Blackbird Power BI Connector Guide

Published: 11. October 2019

The Blackbird Power Bl Custom Connector, enables users to liberally query, analyze and visualize data from the Blackbird system. This can be useful for making custom reports, or connecting Blackbird with other data sources, available in the organization.

This guide will take you through preparing Power BI Desktop for the connector, and how to use it. It is assumed that Power BI Desktop is already installed. If this is not the case, please either download it¹ or contact your local IT administrator for help on this.

Please have the following ready:

- A computer with Power BI Desktop installed
- A Blackbird API token

If you are missing either of these, please contact your local administrator for help on how to set these up.

Contents

Preparing Power BI Desktop	3
Using the Custom Connector	5
Selecting Your Data	7
Alternative Method for Selecting Data (e.g. in Excel)	12
Query 1: A list of Devices and Lines	15
Query 2: Device Data	15
Query 3: Line OEE	16
Query 4: Device Batches	16
Connecting your Excel Power Query with Parameters	16
Creating a Data Graph from the Samples Data	25
Creating the Data Graph	26
Creating a Stops Pareto from the Stops Data	27
Creating the Stops Pareto	
Advanced Reports: Combining Two Data Sources	
Publishing a Report	
Reset or Change Credentials	
Very Quick Tour of the Power BI Connector	

¹ https://powerbi.microsoft.com/da-dk/desktop/

Resources for Getting Started with Power BI41

Preparing Power BI Desktop

We first need to enable loading Custom Data Connectors, by going into *File -> Options and Settings - > Options*.



Once the *Options* dialog has opened, switch to the *Security* tab, and in the *Data Extensions* section, choose *Allow any extension to load without validation or warning*.



Press OK and close Power BI Desktop.

Copy the Blackbird Data Connector (the **.mez** file) into the folder [*My Documents*]*Power BI Desktop**Custom Connectors*. This will make it available to Power BI Desktop. If this is the first time you add a custom data connector, you might need to create both the *Power BI Desktop* folder and the subsequent *Custom Connectors* folder.

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Using the Custom Connector

You are now ready to open Power BI Desktop again. Once the application is ready, choose *Get Data* and then *More...*.



Choose All and then search for Blackbird. You should now be able to select the Blackbird Connector (beta) from the list of connectors.

Blackbird	×	All
All		Ilackbird Connector (Beta)
Other		

You might get a warning dialog, stating the connector is still under development. Check off *Don't* warn me again for this connector and press *Continue*.

Preview connector	×
The Blackbird Connector connector is still under development. Please try it out and give us feedback. We can't guarantee it will work the same way in the final version. Future changes may cause your queries to be incompatible.	
✓ Don't warn me again for this connector:	
Continue Cancel	

First step is to choose the correct Cloud to connect to. If you are located on <u>https://cloud.blackbird.online</u>, then simply enter either "cloud" or "shared" and press *OK*.

NOTE: If you are on a private cloud, you'll need to enter the name of your private cloud. This can be found in the URL you use to access Blackbird, and will be the part between cloud and blackbird, e.g. the YOURCLOUD part in https://cloud.YOURCLOUD.blackbird.online.

From Blackbird.Contents	×	From Blackbird.Contents	×
cloud		cloud shared	
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You will now be asked to enter your Authorization credentials. Enter your API token. If you do not have any API tokens yet, please contact your local administrator for help on this.

	Blackbird Connector	×		Blackbird Connector	×
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Selecting Your Data

You should now be presented with the navigation view, which will allow you to select the data you are interested in.

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Þ 🛄 2019		
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You should now see a list of years, starting from 2019, and going until the current year you are in. Expand the year, by clicking on the arrow icon. You should now see a list of months of the year, quarters, and finally a combination of quarters for a 6 month view.

