

Open Data Protocol (OData)

Estimated time to read: 8 minutes

This document will provide a quick guide for the configuration of an OData endpoint to easily retrieve MES data that can be used for advanced analysis in external tools.

Overview

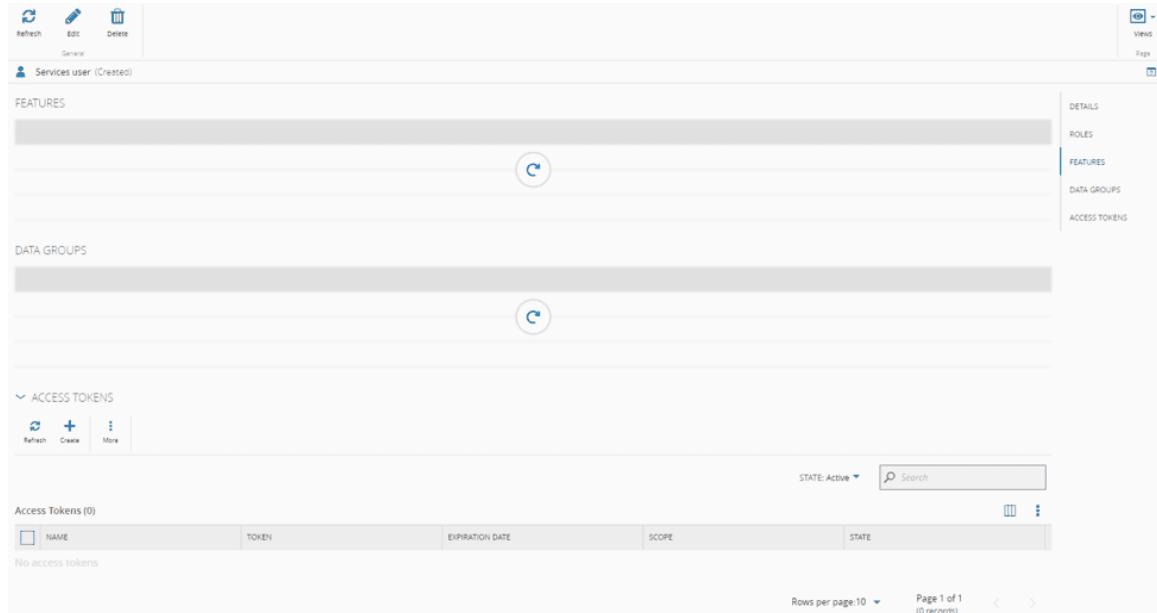
Open Data Protocol (OData) is an "open" application-level protocol for interacting with data via RESTful APIs. It supports the description of data models, and the editing and querying of data according to those models, in a simple and standard way.

OData is a widely accepted standard that is supported by Analytics tools such as Microsoft Excel, Microsoft Power BI, Tableau, QlikView among many others. To provide easy interoperability, and provide quick and simple access to MES data, which can then be used for any sort of user advanced analysis (and dashboards), starting on version 8.0, all MES Data is exposed via an OData endpoint.

There are two ways to access OData endpoints:

- You can configure an OData endpoint in the MES and assign it to the user defined query in the **Queries** section, which is located in the **Low Code** menu for easy access.
- With **Data Platform** you can access all Data Sets in MES from CDM, ODS, and DWH via OData endpoints.

It is worth mentioning that, besides the endpoint URL, **you are required to generate an access token which will then be used for authentication**. For that, you should open your **User** page and go to the **Access Tokens** section:



The screenshot shows the 'Access Tokens' section of the Critical Manufacturing 11.1 User interface. The top navigation bar includes 'Refresh', 'Edit', 'Delete', and 'View/Print' buttons. The main content area is titled 'Access Tokens (0)'. It features a table with columns: NAME, TOKEN, EXPIRATION DATE, SCOPE, and STATE. A search bar and pagination controls are at the bottom of the table.

Select the **Create** button on the top ribbon, fill in a meaningful name (important in case you need to invalidate the token in future), set an expiration date, select **Create** and then copy the new token:

Access Token

Access Token was created successfully.

Make sure you copy the access token now. You will not be able to see it again.

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJjbGllbnRJZCI6Ik1FU0RldFBi...

Copy

Close

⚠ Warning

This token will only appear once, so you must store it in a safe location for future use.

