

## Public API manual



embion

# Table of contents

|          |                                    |          |
|----------|------------------------------------|----------|
| <b>1</b> | <b>Introduction</b>                | <b>4</b> |
| <b>2</b> | <b>About this manual</b>           | <b>4</b> |
| 2.1      | Callouts . . . . .                 | 4        |
| <b>3</b> | <b>Getting started</b>             | <b>5</b> |
| 3.1      | Access tokens . . . . .            | 5        |
| 3.1.1    | Token creation . . . . .           | 5        |
| 3.1.2    | Request limits . . . . .           | 5        |
| 3.1.3    | Use of access token . . . . .      | 6        |
| 3.1.3.1  | Header example . . . . .           | 6        |
| 3.2      | HTTP status codes . . . . .        | 7        |
| 3.3      | ISO 8601 . . . . .                 | 7        |
| 3.4      | GZIP . . . . .                     | 8        |
| <b>4</b> | <b>API endpoints</b>               | <b>9</b> |
| 4.1      | GET Status . . . . .               | 9        |
| 4.1.1    | Request header . . . . .           | 9        |
| 4.1.2    | Request query parameters . . . . . | 9        |
| 4.1.3    | Response body . . . . .            | 10       |
| 4.1.4    | Request example . . . . .          | 11       |
| 4.2      | GET UIDs . . . . .                 | 12       |
| 4.2.1    | Request header . . . . .           | 12       |
| 4.2.2    | Request query parameters . . . . . | 12       |
| 4.2.3    | Response body . . . . .            | 13       |
| 4.2.4    | Request example . . . . .          | 14       |
| 4.3      | GET Plant data . . . . .           | 15       |
| 4.3.1    | Request header . . . . .           | 15       |
| 4.3.2    | Request query parameters . . . . . | 15       |
| 4.3.3    | Response body . . . . .            | 17       |
| 4.3.4    | Request example . . . . .          | 19       |

|                                |    |
|--------------------------------|----|
| <b>4.4 GET Meter data</b>      | 21 |
| 4.4.1 Request header           | 21 |
| 4.4.2 Request query parameters | 21 |
| 4.4.3 Response body            | 23 |
| 4.4.4 Request example          | 25 |
| <b>4.5 GET Inverter data</b>   | 27 |
| 4.5.1 Request header           | 27 |
| 4.5.2 Request query parameters | 27 |
| 4.5.3 Response body            | 29 |
| 4.5.4 Request example          | 31 |
| <b>4.6 GET Plant control</b>   | 33 |
| 4.6.1 Request header           | 33 |
| 4.6.2 Request query parameters | 33 |
| 4.6.3 Response body            | 34 |
| 4.6.4 Request example          | 34 |
| <b>4.7 POST Plant control</b>  | 35 |
| 4.7.1 Request header           | 35 |
| 4.7.2 Request body             | 36 |
| 4.7.2.1 Control explanation    | 38 |
| 4.7.2.2 Example request body   | 39 |
| 4.7.3 Response body            | 40 |
| 4.7.3.1 Example response body  | 40 |

# 1 Introduction

This document describes the public customer REST API available for the HUB portal. The API can be used to read plant, inverter and/or meter data and to control the plant, allowing users of the HUB portal to use these components in other platforms.

## 2 About this manual

### 2.1 Callouts

#### Note

Used for notes in this documentation

#### Warning

Used for warnings in this documentation

#### Important

Used for important notes in this documentation

#### Tip

Used for tips in this documentation

#### Caution

Used for caution notes in this documentation

## 3 Getting started

### 3.1 Access tokens

All endpoints in this API require authentication using access tokens. These tokens are unique to each device and determine the permissions and the maximum number of requests that can be made per day.

#### 3.1.1 Token creation

A token can be generated for each individual device that needs to be read or controlled via the public API. The token is generated and managed through the [HUB portal](#). When multiple devices in one namespace need to be accessed by the API, a token per device needs to be generated.

##### Tip

Documentation for creating access tokens can be found [here](#)

#### 3.1.2 Request limits

There is a default limit of 3,000 requests per device per day, with each request counting towards this limit.

Although the maximum requests per day per token can be adjusted, all requests still contribute to the device's 3,000 request limit.

##### Note

If more than 3,000 calls per device per day are required, please contact [Embion](#) for further assistance and to discuss specific needs.

### 3.1.3 Use of access token

All endpoints described in this document require the access token value to be present as the API-KEY in the HTTP header of the request.

#### Note

Any references to an ID in this document correspond to the token's ID.

#### Tip

The access token is structured as follows: the first 13 characters represent the token ID, followed by an X, and then a string that completes the access token.

- **Access token:** wzae211vh4ddXlbwt4wdyh1eSjre435dmpqwd5fnk8amm
- **Token ID:** wzae211vh4dd

#### 3.1.3.1 Header example

```
{ API-KEY: "wzae211vh4ddXlbwt4wdyh1eSjre435dmpqwd5fnk8amm" }
```

#### Important

If the token is not provided or does not match the ID, a response with HTTP status code 401 will be returned, including the following body:

```
[{ "error": "Invalid ID or token used" }]
```

## 3.2 HTTP status codes

The following HTTP status codes can be present in the responses:

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Code | Status           | Description                                                                          |
|------|------------------|--------------------------------------------------------------------------------------|
| 200  | OK               | The request was successfully processed                                               |
| 401  | Unauthorized     | The access token wasn't given, is invalid, and/or doesn't match with the given id    |
| 403  | Forbidden        | The access token is valid, but doesn't have the correct permissions for the endpoint |
| 429  | To many requests | The maximum daily request limit of the token and/or the device has been reached      |

## 3.3 ISO 8601

The ISO 8601 standard is used for all date and time values. In most cases, only the date and optionally the time zone needs to be sent in the requests.