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🖻 🧮 Q4 & Q1 Next Year		

We can either choose to view data directly from one of the quarters, Q1-4, or quarter combinations. Or, we can drill down further, by expanding a month that we are interested in. When you expand a month, again by clicking the arrow icon, you should see a list of days in the month, and additionally an entry called "00 Full Month".

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The full month entry will let you see data for the period of the month (i.e. first day of the month to the last day of the month). If you expand a day, by clicking on the arrow icon, you are now presented with two options, in the form a "Devices" entry, and a "Lines" entry.

 Navigator		_ ×	<
Navigator Display Options ▼ ■ Blackbird Connector [1] ■ 2019 [19] ▷ ① 1 January ■ 02 February [29] ▷ ① 00 Full Month ▷ ① 01 ▷ ① 02 ▷ ② 02 ▷ ③ 03 ■ ③ 44 [2] ▷ □ 166 ▷ ③ 05 ▷ ③ 06 ▷ ③ 08 ▷ ③ 09 ▷ ③ 10 ▷ ◎ 12	ہ ک No items selected fo	r preview	
 ▷ □ 12 ▷ □ 13 ▷ □ 14 ▷ □ 15 			
	Load	Edit Cancel	

This is where you need to know what data you are interested in. If you want to view data from a specific peripheral (i.e. PLC tag, sensor, etc), navigate into *Devices*. If you want to view data for a whole line, navigate into *Lines*.

Let's first explore what data is in a *Device*, by expanding the *Devices* entry.

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▷ 🧰 620-3-1.620-3-1.620-3-1_Status			
▷ 🏥 620-3-1.620-3-1.620-3-1_TotalProd			
620-3-1.620-3-1.620-3-1_VisOperMode	~		

You will now be presented with a list of all the devices that you have access to. We can now expand a specific sensor/PLC tag/etc that we are interested in.

NOTE: This access is based on what permissions your API token has. If you cannot find your own device here, contact your local administrator, to make sure that the API token you have received, also has access to the devices you are interested in.

	P	Information					
Display Options *	De	UUID	Index	Name	Description	Start Time	End Time
Image: Siemens.641-11-0_L01.641-11-0-L01_RUN	~	cb5a27003d794a3085c53ca7277638c5	Siemens.641-6-0_L01.641-6-0_L01-OK	Siemens.641-6-0_L01.641-6-0_L01-OK	Siemens.641-6-0_L01.641-6-0_L01-OK	2019-02-04T00%3A00%3A00.000Z	2019-02-04T23%3A59%3A59.
▷ III Siemens.641-6-0_B01.641-6-0_B01-OK							
5 Em Siemens.641-6-0_B01.641-6-0_B01-reset-counter	r						
Siemens.641-6-0_B01.641-6-0_B01-RUN							
Siemens:641-6-0_B01.641-6-0_B01-SP_SPEED							
Siemens.641-6-0_K01.641-6-0_K01-Counter-Res	a						
Siemens.641-6-0_K01.641-6-0_K01-OK							
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Image: Siemens.641-6-0_K01.641-6-0_K01-RUN							
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📈 🗆 🖽 Batches							
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Siemens 641-7-0 801 641-7-0 801-8UN	\sim						

Once expanded, you now have the option of choosing between different data options. A brief explanation is as follows:

- Information Basic information about the device, and the time range you are looking at
- Samples A list of samples in the time range that you are looking at
- Stops A list of stops in the time range that you are looking at
- KPIs The KPIs, calculated from the time range you are looking at

- OEE The OEE statistics, calculated from the time range you are looking gat
- Batches The batches that have run in the time range you are looking at
- Raw All of the data, in a raw format, if you want to manually create your own data tables

Once you have figured out what data you are interested in, check off the ones you want, and click on the *Load* button.