Step 1: Access to MES data via OData

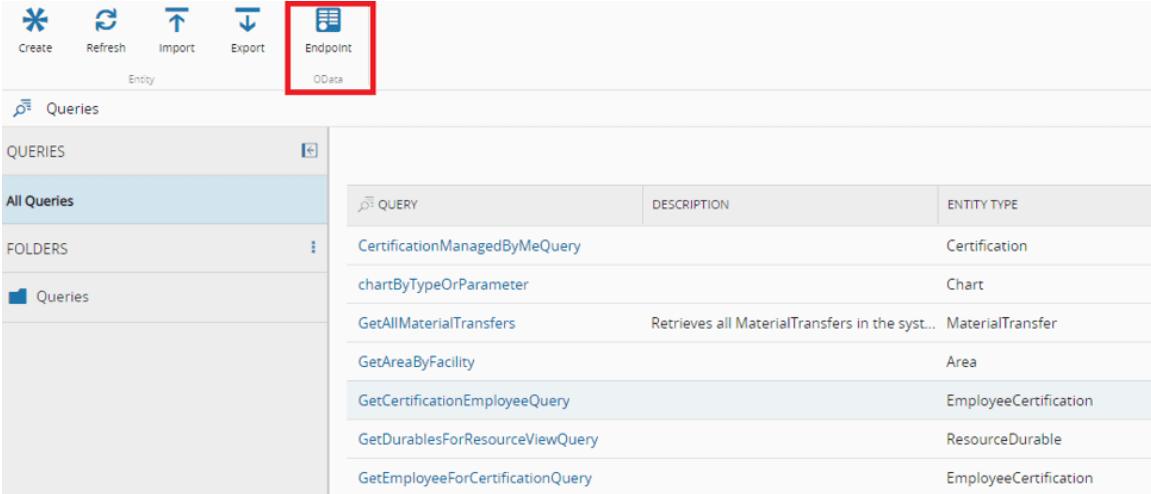
As already mentioned, there are two ways to access OData endpoints:

- Via the **MES Queries** section, which is located in the **Low Code** menu for easy access.
- Via the **Data Platform** built-in OData endpoints.

OData using **MES Queries**

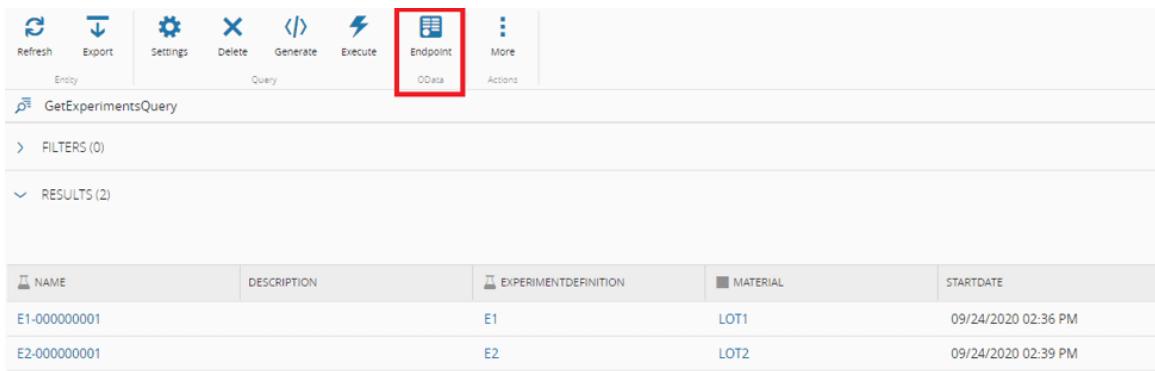
To adopt OData for the **MES Queries** tool, if the required data is not already covered by an existing **MES Query**, you should create a new one in the **MES**. For more information, see the **Queries** section of the User Guide.

