XOLTA Remote Monitoring

API MANUAL

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XOLTA

Contents

1 Setup

This section describes how to get the token for Xolta API in three of the most common languages: Python,C# and JavaScript. The variables: clientId, authority, clientSecret and scopes are provided by Xolta. The token acquisition will be done by using Microsoft Authentication Library (MSAL).

1.1 Python

Install msal

https://github.com/AzureAD/microsoft-authentication-library-for-python

```python
from msal import ConfidentialClientApplication

clientId =  # Your Client ID
clientSecret = # Your client Secret
scope = # Your scope
tennant  =  # Your Tenant
authority = # Your authority

app = ConfidentialClientApplication(
    clientId, authority=authority, client_credential=clientSecret)

result = app.acquire_token_silent(scope,  account=None)
if not result:
    result = app.acquire_token_for_client( scope)
    token = result["access_token"]
```

To send to the API add the token to the headers

```python
http_headers = {'Authorization': 'Bearer ' + token}
```

1.2 C#

Use the Microsoft.Identity.Client nuget package

https://github.com/AzureAD/microsoft-authentication-library-for-dotnet

```csharp
using Microsoft.Identity.Client;

var clientApp = ConfidentialClientApplicationBuilder
                .Create("clientId")
                 .WithClientSecret("clientSecret")
                 .WithTenantId("authority")
                 .Build();
                 string text;
AuthenticationResult authResult = null;
try
{
    Task<AuthenticationResult> task =
        clientApp.AcquireTokenForClient("scopes").ExecuteAsync();
    task.Wait();
    authResult = task.Result;
}
```

```
catch (MsalException)
{
}
```

To send to the API add the token to the headers

```
new AuthenticationHeaderValue("Bearer", authResult.AccessToken);
```

1.3 JavaScript

If you are using JavaScript or any framework like ReactJS or Angular, please follow the guides and samples Microsoft provided at `https://github.com/AzureAD/microsoft-authentication-library-for` Microsoft is currently updating packages for JavaScript, so it will be to hard to keep the examples updated for all frameworks and use cases in this manual.

2 Endpoints

Currently the API have 5 endpoints:

- GetTelemetryRaw: Gets telemetry data over time see chapter 3.2
- GetTelemetrySummary: Gets telemetry data over time see chapter 3.3
- DeviceStatus: Get current status of the queried devices
- GetMetaData:Provides the list in chapter 3.2 and 3.3
- SendStateModeCommand: Send state and mode change and set points to a device

For the up to date list of endpoints please check our Swagger: `https:/external.xolta.com/index.html`

3 Telemetry Signals

For all telemetry signals both in the Raw model and the Summary model will follow the following convention.

The formula of the signal is ”Device_Signal_Function_Function”, and the example here will describe how the signal can be translated into a readable phrase:

BmsCellVoltageTotalRawArrayCloudAvg

To read this signal, follow the formula and start from right to left, so this will be
”The cloud average of raw array of Total values from the cell voltage signal on the BMS”

An other example for an summary signal is given:

MeterGridActivePowerAggAvg

”The Aggregated average of the active power of the grid meter”

3.1 Function

Function name	Description
CloudMin	Takes an array of values and returns the minimum
CloudMax	Takes an array of values and returns the maximum
CloudAvg	Takes an array of values and returns the average
CloudTotal	Takes an array of values and return the sum of all elements
CloudTrimmed	Takes an array of values and returns the average trimmed to be between 0-100
AggMin	Takes a timeseries of values and returns the minimum
AggMax	Takes a timeseries of values and returns the maximum
AggAvg	Takes a timeseries of values and returns the average
AggStd	Takes a timeseries of values and return the standard deviation
AggCount	Takes a timeseries of values and return the amount of values

3.2 Raw

Signals	Type	Unit	Description
bmsAirInletTemperatureRawArrayCloudMin	Float32	°C	Minimum temperature of the cooling inlet air over all racks.
bmsAirInletTemperatureRawArrayCloudMax	Float32	°C	Maximum temperature of the cooling inlet air over all racks.
bmsAirInletTemperatureRawArrayCloudAvg	Float32	°C	Average temperature of the cooling inlet air over all racks.
bmsAirInletTemperatureRawArray	[Float32]	°C	Temperature of the cooling inlet air for individual racks.
bmsCellTemperatureMinRawArrayCloudMin	Float32	°C	Minimum cell temperature over all racks
bmsCellTemperatureMaxRawArrayCloudMax	Float32	°C	Maximum cell temperature over all racks.
bmsCellTemperatureMinRawArray	[Float32]	°C	Minimum cell temperature for individual racks.