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Image: Siemens.641-6-0_B01.641-6-0_B01-OK		04/02/2019 12.45.50 +00:00	04/02/2019 12.59.27 +00:00	817163	null	null	null	null
Siemens.641-6-0 B01.641-6-0 B01-reset-counter		04/02/2019 13.00.13 +00:00	04/02/2019 13.02.29 +00:00	136150	null	null	null	null
Siemens 641-6-0, R01 641-6-0, R01-RUN		04/02/2019 13.02.51 +00:00	04/02/2019 13.05.53 +00:00	182105	null	null	null	null
		04/02/2019 13.07.02 +00:00	04/02/2019 13.08.56 +00:00	1134//	null	null	null	null
V EEE Siemens.641-6-0_B01.641-6-0_B01-5P_SPEED 		04/02/2019 13.09.19 +00:00	04/02/2019 13.09.41 +00:00	22595	nuli	nuli	null	null
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Diametric Siemens.641-6-0_K01.641-6-0_K01-OK		04/02/2019 13.14.15 +00:00	04/02/2019 13.15.23 +00:00	68067	null	nuli	null	null
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D Siemens.641-6-0_L01.641-6-0_L01-Reset-Counter		04/02/2019 15 58 44 +00:00	04/02/2019 16:01:00 +00:00	136305	null	null	null	null
Diametric Siemens.641-6-0_L01.641-6-0_L01-RUN		04/02/2019 16.01.23 +00:00	04/02/2019 16:03:45 +00:00	142057	null	null	null	null
Siemens.641-7-0_B01.641-7-0_B01-OK		04/02/2019 16 04 42 +00:00	04/02/2019 16 05 12 +00:00	29471	null	null	null	null
Siemens 641-7-0 801 641-7-0 801-Reset-Counter		04/02/2019 16.06.09 +00:00	04/02/2019 16 15 14 +00:00	545004	null	null	null	null
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You will now see a loading screen, while Power BI fetches the data from the Blackbird API.



After the data has been fetched, you can see your data fields, in the right side of the Power BI app, in the *FIELDS* column.



With these fields, you can create your own reports, and even combine the Blackbird data, with data from other systems.

If you have chosen the same data as in the screenshots (Information, Samples and Stops), you are ready to proceed to the two next sections, on creating a Data Graph and Stops Pareto from the data.

Alternative Method for Selecting Data (e.g. in Excel)

While the navigator might be great for exploring your lines and devices, sometimes you just want to get ahold of some specific data. Unfortunately, Excel does not support Custom Connectors, so we will have to inline the functionality that the Connector exposes.

This does require a bit of familiarity with Power BI and the M Language, but that quickly pays of. We will just give two examples of common cases.

First, open Excel and navigate to the Data tab.



Now, open the Get Data menu, and find the Blank Query option.



With the *Power Query Editor* window open, choose *Advanced Query Editor*, to get access to the raw M query.

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This will open up the *Advanced Editor* for you. In here we will throw the query we need to extract data, from either *Query 1* or *Query 2* below. Once you've done that, make sure to adjust it to your needs, by updating the highlighted fields in the image below (will vary a bit between *Query 1* and *Query 2*).

Table		LL ▼ = Qu] ery1 - Por	Ver Query Editor	Z	L Z V	Sci Reapply	<u></u>	₩ ▶×				₩1 ? E	<u>уш</u> ,	28
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After this, it's just a matter of navigating via the interface to the data you want to access.



Once you have navigate to the data, click *Close & Load* to finalize the data import.

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12 0 0 0 2019-08-01107:07:16.3	2881.65.06°0718.88.45250718.88.45250718.88.45250718.68.4525.0	
18 0 0 0 0 019-08-01107-08-01 4	· · Sheet2 Sheet1 (e) · · · · · · · · · · · · · · · · · · ·	
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You can now work with your data like you are used to from Excel!

Query 1: A list of Devices and Lines

The code is included in a file.

- 1. Open the attached file Blackbird Raw Excel.query.pq
- 2. Update the parameters
 - a. apiKey should be your API token
 - b. **cloud** should point to your cloud (either "shared" or your private cloud)
- 3. Make sure the 3rd last line says rawData = QueryList(apiKey, cloud)

From this list, you can get easy access to your line ids and device uuid and index.