You can select the **Endpoint** button on the top ribbon in either the main **Queries** page or a specific **Query** page and get the specific endpoint for the OData API:



The screenshot shows the MES Queries interface. At the top, there is a ribbon with buttons for Create, Refresh, Import, Export, and Endpoint. The Endpoint button is highlighted with a red box. Below the ribbon, there is a navigation bar with a Queries icon and the word 'Queries'. On the left, there is a sidebar with sections for QUERIES (All Queries selected), FOLDERS, and a 'Queries' folder. The main area displays a table of queries with columns for QUERY, DESCRIPTION, and ENTITY TYPE. The table data is as follows:

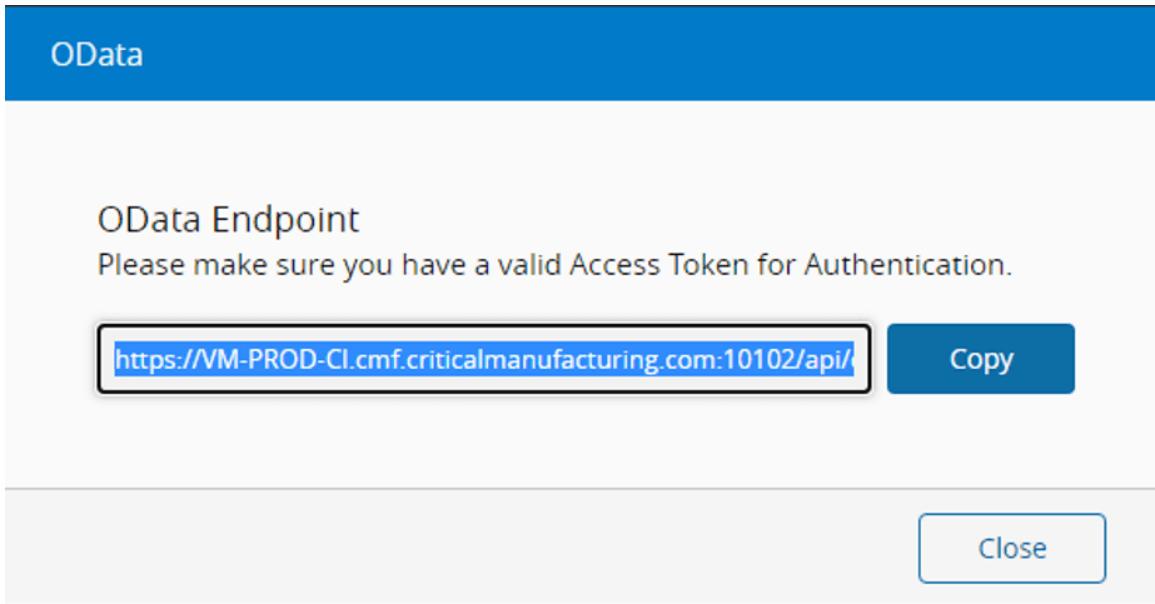
QUERY	DESCRIPTION	ENTITY TYPE
CertificationManagedByMeQuery		Certification
chartByTypeOrParameter		Chart
GetAllMaterialTransfers	Retrieves all MaterialTransfers in the syst...	MaterialTransfer
GetAreaByFacility		Area
GetCertificationEmployeeQuery		EmployeeCertification
GetDurablesForResourceViewQuery		ResourceDurable
GetEmployeeForCertificationQuery		EmployeeCertification



The screenshot shows the Data Platform interface with the 'OData' button highlighted by a red box in the top navigation bar. Below the navigation bar, there is a query editor with the text 'GetExperimentsQuery' and a table showing two results. The table has columns: NAME, DESCRIPTION, EXPERIMENTDEFINITION, MATERIAL, and STARTDATE. The data is as follows:

NAME	DESCRIPTION	EXPERIMENTDEFINITION	MATERIAL	STARTDATE
E1-000000001		E1	LOT1	09/24/2020 02:36 PM
E2-000000001		E2	LOT2	09/24/2020 02:39 PM

In either situation, a new wizard will open with an option to copy the endpoint URL, which you will use when configuring access on the external tool:



The screenshot shows a configuration wizard for an OData endpoint. The title bar says 'OData'. The main content area is titled 'OData Endpoint' and includes a note: 'Please make sure you have a valid Access Token for Authentication.' Below this, a text input field contains the URL <https://VM-PROD-Cl.cmf.criticalmanufacturing.com:10102/api/>. To the right of the URL is a 'Copy' button. At the bottom right of the wizard is a 'Close' button.

OData using Data Platform

The is a native feature of the Data Platform that allows you to access all Data Sets in MES from CDM, ODS, and DWH via OData endpoints. Thus, all Data Sets in MES can be accessed from the following endpoint:
<https://<host url>/datamanager/odata>.