Some valid date-time examples using the ISO 8601 standard:

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Notation                     | Date                | Timezone |
|------------------------------|---------------------|----------|
| 2022-12-14T08:00Z            | 14-12-2022 8:00:00  | UTC      |
| 2022-12-14T08:00             | 14-12-2022 8:00:00  | UTC      |
| 2022-12-14T08Z               | 14-12-2022 8:00:00  | UTC      |
| 2022-12-14T08:00:00.000+0100 | 14-12-2022 8:00:00  | GMT+1    |
| 2022-12-14                   | 14-12-2022 00:00:00 | UTC      |
| 2022-12-14GMT+0100           | 14-12-2022 00:00:00 | GMT+1    |
| 2022-12                      | 01-12-2022 00:00:00 | UTC      |
| 2022                         | 01-01-2022 00:00:00 | UTC      |

## 3.4 GZIP

Gzip compression is a data optimization technique that reduces the size of the data transferred over the internet.

When a requests is made to the public-API, it can compress the response data using Gzip. This means that the data sent from the server to the customer application is smaller in size, leading to faster responses and lower bandwidth usage.

To enable Gzip compression, add the following header to the request:

Warning in `make_label(ht)`: quarto cell labels do not work with `huxtable` in TeX for quarto version 1.4 or above.

Use `huxtable` labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var                      | Description                                     | Mandatory | Format |
|--------------------------|-------------------------------------------------|-----------|--------|
| Accept-Encoding:<br>gzip | Enables Gzip compression for all reply messages | No        | String |

## 4 API endpoints

To fetch data or control devices, HTTP requests can be sent to the API endpoints described below. Replacing placeholders with the appropriate ID, API-KEY, and start\_date should return valid data.

### 4.1 GET Status

**Method:** GET | **URL:** <https://api.hub.embion.nl/v1/status>

This endpoint returns status information about the given device. The request does not have a body, but it requires a query parameter in order to work properly.

#### 4.1.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

#### 4.1.2 Request query parameters

Query parameters must be appended to the URL, starting with a question mark (?) and separated by ampersands (&).

For example: [https://api.hub.embion.nl/v1/status?id=\[id\]](https://api.hub.embion.nl/v1/status?id=[id]).

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var | Description                            | Mandatory |
|-----|----------------------------------------|-----------|
| ID  | ID of the token (generated in the HUB) | Yes       |

### 4.1.3 Response body

| var             | description                                                                                         | format       |
|-----------------|-----------------------------------------------------------------------------------------------------|--------------|
| status          | actual status of the plant                                                                          | string       |
| online          | true if plant is online, false if offline                                                           | bool         |
| last_contact    | last contact in ISO 8601 layout                                                                     | string       |
| serial          | serial number of device                                                                             | string       |
| version         | actual software version of device                                                                   | string       |
| pn              | product number of device                                                                            | string       |
| name            | reference name of device                                                                            | string       |
| namespace       | namespace location of device                                                                        | string       |
| status_message  | returns the actual status message of the device                                                     | string       |
| support_status  | returns the actual support status, disabled or support ID when enabled                              | string       |
| safe_state      | true if safe_state is enabled on the device                                                         | bool         |
| plant_control   | idle, pending, sent, accepted, failed                                                               | string       |
| epex_configured | True if the device has energy price control rules (defined in the energy pricing app), false if not | bool         |
| token           | token data (see table below)                                                                        | <b>token</b> |

#### Definition of **token**:

| var                  | description                                                                                                            | format  |
|----------------------|------------------------------------------------------------------------------------------------------------------------|---------|
| control_allowed      | true if control access is enabled for the given token                                                                  | bool    |
| expire_date          | expiration date of the given token if set                                                                              | string  |
| request_limit        | maximum daily requests for the token when configured, otherwise the configured maximum device requests (default 3000). | Integer |
| requests_today_token | number of requests done for the token today                                                                            | Integer |

### 4.1.4 Request example

**Request:**

[https://api.hub.embion.nl/v1/status?id=\[id\]](https://api.hub.embion.nl/v1/status?id=[id])

**Response:**

```
{
  "status": "ok",
  "online": true,
  "last_contact": "2022-12-14T12:48:13.000Z",
  "serial": "0100211001090B",
  "version": "1.3.1",
  "pn": "GSE-A010-POE",
  "name": "main-solar",
  "namespace": "Embion",
  "status_message": "reducing inverters",
  "support_status": "A291D88",
  "safe_state": false,
  "plant_control": "idle",
  "epex_configured": false,
  "token": {
    "control_allowed": true,
    "expire_date": "2024-09-30T00:00:00.000Z",
    "request_limit": 3000,
    "requests_today_token": 40
  }
}
```

## 4.2 GET UIDs

**Method:** GET | **URL:** <https://api.hub.embion.nl/v1/uids>

This endpoint returns all UIDs available for the given token. The result can include either all UIDs or a subset of UIDs, depending on the token's configuration.