Query 2: Device Data

The code is included in a file.

- 1. Open the attached file **Blackbird Raw Excel.query.pq**
- 2. Update the parameters
 - a. **apiKey** should be your API token
 - b. cloud should point to your cloud (either "shared" or your private cloud)
 - c. uuid to the the UUID of your device
 - d. index to the the index of your device
 - e. starTime to the start of when you want data from
 - f. endTime to the end of when you want data to

3. Make sure the 3rd last line says rawData = QueryDevice(apiKey, uuid, index, startTime, endTime, cloud)

One thing to note in the second query is the use of *MkIsoStartTime* and *MkIsoEndTime*, which are used to construct the time formats we need for the query to work. It takes a year, month, date and then an optional hour and minute, as its arguments.

If you give it no hour, start will default to 00 and end will default to 23. If you give it no minute, start will default to 00 and end will default to 59.

Query 3: Line OEE

The code is included in a file.

- 1. Open the attached file Blackbird Raw Excel.query.pq
- 2. Update the parameters
 - a. apiKey should be your API token
 - b. cloud should point to your cloud (either "shared" or your private cloud)
 - c. lineId to the the id of your line
 - d. starTime to the start of when you want data from
 - e. endTime to the end of when you want data to
- Make sure the 3rd last line says rawData = QueryLine(apiKey, lineId, startTime, endTime, cloud)

Query 4: Device Batches

The code is included in a file.

- 1. Open the attached file Blackbird Raw Excel.query.pq
- 2. Update the parameters
 - a. apiKey should be your API token
 - b. cloud should point to your cloud (either "shared" or your private cloud)
 - c. **uuid** to the the UUID of your device
 - d. index to the the index of your device
 - e. starTime to the start of when you want data from
 - f. endTime to the end of when you want data to
- 3. Make sure the 3rd last line says rawData = QueryBatches(apiKey, uuid, index, startTime, endTime, cloud)

Connecting your Excel Power Query with Parameters

Often you want to be able to extract parts of your query out into your Excel spreadsheet, to make it easy to change. For example, we could extract the start and end times, so that when these are updated, your query will pull data from these times as well.

To do this, open up Excel and create a table that will hold the parameters you are interested in. For this example, we will create the parameters that we use in the previously listed queries:

- startTime
- endTime
- lineId
- uuid
- index

Once we have done that, we will have something like the following:

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Now, select your table, go to the *Data* tab and click on *From Table/Range*:

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2										
3	Paramter	Value	Converted Value							
4	startTime	10/1/2019	2019-10-01T00:00:00.000Z							
S	endTime	1/30/2020	2020-01-30T00:00:00.000Z							
6	lineId	aaabbbbbcccc	aaabbbbcccc							
7	uuid	aaaabbbbbccc	aaaabbbbccc							
8	index	aaaaabbbbbccc	aaaaabbbbccc							
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This will ask you if your table has headers. Make sure it's checked off, and click OK:

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This will drop you into the a Power Query window, which will show your table. We change the name, located on the right, to *Parameters*, so we can easily refer to it later on.

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After this, press *Close & Load* in the upper left corner. This will create a new sheet, which we will delete.

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You should now only have your *Parameters* sheet left. Right click the *Parameters* connection, on the right side, and choose *Edit*.



In the Power Query window, right click on you *Parameters* query, and choose *Duplicate*:



We'll repeat this for every parameter we want to extract, and name each of them after the parameter. You should end up with five different items in the query list (not counting the original *Parameters* table).

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We will now convert each of these tables to a specific value, from the *Parameters* table. In each of the tables, right click and choose *Drill Down* on the value in the *Converted Value* column that corresponds to the parameter you want. E.g. in *StartTime* I will right click on the 2019-10-01... value and choose *Drill Down*:

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Each parameter that was previously a table, will now be a single value for each of them.

