



Tenovi Hardware Integration (HWI) API Documentation

The Tenovi HWI API allows third-party Clients to:

- 1) Receive measurement data from Tenovi Devices at a specified Webhook, or fetch measurement data directly from a specified Endpoint
- 2) Receive status updates (e.g. related to fulfillment) for Tenovi Device at a specified Webhook.
- 3) Activate/Deactivate Tenovi Devices (Note: only activated devices will send measurement & status data; charges may apply when activating new devices)
- 4) Optionally include shipping information when activating a device, so that Tenovi (or the client, via our dashboard) can provide fulfillment services (note, additional charges may apply)

Each of these features is executed/implemented using HTTPS requests.

For features 1 & 2, the Client must register a callback Webhook using the Tenovi dashboard. The Tenovi API will then send a POST request with measurement data or status updates to these endpoints. All data sent via the API is in JSON format. Header-based authentication methods (e.g. Basic Auth) can be optionally included in the POST request, if required by the Client. **Note,**

For features 3 & 4, you need a valid API Key included in the request header. You can generate your API key using the Tenovi dashboard. Each API Key has a rate limit of 1 request per second. All requests to the API must be performed over HTTPS.

To authenticate an API request, the API key must be included in an HTTP Authorization header. The key should be prefixed by the string literal "Api-Key" with whitespace separating the two strings. For example:

```
`Authorization: Api-Key TENOVI_API_KEY`
```

Specific documentation for each of the above features is included below.

Base URL

All API calls will use the following root URL:

```
https://api2.tenovi.com/clients/CLIENT_DOMAIN
```

Note, the Tenovi backend separates all client data in our database to ensure security & HIPAA compliance. For each client, a client-specific URL must be used when communicating with our API. Simply replace the CLIENT_DOMAIN field in the URL above with your custom domain (provided by your Tenovi representative) when making calls to our API.

1) Activating/Deactivating Devices

Devices are activated/deactivated through HTTP requests to the following endpoint:

```
/hwi/hwi-devices/
```

Allowed HTTP Methods:

GET – Returns a list of activated devices

POST – Activates a new device

DELETE (/hwi/hwi-devices/{id}/) – Deactivates & deletes a device

HWI Device object format (* indicates a required field):

```
{
  id                string($uuid)
                   readOnly: true
  status            string
                   readOnly: true
  device*           {
    id              string($uuid)
                   readOnly: true
    created         string($date-time)
                   readOnly: true
    name*           string
                   maxLength: 255
                   minLength: 1
    hardware_uuid*  string
                   maxLength: 255
                   nullable: true
    sensor_code*   string
                   default:
                   maxLength: 3
    fulfillment_request object (see below)
  }
  patient_id        string
                   minLength: 1
  patient_phone_number string
                   minLength: 1
}
```

Example JSON (without nested fulfillment_request object):

```
{
  "device": {
    "name": "Tenovi BPM",
    "hardware_uuid": "123456789100",
    "sensor_code": "10",
  },
  "patient_id": "12345678-1234-12345678",
  "patient_phone_number": "1234567890",
}
```

fulfillment_request Object format:

```

{
  created                string($date-time)
                        readOnly: true
  shipping_status        string
                        Enum:
                        [ PE, SH, DE, CN, RE ]
  shipping_name           string
                        maxLength: 255
                        nullable: true
  shipping_address        string
                        maxLength: 255
                        nullable: true
  shipping_city           string
                        maxLength: 255
                        nullable: true
  shipping_state          string
                        maxLength: 255
                        nullable: true
  shipping_zip_code       string
                        maxLength: 255
                        nullable: true
  shipping_tracking_link string($uri)
                        maxLength: 2000
                        nullable: true
  notify_emails           string
                        maxLength: 2048
                        nullable: true
  fulfilled               boolean
                        readOnly: true
  client_will_fulfill     Boolean
                        default: false
}

```

Example JSON (with nested fulfillment_request object):

```

{
  "device": {
    "fulfillment_request": {
      "shipping_name": "Patient One",
      "shipping_address": "123 Street",
      "shipping_city": "Townsville",
      "shipping_state": "CA",
      "shipping_zip_code": "12345",
      "client_will_fulfill": false,
      "notify_emails": "test@email.com",
    },
    "name": "Tenovi BPM",
    "hardware_uuid": null,
    "sensor_code": "",
  },
  "patient_id": "12345678-1234-12345678",
  "patient_phone_number": "1234567890"
}

```

Notes:

If successful, the HWI Device Activation Request will return a HWI Device object with an "id" parameter. **This id must be saved and used as a unique identifier for this specific device.** This id is included in the "hwi_device_id" field in the Webhook callbacks to allow data from a specific HWI Device to be associated with a particular patient in the Client's software (see below). This id is also required to delete this specific HWI Device to remove it from your account. Charges may occur for devices that are not deleted when no longer in use. If you forget to save it, you can retrieve this value using the GET method on the Activation Request endpoint.

