name for your *Resource Group* (i.e. you can call this the name of your project or application) and *IoT Hub Name* (you can call this the location of your device or reuse the DeviceID of the FATBOX G3). Click the 'Review + Create' tab to create.

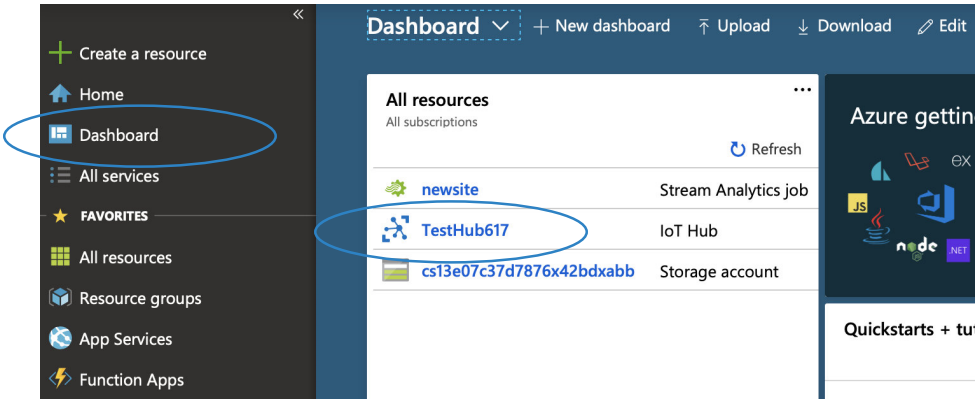
*Note on subscriptions: if you are doing a proof of concept or testing you can proceed with the rest of the set up using the 'free trail' (this gives you complimentary 30 days or $200 of value, whichever comes f rst).

3C. Obtain your 'Primary Key Connection String'.

To register the FATBOX G3 as a new device in AZURE we f rst need a Shared Access Key known as the Primary Key Connection String. The form of the string will be like this:

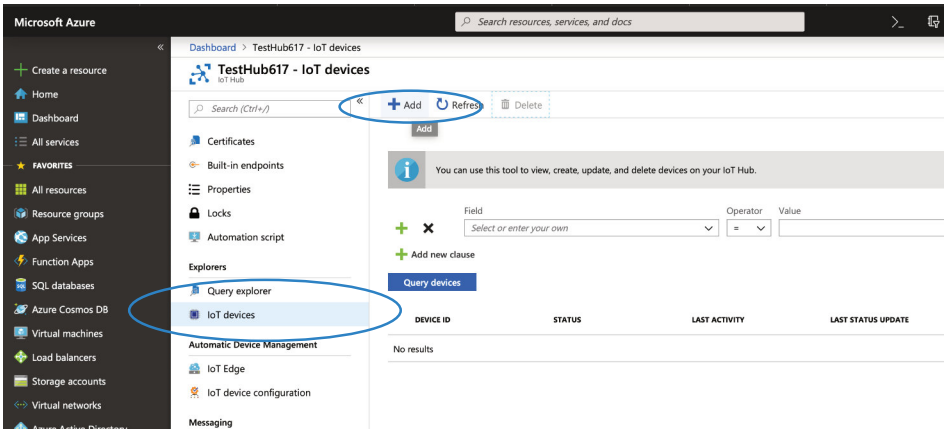
```
HostName=[YourIoTHubName];CredentialType=SharedAccessSignature;
CredentialScope=[ContosolotHub];SharedAccessKeyName=[YourAccess
KeyName];SharedAccessKey=[YourAccessKey]
```

Go to the AZURE Dashboard and select the IOT Hub you just created (in our example we called our new IOT Hub "TestHub617")

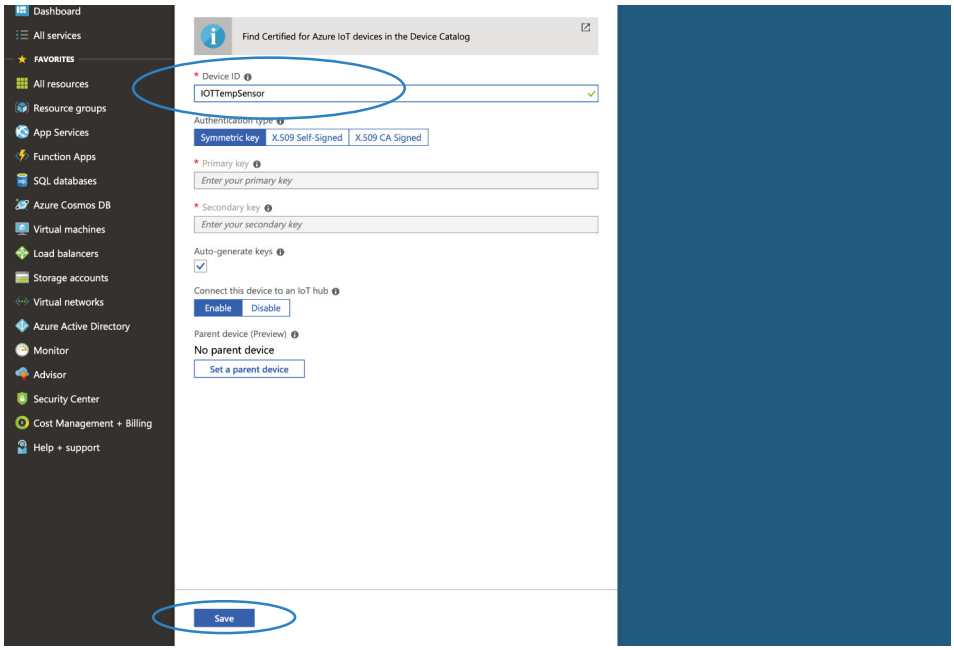


*as of writing

Scroll down the IoT Hub navigation pane till you get > Explorers > IOT Devices
On the right panel click "+Add".