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We are finally ready to use our parameters in our query! Open up a new blank query, by right clicking anywhere in the queries list, and navigating to *Blank Query*.

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We open up the *Advanced Editor* in the top, and input our query:

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We can now replace our variables in our query, with the names of the parameters on the left side:



Click on *Done* and you will probably meet an error stating something like *Formula*.*Firewal: Query....*. Before we are done, we need to *Close & Load* all our queries. Press *OK* when Excel comes with a warning.

The final step is to update a Excel setting for the specific worksheet. We want to let it allow us to read data from our own Excel sheet, so we need to disable a privacy setting. Open *Get Data* and choose *Query Options*:



GLOBAL Privacy Levels Data Load
Privacy Diagnostics CURRENT WORKBOOK Data Load Regional Settings

Go to the Privacy tab, and choose Always ignore Privacy Level settings. Click OK:

Finally, press the refresh button on your Query, and it will load the data using your parameters!



You will also need to press this button if you change the parameters, and you want the query to update.

Creating a Data Graph from the Samples Data

NOTE: If you already have the data available, you can skip down to the Creating the Data Graph section.

Before we can work with the data, we need to make it available to ourselves. Launch the Blackbird Connector, from the *Get Data* button.

Get Data		×
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All	Ilackbird Connector (Beta)	
Other		

Enter your cloud name ("shared" or your private cloud name), and press OK.

After this, navigate to the device/sensor/PLC tag that you want to work with, and load the Samples data, by checking off *Samples* and clicking the *Load* button.

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Coaters.Coater 2.PV		null	null	null	20/02/2019 00.00.00 +00:0
Modbus.620-3-4.620-3-4-0 CA OK		null	null	null	20/02/2019 00.03.00 +00:0
Modbus 620-3-4 620-3-4-0 CA RUN NOK		null	null	null	20/02/2019 00.06.00 +00:0
		null	null	null	20/02/2019 00.09.00 +00:0
Modbus.620-5-4.620-5-4-0_CA_SOP_NOK		null	null	null	20/02/2019 00.12.00 +00:0
D Modbus.620-3-4.620-3-4-0_CYC		null	null	null	20/02/2019 00.14.59 +00:6
Modbus.620-3-4.620-3-4-0_RUN		null	null	null	20/02/2019 00.17.59 +00:0
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🔲 🧮 Information		null	null	null	20/02/2019 00.29.59 +00:0
KPIs KPIs		null	null	null	20/02/2019 00.32.59 +00:0
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Raw		null	null	null	20/02/2019 00.38.58 +00:0
Samples		null	null	null	20/02/2019 00.41.58 +00:0
Ctops		null	null	null	20/02/2019 00.44.58 +00:0
		null	null	null	20/02/2019 00.47.58 +00:0
Modbus.020-3-5.020-3-5-0_CA_RON_NOK		null	null	null	20/02/2019 00.50.58 +00:0
Modbus.620-3-5.620-3-5-0_CA_SUP_NOK		null	null	null	20/02/2019 00.53.58 +00:0
Modbus.620-3-5.620-3-5-0_CYC		null	null	null	20/02/2019 00.56.58 +00:0
Modbus.620-3-5.620-3-5-0_RUN		null	nun	null	20/02/2019 00:39:38 +00:0
Modbus.620-3-6.620-3-6-0_CA_OK		null	null	null	20/02/2019 01:05:57 +00:0
Modbus.620-3-6.620-3-6-0_CA_RUN_NOK	\sim	1			``

After the data has loaded, you should now see *Samples* in the right-side of Power BI. Expand the *Samples* entry, if it's not already expanded.



We are now ready to create our Data Graph.