HWI Device Activation Requests must reflect one of three possible real-world Cases: 1) devices are given to patients on-site (so the Gateway ID is known), 2) devices need to be shipped to the patient by a client's internal staff, or 3) devices need to be shipped to the patient from Tenovi (**NOTE: additional charges may be incurred for this service**).

For Case #1: The nested Device object in the Activation Request must include the Gateway ID in the "hardware_uuid" field; in this case, the "status" parameter of the returned HWI Device object will be set to "Delivered".

For Cases #2 and #3: The "hardware_uuid" field must be set to *null*, and the shipping information must be included in the nested "fulfillment_request" object.

For Case #2: The "client_will_fulfill" field of the "fulfillment_request" object must be set to *true*; here, the "status" will be set to "Pending Shipment".

For Case #3: The "client_will_fulfill" field should be set to *false*; here, the "status" will be set to "Dropship Requested".

For all requests, the device name and sensor code must match the values in the following list:

Device Name	Sensor Code
Tenovi BPM	10
Tenovi BPM - XL	10
Tenovi Pulse Ox	11
Tenovi Glucometer	12
Tenovi Scale	13

The "patient_id" field in the Activation Request is optional, but if it is included, this value will be included in all Webhook callbacks associated with that HWI Device.

The "patient_phone_number" field in the Activation Request is optional, and only has an effect if a patient_id is included. If both the patient_id and patient_phone_number fields are included, the patient_phone_number will be stored for Tenovi Customer Service to use in the event they need to troubleshoot any device issues with a patient directly.

The "notify_emails" field of the "fulfillment_request" object is also optional, but it can include a list of comma-separated email addresses, which will receive shipping update emails as updates occur.

3) Measurement Webhook

The Tenovi Logistics API allows third-party Clients to receive measurement data from Tenovi Devices at a specified endpoint. The Client must provide Tenovi with a callback endpoint that the Tenovi API will POST to whenever a measurement is received from a Tenovi Device. All data sent via the API is in JSON format. Header-based authentication methods (e.g. Basic Auth) can be optionally included in the POST request, if required by the Client. **Note, for devices that measure multiple metrics simultaneously (e.g. BPMs measure both *blood_pressure* and *pulse* metrics), two separate POSTs will be sent to the specified endpoint for each metric. If you would like to link simultaneous measurements together, you can use the “created” field, which will be identical for the two measurements.**

The following data is included in each POST request:

Parameter	Description
metric	The type of metric. Valid options are: <i>blood_pressure</i> , <i>weight</i> , <i>pulse</i> , <i>glucose</i> , <i>spO2</i> .
device_name	The name of the device
hwi_device_id	The unique id returned when activating a HWI Device. This can be used to identify measurements by activated HWI Devices
patient_id	The internal patient ID associated with this device, if it was provided when the device was requested (see Requesting Devices)
hardware_uuid	A unique identifier associated with the Tenovi Gateway (printed on the back). This is primarily useful for troubleshooting, or if a replacement Gateway is needed (Tenovi must be provided the old ID so they can replace it with the new ID after a replacement unit is shipped out). Do NOT use this field to associate measurements with a patient, as it will change if a Gateway is replaced.
sensor_code	The sensor code of the device (see Activating devices for valid sensor codes)
value_1	A first measurement value. For the given metrics, these are: <ul style="list-style-type: none"> • blood_pressure: systolic blood pressure (in mmHG) • weight: weight (in US pounds) • pulse: pulse (in beats per minute) • glucose: glucose level (in mg/dL) • spO2: oxygen saturation (in percent saturation)
value_2	A second measurement value. For the given metrics, these are: <ul style="list-style-type: none"> • blood_pressure: diastolic blood pressure (in mmHG) • pulse & spO2: standard deviation of measurement (if multiple samples were taken) • all others: N/A
created	A timestamp (in UTC) of when the device was originally received by the Tenovi API in ISO 8601 format (i.e. YYYY-MM-DDTHH:MM:SSZ)
timezone_offset	Offset (in hours) between timezone where measurement was taken and UTC. Can be negative.
filter_params	A json object with any additional context information. Currently only included for glucometer measurements with key = “meal_context” and possible values = “pre-prandial”, “post-prandial”, & “fasting”

