

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

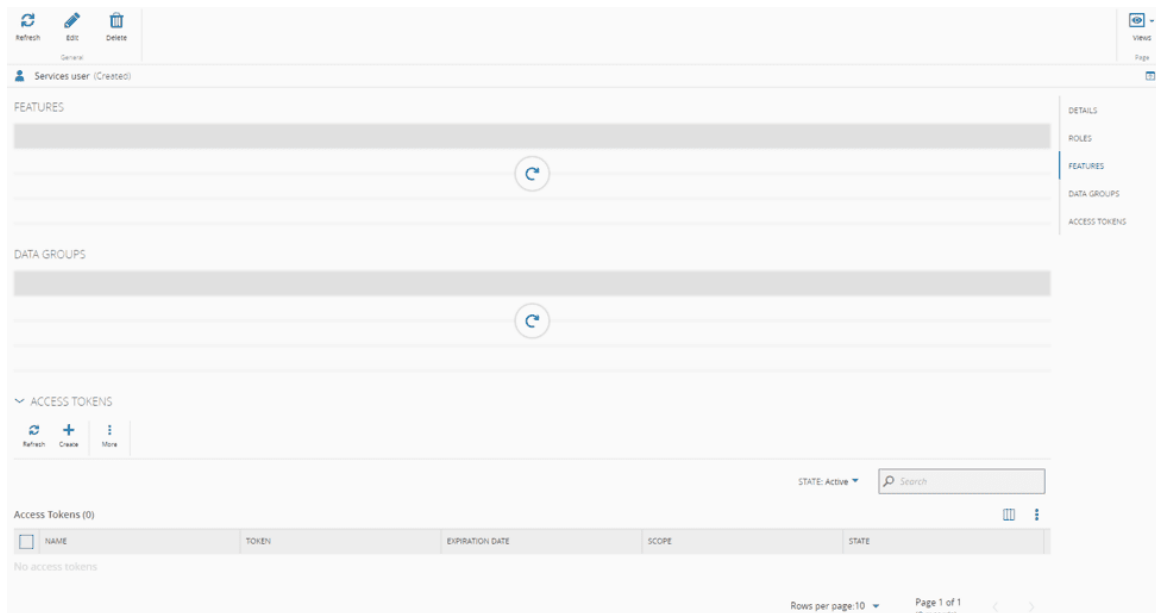
Open Data Protocol (OData) is an "open" application-level protocol for interacting with data via RESTful APIs. It supports the description of data models, and the editing and querying of data according to those models, in a simple and standard way.

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:



Select the **Create** button on the top ribbon, fill in a meaningful name (important in case the 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.eyJjbGllbnRJZCI6Ikp1FU0RldlFBIn

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

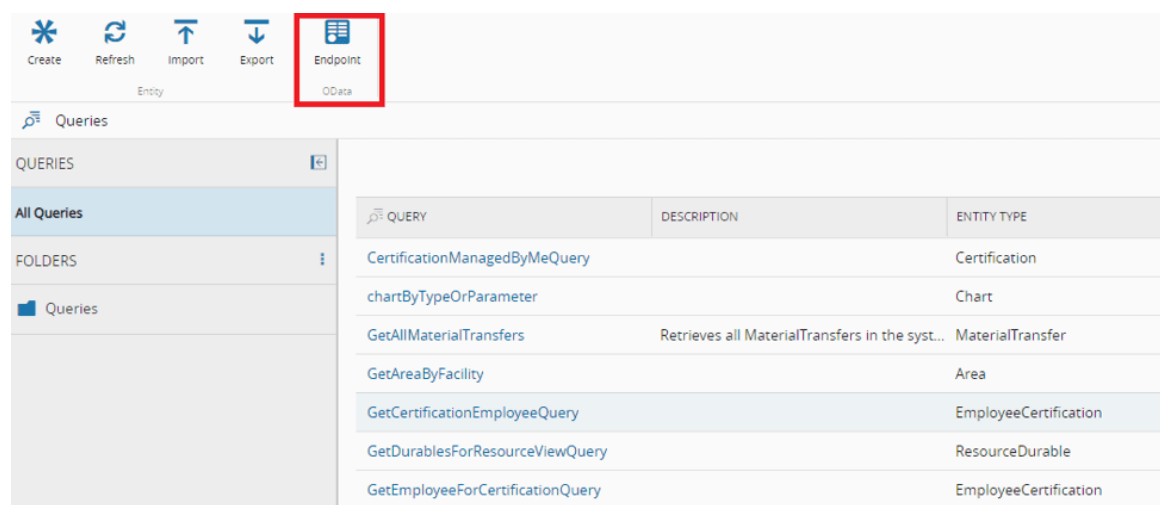
As already mentioned, there are two ways to access OData endpoints:

- 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. The top ribbon contains buttons for Create, Refresh, Import, Export, and Endpoint. The Endpoint button is highlighted with a red box. Below the ribbon, the Queries section is visible, showing a list of queries and their descriptions.