### 4.2.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

### 4.2.2 Request query parameters

Query parameters must be appended to the URL, starting with a question mark (?) and separated by ampersands (&).

For example: [https://api.hub.embion.nl/v1/uids?id=\[id\]&isonline=true](https://api.hub.embion.nl/v1/uids?id=[id]&isonline=true).

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var      | Description                                                                                                                 | Mandatory | Format  |
|----------|-----------------------------------------------------------------------------------------------------------------------------|-----------|---------|
| ID       | ID of the token (generated in the HUB)                                                                                      | Yes       | String  |
| isonline | When <code>true</code> , it will only return UIDs that were online in the last two days.<br>Default is <code>false</code> . | No        | Boolean |

### **4.2.3 Response body**

| var      | description                                         | format |
|----------|-----------------------------------------------------|--------|
| allowall | true if use of all UIDs is configured for the token | string |
| isonline | true or false based on the request                  | string |
| uids     | array of all UIDs or a subset of UIDs               | array  |

### 4.2.4 Request example

**Request:**

[https://api.hub.embion.nl/v1/uids?id=\[id\]&isonline=true](https://api.hub.embion.nl/v1/uids?id=[id]&isonline=true)

**Response:**

```
{  
  "allowall": true,  
  "isonline": true,  
  "uids": [  
    "inverter1_Growatt:1",  
    "inverter1_Inv:1",  
    "inverter1_Inv:2",  
    "inverter1_Inv:3",  
    "meter1_Hoofd:1",  
    "meter1_P1:1"  
  ]  
}
```

## 4.3 GET Plant data

**Method:** GET | **URL:** <https://api.hub.embion.nl/v1/plant>

This API endpoint returns data from the given plant. It does not have a body, but it does require a few query parameters in order to work properly.

### 4.3.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

### 4.3.2 Request query parameters

Query parameters must be appended to the URL, starting with a question mark (?) and separated by ampersands (&).

For example: [https://api.hub.embion.nl/v1/plant?id=\[id\]&period=q&range=d&type=max&start\\_date=2022-12-14](https://api.hub.embion.nl/v1/plant?id=[id]&period=q&range=d&type=max&start_date=2022-12-14).

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var        | Description                                                                                                                                                            | Mandatory | Format |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|
| ID         | ID of the token (generated in the HUB)                                                                                                                                 | Yes       | String |
| period     | Select data return period: <b>l</b> last sample (default), <b>q</b> 15 minute, <b>h</b> hourly, <b>w</b> weekly, <b>d</b> daily, <b>m</b> monthly, <b>y</b> yearly     | No        | String |
| range      | Time range to show: <b>d</b> day (default), <b>w</b> week, <b>m</b> month, <b>y</b> year                                                                               | No        | String |
| type       | Combination type of multiple datapoints: <b>min</b> minimum value in timerange, <b>max</b> maximum value in timerange (default), <b>avg</b> average value in timerange | No        | String |
| start_date | Date of the first sample in ISO 8601 layout, if not set current day is used                                                                                            | No        | String |

#### Last value

Note that the last data sample is only available within the last two hours. If both the start date and period are not defined in the call, only the last data sample is returned if data is available; otherwise, no data will be returned.

#### Data time range

- Users can optionally include a time with the **start\_date**, which shifts the day interval. However, the total number of returned entries remains unchanged. If no time is specified, a day is considered from 00:00:00 to 23:59:59 in the selected timezone.
- The **start\_date** determines the beginning of the data **range**. The **period** defines the interval between returned dates, while the **range** specifies the end date/time relative to **start\_date**, thereby determining the number of entries returned.

#### Period limitations

Please note there are some limitations when combining period and range

- For period **q** (quarter-hourly) and **h** (hourly), the maximum range is **d** (one day).
- For period **d** (daily), the maximum range is **w** (one week).
- For period **w** (weekly), the maximum range is **m** (one month).
- For period **m** (monthly), the maximum range is **y** (one year).

### **4.3.3 Response body**

The plant data is included in the JSON body of the response. The actual lay-out of the body varies depending on the query parameters given in the request.

The following parameters can be present, if the data is available:

| var       | description                                                                   | units    | format                      |
|-----------|-------------------------------------------------------------------------------|----------|-----------------------------|
| timestamp | Timestamp of the measurement                                                  | ISO 8601 | string                      |
| psol      | Actual solar power                                                            | 1 W      | Integer                     |
| kdy       | Cumulative daily yield                                                        | 1 Wh     | Integer                     |
| kt        | Cumulative total yield                                                        | 1 Wh     | Integer                     |
| soc       | Average state of charge                                                       | 0.1%     | Integer                     |
| evku      | Cumulative EV charger consumption                                             | 1 Wh     | Integer                     |
| pev       | Total EV charger power                                                        | 1 W      | Integer                     |
| pbat      | Total battery power                                                           | 1 W      | Integer                     |
| run       | # inverters in RUN state                                                      | -        | Integer                     |
| warn      | # inverters in WARN state                                                     | -        | Integer                     |
| err       | # inverters in ERR state                                                      | -        | Integer                     |
| red       | Actual reduction value (10000 == 100% => no reduction) Represents power limit | %        | Integer                     |
| var1      | Free to use variable                                                          | -        | Integer                     |
| var2      | Free to use variable                                                          | -        | Integer                     |
| var3      | Free to use variable                                                          | -        | Integer                     |
| var4      | Free to use variable                                                          | -        | Integer                     |
| in1       | State of digital input 1                                                      | -        | Integer<br>0 or 1<br>(bool) |
| in2       | State of digital input 2                                                      | -        | Integer<br>0 or 1<br>(bool) |
| out1      | State of digital output 1                                                     | -        | Integer<br>0 or 1<br>(bool) |
| out2      | State of digital output 2                                                     | -        | Integer<br>0 or 1<br>(bool) |
| con       | # of inverters connected to the gateway                                       | -        | Integer                     |
| pgrid     | gridpower                                                                     | 1 W      | Integer                     |
| egi       | Grid import energy                                                            | 1 Wh     | Integer                     |
| ege       | Grid export energy                                                            | 1 Wh     | Integer                     |
| gil1      | Grid phase 1 current                                                          | 0.1 A    | Integer                     |
| gil2      | Grid phase 2 current                                                          | 0.1 A    | Integer                     |
| gil3      | Grid phase 3 current                                                          | 0.1 A    | Integer                     |
| gul1      | Grid phase 1 voltage                                                          | 0.1 V    | Integer                     |
| gul2      | Grid phase 2 voltage                                                          | 0.1 V    | Integer                     |
| gul3      | Grid phase 3 voltage                                                          | 0.1 V    | Integer                     |

### 4.3.4 Request example

**Request:**

[https://api.hub.embion.nl/v1/plant?id=\[id\]&period=q&range=d&type=max&start\\_date=2022-12-14](https://api.hub.embion.nl/v1/plant?id=[id]&period=q&range=d&type=max&start_date=2022-12-14)

**Response:**

```
[
  {
    "timestamp": "2022-12-14T10:00:00.000Z",
    "con": 3,
    "ege": 3500,
    "egi": 2000,
    "err": 0,
    "in1": 1,
    "in2": 0,
    "out1": 0,
    "out2": 0,
    "gil1": 5,
    "gil2": 6,
    "gil3": 7,
    "gul1": 220,
    "gul2": 230,
    "gul3": 240,
    "kdy": 1010,
    "kty": 7200,
    "pgrid": 1000,
    "psol": 1750,
    "soc": 550,
    "pbat": 1550,
    "pev": 750,
    "evku": 2450,
    "red": 10000,
    "run": 2,
    "var1": 1,
    "var2": 2,
    "var3": 3,
    "var4": 4,
    "warn": 1
  },
  {
```

```
"timestamp": "2022-12-14T10:15:00.000Z",  
"con": 3,  
"ege": 4100,  
"egi": 2000,  
"err": 0,  
"in1": 1,  
"in2": 0,  
"out1": 0,  
"out2": 0,  
"gil1": 56,  
"gil2": 63,  
"gil3": 78,  
"gul1": 2218,  
"gul2": 2301,  
"gul3": 2368,  
"kdy": 12010,  
"kty": 7200,  
"pgrid": -11600,  
"psol": 2000,  
"soc": 550,  
"pbat": -15000,  
"pev": 750,  
"evku": 2450,  
"red": 10000,  
"run": 3,  
"var1": 1,  
"var2": 2,  
"var3": 3,  
"var4": 4,  
"warn": 0  
}  
]
```

## 4.4 GET Meter data

**Method:** GET | **URL:** <https://api.hub.embion.nl/v1/meter>

This API endpoint returns individual meter data. It does not have a body, but it does require a few query parameters in order to work properly.

### 4.4.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

### 4.4.2 Request query parameters

Query parameters must be appended to the URL, starting with a question mark (?) and separated by ampersands (&). For example: [https://api.hub.embion.nl/v1/meter?id=\[id\]&uid=\[uid\]&period=q&range=d&type=max&start\\_date=2022-12-14](https://api.hub.embion.nl/v1/meter?id=[id]&uid=[uid]&period=q&range=d&type=max&start_date=2022-12-14)

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

#### Last value

Note that the last data sample is only available within the last two hours. If both the start date and period are not defined in the call, only the last data sample is returned if data is available; otherwise, no data will be returned.

| Var        | Description                                                                                                                                                            | Mandatory | Format |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|
| ID         | ID of the token (generated in the HUB)                                                                                                                                 | Yes       | String |
| uid        | the uid of the meter to read, only one uid can be entered                                                                                                              | Yes       | String |
| period     | Select data return period: <b>l</b> last sample (default), <b>q</b> 15 minute, <b>h</b> hourly, <b>w</b> weekly, <b>d</b> daily, <b>m</b> monthly, <b>y</b> yearly     | No        | String |
| range      | Time range to show: <b>d</b> day (default), <b>w</b> week, <b>m</b> month, <b>y</b> year                                                                               | No        | String |
| type       | Combination type of multiple datapoints: <b>min</b> minimum value in timerange, <b>max</b> maximum value in timerange (default), <b>avg</b> average value in timerange | No        | String |
| start_date | Date of the first sample in ISO 8601 layout, if not set current day is used                                                                                            | No        | String |

#### Data time range

- Users can optionally include a time with the **start\_date**, which shifts the day interval. However, the total number of returned entries remains unchanged. If no time is specified, a day is considered from 00:00:00 to 23:59:59 in the selected timezone.
- The **start\_date** determines the beginning of the data **range**. The **period** defines the interval between returned dates, while the **range** specifies the end date/time relative to **start\_date**, thereby determining the number of entries returned.