An example JSON package is included below.

```
{
  "metric": "blood_pressure",
  "device_name": "Tenovi BPM",
  "hwi_device_id": "12345678-abcd-1234-abcd-1234567890ab",
  "patient_id": "12345678-1234-12345678",
  "hardware_uuid": "fed091a643ff",
  "sensor_code": "10",
  "value_1": 120.00,
  "value_2": 80.00,
  "created": "2021-01-15T12:15:20Z",
  "timezone_offset": -7,
  "filter_params": {}
}
```

4) Fulfillment Webhook

If Tenovi will be providing fulfillment services, after a Device has been requested, Tenovi will send a callback HTTPS POST request to a provided endpoint to indicate the device status (e.g. “Shipped” or “Connected”), tracking link, and the unique hardware_uuid for the physical device that was shipped to the patient.

The following data is included in each POST request:

Parameter	Description
hwi_device_id	The unique id returned when activating a HWI Device, which should be used to link shipping updates to a particular Patient or HWI Device in the Client’s software.
patient_id	The patient ID associated with this device, if it was provided when the device was requested (see Requesting Devices)
hardware_uuid	A unique identifier associated with the Tenovi Gateway. This is primarily useful for troubleshooting, or if a replacement Gateway is needed (Tenovi must be provided with the old ID so they can replace it with the new ID after a replacement unit is shipped out). Do NOT use this field to associate measurements with a patient, as it will change if a Gateway is replaced.
sensor_code	The sensor code of the device (see Activating devices for valid sensor codes)
device_name	The name of the Device that was shipped (i.e. “Tenovi Scale”, “Tenovi BPM”, “Tenovi Pulse Ox”, or “Tenovi Glucometer”).
status	The status of the device. Options are: <ul style="list-style-type: none"> • “Pending Shipment” • “Dropship Requested” • “Shipped” • “Dropshipped” • “Delivered” • “Returned” • “Connected”
tracking_link	The tracking link for this device, if it has been shipped

An example JSON package is included below.

```
{
  "hwi_device_id": "12345678-abcd-1234-abcd-1234567890ab",
  "patient_id": "12345678-1234-12345678",
  "hardware_uuid": "fed091a643ff",
  "sensor_code": "10"
  "device_name": "Tenovi BPM",
  "status ": "Shipped",
  "tracking_link": "ups.com/tracking-number"
}
```

5) Measurement Endpoints

If data is either missed or improperly handled by the Measurement Webhook, or a client simply wants to validate the data in their system with the data stored by Tenovi, two Measurement endpoints are available to fetch measurement data on request. The endpoints are:

- 1) /hwi/hwi-devices/{hwi_device_id}/measurements/
- 2) /hwi/patients/{patient_external_id}/measurements/

Allowed HTTP Methods:

GET – Returns a list of measurements

Optional Query Parameters:

metric__name: string

created__gte: ISO 8601 timestamp in UTC (i.e. YYYY-MM-DDTHH:MM:SSZ)

created__lte: ISO 8601 timestamp in UTC (i.e. YYYY-MM-DDTHH:MM:SSZ)

Measurement Response format:

```
[
  {
    "metric": "string",
    "device_name": "string",
    "hwi_device_id": "string",
    "patient_id": "string",
    "hardware_uuid": "string",
    "sensor_code": "string",
    "value_1": "string",
    "value_2": "string",
    "created": "2019-08-24T14:15:22Z",
    "timezone_offset": -2147483648,
    "filter_params": { }
  }
]
```

Notes:

The response data fields are identical to those sent in the Measurement Webhook POST requests (see above).

For Endpoint #1, all measurements for a given HWI Device are returned. The hwi_device_id must be included in the URL.

For Endpoint #2, all measurements for a given Patient External ID (optionally set during device activation) are returned. The patient_external_id must be included in the URL. Note, uniqueness is not enforced for this field. All measurements from all devices associated with a patient with the given External ID will be returned.

The optional query parameters all the request to be filtered by metric name (metric__name = blood_pressure, weight, pulse, glucose, or spO2) or creation date greater than or equal to (created__gte) or less than or equal to (created__lte) a given timestamp in UTC. **Note, each query parameter includes a double-underscore. This must be included for the filter to function properly.** An example URL with a query parameter is:

```
/hwi/patients/12345/measurements/?metric__name=glucose
```