Ultimo IoT connector
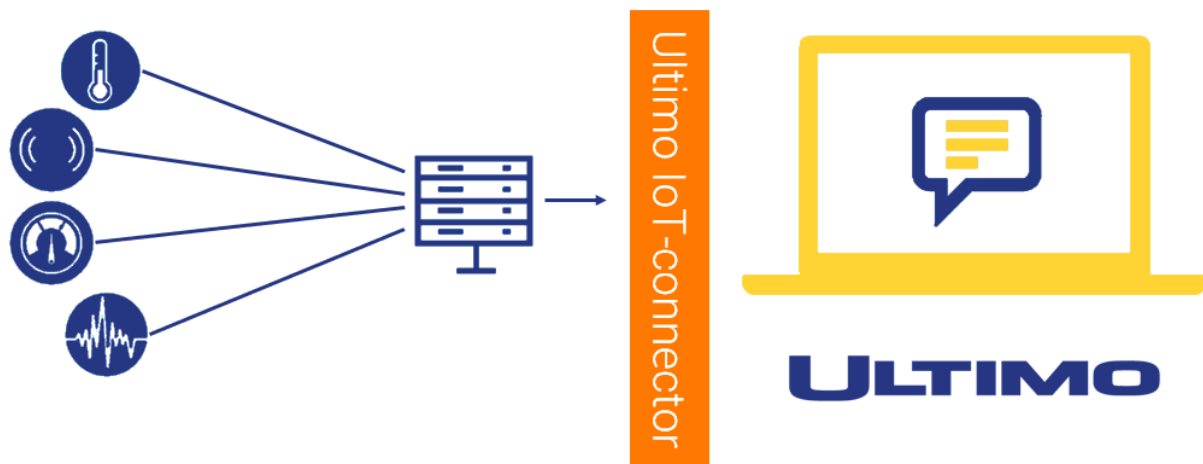# API documentation

ULTIMO

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1 Introduction

The Ultimo IoT connector enables third parties to provide measurements (i.e. based on sensor data) to Ultimo. There are three different ways to connect to Ultimo:

1. REST
2. HTTP POST request with an XML in the body
3. SOAP (XML)

After importing a measurement, various validations and business rules will be executed in Ultimo.

Ultimo is not suitable for *raw sensor data*, so it is not allowed to directly connect sensors to Ultimo or send unfiltered sensor data to Ultimo. The Ultimo IoT connector is intended to connect with a server or platform that collects and filters / aggregates data from sensors.

To avoid an overload of sensor data, there is a maximum limit of measurements. When processing measured values, Ultimo will check if there are no more than 3 days with more than 25 measured values in the past 10 days.

It is also possible to create new measurement points with the REST interface.

2 Functional details

Objects or meters can have measurement points. These can be stored on an equipment or a process function. Each measurement should refer to an existing measurement point (for an equipment or process function).

A measurement contains:

EquipmentId or ProcessFunctionId	Use an *EquipmentId* or *ProcessFunctionId* depending on where the object is stored (internal Ultimo ID). It is recommended to use a Meter, which is an Equipment. This property is required.
MeasurementPointId	The code of the measurement point (int. Ultimo ID).
Date	The date and time of the measurement. This property is required. Allowed formats: - yyyy-MM-dd hh:mm:ss (i.e. 2018-08-21 15:21:59) - UTC: yyyy-MM-ddThh:mm:ssZ (i.e. 2018-08-20T15:17:59Z)
Value or Delta	Use *Value* when the measured value should be interpreted as an absolute value. Examples: a temperature or the total running hours of a machine. Use *Delta* when the measured value is a difference relative to the previous measurement and it is desired to be cumulated in Ultimo. Example: the running hours since the last measurement. Note: Delta is only available in REST-API.
Text	Additional information or remarks for the measurement.

With the REST interface it is possible to create a new measurement point. When the new measurement point is the first measurement point for an equipment or process function, this will be the default measurement point.

A measurement point contains:

EquipmentId or ProcessFunctionId	Use an *EquipmentId* or *ProcessFunctionId* depending on where the object is stored (internal Ultimo ID). It is recommended to use a Meter, which is an Equipment. This property is required.
MeasurementPointId	The new code of the measurement point (internal Ultimo ID). This property is required.
Description	Additional description for the measurement point. This property is required.