The Data Sets are organized into several folders namely:

- Apps
- CDM
- ODS
- DWH
- IoTEvents
- User Defined



Metadata

GET	/datamanager/odata/\$metadata
GET	/datamanager/odata/CDM/\$metadata
GET	/datamanager/odata/IoTEvents/\$metadata
GET	/datamanager/odata/UserDefined/\$metadata
GET	/datamanager/odata/Apps/\$metadata
GET	/datamanager/odata/ODS/\$metadata
GET	/datamanager/odata/DW/H/\$metadata
GET	/datamanager/odata/odata
GET	/datamanager/odata/CDM
GET	/datamanager/odata/IoTEvents
GET	/datamanager/odata/UserDefined
GET	/datamanager/odata/Apps
GET	/datamanager/odata/ODS
GET	/datamanager/odata/DW/H

Schemas

i **Info**

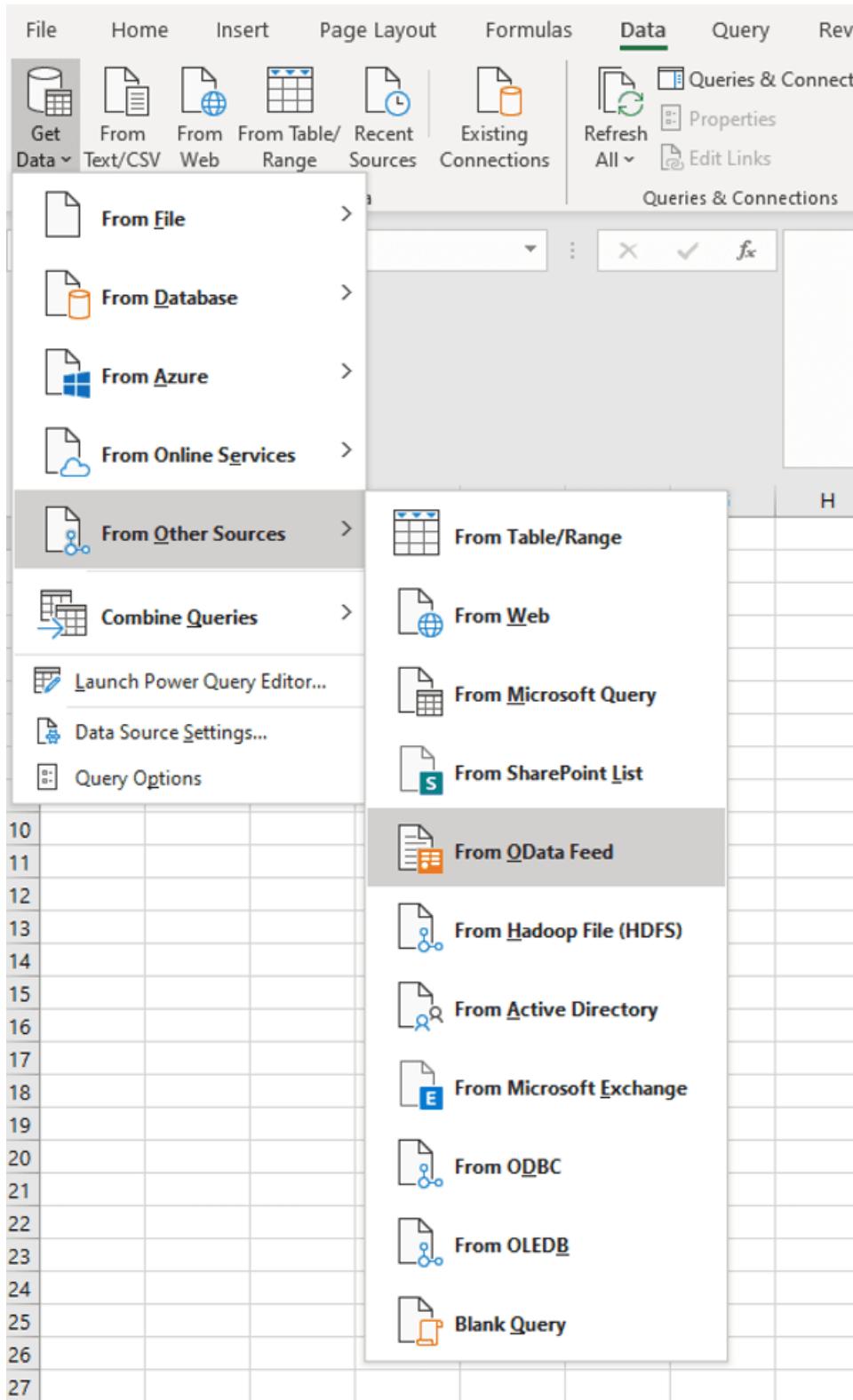
Step 2 is identical for both OData approaches. Just choose the OData endpoint you want to connect during basic authentication.