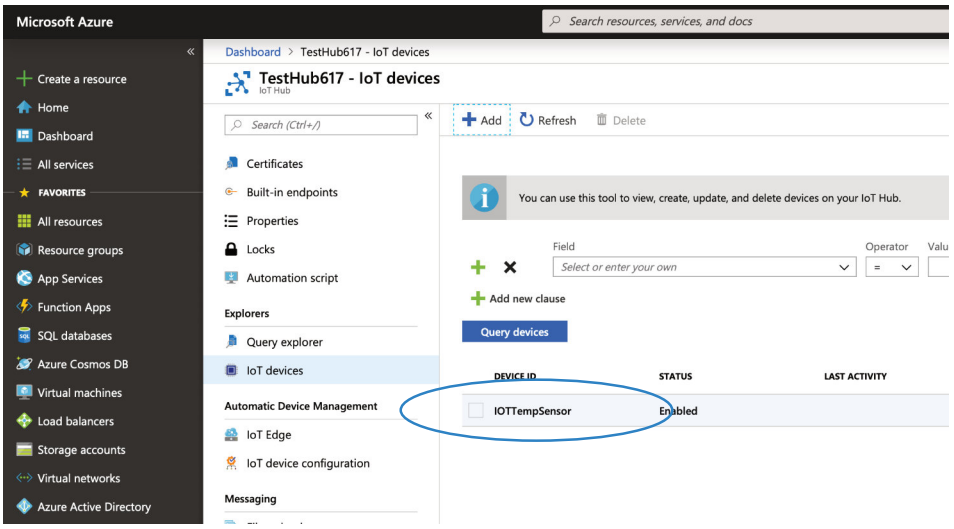


Create a name for your device and click "Save".

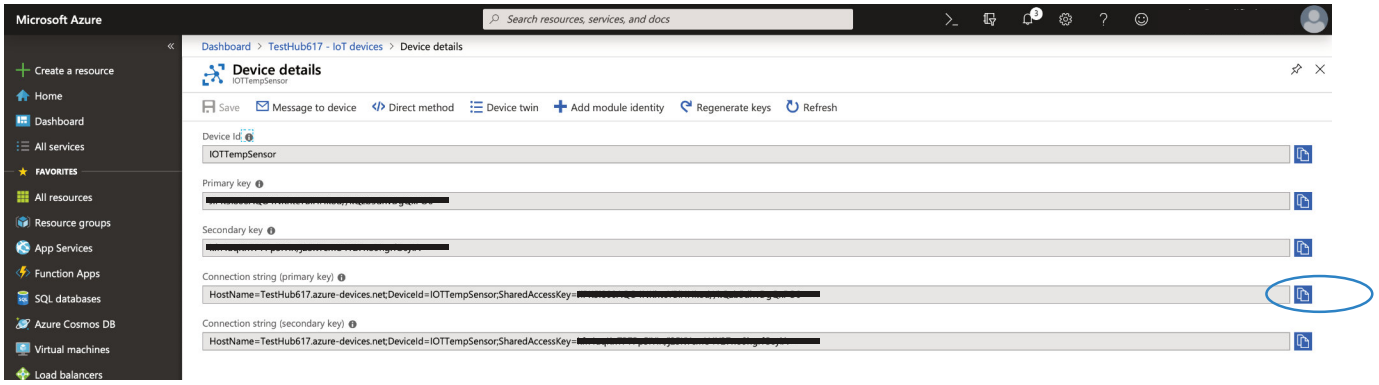


3D. Registering a new device on the G3

Select the Device ID you have just created.



You should see a section with the heading 'Connection String-Primary Key' under this menu. Click on the 'clipboard' icon to copy or select the entire string and copy it using the 'Ctrl-C' keyboard shortcut.



Create a f le called 'connstr.txt' on *TextEdit*. Paste the copied connection string in this f le and save it.

3E. Download the new settings to the G3

Open a terminal session and run the following commands:

> **cd <folder where you saved the connstr.txt>** *i.e." cd documents"*
> **scp connstr.txt root@192.168.1.1:/user**
> enter in the password for your G3 [default is **fatbox12345**].

You can run the following commands to check that you connstr.txt is loaded:

> **ssh root@192.168.1.1**
> enter the password.
> **cd /user**
> **ls** [check to see if there is a connstr.txt f le in the list]
> **cat connstr.txt** [verify the contents of the connstr.txt f le]

3F. Reboot the G3 to save your settings

You can reboot the G3 box by powering down and up again. ◢

Testing your settings

We can check if everything is connected well at this point by ensuring that your AZURE account has started to receive data from your NOVUS modules.

To do this go to the following site:

https://shell.azure.com/

Key in the following command lines:

> **az extension add --name azure-cli-iot-ext**
> **az iot hub monitor-events --hub-name 'Your HUBNAME' --output table**
(in our example we used "*az iot hub monitor-events --hub-name Amplif edHub --output table*")

You should see an output similar to the following:

```
wayne@Azure:~$ az iot hub monitor-events --hub-name AmplifiedHub --output table
Starting event monitor, use ctrl-c to stop...
event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"Tcpucore","RecOn":"2019-01-16T07:43:07Z","Val":630}]'

event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"Tmodule","RecOn":"2019-01-16T07:43:07Z","Val":560}]'

event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"Tcase","RecOn":"2019-01-16T07:43:24Z","Val":492}]'

event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"Tinternal","RecOn":"2019-01-16T07:43:24Z","Val":528}]'

event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"Tcompressor","RecOn":"2019-01-16T07:43:24Z","Val":468}]'

event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"Tambient","RecOn":"2019-01-16T07:43:24Z","Val":478}]'

event:
  origin: Officemonitoring
  payload: '[{"DeviceId":"officemonitor","Key":"FanState","RecOn":"2019-01-16T07:43:24Z","Val":1}]'

event:
```