bmsCellTemperatureMaxRawArray	[Float32]	°C	Maximum cell temperature for individual racks.
bmsCellVoltageAvgRawArrayCloudAvg	Float32	V	Average cell voltage over all racks.
bmsCellVoltageMinRawArrayCloudMin	Float32	V	Minimum cell voltage over all racks.
bmsCellVoltageMaxRawArrayCloudMax	Float32	V	Maximum cell voltage over all racks.
bmsCellVoltageTotalRawArrayCloudAvg	Float32	V	Average sum of cell voltage over all racks
bmsCellVoltageAvgRawArray	[Float32]	V	Average cell voltage across individual racks.
bmsCellVoltageMinRawArray	[Float32]	V	Minimum cell voltage across for individual racks.
bmsCellVoltageMaxRawArray	[Float32]	V	Maximum cell voltage across for individual racks.
bmsCellVoltageTotalRawArray	[Float32]	V	Sum of cell voltages for individual racks.
bmsShuntChargeDcCurrentRawArray	[Float32]	A	Charge/discharge DC current measured by the shunt for individual racks.
bmsShuntChargeDcCurrentRawArrayCloudTotal	Float32	A	Sum of battery charge/discharge DC current measured by the shunt over all racks.
bmsShuntTemperatureRawArrayCloudMin	Float32	°C	Minimum temperature of the shunt sensor inside the BPU over all racks.
bmsShuntTemperatureRawArrayCloudMax	Float32	°C	Maximum temperature of the shunt sensor inside the BPU over all racks.
bmsShuntTemperatureRawArrayCloudAvg	Float32	°C	Average temperature of the shunt sensor inside the BPU over all racks.
bmsShuntTemperatureRawArray	[Float32]	°C	Temperature of the shunt sensor inside the BPU for individual racks.
bmsSocRawArrayCloudTrimmed	Float32	%	State of charge trimmed between 0 and 100.
bmsSocRawArray	[Float32]	%	State of charge for individual racks
batteryPower	Float32	kW	Total DC power of the battery sum(V*I) for all racks **This needs to be changed from the cloud side**
inverterActivePower	Float32	kW	Active power of the inverter.
inverterActivePowerSetPoint	Float32	kW	Three-phase active power setpoint sent to the inverter.
inverterReactivePower	Float32	kVA	Reactive power of the inverter.
inverterAcCurrentP1	Float32	A	Not available
inverterAcCurrentP2	Float32	A	Not available
inverterAcCurrentP3	Float32	A	Not available
inverterAcVoltageP1P2	Float32	V	Phase 1 to phase 2 voltage measured by the inverter
inverterAcVoltageP2P3	Float32	V	Phase 2 to phase 3 voltage measured by the inverter

inverterAcVoltageP3P1	Float32	V	Phase 3 to phase 1 voltage measured by the inverter
inverterReactivePowerSetPoint	Float32	kVA	Three-phase reactive power setpoint sent to the inverter.
meterConsumptionActivePower	Float32	kW	Active power consumed by load and auxiliaries on the site (e.g. cooling, BPU, etc.) and measured by a meter.
meterGridActivePower	Float32	kW	Active power injected/taken from the grid at PCC and measured by a meter. It includes net power (injected/taken from the grid).
meterHeatPumpActivePower	Float32	kW	Active power of the heat pump.
meterInverterActivePower	Float32	kW	Inverter's active power measured by a meter.
meterInverterReactivePower	Float32	kVA	Inverter's reactive power measured by a meter.
meterPvActivePower	Float32	kW	Active power produced by the PV system and measured by a meter.
meterGridVoltageP1	Float32	V	Phase 1 Voltage measured by grid meter (line to neutral)
meterGridVoltageP2	Float32	V	Phase 2 Voltage measured by grid meter (line to neutral)
meterGridVoltageP3	Float32	V	Phase 3 Voltage measured by grid meter (line to neutral)
inverterFrequency	Float32	Hz	Grid frequency measured by the inverter