For more information on Data Manager API, see the following documentation: <https://<host url>/datamanager/swagger/index.html>

Step 2: External Tool Configuration

Using Microsoft Excel as an example, and to open the OData dataset, the steps are as follows:

1. Use the **Get Data** functionality from the **Data** menu, as shown in the image below, and select the **From OData Feed** option in the **From Other Sources** submenu:



2. Paste the OData endpoint into the **URL** field and select **OK**. The application should redirect you to the **OData feed** window:

OData feed

Basic Advanced

URL

<https://VM-PROD-CI.cmf.criticalmanufacturing.com:10102/api/odata>

Info

If this redirection does not happen or if the system throws an error, see the [Credentials Cleanup](#) section.

- Anonymous
- Windows
- Basic**
- Web API
- Organizational account

OData feed

<https://vm-prod-ci.cmf.criticalmanufacturing.com:10102/>

Use anonymous access for this OData feed.

Select which level to apply these settings to

<https://vm-prod-ci.cmf.criticalmanufacturing.com:10102/>

3. Select the **Basic** option on the left side panel and paste your **Access Token** in the **Password** field and select **Connect** (you can leave the **User name** field empty):

The screenshot shows a Microsoft Excel window with the ribbon at the top. A 'Queries & Connections' dialog box is open in the foreground, centered over a blank worksheet. The dialog box has a sidebar on the left with options: 'Anonymous', 'Windows', **Basic** (which is selected), and 'Web API' and 'Organizational account'. The main area of the dialog box shows the URL 'https://tech-datalayer-dev.apps.rhos.cm-mes.d...' and a dropdown menu set to the same URL. Below the URL, there are fields for 'User name' (empty) and 'Password' (a redacted string). At the bottom of the dialog box are 'Back' and 'Connect' buttons, with 'Connect' being highlighted. The background of the Excel window is a blank worksheet with a grid of cells labeled A1 through AA37.

4. If the access token is valid, the **Navigator View** should open and provide a list of all the available Queries:

Navigator

GetExperimentsQuery

ID	Name	Description	Start Date	System State
2,00924E+18	E1-0000000001		24-09-2020 13:36:34 +01:00	null
2,00924E+18	E2-0000000001		24-09-2020 13:39:35 +01:00	null

Select Related Tables Load Transform Data Cancel

5. A sneak preview of the output data for each query is shown, allowing you to select the queries that should be imported. After selecting **Load**, the data will be imported:

ID	Name	Description	Start Date	System State	cmf_html_ExperimentDefinition_ID	cmf_html_ExperimentDefinition_Name	cmf_html_ExperimentDefinitionFirstStep_ID	cmf_html_ExperimentDefinitionLastStep_ID
2,00924E+18	E1-0000000001		24-09-2020 13:36	1	2,00924E+18 E1		2,00924E+18	
2,00924E+18	E2-0000000001		24-09-2020 13:39	1	2,00924E+18 E2		2,00924E+18	

Queries & Connections

Queries Connections

Query

GetExperimentsQuery

2 rows loaded.

Support for MES Queries with parameters

Parameterization of MES Queries increases the complexity of integration by OData since additional steps are required to correctly configure the OData feed.

On parameterized MES Queries, parameters are seen in the Excel navigator as `$VarName`. In the example below, the MES Query **GetAreaByFacility** has a parameter named `$Area_Facility`:

Navigator

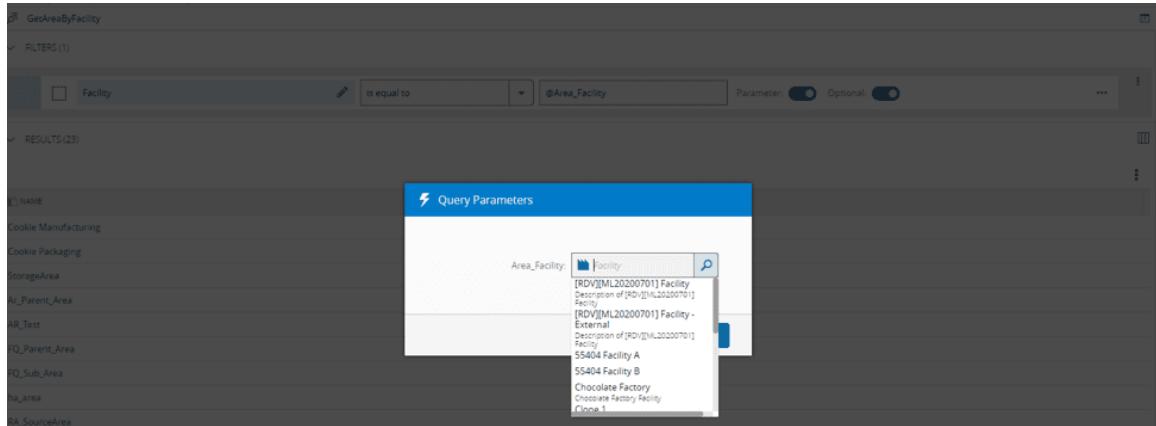
Get

GetAreaByFacility

\$Area_Facility	ID	Name
null	null	null

As expected, a query that includes a mandatory parameter without a default value defined will return no data. We will walk through this example to illustrate how to properly configure the OData feed. Additional functionalities such as filtering, ordering, and paging are also supported when using the advanced query options.

First, you need to know what sort of parameter `$Area_Facility` represents. In this case we can use the MES UI to try to run the same MES Query:



It is important to notice that although an entity filter option will be presented in the MES UI, the parameter itself will pass the Id of the **Facility** to the Query engine. This, however, is not a rule and depends on how the MES Query is defined.

For this example, the target **Facility** for which you want to retrieve existing **Areas** is called Cookie Factory. At this moment, the Id of the Cookie Factory **Facility** most likely is still unknown but can be consulted in the MES UI by simply opening the target **Facility** and copying from the **Info** section:



Now that the parameter value is known, you can select the **GetAreasByFacility** entity in the Navigator view and select **Transform Data**:

Navigator

Get

Select multiple items

Display Options

- GetAreaByFacility
- GetCertificationEmployeeQuery
- GetCookies
- GetDurablesForResourceViewQuery
- GetEmployeeForCertificationQuery
- GetExperimentsQuery

Search results are limited to already expanded items

Select Related Tables

Load Transform Data Cancel

The Power Query editor should open, and you should select the **Advanced Editor** button:

GetAreaByFacility - Power Query Editor

File Home Transform Add Column View

Close & Load Refresh Preview Manage Advanced Editor Properties

Choose Columns Remove Columns Keep Rows Remove Rows Split Column Group By Data Type: Text Use First Row as Headers

Close Query Manage Columns Reduce Rows Sort Replace Values Transform

Queries > = Source{[Name="GetAreaByFacility",Signature="table"]}[Data]

	A ^B \$Area_Facility	1 ² 3 Id	A ^B Name
1	null	null	null

Now you should replace the existing code by:

```
0Data.Feed("<ODataURL>/<QueryName>?$filter=$VarName Eq 'value'", null, [ Implementation="2.0" ])
```

Using the current example this line would be:

```
0Data.Feed("<http://VM-PROD-CI.cmf.criticalmanufacturing.com:10082/api/odata/GetAreaByFacility>?
$filter=$Area_Facility Eq '200629152952000006'", null, [ Implementation="2.0" ])
```

Advanced Editor

GetAreaByFacility

Display Options

```
0Data.Feed("http://VM-PROD-CI.cmf.criticalmanufacturing.com:10082/api/odata/GetAreaByFacility?$filter=$Area_Facility Eq '200629152952000006'", null, [ Implementation="2.0" ])
```

Select **Done** and you should be able to see the expected results:

GetAreaByFacility - Power Query Editor

File Home Transform Add Column View

Queries

APC_SArea_Facility

	APC_SArea_Facility	Id	Name
1	200629152952000006	2,00629E+18	Ar_Parent_Area
2	200629152952000006	2,00629E+18	AR_Test
3	200629152952000006	2,00629E+18	FO_Parent_Area
4	200629152952000006	2,00629E+18	FO_Sub_Area
5	200629152952000006	2,00721E+18	ha_area_7
6	200629152952000006	2,00721E+18	ha_area_6
7	200629152952000006	2,00721E+18	ha_area_5
8	200629152952000006	2,00721E+18	ha_area_4
9	200629152952000006	2,00721E+18	ha_area_3
10	200629152952000006	2,00721E+18	ha_area_2
11	200629152952000006	2,00721E+18	dfgdfg
12	200629152952000006	2,00721E+18	TESTTTTTTTT
13	200629152952000006	2,00701E+18	RA_DestinationArea
14	200629152952000006	2,00701E+18	RA_SourceArea
15	200629152952000006	2,00629E+18	ha_area
16	200629152952000006	2,00629E+18	StorageArea
17	200629152952000006	2,00629E+18	Cookie_Packaging
18	200629152952000006	2,00629E+18	Cookie_Manufacturing
19	200629152952000006	2,00901E+18	RDW_Cookie_Manufactu...
20	200629152952000006	2,00723E+18	FC_StorageArea2
21	200629152952000006	2,00722E+18	FC_StorageArea
22	200629152952000006	2,00722E+18	FC_Area
23	200629152952000006	2,0071E+18	Area_PL

In case of error, check whether the parameter is numeric or string. If it is numeric, you should set the filter as:

`$filter=$Area_Facility Eq 2006291529520000006" instead of "$filter=$Area_Facility Eq '2006291529520000006'`

You can also apply additional conditions like filtering, sorting and pagination. Except for OData Functions, all other conditions should be supported.

Filtering

Filtering by complex expression with AND / OR and selecting "Name" (Id is returned as null). Expression:

```
$filter=$Area_Facility Eq '200629152952000006' AND Name ge 'Cookie' AND (Id Eq 190718002725000002 OR Id Ne 190718002725000002 )&$select=Name;
```

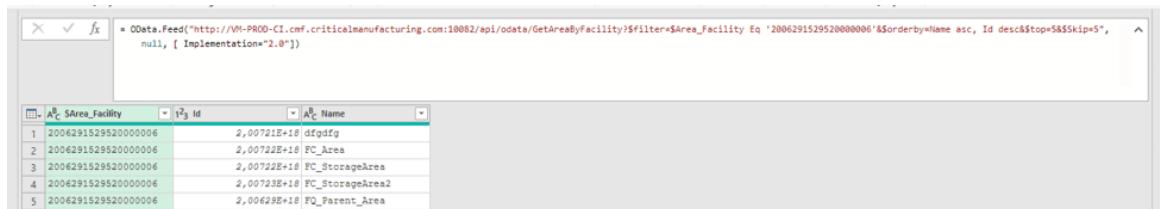
Queries > [X](#) ✓ fx = `odata.Feed("http://VM-PROD-CI.cmfcriticalmanufacturing.com:10002/api/odata/GetAreaByFacility?$filter=$Area_Facility Eq '2006291529520000006' AND Name ge 'Cookie' AND (Id Eq 190718002725000002 OR Id Ne 190718002725000002)$select=Name", null, { Implementation="2.0" })`

	A ₂ Area_Facility	A ₃ Id	A ₄ Name
1	200629152952000006	null	Cookie Manufacturing
2	200629152952000006	null	Cookie Packaging
3	200629152952000006	null	dfgdfg
4	200629152952000006	null	FC_Area
5	200629152952000006	null	FC_StorageArea
6	200629152952000006	null	FC_StorageArea2
7	200629152952000006	null	FO_Parent_Area
8	200629152952000006	null	FO_Sub_Area
9	200629152952000006	null	ha_area
10	200629152952000006	null	ha_area_2
11	200629152952000006	null	ha_area_3
12	200629152952000006	null	ha_area_4
13	200629152952000006	null	ha_area_5
14	200629152952000006	null	ha_area_6
15	200629152952000006	null	ha_area_7
16	200629152952000006	null	RA_DestinationArea
17	200629152952000006	null	RA_SourceArea
18	200629152952000006	null	RDV Cookie Manufactu...
19	200629152952000006	null	StorageArea
20	200629152952000006	null	TESTTTTTTT

Ordering

Ordering by Name ascending, Id descending and retrieving the top 5 rows after skipping 5 rows. Expression:

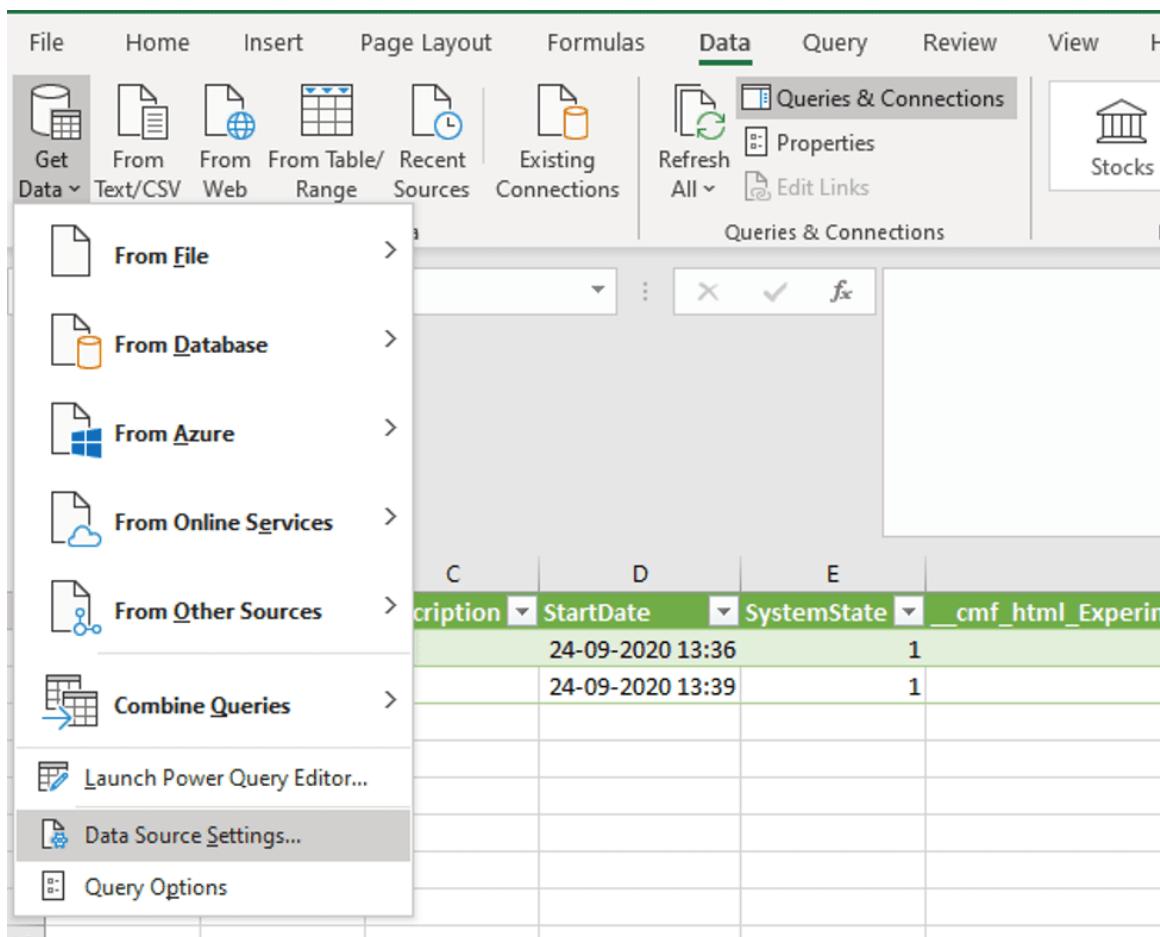
```
$filter=$Area Facility Eq '200629152952000006'&$orderby=Name asc, Id desc&$top=5&$skip=5;
```



SArea_Facility	
1	200629152952000006
2	2,00721E+18 dfqdfg
2	200629152952000006
3	2,00722E+18 FC_Area
4	200629152952000006
4	2,00723E+18 FC_StorageArea2
5	200629152952000006
5	2,00629E+18 PQ_Parent_Area

Credentials Cleanup

If the system hangs when connecting to the OData feed, clearing the database credentials should solve the problem:



Use the **Get Data** functionality from the **Data** menu, as shown in the image above, and select the **Data Source Settings** option. In the following screen, select the endpoint causing the issue and select **Clear permissions**. Select **Delete** in the next dialog to confirm the operation and repeat the connection configuration:

Data source settings

Manage settings for the data sources used in queries.

Data sources in current workbook Global permissions

Search data source settings

A
Z

 <https://vm-prod-ci.cmf.criticalmanufacturing.com:10102/api/odata>

Clear Permissions

Are you sure you want to clear permissions for this entry? If you clear it you will have no way of getting it back.

Delete

Cancel

Change Source...

Edit Permissions...

Clear Permissions ▾

Close