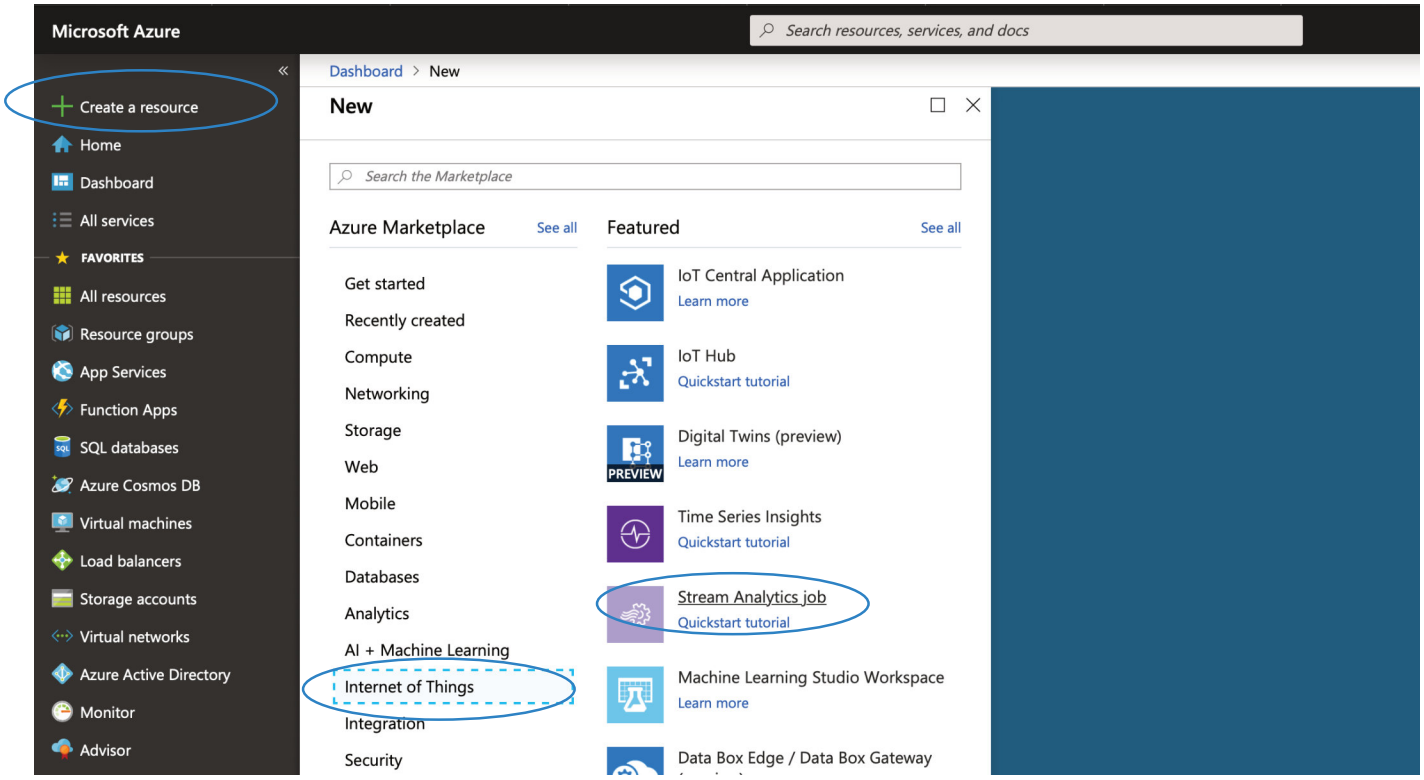
4. Setting Up Stream Analytics

4A. Log into AZURE

Log into AZURE using your account settings

4B. Create a New Stream Analytics Job

In the dashboard, select > Create a resource > Internet of Things > Stream Analytics Job

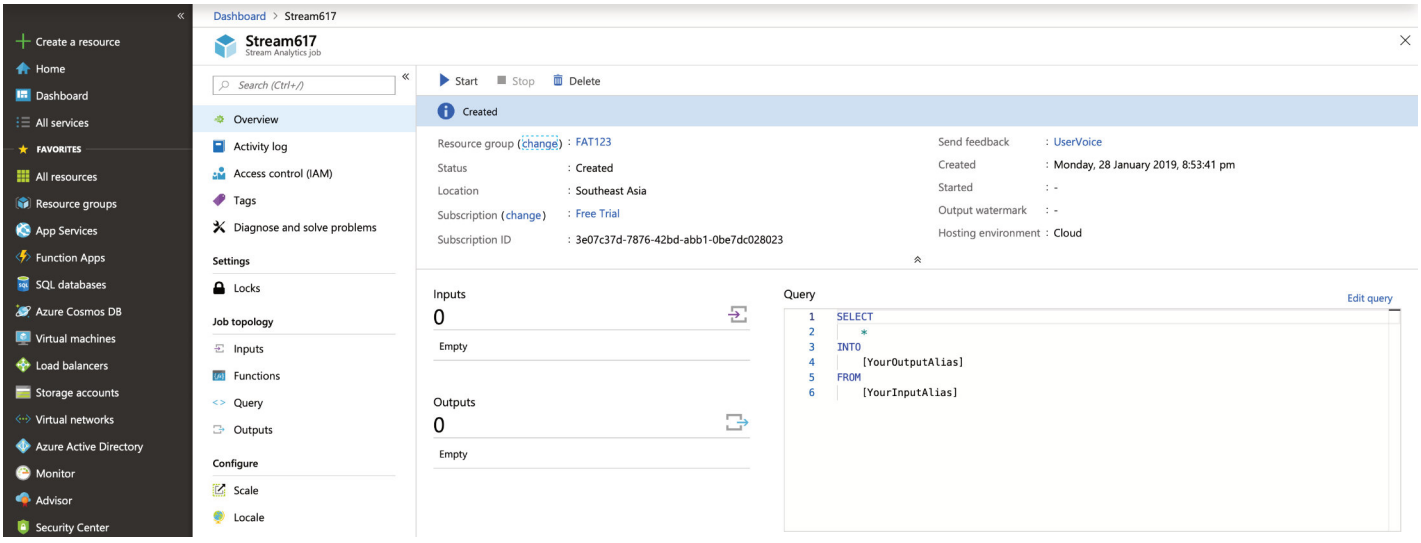


Create a distinct name for the Analytics Job. In this example we will call it 'Stream617'.

* Note on Subscription: again if you are doing a proof of concept or testing you can proceed with the *free trial* which will give you 30 days or a $200 credit with Azure.

