

Sensoterra

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Network integration guide

Version 1.0

Table of contents

Scope	3
Introduction	3
LoRaWAN specification	3
Network requirements (US915, AU915)	4
Certification & validation	4
Probe registration	4
Obtain measurement data	4
HTTP endpoint versus Portal API	5
Sensoterra HTTP endpoint	5
Implementation	6
Uplink messages	6
Downlink messages	6
Provider API	6
Excel upload for device creation	7
Examples	7
Portal API	7
Decoder call	7
Encoder call	8

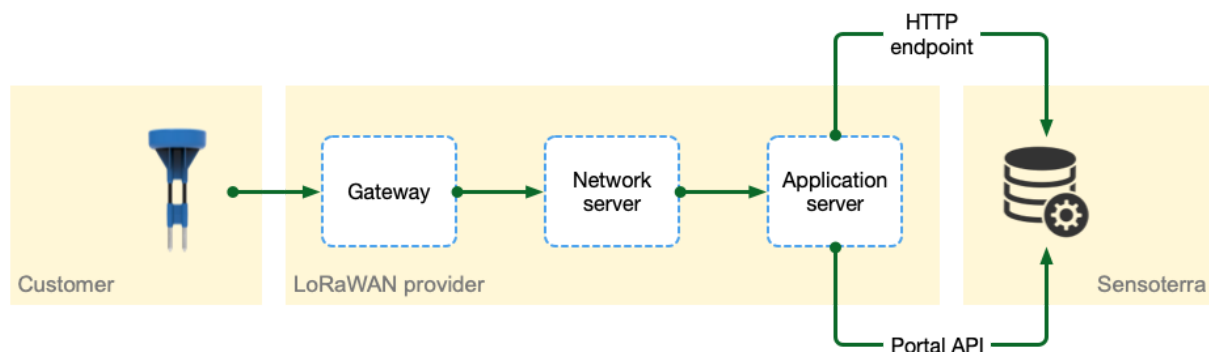
Scope

This guide describes how to operate Sensoterra probes on a LoRaWAN network. How to deploy probes and how to process payloads. Intended audience are LoRaWAN providers who need to support Sensoterra probes.

In order to understand how to interface probes to an external system, please consult “Probe Integration Guide”.

Introduction

Schematically the data flow is:



LoRaWAN specification

Sensoterra probes have the following characteristics:

- Based on the Multitech xDot LoRaWAN module
- ISM Bands: 863 MHz - 868 MHz, 902 MHz - 928 MHz, 915 MHz - 935 MHz
- Max Transmitter Power Output (TPO): 20 dBm (USA, AU), 14 dBm (other regions)
- Available channel plans¹: EU868, US915, AU915, AS923
- LoRaWAN 1.0.2² compliant, and supports:
 - Activation over air (OTAA)
 - ADR
 - For US/AU: all 72 channels are enabled by default
- Number of uplink messages typically 24 a day (customizable). However after been removed from the soil for more than 24 hours, the uplink frequency will be reduced to a single upload a day.

¹ More channel plans will be available in the future.

² Probes sold before August 2017 are LoRaWAN 1.0.1 compliant.

Network requirements (US915, AU915)

When a Sensoterra probe wants to join a LoRaWAN network it iterates over the 8 subbands of 8+1 channels. So first a random channel between 0 and 7 is tried, then channel 64, then a random channel between 8 to 15, then channel 65, etc. As soon as a join accept is received, the probe will stick to the last set of 8+1 channels. Also the spread factor is kept to 10 (DR 0) and transmission power to 20 dBm.

It is good practice for the network server to send a sequence of ADR requests in response to the first uplink message to configure the permitted channels, the data rate, and the transmit power. Please contact the network server supplier for instructions on how to configure ADR commands.

Certification & validation

The following certifications are available:

- LoRa Alliance LoRaWAN End-Device
- FCC
- CE
- Actility Validation (pending)

Probe registration

In order for Sensoterra to accept a device uplink payload, the probe must first be registered by the customer. For this the customer needs to install the Sensoterra app (Android/iOS) and scan the QR code as instructed. This ties the device to the end-user. Alternatively, the Customer API can be used to register a probe automatically. Please consult “Probe Integration Guide”.

Obtain measurement data

Various ways exist to gain access to probe measurement data, namely:

- Excel download, GeoRSS feed
- Download via the Customer API
- Real time server push notifications
- Immediate as return data from the decode call of the Portal API

Download through the Customer API has the disadvantage that you need to regularly poll for new data. That’s why server push notifications are often the preferred way to obtain measurements.

Please consult “Probe Integration Guide” for the details on how to set it up.