#### Period limitations

Please note there are some limitations when combining period and range

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- For period **d** (daily), the maximum range is **w** (one week).
- For period **w** (weekly), the maximum range is **m** (one month).
- For period **m** (monthly), the maximum range is **y** (one year.)

### **4.4.3 Response body**

The meter data is included in the JSON body of the response. The actual lay-out of the body varies depending on the query parameters given in the request. Data that is not used by the given meter is left out from the response body.

The following parameters can be present, if the data is available:

| var       | description                  | units                | format  |
|-----------|------------------------------|----------------------|---------|
| timestamp | Timestamp of the measurement | ISO 8601             | string  |
| actpow    | Total active power           | 1 W                  | Integer |
| apparpow  | Total apparent power         | 1 VA                 | Integer |
| reactpow  | Total reactive power         | 1 VAR                | Integer |
| pf        | Total powerfactor            | 0.01 $\cos(\varphi)$ | Integer |
| pfl1      | Phase 1 powerfactor          | 0.01 $\cos(\varphi)$ | Integer |
| pfl2      | Phase 2 powerfactor          | 0.01 $\cos(\varphi)$ | Integer |
| pfl3      | Phase 3 powerfactor          | 0.01 $\cos(\varphi)$ | Integer |
| actpowl1  | Phase 1 active power         | 1 W                  | Integer |
| actpowl2  | Phase 2 active power         | 1 W                  | Integer |
| actpowl3  | Phase 3 active power         | 1 W                  | Integer |
| il1       | Phase 1 current              | 0.1 A                | Integer |
| il2       | Phase 2 current              | 0.1 A                | Integer |
| il3       | Phase 3 current              | 0.1 A                | Integer |
| vll12     | Phase1-2 line-line voltage   | 0.1 V                | Integer |
| vll13     | Phase1-3 line-line voltage   | 0.1 V                | Integer |
| vll23     | Phase2-3 line-line voltage   | 0.1 V                | Integer |
| vl1       | Phase1 to neutral voltage    | 0.1 V                | Integer |
| vl2       | Phase2 to neutral voltage    | 0.1 V                | Integer |
| vl3       | Phase3 to neutral voltage    | 0.1 V                | Integer |
| eimp      | imported energy counter      | 1 Wh                 | Integer |
| eexp      | exported energy counter      | 1 Wh                 | Integer |
| esolar    | used solar energy counter    | 1 Wh                 | Integer |
| egrid     | used grid energy counter     | 1 Wh                 | Integer |
| fgrid     | Measured grid frequency      | 0.01 Hz              | Integer |
| thdul1    | Phase 1 voltage THD          | 0.01 %               | Integer |
| thdul2    | Phase 2 voltage THD          | 0.01 %               | Integer |
| thdul3    | Phase 3 voltage THD          | 0.01 %               | Integer |
| thdil1    | Phase 1 current THD          | 0.01 %               | Integer |
| thdil2    | Phase 2 current THD          | 0.01 %               | Integer |
| thdil3    | Phase 3 current THD          | 0.01 %               | Integer |
| gas       | Used gas counter             | 0.01 m3              | Integer |
| water     | Used water counter           | 0.01 m3              | Integer |
| heat      | Used heat counter            | 100 J                | Integer |
| radi      | Measured radiation           | 0.1 W/m2             | Integer |
| temp      | Measured temperature         | 0.1 C                | Integer |
| humi      | Measured humidity            | 0.01 %               | Integer |
| pres      | Measured pressure            | 1000 Pa              | Integer |
| flow      | Measured flow                | 0.01 liter/min       | Integer |
| weight    | Measured weight              | 1 gram               | Integer |

### 4.4.4 Request example

**Request:**

[https://api.hub.embion.nl/v1/meter?id=\[id\]&uid=\[uid\]&period=q&range=d&type=max&start\\_date=2022-12-14](https://api.hub.embion.nl/v1/meter?id=[id]&uid=[uid]&period=q&range=d&type=max&start_date=2022-12-14)

**Response:**

```
[
  {
    "timestamp": "2022-12-14T08:00:00.000Z",
    "actpow": 1000,
    "actpowl1": 100,
    "actpowl2": 1200,
    "actpowl3": -300,
    "apparpow": 1005,
    "eexp": 0,
    "egrid": 13541,
    "eimp": 36578912,
    "esolar": 31575661,
    "fgrid": 5011,
    "gas": 12300,
    "il1": 1000,
    "il2": 2000,
    "il3": 500,
    "pf": 30,
    "pfl1": 50,
    "pfl2": -50,
    "pfl3": 100,
    "reactpow": 100,
    "thdil1": 100,
    "thdil2": 200,
    "thdil3": 140,
    "thdul1": 111,
    "thdul2": 15,
    "thdul3": 109,
    "ul1": 23011,
    "ul2": 24011,
    "ul3": 23544,
    "ull12": 39821,
    "ull13": 40201,
    "ull23": 39098
  }
]
```

```
},  
{  
  "timestamp": "2022-12-14T08:15:00.000Z",  
  "actpow": 1000,  
  "actpowl1": 100,  
  "actpowl2": 1200,  
  "actpowl3": -300,  
  "apparpow": 1005,  
  "eexp": 0,  
  "egrid": 13541,  
  "eimp": 36578912,  
  "esolar": 31575661,  
  "fgrid": 5011,  
  "gas": 15300,  
  "il1": 1000,  
  "il2": 2000,  
  "il3": 500,  
  "pf": 30,  
  "pfl1": 50,  
  "pfl2": -50,  
  "pfl3": 100,  
  "reactpow": 100,  
  "thdil1": 100,  
  "thdil2": 200,  
  "thdil3": 140,  
  "thdul1": 111,  
  "thdul2": 15,  
  "thdul3": 109,  
  "ul1": 23011,  
  "ul2": 24011,  
  "ul3": 23544,  
  "ull12": 39821,  
  "ull13": 40201,  
  "ull23": 39098  
}  
]
```