4C. Designate the Job's Scope (or Topology)

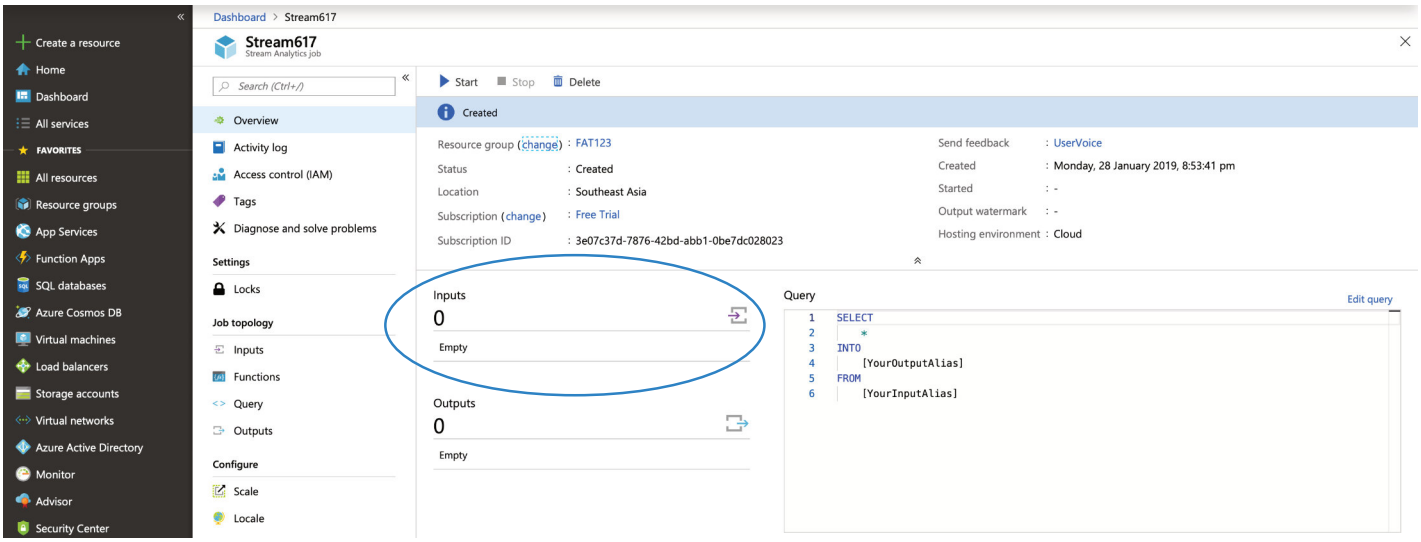
Go back to the AZURE dashboard, select the Stream Analytics Job you just created. This will open up the Job Topology table you see below.



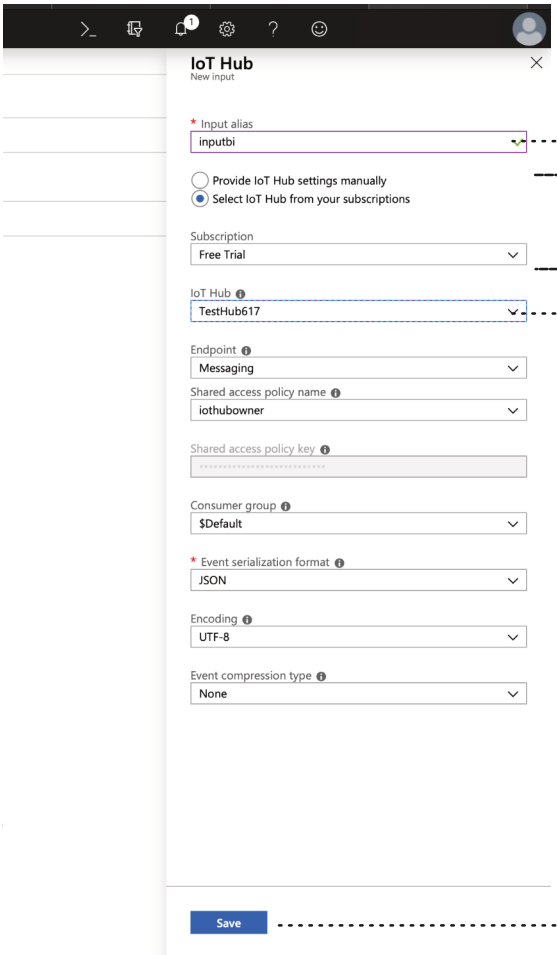
* as of writing

4D. Designate the Input for the Job Topology

Click on the <INPUTS> f eld, then select > Add Stream Input > IOT Hub.



You can complete the rest of the inputs as follows:



You can use any input alias you like.

Select the IoT Hub from your subscription.

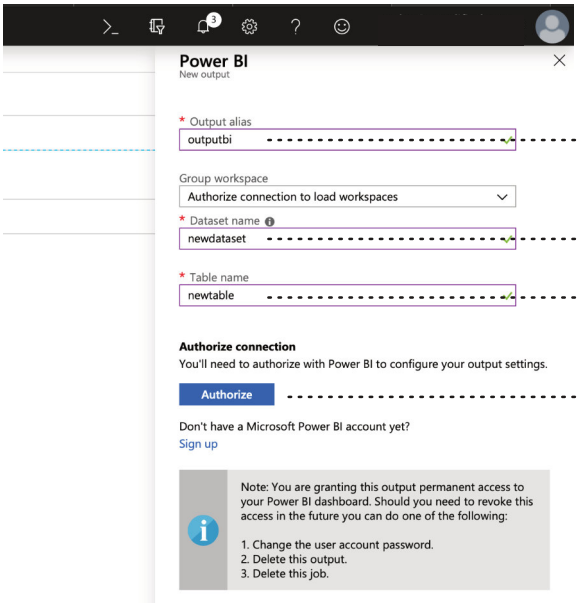
Enter in the name of the IoT Hub you created. (ours was called TestHub617).

Click <SAVE> to set the input for the job.

4E. Designate the Output for the Analytics Job

We will designate the output for the job in the same manner.

Go back to your Stream Analytics Job and click on the <OUTPUTS> f eld
Then select > Add. Choose **PowerBI** from the scroll down list.



You can choose your own output alias.

You can choose your own dataset name.

You can choose your own table name.

Authorise with the PowerBI account you have set up.

Click on the <SAVE> tab to set your output for the job.

4D. Designate the Query for the Analytics Job

Next select <EDIT QUERY> at the top right of Query f eld in the Job Topology table.