Creating the Data Graph

With the sample data loaded, we are now ready to start working with it. Power BI gives us a bunch of tools to visualize our data, but for our purpose right now, we will only use the *Line chart*. Click on the *Line chart* button, in the *VISUALIZATIONS* toolbar. This should add an empty block in the Power BI sheet, that we can now manipulate.



From the expanded *Samples* in the right-side, drag the *to* field from the field and drop it onto the *Line chart* block, in the Power BI page. Do the same with the *from* and *accValue* (accumulated value) fields. You line block should now look like the screenshot below.



This is not quite what we want. The data looks like this, because Power BI has, by default, expanded our *to* and *from* fields, into date hierarchies. We can fix this by pressing the dropdown button in the *to* and *from* properties, on the right-side, and choosing *to* and *from* respectively, instead of *Date Hierarchy*.

Axis	✓ to	F @	$\square \Sigma$ maxValue $\square \Sigma$ minValue
to	- x	Axis	✓ to
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Legend		accValue	×

Our *Line Chart* should now look a bit more like what we intended.



The last step is just a simple one, we can change the size of the chart, by dragging the handles in the corner of the graph. Drag the handles until you are satisfied with the size of the graph.





Congratulations! You have now managed to visualize the data samples our PLC tag/sensor/etc. Play around with the other types of visualizations, using this data, to get a feel of what Power BI can do.

Creating a Stops Pareto from the Stops Data

NOTE: If you already have the data available, you can skip down to the Creating the Stops Pareto section.

Before we can work with the data, we need to make it available to ourselves. Launch the Blackbird Connector, from the *Get Data* button.



Navigate to the PLC tag/sensor/etc that you want to work with, and load the Stops data, by checking off *Stops* and clicking the *Load* button.

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Modbus.620-3-4.620-3-4-0_CA_SUP_NOK		20/02/2019 09.06.34 +00:00	20/02/2019 09.13.43 +00:00	42829
Modbus.620-3-4.620-3-4-0_CYC		20/02/2019 09.26.19 +00:00	20/02/2019 09.37.16 +00:00	65703
Modbus.620-3-4.620-3-4-0 RUN		20/02/2019 09.40.54 +00:00	20/02/2019 09.51.14 +00:00	61962
4 III Modhur 620-3-5 620-3-5-0 CA OK [7]		20/02/2019 12.22.38 +00:00	20/02/2019 12.32.05 +00:00	56704
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(1) Information (2) KPIs (2) CE				

After the data has loaded, you should now see *Stops* in the right-side of Power BI. Expand the *Stops* entry, if it's not already expanded.

	✓ Search▲ ■ Stops
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	from initials
Values	registeredTime
Add data fields here	■ stopCause
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We are now ready to create our Stops Pareto.

Creating the Stops Pareto

With the stops data loaded, we are now ready to start working with it. Power BI gives us a bunch of tools to visualize our data, but for our purpose right now, we will only use the *Stacked column chart*. Click on the *Stacked column chart* button, in the *VISUALIZATIONS* toolbar. This should add an empty block in the Power BI sheet, that we can now manipulate.

 Stacked co	lumn chart	ATIONS	>		ą
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From the expanded *Stops* in the right-side, drag the *stopCause.stopType* field from the field and drop it onto the *Stacked column chart* block, in the Power BI page. Do the same with the *duration* and *stopCause.name* fields. You stacked column block should now look like the screenshot below.



Expand the *Stacked column chart*, by dragging the handles in the corners, until it fits a comfortable size.



Congratulations! You have now managed to visualize the stops of our PLC tag/sensor/etc. Play around with the other types of visualizations, using this data, to get a feel of what Power BI can do.

Advanced Reports: Combining Two Data Sources

We will now have a look at how to merge data from two sources together. By now, you should be familiar with how to extract data from the devices or lines you are interested in. If not, you can jump back to e.g. the section *Creating a Stops Pareto from the Stops Data* to learn how.