## 4.5 GET Inverter data

**Method:** GET | **URL:** <https://api.hub.embion.nl/v1/inverter>

This API endpoint returns individual inverter data. It does not have a body, but it does require a few query parameters in order to work properly.

### 4.5.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

### 4.5.2 Request query parameters

Query parameters must be appended to the URL, starting with a question mark (?) and separated by ampersands (&). For example: [https://api.hub.embion.nl/v1/inverter?id=\[id\]&uid=\[uid\]&period=h&range=d&type=max&start\\_date=2022-12-14GMT+0100](https://api.hub.embion.nl/v1/inverter?id=[id]&uid=[uid]&period=h&range=d&type=max&start_date=2022-12-14GMT+0100).

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

#### Last value

Note that the last data sample is only available within the last two hours. If both the start date and period are not defined in the call, only the last data sample is returned if data is available; otherwise, no data will be returned.

| Var        | Description                                                                                                                                                            | Mandatory | Format |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|
| ID         | ID of the token (generated in the HUB)                                                                                                                                 | Yes       | String |
| uid        | the uid of the inverter to read, only one uid can be entered                                                                                                           | Yes       | String |
| period     | Select data return period: <b>l</b> last sample (default), <b>q</b> 15 minute, <b>h</b> hourly, <b>w</b> weekly, <b>d</b> daily, <b>m</b> monthly, <b>y</b> yearly     | No        | String |
| range      | Time range to show: <b>d</b> day (default), <b>w</b> week, <b>m</b> month, <b>y</b> year                                                                               | No        | String |
| type       | Combination type of multiple datapoints: <b>min</b> minimum value in timerange, <b>max</b> maximum value in timerange (default), <b>avg</b> average value in timerange | No        | String |
| start_date | Date of the first sample in ISO 8601 layout, if not set current day is used                                                                                            | No        | String |

#### Data time range

- Users can optionally include a time with the **start\_date**, which shifts the day interval. However, the total number of returned entries remains unchanged. If no time is specified, a day is considered from 00:00:00 to 23:59:59 in the selected timezone.
- The **start\_date** determines the beginning of the data **range**. The **period** defines the interval between returned dates, while the **range** specifies the end date/time relative to **start\_date**, thereby determining the number of entries returned.

#### Period limitations

Please note there are some limitations when combining period and range

- For period **q** (quarter-hourly) and **h** (hourly), the maximum range is **d** (one day).
- For period **d** (daily), the maximum range is **w** (one week).
- For period **w** (weekly), the maximum range is **m** (one month).
- For period **m** (monthly), the maximum range is **y** (one year.)

### **4.5.3 Response body**

The inverter data is included in the JSON body of the response. The actual lay-out of the body varies depending on the query parameters given in the request.

The body can contain the following parameters, if the data is available:

| var         | description                                      | units             | format  |
|-------------|--------------------------------------------------|-------------------|---------|
| timestamp   | Timestamp of the measurement                     | ISO 8601          | string  |
| stat        | Inverter status                                  |                   | Integer |
| kdy         | Inverter daily yield                             | 1 Wh              | Integer |
| kty         | Inverter total yield                             | 1 Wh              | Integer |
| pac         | Inverter AC power                                | 1 W               | Integer |
| psol        | Inverter solar power                             | 1 W               | Integer |
| ul1         | Inverter phase 1 voltage                         | 0.1 V             | Integer |
| ul2         | Inverter phase 2 voltage                         | 0.1 V             | Integer |
| ul3         | Inverter phase 3 voltage                         | 0.1 V             | Integer |
| il1         | Inverter phase 1 current                         | 0.1 A             | Integer |
| il2         | Inverter phase 2 current                         | 0.1 A             | Integer |
| il3         | Inverter phase 3 current                         | 0.1 A             | Integer |
| tmp1        | Inverter internal temperature 1                  | 0.1 C             | Integer |
| tmp2        | Inverter internal temperature 2                  | 0.1 C             | Integer |
| ilk         | Inverter leakage current or isolation resistance | 0.0001 A          | Integer |
| arc         | Inverter arc detection status                    |                   | Integer |
| batpow      | Battery power (+charge, -discharge)              | 1 W               | Integer |
| batcap      | Remaining battery capacity                       | 1 Wh              | Integer |
| batsoc      | Battery State Of Charge                          | 0.1 %             | Integer |
| batsoh      | Battery State Of Health                          | 0.1 %             | Integer |
| batttemp    | Battery temperature                              | 0.1 C             | Integer |
| string_data | Individual string data (see table below)         | <b>stringdata</b> |         |