3.3 Summary

Signals	**Type**	**Unit**	**Description**
meterConsumptionActivePowerAggAvg	Float32	kW	Average of the active power of the consumption that measured by the load meter over given time
meterConsumptionActivePowerAggMin	Float32	kW	Minimum of the active power of the consumption that measured by the load meter over given time
meterConsumptionActivePowerAggMax	Float32	kW	Maximum of the active power of the consumption that measured by the load meter over given time
meterConsumptionActivePowerAggStd	Float32	kW	Standard deviation of the active power of the consumption that measured by the load meter over given time
meterConsumptionActivePowerAggCount	Int32		Count of the active power of the consumption that measured by the load meter over given time

meterPvActivePowerAggAvg	Float32	kW	Average of the active power that measured by the PV meter over given time
meterPvActivePowerAggMin	Float32	kW	Minimum of the active power that measured by the PV meter over given time
meterPvActivePowerAggMax	Float32	kW	Maximum of the active power that measured by the PV meter over given time
meterPvActivePowerAggStd	Float32	kW	Standard deviation of the active power that measured by the PV meter over given time
meterPvActivePowerAggCount	Int32		Count of the active power that measured by the PV meter over given time
meterGridActivePowerAggAvg	Float32	kW	Average of the active power that measured by the grid meter over given time
meterGridActivePowerAggMin	Float32	kW	Minimum of the active power that measured by the grid meter over given time
meterGridActivePowerAggMax	Float32	kW	Maximum of the active power that measured by the grid meter over given time
meterGridActivePowerAggStd	Float32	kW	Standard deviation of the active power that measured by the grid meter over given time
meterGridActivePowerAggCount	Int32		Count of the active power that measured by the grid meter over given time
meterInverterActivePowerAggAvg	Float32	kW	Average of the active power that measured by the inverter meter over given time
meterInverterActivePowerAggMin	Float32	kW	Minimum of the active power that measured by the inverter meter over given time
meterInverterActivePowerAggMax	Float32	kW	Maximum of the active power that measured by the inverter meter over given time
meterInverterActivePowerAggStd	Float32	kW	Standard deviation of the active power that measured by the inverter meter over given time

meterInverterActivePowerAggCount	Int32		Count of the active power that measured by the inverter meter over given time
meterHeatPumpActivePowerAggAvg	Float32	kW	Average of the active power that measured by the heatpump meter over given time
meterHeatPumpActivePowerAggMin	Float32	kW	Minimum of the active power that measured by the heatpump meter over given time
meterHeatPumpActivePowerAggMax	Float32	kW	Maximum of the active power that measured by the heatpump meter over given time
meterHeatPumpActivePowerAggStd	Float32	kW	Standard deviation of the active power that measured by the heatpump meter over given time
meterHeatPumpActivePowerAggCount	Int32		Count of the active power that measured by the heatpump meter over given time
meterInverterReactivePowerAggAvg	Float32	kVA	Average of the reactive power that measured by the inverter meter over given time
meterInverterReactivePowerAggMin	Float32	kVA	Minimum of the reactive power that measured by the inverter meter over given time
meterInverterReactivePowerAggMax	Float32	kVA	Maximum of the reactive power that measured by the inverter meter over given time
meterInverterReactivePowerAggStd	Float32	kVA	Standard deviation of the reactive power that measured by the inverter meter over given time
meterInverterReactivePowerAggCount	Int32		Count of the reactive power that measured by the inverter meter over given time
meterGridReactivePowerAggAvg	Float32	kVA	Average of the reactive power that measured by the grid meter over given time
meterGridReactivePowerAggMin	Float32	kVA	Minimum of the reactive power that measured by the grid meter over given time

meterGridReactivePowerAggMax	Float32	kVA	Maximum of the reactive power that measured by the grid meter over given time
meterGridReactivePowerAggStd	Float32	kVA	Standard deviation of the reactive power that measured by the grid meter over given time
meterGridReactivePowerAggCount	Int32		Count of the reactive power that measured by the grid meter over given time
inverterActivePowerAggAvg	Float32	kW	Average of the active power that measured by the inverter over given time
inverterActivePowerAggMin	Float32	kW	Minimum of the active power that measured by the inverter over given time
inverterActivePowerAggMax	Float32	kW	Maximum of the active power that measured by the inverter over given time
inverterActivePowerAggStd	Float32	kW	Standard deviation of the active power that measured by the inverter over given time
inverterActivePowerAggCount	Int32		Count of the active power that measured by the inverter over given time
inverterReactivePowerAggAvg	Float32	kVA	Average of the reactive power that measured by the inverter over given time
inverterReactivePowerAggMin	Float32	kVA	Minimum of the reactive power that measured by the inverter over given time
inverterReactivePowerAggMax	Float32	kVA	Maximum of the reactive power that measured by the inverter over given time
inverterReactivePowerAggStd	Float32	kVA	Standard deviation of the reactive power that measured by the inverter over given time
inverterReactivePowerAggCount	Int32		Count of the reactive power that measured by the inverter over given time
batteryPowerAggAvg	Float32	kW	Average of the battery DC side power over given time