Enter the following into the empty f eld given:

Under SELECT

```
deviceId,RecOn as TIMESTAMP,[Key],
CAST (Val AS bigint) as VAL
```

Under INTO

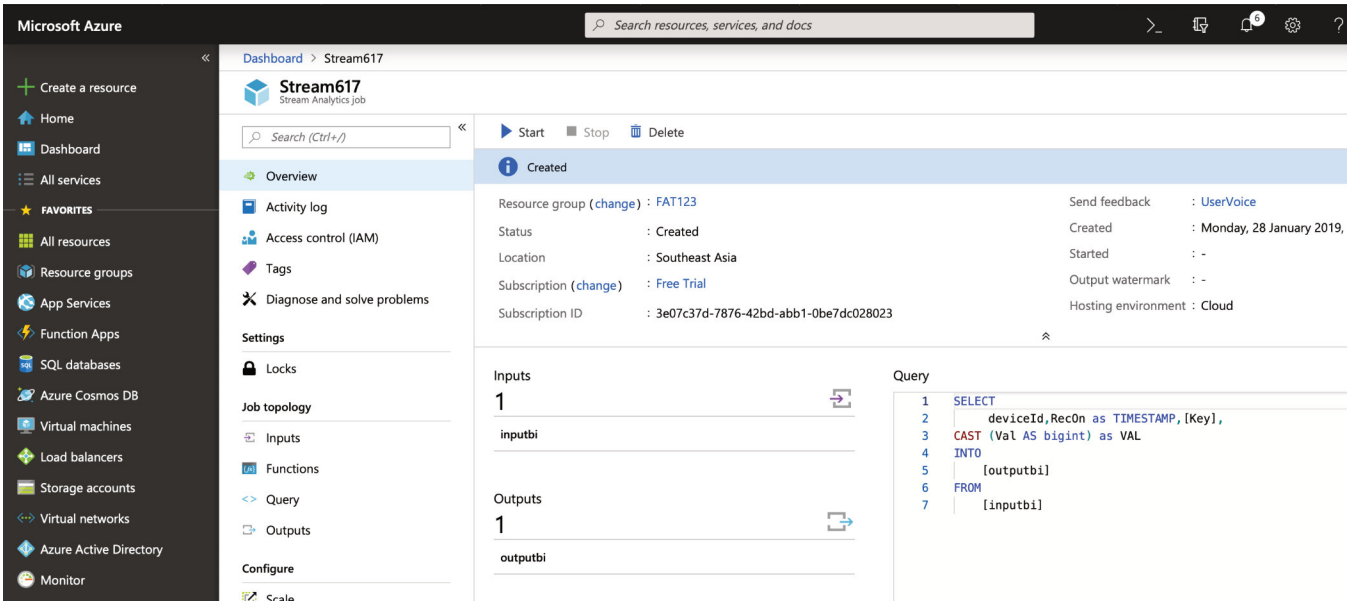
The output alias you have set in step 4E. --------- i.e. `[outputbi]`

Under FROM

The input alias you have set in step 4D. --------- i.e. `[inputbi]`

Click **<SAVE>**

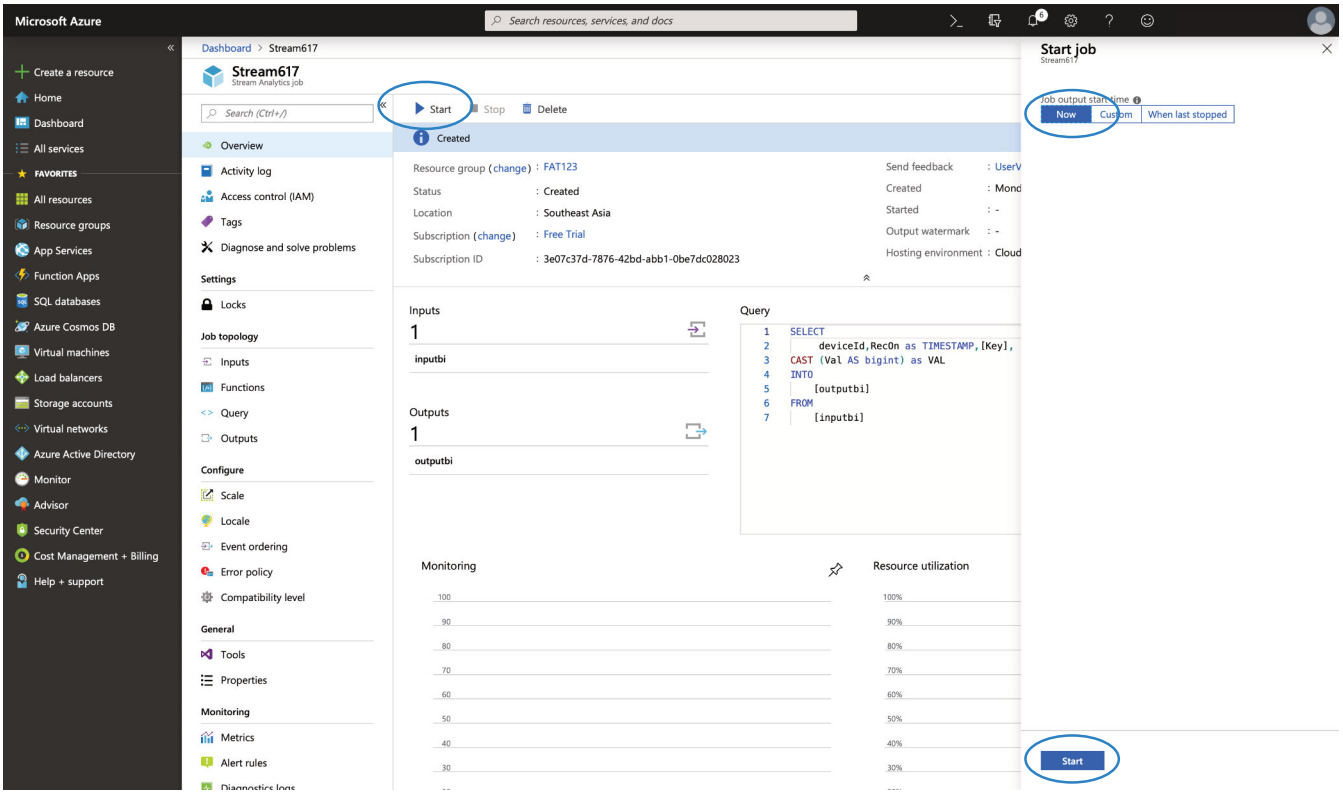
This should give you a set up similar to the following:



Testing your settings

Let's test is everything is going well so far and that the Stream Analytics has started receiving data for its job.