**Definition of [stringdata](#):**

| var  | description                   | units | format  |
|------|-------------------------------|-------|---------|
| sid  | string number of inverter uid |       | string  |
| idc  | String current                | 0.1 A | Integer |
| udc  | String voltage                | 0.1 V | Integer |
| pdc  | String power                  | 1 W   | Integer |
| ydc  | String daily yield            | 1 Wh  | Integer |
| sarc | String arc detection status   |       | Integer |

### 4.5.4 Request example

**Request:**

[https://api.hub.embion.nl/v1/inverter?id=\[id\]&uid=inv1:1&period=h&range=d&type=max&start\\_date=2022-12-14GMT+0100](https://api.hub.embion.nl/v1/inverter?id=[id]&uid=inv1:1&period=h&range=d&type=max&start_date=2022-12-14GMT+0100)

**Response:**

```
{
  "timestamp": "2022-12-13T23:00:00.000Z",
  "arc": 0,
  "batcap": 0,
  "batpower": 0,
  "batsoc": 0,
  "batsoh": 0,
  "battemp": 0,
  "il1": 56,
  "il2": 63,
  "il3": 77,
  "ilk": 3,
  "kdy": 1100000,
  "kty": 6100000,
  "pac": 10000,
  "psol": 20000,
  "string_data": [
    {
      "sid": "1",
      "idc": 50,
      "udc": 5000,
      "pdc": 2500,
      "sarc": 0
    }
  ],
  "stat": 1,
  "tmp1": 531,
  "tmp2": 366,
  "ul1": 2301,
  "ul2": 2405,
  "ul3": 2508
},
{
  "timestamp": "2022-12-14T00:00:00.000Z",
```

```
"arc": 0,  
"batcap": 0,  
"batpower": 0,  
"batsoc": 0,  
"batsoh": 0,  
"battemp": 0,  
"il1": 120,  
"il2": 130,  
"il3": 120,  
"ilk": 3,  
"kdy": 1200000,  
"pac": 14000,  
"string_data": [  
  {  
    "sid": "1",  
    "idc": 50,  
    "udc": 5000,  
    "pdc": 2500,  
    "sarc": 0  
  }  
],  
"stat": 1,  
"tmp1": 551,  
"tmp2": 346,  
"ul1": 2301,  
"ul2": 2405,  
"ul3": 2508  
}
```

## 4.6 GET Plant control

**Method:** GET | **URL:** [https://api.hub.embion.nl/v1/read\\_plantcontrol](https://api.hub.embion.nl/v1/read_plantcontrol)

This endpoint returns plantcontrol information about the given device. The request does not have a body, but it requires a query parameter in order to work properly.

### 4.6.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

### 4.6.2 Request query parameters

Query parameters must be appended to the URL, starting with a question mark (?) and separated by ampersands (&).

For example: [https://api.hub.embion.nl/v1/read\\_plantcontrol?id=\[id\]](https://api.hub.embion.nl/v1/read_plantcontrol?id=[id]).

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var | Description                            | Mandatory |
|-----|----------------------------------------|-----------|
| ID  | ID of the token (generated in the HUB) | Yes       |

### 4.6.3 Response body

| var                      | description                                              | Units    | Format |
|--------------------------|----------------------------------------------------------|----------|--------|
| dtcreated                | Time that the control command is created                 | ISO 8601 | String |
| dtupdated                | Time that the control command is updated                 | ISO 8601 | String |
| valid_time               | Time in seconds that the control command is being active | Seconds  | Int    |
| p_import_limit           | Grid import limit                                        | W        | Int    |
| p_export_limit           | Grid export limit                                        | W        | Int    |
| rel_p_import_limit       | Relative grid export limit                               | W        | Int    |
| rel_p_export_limit       | Relative grid export limit                               | W        | Int    |
| control_generation       | Control generation                                       | -        | String |
| control_consumption      | Control consumption                                      | -        | String |
| control_pv_limit         | Control plant PV limit                                   | %        | Int    |
| control_battery_setpoint | Control battery setpoint                                 | %        | Int    |
| control_ev_limit         | Control planr EV limit                                   | %        | Int    |

### 4.6.4 Request example

**Request:**

[https://api.hub.embion.nl/v1/read\\_plantcontrol?id=\[id\]](https://api.hub.embion.nl/v1/read_plantcontrol?id=[id])

**Response:**

```
{
  "dtcreated": "2025-01-21T13:56:37.236Z",
  "dtupdated": "2025-01-21T13:56:37.236Z",
  "valid_time": 90,
  "p_export_limit": 100,
  "p_import_limit": 100,
  "control_ev_limit": 100,
  "control_pv_limit": 100,
  "control_generation": "min",
  "rel_p_export_limit": 100,
  "rel_p_import_limit": 100,
  "control_consumption": "nom",
  "control_battery_setpoint": 100
}
```

## 4.7 POST Plant control

**Method:** **POST** | **URL:** <https://api.hub.embion.nl/v1/plantcontrol>

This API endpoint enables external control of the plant. The GSE ensures that all provided values are constrained within the plant's maximum and minimum allowable limits.

Although it is possible to send values exceeding the plant's capabilities, the GSE will automatically adjust them to remain within the permissible range.

At least one control value must be provided. If a control value is omitted or the `valid_time` has expired, that control value will not be actively managed by the GSE.

If a plant control action is still active when a new command is sent, the previous command will be overwritten or merged based on the request, and the return message will be updated accordingly.

The endpoint can be triggered by sending a **POST** request to <https://api.hub.embion.nl/v1/plantcontrol>, with a JSON body described below.