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

Refresh	Export	Settings	Delete	Generate	Execute	Endpoint	More
Entity		Query		OData		Actions	

GetExperimentsQuery

> FILTERS (0)

▼ RESULTS (2)

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:

OData

OData Endpoint

Please make sure you have a valid Access Token for Authentication.

<https://VM-PROD-Cl.cmf.criticalmanufacturing.com:10102/api/>
Copy

Close

OData using Data Platform

There 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
- lotEvents
- 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/DWH/\$metadata
GET	/datamanager/odata
GET	/datamanager/odata/CDM
GET	/datamanager/odata/IoTEvents
GET	/datamanager/odata/UserDefined
GET	/datamanager/odata/Apps
GET	/datamanager/odata/ODS
GET	/datamanager/odata/DWH
Schemas	

Info

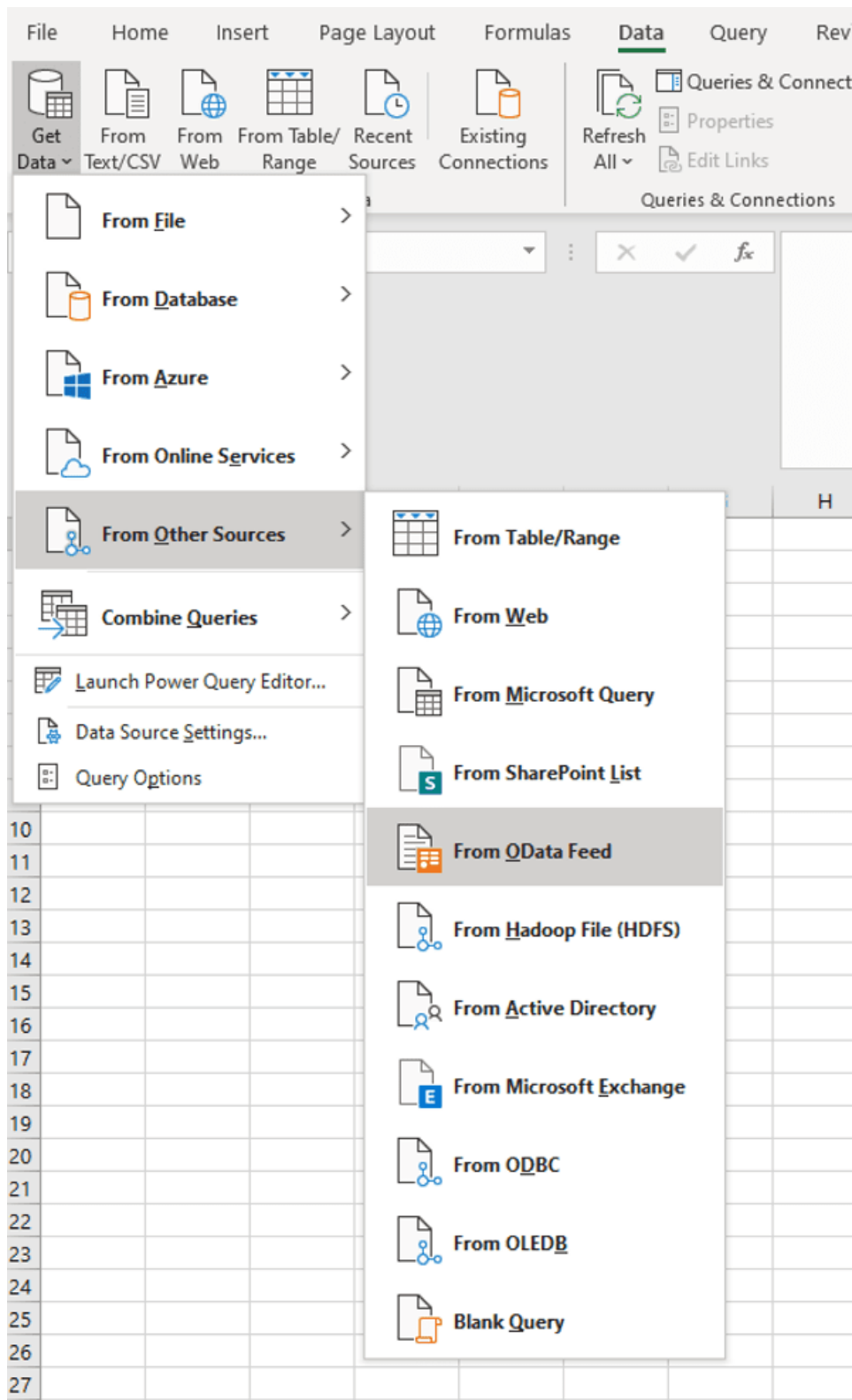
Step 2 is identical for both OData approaches. Just choose the OData endpoint you want to connect during basic authentication.