HTTP endpoint versus Portal API

Network integration is possible in two ways:

- A. Forward the LoRaWAN payload to a dedicated HTTP endpoint in the Sensoterra infrastructure. Possibly extended with the integration of the LoRaWAN provider infrastructure for management, uplink, and downlink processing:
 - Sensoterra provisions probes in the network of the provider, either by an API or CSV upload (optional)
 - LoRaWAN network server routes uplink payloads from devices to a dedicated Sensoterra endpoint for further processing
 - LoRaWAN provider offers an API to send downlink configuration messages to a device (optional)
- B. The alternative is that the network provider uses the Portal API to decode uplink payloads directly. The provider is responsible for the provisioning of the probes. The API is protected by OAuth.

The next table shows some of the differences:

	<i>HTTP Endpoint</i>	<i>Portal API</i>
Real time decoding	No, but server push notifications come close	Yes, each decode call returns the actual soil moisture data
Downlink configuration messages	By Sensoterra, depending on the level of integration	By network provider, using the encode call
Device creation	By Sensoterra, depending on the level of integration	By network provider
Sensoterra support	Yes	Limited as Sensoterra has no access to the network metrics.
Setup	Mainly by Sensoterra	By network provider

Sensoterra HTTP endpoint

In order for Sensoterra to support a new LoRaWAN network provider, the following needs to be taken into consideration:

1. Agreement on contractual terms, like costs, volume, maximum number of uplinks/downlinks per day, what channel plans will be supported, etc.

2. Procedure to deploy new LoRaWAN probes. And how to remove them. Through an API, Excel upload, mail?
3. Sensoterra must setup endpoint to handle uplink messages.
4. Optional: Sensoterra must implement API to send downlink messages to a device.
5. Optional: implement automatic device deployment.
6. Optional: customer can configure an endpoint to receive server push notifications to for real time probe readings.

Implementation

What Sensoterra needs:

- Access to the portal where devices are managed, if possible.
- Specification of the uplink message format.
- Specification how to submit a downlink message to a probe.
- Specification on how to manage probes (API, Excel upload, ...).

Uplink messages

Sensoterra will provide (or configure in the provider portal) an endpoint URL to which device payloads should be sent.

When the LoRaWAN provider gets a payload from a probe, the endpoint must be called preferably as a JSON message, containing at least:

- DevEUI
- Timestamp with timezone indication, like ISO 8601
- Uplink counter (FCntUp)
- The payload
- RSSI and SNR levels

Downlink messages

To remotely configure a probe, Sensoterra needs to be able to send downlink messages to the probe. The LoRaWAN provider needs to supply an API which facilitates this. The following parameters will be supplied:

- DevEUI
- Payload
- FPort (typically 1)

Provider API

If an API to deploy devices exists, like registering, activating and deactivating LoRaWAN devices, Sensoterra needs the API documentation in order to implement it.

Excel upload for device creation

When devices need to be created or removed through Excel uploads, the providers need to specify the format of the import file. Typically, it will contain at least:

- DevEUI
- AppEUI
- AppKey
- Name (to help identify the device)

Examples

Sensoterra can give guides on how to setup ThingPark (from Actility) or Everynet on request.

Portal API

In order to support a LoRaWAN provider, the following needs to be taken care of:

1. Agreement on contractual terms, like costs, volume, etc.
2. Procedure to communicate LoRaWAN keys to provider (API, mail)?
3. Provider needs to integrate the decoder API into their infrastructure.

Documentation on the Portal API is available at <https://monitor.sensoterra.com/apiportal/v2/>.

Decoder call

Sensoterra will provide the decoder API documentation. This is essentially a RESTful call where the DevEUI and payload (and in some cases the soil type) is POSTed. Response will be the decoded payload in the format of a SenML message. An example of two soil measurements is:

```
[
  {
    "bver": 3, "bn": "urn:dev:com.sensoterra:18000125819",
    "bt": 1505747862
  },
  { "u": "%EL", "v": 100 },
  { "u": "%vol", "v": 32.3, "depth": 30, "soil": "CLAY", "ut": 5400 },
  { "u": "%vol", "v": 32.0, "depth": 60, "soil": "CLAY", "ut": 5400, "t": -3600 }
]
```

Notes:

- Part of the Base Name (“bn”) is the probe serial label.
- Times (like “bt”) are Unix timestamps from 1970-1-1, “t” is a relative time offset with respect to “bt”.
- The following units (“u”) describe the sensor value (“v”):
 - %EL: battery voltage (0% = empty, 100% = full)
 - %vol: soil moisture content at a certain depth/soil type
- Depth (“depth”) in centimeters.

For more details on SenML, please check <https://tools.ietf.org/html/draft-ietf-core-senml-10>.