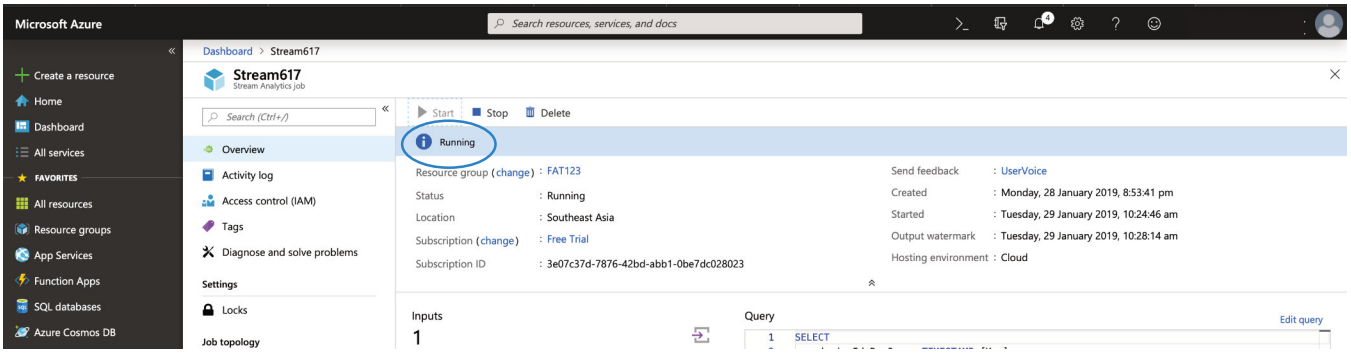
Go to your Stream Analytics Dashboard and click on the **START** button.



At the prompt for "**Job Output Start Time**'.

Select **NOW.**

Click on the **START** tab at the bottom right.



> If everything is set up well you should see a **RUNNING** status notif cation. ◢

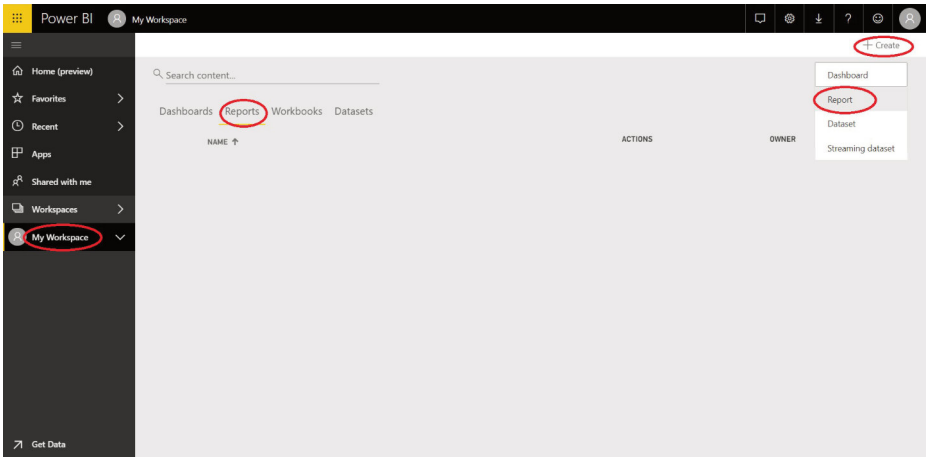
5. Setting Up Power BI

5A. Open your PowerBI account

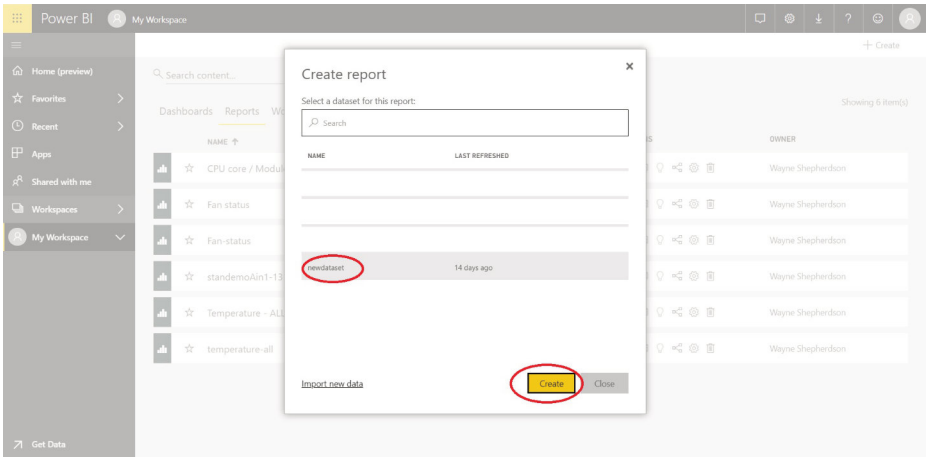
Log into PowerBI using your account settings. Please also ensure Stream Analytics is running and your G3 and Novus IO modules are switched on.

5B. Select your dataset

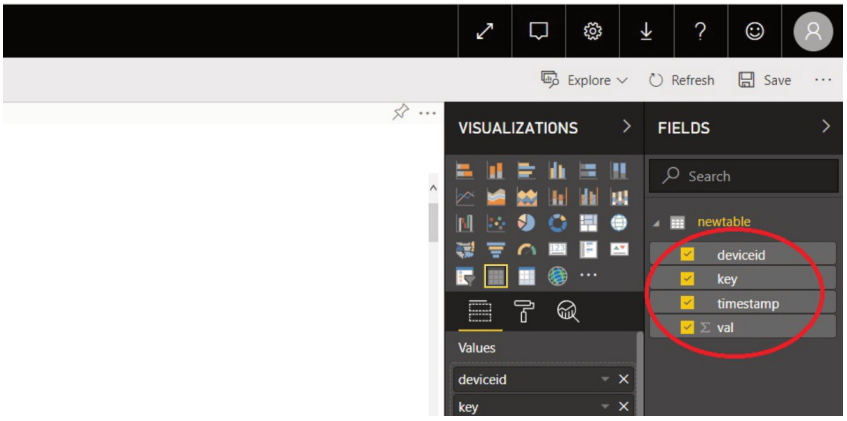
Go to My workspace->reports->create-> report



Select the dataset which you have created earlier



Then select all the values on the right by checking their boxes.