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

OK

Cancel

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:10...

Use anonymous access for this OData feed.

Select which level to apply these settings to

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

Back

Connect

Cancel

- 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):



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

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Navigator

☐ Select multiple items

Display Options ▾

https://VM-PROD-CL.cmf.criticalmanufacturi...

- CertificationManagedByMeQuery
- chartByTypeOrParameter
- GetAllMaterialTransfers
- GetAreaByFacility
- GetCertificationEmployeeQuery
- GetDurablesForResourceViewQuery
- GetEmployeeForCertificationQuery
- GetExperimentsQuery
- GetLoadPortsForResourceView
- GetMaterialsForResourceByStateForResour...
- GetProductByStepAndProductGroup
- GetProductByStepAndProductGroupAndPr...
- GetProductGroupByStep
- GetProductionOrders
- GetResourceByArea
- GetResourceByAreaAndResourceType
- GetResourceConsumablePortsForResource...
- GetResourceDurablesForResourceView

GetExperimentsQuery

Id	Name	Description	StartDate	Syst
2,00924E+18	E1-000000001	null	24-09-2020 13:36:34 +01:00	
2,00924E+18	E2-000000001	null	24-09-2020 13:39:35 +01:00	

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:

A	B	C	D	E	F	G	H
Id	Name	Description	StartDate	SystemState	conf.html ExperimentDefinition Id	conf.html ExperimentDefinition Name	conf.html ExperimentDefinitionFirstStep Id
2,00924E+18 E1-000000001		24-09-2020 13:36	1	2,00924E+18 E1		2,00924E+18 Wet Bench	
2,00924E+18 E2-000000001		24-09-2020 13:39	1	2,00924E+18 E2		2,00924E+18 Ash Clean	

Queries & Connections

Queries | Connections

1 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

☐ Select multiple items

Display Options ▾

GetAreaByFacility

GetCertificationEmployeeQuery

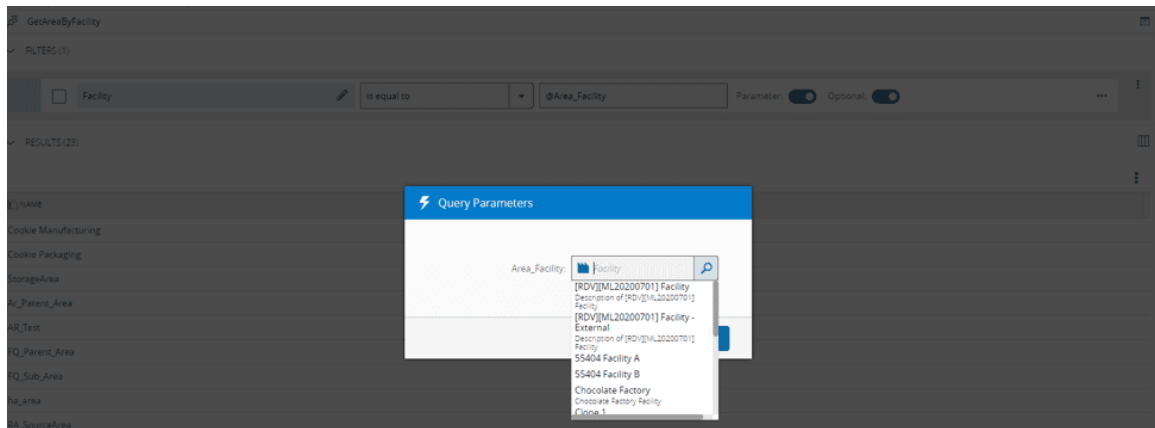
GetCookies

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:

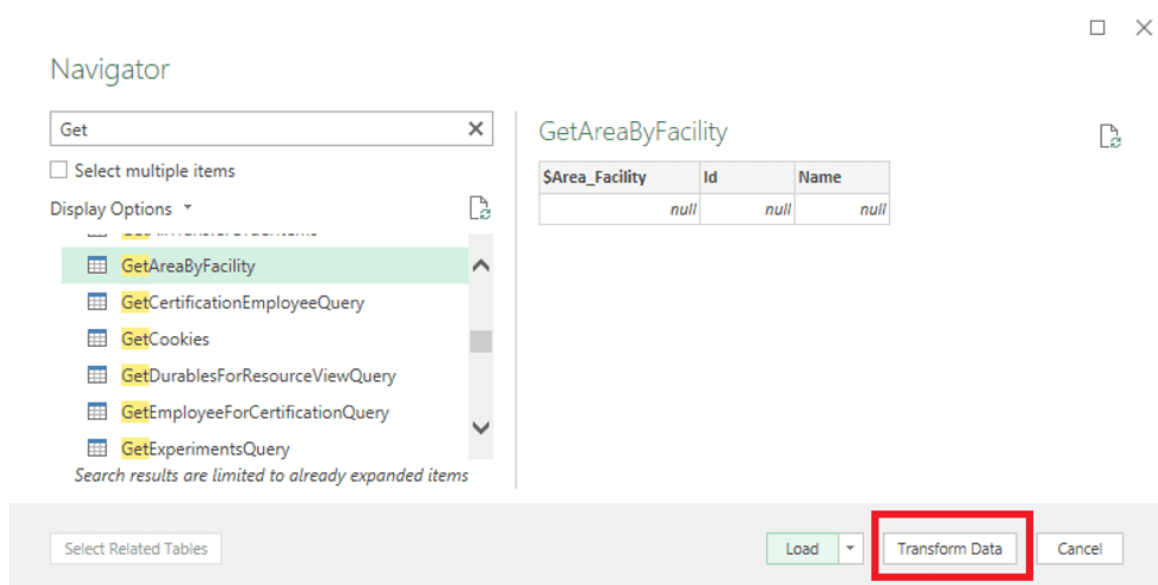


It is important to notice that although an entity filter option will be presented in the MES UI, the parameter itself will pass the Id of the **Facility** to the Query engine. This, however, is not a rule and depends on how the MES Query is defined.

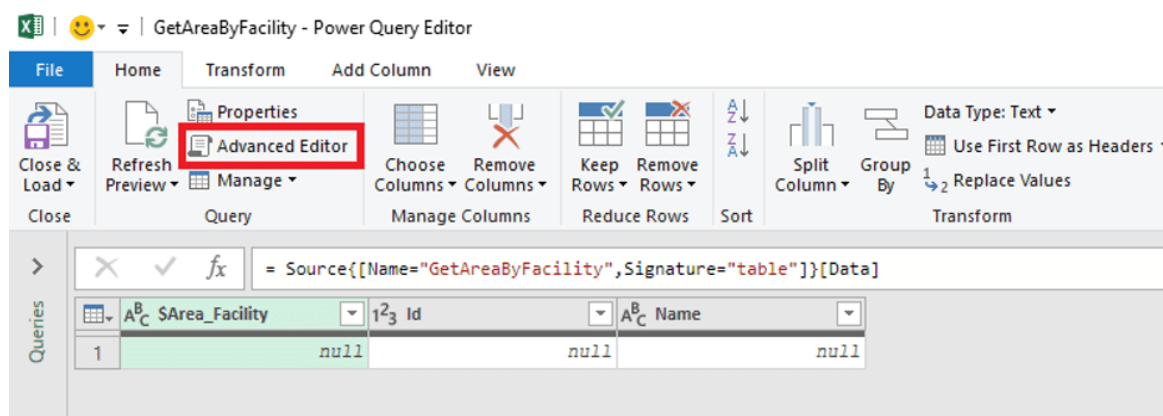
For this example, the target **Facility** for which you want to retrieve existing **Areas** is called Cookie Factory. At this moment, the Id of the Cookie Factory **Facility** most likely is still unknown but can be consulted in the MES UI by simply opening the target **Facility** and copying from the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



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



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



Now you should replace the existing code by:

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

Using the current example this line would be:

```
OData.Feed("<http://VM-PROD-CI.cmf.criticalmanufacturing.com:10082/api/odata/GetAreaByFacility>?$filter=$Area_Facility Eq '2006291529520000006'", 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

Close & Load Refresh Preview Advanced Editor Query

Choose Columns Remove Columns Manage Columns

Keep Rows Remove Rows Reduce Rows

Sort Split Column Group By

Data Type: Text Use First Row as Headers Replace Values Transform

Merge Queries Append Queries Combine Files Combine Parameters Data source settings Data Sources New Source Recent Sources Enter Data New Query

Queries

fx = OData.Feed("http://VM-PROD-CI.cmf.criticalmanufacturing.com:18082/api/odata/GetAreaByFacility?filter=\$Area_Facility Eq '2006291529520000006'", null, [Implementation="2.0"])

Area_Facility	Id	Name
2006291529520000006	2,00629E+18	Ar_Parent_Area
2006291529520000006	2,00629E+18	AR_Test
2006291529520000006	2,00629E+18	FQ_Parent_Area
2006291529520000006	2,00629E+18	FQ_Sub_Area
2006291529520000006	2,00721E+18	ha_area_7
2006291529520000006	2,00721E+18	ha_area_6
2006291529520000006	2,00721E+18	ha_area_5
2006291529520000006	2,00721E+18	ha_area_4
2006291529520000006	2,00721E+18	ha_area_3
2006291529520000006	2,00721E+18	ha_area_2
2006291529520000006	2,00721E+18	dfgdfg
2006291529520000006	2,00721E+18	TESTTTTTTT
2006291529520000006	2,00701E+18	RA_DestinationArea
2006291529520000006	2,00701E+18	RA_SourceArea
2006291529520000006	2,00629E+18	ha_area
2006291529520000006	2,00629E+18	StorageArea
2006291529520000006	2,00629E+18	Cookie Packaging
2006291529520000006	2,00629E+18	Cookie Manufacturing
2006291529520000006	2,00901E+18	RDV Cookie Manufactu...
2006291529520000006	2,00723E+18	FC_StorageArea2
2006291529520000006	2,00722E+18	FC_StorageArea
2006291529520000006	2,00722E+18	FC_Area
2006291529520000006	2,0071E+18	Area_FL

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 '2006291529520000006' AND Name ge 'Cookie' AND (Id Eq 1907180027250000002 OR Id Ne 1907180027250000002 )&$select=Name:
```

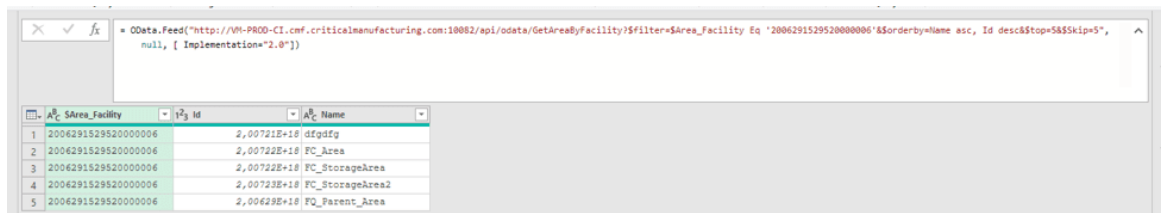
fx = OData.Feed("http://VM-PROD-CI.cmf.criticalmanufacturing.com:18082/api/odata/GetAreaByFacility?filter=\$Area_Facility Eq '2006291529520000006' AND Name ge 'Cookie' AND (Id Eq 1907180027250000002 OR Id Ne 1907180027250000002)&\$select=Name", null, [Implementation="2.0"])

Area_Facility	Id	Name
2006291529520000006		null Cookie Manufacturing
2006291529520000006		null Cookie Packaging
2006291529520000006		null dfgdfg
2006291529520000006		null FC_Area
2006291529520000006		null FC_StorageArea
2006291529520000006		null FC_StorageArea2
2006291529520000006		null FQ_Parent_Area
2006291529520000006		null FQ_Sub_Area
2006291529520000006		null ha_area
2006291529520000006		null ha_area_2
2006291529520000006		null ha_area_3
2006291529520000006		null ha_area_4
2006291529520000006		null ha_area_5
2006291529520000006		null ha_area_6
2006291529520000006		null ha_area_7
2006291529520000006		null RA_DestinationArea
2006291529520000006		null RA_SourceArea
2006291529520000006		null RDV Cookie Manufactu...
2006291529520000006		null StorageArea
2006291529520000006		null TESTTTTTTT