3 Technical details

3.1 REST

3.1.1 Create measurement points for an equipment

Basic URL (POST):

https://customer.ultimo.com/api/V1/Action/REST_ CreateEquipmentMeasurementPoint

Header data:

ApiKey	Request an API key at (application manager or consultant)
ApplicationElementId	Fixed value "a90b326b-ff33-421a-a3a8-7d674e37ae22"

Body (example) with measurement point for equipment:

```
{
    "EquipmentId": "00001",
    "MeasurementPointId": "TEMP",
    "Description": "Description for measurement point"
}
```

3.1.2 Create measurement points for a process function

Basic URL (POST):

https://customer.ultimo.com/api/V1/Action/REST_CreateProcessFunctionMeasurementPoint

Header data:

ApiKey	Request an API key at (application manager or consultant)
ApplicationElementId	Fixed value "59275fff-2bcb-425c-a933-90513542c212"

Body (example) with measurement point for process function:

```
{
    "ProcessFunctionId": "00001",
    "MeasurementPointId": "TEMP",
    "Description": "Description for measurement point"
}
```

3.1.3 Measurements for an equipment measurement point
Basic URL (POST):

Header data:

ApiKey	Request an API key at (application manager or consultant)
ApplicationElementId	Fixed value "e57ecb14-6c6f-46ff-fbf7-e65c22a3df61"

Body (example) with absolute value:

```
{
    "EquipmentId": "00001",
    "MeasurementPointId": "TEMP",
    "Date": "2018-08-20 15:57:59",
    "Value": "22",
    "Text": "Some remarks for measurement"
}
```

Body (example) with delta:

```
{
    "EquipmentId": "00001",
    "MeasurementPointId": "RUNHOURS",
    "Date": "2018-08-21 15:17:59",
    "Delta": "5",
    "Text": "Some remarks for measurement"
}
```

3.1.4 Measurements for a process function measurement point

Basic URL (POST):

```
https://customer.ultimo.com/api/V1/Action/REST_ProcessFunctionMeasurementPointValue_Import
```

Header data:

ApiKey	Request an API key at (application manager or consultant)
ApplicationElementId	Fixed value "7dc5815c-1cce-470f-9656-02113d13e635"

Body (example) with absolute value:

```json
{
    "ProcessFunctionId": "0001",
    "MeasurementPointId": "RUNHOURS",
    "Date": "2018-08-21 15:17:59",
    "Value": "25482",
    "Text": "Some remarks for measurement"
}
```

Body (example) with delta:

```json
{
    "ProcessFunctionId": "0001",
    "MeasurementPointId": "RUNHOURS",
    "Date": "2018-08-21 15:17:59",
    "Delta": "5",
    "Text": "Some remarks for measurement"
}
```

3.1.5 Responses

When the measurement or measurement point is accepted:

```
Status: 200 OK
```
```json
{
    "properties": {}
}
```

When the measurement is rejected:

```
Status: 400 Bad Request
```
```json
{
    "message": "Value 5 measured on 21-8-2018 15:17 cannot be processed.\r\nCause: measurement
    "type": 3,
    "code": "3095"
}
```

When the measurement point is rejected:

```
Status: 400 Bad Request
```
```json
{
    "message": "Measurement point cannot be added.\r\nCause:equipment '000011222' was not found.",
    "type": 3,
    "code": "3395"
}
```

```
{
    "message": "Measurement point TEMP cannot be added.\r\nCause: equipment 00001 has already been linked to the
selected measurement point.",
    "type": 3,
    "code": "0687"
}
```

When the API-key is invalid (for a measurement or a measurement point):

Status: 401 Unauthorized

```
{
    "message": "The API key is invalid",
    "code": "InvalidApiKey"
}
```

Other:

Status: 500 Internal Server Error

```
{
    "message": "An error has occured",
    "exceptionType": "System.FormatException",
    "detailMessage": "Guid should contain 32 digits with 4 dashes (xxxxxxxx-xxxx-xxxx-xxxx-xxx
    "type": 1,
    "stackTrace": "    at System.Guid.TryParseGuidWithDashes(String guidString, GuidResult& res
    "code": "InternalServerError"
}
```

3.2 HTTP POST (XML)

Basic URL (POST):

`https://customer.ultimo.com/webservices/connector.ashx`

Parameters:

username	Username that has the rights to use the IoT-connector
password	Password of the user
action	Fixed value "import"
importName	Fixed value "IOT-MEASUREMENT"

Note: escape a character when using special characters in the URL.