We start by pulling down the *Stops* data, from two different devices, on the same day. Once you have the two *Stops* entries in your *FIELDS* sidebar, we add a single table. From the *Stops* fields (not *Stops (2)*!) we add the *stopCause.stopType*, *duration* and *stopCause.name* fields.



We now open up the Power BI Query Editor, by clicking *Edit Queries*, in the toolbar.



You should now get a new window, with the available queries, and their data.



We click on Append Queries in the toolbar.

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This will open up an Append window, which gives us some options as for what we want to do.

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In the Table to append dropdown, we choose Stops (2), and click on the OK button.

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We can now see that all our data has been merged into one single table.

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To make these changes take effect, we click *Close & Apply*, in the toolbar.



Power BI will now apply the updates.



We can then change the visualization of our data from a table, to e.g. a *Stacked column chart*.

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Congratulations! You now have an overview of the stops from different production lines, in just one graph.

Publishing a Report

Now that we have created our reports, we would like to share them with our colleagues. Power BI makes this easy, with the push of a button. Click the *Publish* button in the toolbar (on the *Home* tab).

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You now need to select a destination for your report. You can create several different workspaces, for different purposes. In our case, we will simply publish it to the default workspace. Click on *Select* once you have chosen your workspace.

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Select a destination	
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	Select Cancel

Once you have clicked *Select*, Power BI will begin publishing your report. Once it is done, it will present you with two links. The first is directly to your newly published report, and the second is to your dashboard. Click on the first link, to go to the report.

Publishing to Power BI	Publishing to Power Bl Success! Open 'Custom Report - Stops Pareto pbix' in Power Bl Get Quick Insights
You can create a portrait view of your report tailored for mobile phones, on the View tab select Phone Layout Learn more Cancel	Did you know? You can create a portrait view of your report tailored for mobile phones, on the View tab select Phone Layout Learn more Cost r

This should open a webpage with your report in a browser. It could look something like the picture below.

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You are now ready to share your report with your colleagues!

Reset or Change Credentials

To reset your credentials, navigate to *File -> Options and settings -> Data source settings*, opening up the dialog.

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Right-click on the *Blackbird Connector* entry, and choose *Edit Permissions…* from the context menu. If you just want to reset the credentials, you can instead choose *Clear Permissions*, and then close the dialog. NOTE: If you cannot find the Blackbird Connector in the list, make sure you have selected *Global Permissions*, and that you actually have connected with the Data Connector before.

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In the Edit Permissions dialog, choose Edit

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You can now update the credentials for the Blackbird Connector, by entering the new API token in the input field, and pressing *Save*.

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You are now ready to run your queries, with your new credentials!

Very Quick Tour of the Power BI Connector

Opening up Power BI, we click on *Get Data*, which let's us select the *Blackbird Connector*.



We can now navigate to the month we want to view.

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We continue our navigation to the day we want to view.

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Finally, we find the device we are interested in, and select the *Stops* data.

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This adds the *Stops* data to the *FIELDS* sidebar, in the right-side of Power BI.



We then add a new visualization, *Stacked column chart*, and drag the *stopCause.stopType* field onto the chart block. After this, we add *duration* followed by *stopCause.name*. We should end up with a a new column chart, giving us an overview of what types of stops we have, and the breakdown of the different stops in these blocks.



That's it for the quick tour!

Resources for Getting Started with Power BI

The following is a list of resources that might prove helpful, for getting started with using Power BI. They are listed in no particular order, and the reader is encouraged to explore each of them and decide which might be relevant.

- Overview of Power BI Desktop and Power BI Service https://www.youtube.com/watch?v=1Bo1BrpR3AY
- Power BI Guided Learning <u>https://docs.microsoft.com/en-us/power-bi/guided-learning/</u>
- Shaping and combining data <u>https://docs.microsoft.com/en-us/power-bi/desktop-shape-and-combine-data</u>

The Power BI Guided Learning resource provides a collection of courses, which the user can pick from, depending on their needs.