5C. Design and Save your Visual Reports

PowerBI offers you many different options for displaying your data in their <VISUALISATIONS> tab. You can explore which option suits your application best.

VISUAL DESIGN

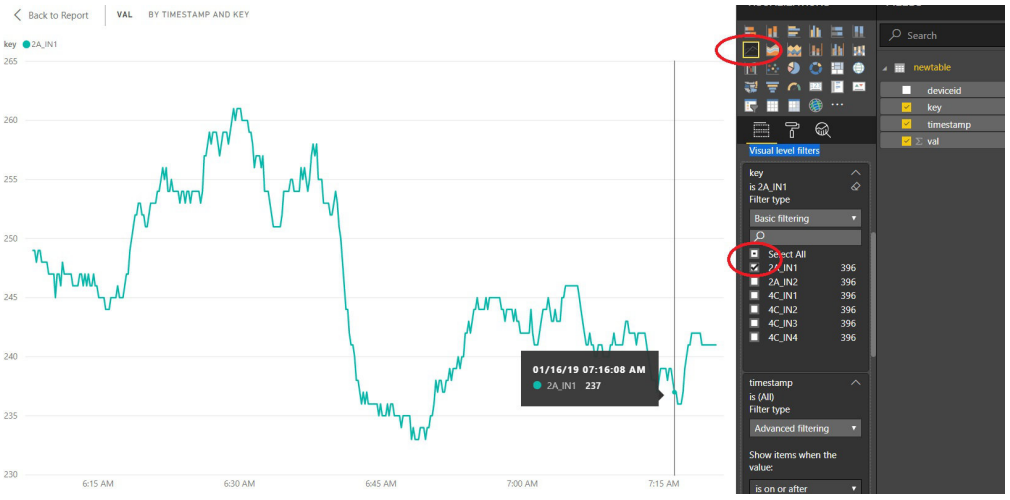
For our example, we will be creating a line chart for readings from our Modbus modules. We do this by selecting the corresponding 'line chart' icon from the options.

FILTERING

By default we have 6 different inputs connected to our NOVUS modules but I do not want to display them altogether. I can set f lters so that each input reading is displayed individually to give me a report that makes more sense.

Scroll down & select > Filters > Visual Level Filters.

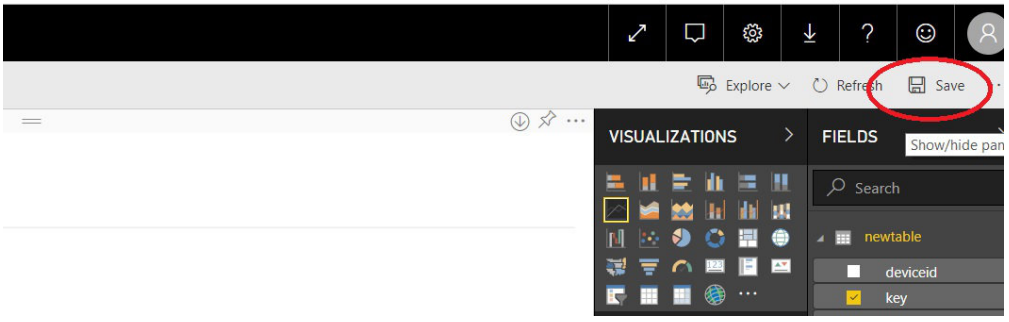
This displays a set of options to sort your data. (Options 2AIN1 & 2AIN2 refer to the analog inputs from the NOVUS 2A module; 4CIN1 to 4CIN4 refer to the digital inputs from the NOVUS 4C module).



SAVING YOUR REPORTS

To save a report, check the f lter you like & click on the <SAVE> tab. We are going to save the report for our f rst input as '2AIN1'.

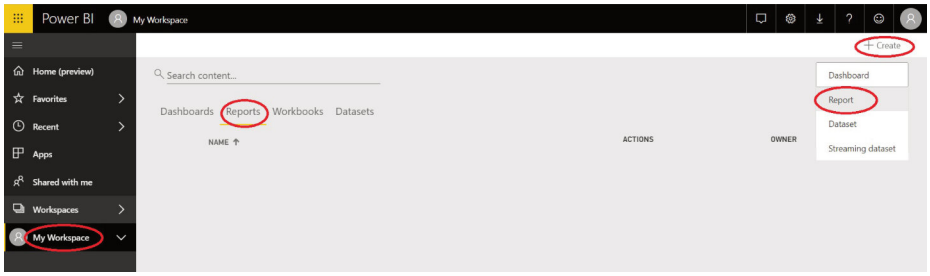
To create separate reports for each input, repeat steps 5B & 5C.
Remember to save each report with a distinct & relevant name.



5D. Churning the Visual Report

With the reports saved, we are now ready for our last step to churn the Visual Report for the data from our connected devices.

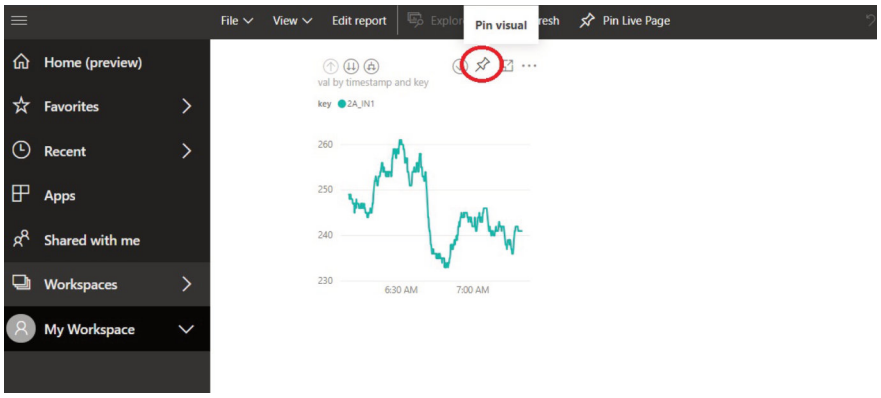
> Go to <My Workspace> in your Primary Navigation Pane
> Create a new Report with the <+ Create> tab.
> Give a name to your report. We will call ours 'IOTtestsite'



> Next go to the reports that we created earlier > My Workspace> Reports Select the report for which you wish to churn as a Visual Report.