Example:

`https://customer.ultimo.com/webservices/connector.ashx?userName=user1&password=Passw0rd%21&action=import&importName=IOT-MEASUREMENT`

The body can contain multiple measurements:

```xml
<?xml version="1.0" encoding="utf-8"?>
<Measurements>
        <Measurement>
                <EquipmentId>00001</EquipmentId>
                <MeasurementPointId>TEMP</MeasurementPointId>
                <Value>22</Value>
                <Date>2018-08-20T15:17:59Z</Date>
                <Text>Some remarks for measurement</Text>
        </Measurement>
        <Measurement>
                <ProcessFunctionId>0001</ProcessFunctionId>
                <MeasurementPointId>RUNHOURS</MeasurementPointId>
                <Value>22</Value>
                <Date>2018-08-21 15:17:59</Date>
                <Text>Some remarks for measurement</Text>
        </Measurement>
</Measurements>
```

The response will contain the imported measurements in the internal Ultimo data structure, including the generated IDs. When a measurement is imported successfully, the attribute *Action* is "Insert". Example response:

Status: 200 OK

```xml
<?xml version="1.0" encoding="utf-8"?>
<Data>
    <Object Type="EquipmentMeasurementPointValue" Action="Insert">
        <Property Name="Id.EquipmentMeasurementPoint.Id.Equipment.Id" Value="00001" />
        <Property Name="Id.EquipmentMeasurementPoint.Id.Id" Value="TEMP" />
        <Property Name="Id.LineId" Value="00000000000001" />
    </Object>
    <Object Type="ProcessFunctionMeasurementPointValue" Action="Insert">
        <Property Name="Id.ProcessFunctionMeasurementPoint.Id.Id" Value="RUNHOURS" />
        <Property Name="Id.ProcessFunctionMeasurementPoint.Id.ProcessFunction.Id" Value="0001" />
        <Property Name="Id.LineId" Value="00000000000001" />
    </Object>
</Data>
```

When the measurement is not accepted by the Ultimo business rules or an error occurs during the processing of the measurement, the *Action* attribute will have the value "Error". Example of a response that contains errors:

Status: 200 OK

```xml
<?xml version="1.0" encoding="utf-8"?>
<Data>
    <Object Type="EquipmentMeasurementPointValue" Action="Error">
        <Property Name="ErrorMessage" Value="Cannot import entity 'EquipmentMeasurementPointVal
        <Property Name="ShortErrorMessage" Value="Error wile executing workflow 'EquipmentMeasu
    </Object>
    <Object Type="ProcessFunctionMeasurementPointValue" Action="Error">
        <Property Name="ErrorMessage" Value="Cannot import entity 'ProcessFunctionMeasurementPo
        <Property Name="ShortErrorMessage" Value="Entity 'ProcessFunctionMeasurementPoint' With
    </Object>
</Data>
```

When the connector cannot be reached at all (i.e. when username or password is incorrect), the format of the error message will be as follows:

Status: 500 Internal Server Error

```
Ultimo.Framework.Core.Tools.GeneralException: Username or password not correct, login failed.
   at Ultimo.Web.Core.Authentication.ConnectorLogOn(String userName, String password)
   at Ultimo.Web.SiteRoot.WebServices.Connector.System.Web.IHttpHandler.ProcessRequest(HttpContext context)
```

3.3 SOAP (XML)

WSDL:

`https://customer.ultimo.com/webservices/soapconnector.svc?wsdl`

The body contains the following information:

importName	Fixed value "IOT-MEASUREMENT"
username	Username that has the rights to use the IoT-connector
password	Password of the user
importData	The measurements XML in a <![CDATA[..]]> block