batteryPowerAggMin	Float32	kW	Minimum of the battery DC side power over given time
batteryPowerAggMax	Float32	kW	Maximum of the battery DC side power over given time
batteryPowerAggStd	Float32	kW	Standard deviation of the battery DC side power over given time
batteryPowerAggCount	Int32		Count of the battery DC side power over given time
bmsCellVoltageAvgRawArrayCloudAvgAggAvg	Float32	V	Average of the average cell voltage over all racks over given time
bmsCellVoltageAvgRawArrayCloudAvgAggCount	Int32		Count of the average cell voltage over all racks over given time
bmsCellVoltageMinRawArrayCloudMinAggMin	Float32	V	Minimum of the minimum cell voltage over all racks over given time
bmsCellVoltageMinRawArrayCloudMinAggCount	Int32		Count of the minimum cell voltage over all racks over given time
bmsCellVoltageMaxRawArrayCloudMaxAggMax	Float32	V	Maximum of the maximum cell voltage over all racks over given time
bmsCellVoltageMaxRawArrayCloudMaxAggCount	Int32		Count of the maximum cell voltage over all racks over given time
bmsCellTemperatureMinRawArrayCloudMinAggMin	Float32	°C	Minimum of the minimum cell temperature over all racks over given time
bmsCellTemperatureMinRawArrayCloudMinAggCount	Int32		Count of the minimum cell temperature over all racks over given time
bmsCellTemperatureMaxRawArrayCloudMaxAggMax	Float32	°C	Maximum of the maximum cell temperature over all racks over given time
bmsCellTemperatureMaxRawArrayCloudMaxAggCount	Int32		Count of the maximum cell temperature over all racks over given time
bmsSocRawArrayCloudTrimmedAggAvg	Float32	%	Average of the state of charge trimmed between 0 and 100 over given time
bmsSocRawArrayCloudTrimmedAggMin	Float32	%	Minimum of the state of charge trimmed between 0 and 100 over given time
bmsSocRawArrayCloudTrimmedAggMax	Float32	%	Maximum of the state of charge trimmed between 0 and 100 over given time

bmsSocRawArrayCloudTrimmedAggStd	Float32	%	Standard deviation of the state of charge trimmed between 0 and 100 over given time
bmsSocRawArrayCloudTrimmedAggCount	Int32		Count of the state of charge trimmed between 0 and 100 over given time
bmsAirInletTemperatureRawArrayCloudMinAggMin	Float32	°C	Minimum of the minimum temperature of the cooling inlet air over all racks over given time
bmsAirInletTemperatureRawArrayCloudMinAggCount	Int32		Count of the minimum temperature of the cooling inlet air over all racks over given time
bmsAirInletTemperatureRawArrayCloudMaxAggMax	Float32	°C	Maximum of the maximum temperature of the cooling inlet air over all racks over given time
bmsAirInletTemperatureRawArrayCloudMaxAggCount	Int32		Count of the maximum temperature of the cooling inlet air over all racks over given time
bmsAirInletTemperatureRawArrayCloudAvgAggAvg	Float32	°C	Average of the average temperature of the cooling inlet air over all racks over given time
bmsAirInletTemperatureRawArrayCloudAvgAggCount	Int32		Count of the average temperature of the cooling inlet air over all racks over given time
bmsShuntTemperatureRawArrayCloudMinAggMin	Float32	°C	Minimum of the minimum temperature of the shunt sensor inside the BPU over all racks over given time
bmsShuntTemperatureRawArrayCloudMinAggCount	Int32		Count of the minimum temperature of the shunt sensor inside the BPU over all racks over given time
bmsShuntTemperatureRawArrayCloudMaxAggMax	Float32	°C	Maximum of the maximum temperature of the shunt sensor inside the BPU over all racks over given time
bmsShuntTemperatureRawArrayCloudMaxAggCount	Int32		Count of the maximum temperature of the shunt sensor inside the BPU over all racks over given time
bmsShuntTemperatureRawArrayCloudAvgAggAvg	Float32	°C	Average of the average temperature of the shunt sensor inside the BPU over all racks over given time