Ordering

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

```
$filter=$Area_Facility Eq '2006291529520000006'&$orderby=Name asc, Id desc&$top=5&$Skip=5:
```

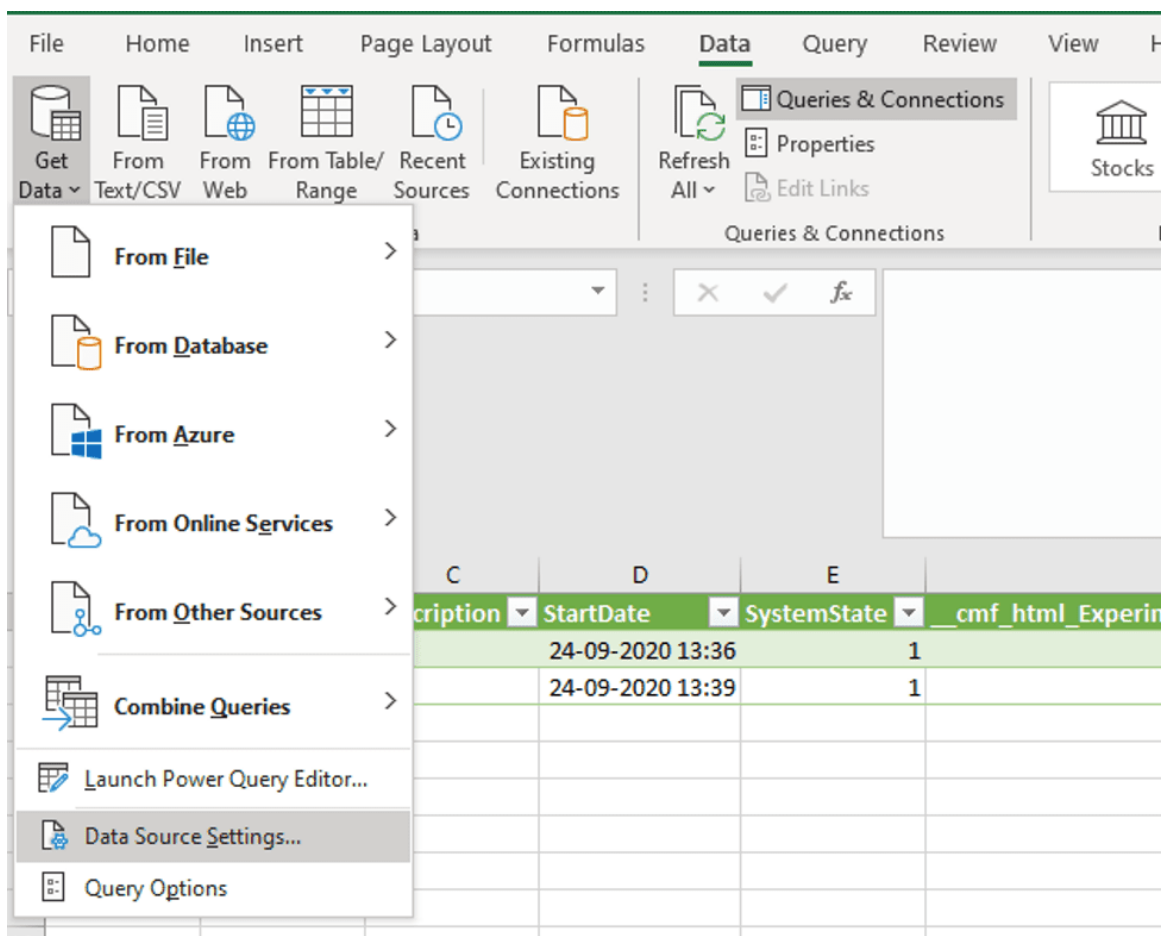


Formula bar: =OData.Feed("http://VM-PROD-CI.cmf.criticalmanufacturing.com:10082/api/odata/GetAreaByFacility?filter=\$Area_Facility Eq '2006291529520000006'&\$orderby=name asc, Id desc&\$top=5&\$skip=5", null, [Implementation="2.0"])

	Area_Facility	Id	Area_Name
1	2006291529520000006	2,00721E+10	dfgdfg
2	2006291529520000006	2,00722E+10	FC_Area
3	2006291529520000006	2,00722E+10	FC_StorageArea
4	2006291529520000006	2,00723E+10	FC_StorageArea2
5	2006291529520000006	2,00629E+10	FC_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

⌵

 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