Example:

```xml
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:tem="http://tempuri.org/">
    <soapenv:Header/>
        <soapenv:Body>
            <tem:ImportData>

            <tem:importName>IOT-MEASUREMENT</tem:importName>

            <tem:userName>user1</tem:userName>

            <tem:password>Passw0rd!</tem:password>
            <tem:importData>
                <![CDATA[<Measurements>
                    <Measurement>
                        <EquipmentId>00001</EquipmentId>
                        <MeasurementPointId>TEMP</MeasurementPointId>
                        <Value>22</Value>
                        <Date>2018-08-20T15:18:59Z</Date>
                        <Text>Some remarks for measurement</Text>
                    </Measurement>
                    <Measurement>
                        <ProcessFunctionId>0001</ProcessFunctionId>
                        <MeasurementPointId>RUNHOURS</MeasurementPointId>
                        <Value>22</Value>
                        <Date>2018-08-21 15:19:59</Date>
                        <Text>Some remarks for measurement</Text>
                    </Measurement>
                </Measurements>]]>
            </tem:importData>
        </tem:ImportData>
    </soapenv:Body>
</soapenv:Envelope>
```

The response will contain the imported measurements in the internal Ultimo data structure, including the generated IDs. When a measurement is imported successfully, the attribute *Action* is "Insert". Example response:

Status: 200 OK

```xml
<s:Envelope xmlns:s="http://schemas.xmlsoap.org/soap/envelope/">
    <s:Body>
        <ImportDataResponse xmlns="http://tempuri.org/">
            <ImportDataResult><![CDATA[<?xml version="1.0" encoding="utf-16"?>
<Data>
  <Object Type="EquipmentMeasurementPointValue" Action="Insert">
    <Property Name="Id.EquipmentMeasurementPoint.Id.Equipment.Id" Value="00001" />
    <Property Name="Id.EquipmentMeasurementPoint.Id.Id" Value="TEMP" />
    <Property Name="Id.LineId" Value="00000000000003" />
  </Object>
  <Object Type="ProcessFunctionMeasurementPointValue" Action="Insert">
    <Property Name="Id.ProcessFunctionMeasurementPoint.Id.Id" Value="RUNHOURS" />
    <Property Name="Id.ProcessFunctionMeasurementPoint.Id.ProcessFunction.Id" Value="0001" />
    <Property Name="Id.LineId" Value="00000000000002" />
  </Object>
</Data>]]></ImportDataResult>
        </ImportDataResponse>
    </s:Body>
</s:Envelope>
```

When the measurement is not accepted by the Ultimo business rules or an error occurs during the processing of the measurement, the *Action* attribute will have the value "Error". Example of a response that contains errors:

Status: 200 OK

```xml
<s:Envelope xmlns:s="http://schemas.xmlsoap.org/soap/envelope/">
    <s:Body>
        <ImportDataResponse xmlns="http://tempuri.org/">
            <ImportDataResult><![CDATA[<?xml version="1.0" encoding="utf-16"?>
<Data>
  <Object Type="EquipmentMeasurementPointValue" Action="Error">
    <Property Name="ErrorMessage" Value="Cannot import entity 'EquipmentMeasurementPointValue' 'ExternalId':
    <Property Name="ShortErrorMessage" Value="Error wile executing workflow 'EquipmentMeasurementPointValue_
  </Object>
  <Object Type="ProcessFunctionMeasurementPointValue" Action="Error">
    <Property Name="ErrorMessage" Value="Cannot import entity 'ProcessFunctionMeasurementPointValue' 'Extern
    <Property Name="ShortErrorMessage" Value="Entity 'ProcessFunctionMeasurementPoint' With id 'ProcessFunct
  </Object>
</Data>]]></ImportDataResult>
        </ImportDataResponse>
    </s:Body>
</s:Envelope>
```

When the connector cannot be reached at all (i.e. when username or password is incorrect), the format of the error message will be as follows:

Status: 500 Internal Server Error

```xml
<s:Envelope xmlns:s="http://schemas.xmlsoap.org/soap/envelope/">
    <s:Body>
        <s:Fault>
            <faultcode>s:ImportData</faultcode>
            <faultstring xml:lang="nl-NL">Username or password incorrect, login failed.</faultstring>
            <detail>
                <ConnectorErrorMessage xmlns="http://schemas.datacontract.org/2004/07/Ultimo.Web.SiteRoot.WebServ
                    <Message>Username or password incorrect, login failed.</Message>
                </ConnectorErrorMessage>
            </detail>
        </s:Fault>
    </s:Body>
</s:Envelope>
```