bmsShuntTemperatureRawArrayCloudAvgAggCount	Int32		Count of the average temperature of the shunt sensor inside the BPU over all racks over given time
bmsCellVoltageTotalRawArrayCloudAvgAggAvg	Float32	V	Average of the average sum of cell voltage over all racks over given time
bmsCellVoltageTotalRawArrayCloudAvgAggMin	Float32	V	Minimum of the average sum of cell voltage over all racks over given time
bmsCellVoltageTotalRawArrayCloudAvgAggMax	Float32	V	Maximum of the average sum of cell voltage over all racks over given time
bmsCellVoltageTotalRawArrayCloudAvgAggStd	Float32	V	Standard deviation of the average sum of cell voltage over all racks over given time
bmsCellVoltageTotalRawArrayCloudAvgAggCount	Int32		Count of the average sum of cell voltage over all racks over given time
bmsShuntChargeDcCurrentRawArrayTotalAggAvg	Float32	A	Average of the sum of battery charge/discharge DC current measured by the shunt over all racks over given time
bmsShuntChargeDcCurrentRawArrayTotalAggMin	Float32	A	Minimum of the sum of battery charge/discharge DC current measured by the shunt over all racks over given time
bmsShuntChargeDcCurrentRawArrayTotalAggMax	Float32	A	Maximum of the sum of battery charge/discharge DC current measured by the shunt over all racks over given time
bmsShuntChargeDcCurrentRawArrayTotalAggStd	Float32	A	Standard deviation of the sum of battery charge/discharge DC current measured by the shunt over all racks over given time
bmsShuntChargeDcCurrentRawArrayTotalAggCount	Int32		Count of the sum of battery charge/discharge DC current measured by the shunt over all racks over given time
meterGridVoltageP1AggAvg	Float32	V	Average of the phase 1 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP1AggMin	Float32	V	Minimum of the phase 1 Voltage measured by grid meter (line to neutral) over given time

meterGridVoltageP1AggMax	Float32	V	Maximum of the phase 1 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP2AggAvg	Float32	V	Average of the phase 2 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP2AggMin	Float32	V	Minimum of the phase 2 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP2AggMax	Float32	V	Maximum of the phase 2 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP3AggAvg	Float32	V	Average of the phase 3 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP3AggMin	Float32	V	Minimum of the phase 3 Voltage measured by grid meter (line to neutral) over given time
meterGridVoltageP3AggMax	Float32	V	Maximum of the phase 3 Voltage measured by grid meter (line to neutral) over given time
inverterFrequencyAggAvg	Float32	Hz	Average of the grid frequency measured by the inverter over given time
inverterFrequencyAggMin	Float32	Hz	Minimum of the grid frequency measured by the inverter over given time
inverterFrequencyAggMax	Float32	Hz	Maximum of the grid frequency measured by the inverter over given time
calculatedConsumption	Float	kW	Average of the load active power that calculated by the available meter measurement on site over given time

4 Fair use policy

The Xolta API gives the possibility of controlling and monitoring devices. To give all users a good experience, a set of fair use policy have been put in place and we kindly ask users to follow it.

- A device sends data to the cloud once per minute with 10s sampling rate, so there is no reason to query the current state of the device more than once a minute. To be noted, the sampling rate is configurable, please contact us if you have different requirement.
- If there is an interest in the current state of all available devices, please use the ”DeviceStatus” API endpoint provided with a list of all devices, this will return the current telemetry of the devices plus the mode and the state of each device.
- If multiple users or applications in the same organization needs access to the same data, please only call the API once, and then provide storage internally in the organization instead of query the API for data every time, because it adds unnecessary stress on our servers and you may experience delay in the communication.

Repeated failing of complying with the above-mentioned user rules will result in penalty, which can be time-based limits on how many calls can be done to a specific API endpoint. If the penalization is not working, then in worst-case scenarios, access to the API will be reworked.