### 4.7.1 Request header

Endpoint require authentication by using the [access token](#) as API-KEY in the header.

#### ! Permission required

The [Control access](#) permission must be enabled for the token, this can be done within the token configuration form. An error response with a [403](#) HTTP status code will be returned otherwise.

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var     | Description                              | Mandatory | Format |
|---------|------------------------------------------|-----------|--------|
| API-KEY | Actual access token generated in the HUB | Yes       | String |

### 4.7.2 Request body

Warning in `make_label(ht)`: quarto cell labels do not work with `huxtable` in TeX for quarto version 1.4 or above.

Use `huxtable` labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var                                                | Description                                                                                                                                                                              | Req. | Format  | Unit |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|------|
| id                                                 | ID of the token                                                                                                                                                                          | Yes  | String  |      |
| p_import_limit                                     | Grid import limit                                                                                                                                                                        | No   | Integer | W    |
| p_export_limit                                     | Grid export limit                                                                                                                                                                        | No   | Integer | W    |
| rel_p_import_limit *                               | Relative grid import limit                                                                                                                                                               | No   | Integer | %    |
| rel_p_export_limit *                               | Relative grid export limit                                                                                                                                                               | No   | Integer | %    |
| control_generation                                 | <b>min</b> minimise generation<br><b>max</b> maximize generation<br><b>nom</b> nominal generation                                                                                        | No   | String  |      |
| control_consumption                                | <b>min</b> minimise consumption<br><b>max</b> maximize consumption<br><b>nom</b> nominal consumption                                                                                     | No   | String  |      |
| control_pv_limit *                                 | Control plant PV limit                                                                                                                                                                   | No   | Integer | %    |
| control_battery_setpoint<br>(+charge, -discharge)* | Control plant battery setpoint                                                                                                                                                           | No   | Integer | %    |
| control_ev_limit *                                 | Control plant EV limit                                                                                                                                                                   | No   | Integer | %    |
| valid_time                                         | Time in seconds that the given command stays active on the GSE (must be equal to or greater than <b>90</b> ).<br>Will be infinite if the value is <b>0</b> or the variable wasn't given. | No   | Integer | sec. |
| merge                                              | If <b>true</b> and a plant control command is active, it will be merged with the given command.                                                                                          | No   | Boolean |      |

**i** Note

\* These request parameters are only compatible with SolarGateway devices running software version 4.2.0 or higher.

**i** Conflicting setpoints

If conflicting setpoints are provided, the setpoint resulting in the lowest power output will take precedence.

**⚠** Commando merge

When `merge` is not used, new commands will overwrite the previous commands. If `merge` is used, previously set limits will be merged with the new command. The latest given `valid_time` will be applied (it will be infinite if the value is `0` or the `valid_time` variable wasn't given).

**4.7.2.1 Control explanation**

The `control_generation` and `control_consumption` items can be used to control plant generation and consumption independently of the plant configuration.

Warning in `make_label(ht)`: quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var                 | Value | Description                                                                                                                                                                                                      |
|---------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| control_generation  | min   | Reduces the power generation to the minimum, resulting in solar power converters to shutdown and wind turbines to stop.                                                                                          |
|                     | nom   | Allows generation of solar and wind to operate normally.                                                                                                                                                         |
|                     | max   | Allows also the start of any extra generators (if available at plant).                                                                                                                                           |
| control_consumption | min   | Reduces the controllable loads like heatpumps and EV-chargers to minimum consumption.                                                                                                                            |
|                     | nom   | Enables normal controllable loads to operate within the plant limits.                                                                                                                                            |
|                     | max   | Increases the power for controllable loads to maximum. EV-chargers will increase charging power to maximum (within plant limits) and heatpumps will increase or decrease setpoint to increase power consumption. |

#### 4.7.2.2 Example request body

```
{  
  "id": "119mt001pj51d",  
  "p_export_limit": 20000,  
  "p_import_limit": 50000,  
  "control_generation": "max",  
  "control_consumption": "nom",  
  "valid_time": 200  
}
```

### 4.7.3 Response body

The response body contains info about whether the command was successfully sent. The body will be in the JSON format and contains the following parameters:

| var     | description                                        | format  | optional |
|---------|----------------------------------------------------|---------|----------|
| success | Whether the command was sent ( <b>true</b> = sent) | boolean | No       |
| value   | Optional description message                       | string  | Yes      |

The **value** field shows up if the command couldn't be sent or when an existing command was overwritten. The field can have any of the following values:

Warning in make\_label(ht): quarto cell labels do not work with huxtable in TeX for quarto version 1.4 or above.

Use huxtable labels instead via ``label()`` or ``set_label()``.

See ``?huxtable-FAQ`` for more details.

| Var                  | Description                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------------------|
| unsupported          | The plant control feature is not supported on the device                                                 |
| disabled             | The plant control feature is actively disabled by the device                                             |
| valid_time_too_short | The <b>valid_time</b> field must be equal to or greater than <b>90</b> , if it isn't this error is shown |
| offline              | The device is offline                                                                                    |
| overwritten          | The previous command will be overwritten                                                                 |
| merged               | The previous command is merged with the provided one                                                     |

#### 4.7.3.1 Example response body

Plant control command successfully sent

```
{
  "success": true
}
```

Plant control command couldn't be sent (plant is offline)

```
{  
  "success": false,  
  "value": "offline"  
}
```



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