> Hover the pointer over the top of the graph and click on 'Focus Mode'.

> Look at the top right hand of the graph and select the 'Pin Visual' icon.



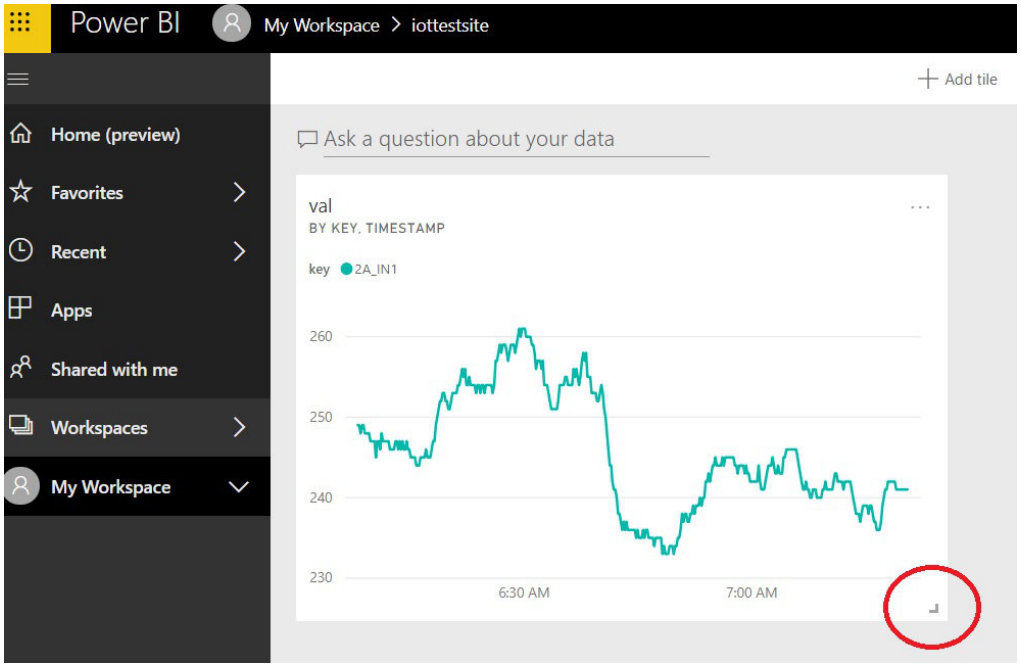
> Select 'PIN' to attach your visual graph to the existing dashboard.

The following steps help you to enhance the professionalism of your reports.

RESIZING THE DATA

> Select the dashboard that you have created.

> To resize it hover the pointer to the bottom edge of each graph and drag the tiles to resize them



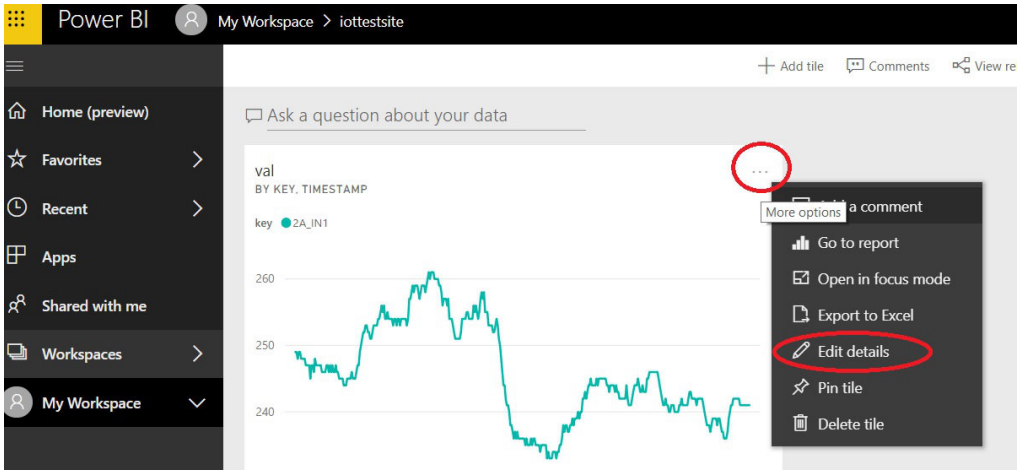
RENAME EACH TILE TO THE PROPER INPUT

> Go to each graph & open the menu at the top right hand

> Select the pencil icon to edit. Then change the title of the tile to the name of the report or the input.

> Click 'APPLY' to rename the tile

The steps in 5D can be replicated to display the rest of the reports you have created onto the same dashboard.



Congratulations! You have successfully set up the data reporting from your device, streamed it through AZURE IoT Hub and visualized it onto PowerBI. ■

Annex Copying files/iotasset.txt to the G3

Create your iotasset.txt f le

Create a f le called 'iotasset.txt' on *TextEdit*. Copy & paste the string below in this f le and save it.

```
MBM_START

TYPE,R
ADDR.3
MBFC,3
REGS,8, 1, UINT16HL
Site,Azure IoT Starter Kit
Eqpt, DIGIRAIL.4C.CH1
Unit,NA
Key,Switch.CH1

TYPE,R
ADDR,2
MBFC,3
REGS,14,1,SINT16HL
Site,amplifed.com.au
Eqpt,DIGIRAIL.2A.CH1
Unit,Celcius/100
Key,Temperature.CH1

TYPE,R
ADDR,4
MBFC,3
REGS,4098,2,UINT16HLhl
Site,Azure IoT Starter Kit
Eqpt, ABB Power Meter
Unit,Volts
Key,Volts.ABB

MBM_STOP
```

Download the new settings to the G3

Open a terminal session and run the following commands:

> **cd <folder where you saved the connstr.txt>** *i.e." cd documents"*
> **scp iotasset.txt root@192.168.1.1:/user**
> enter in the password for your G3 [default is **fatbox12345**].

You can run the following commands to check that your iotasset.txt is loaded:

> **ssh root@192.168.1.1**
> enter the password.
> **cd /user**
> **ls** [check to see if there is a iotasset.txt f le in the list]
> **cat iotasset.txt** [verify the contents of the iotasset.txt f le]

Reboot the G3 to save your settings

You can reboot the G3 box by powering down and up again. ◢

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