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PELICAN ASSET TRACKER

User Guide

Document Number:	T0006940	
Document Version:	3	
Product Names and T-Codes:	PELICAN Enterprise Asset Tracker (Outdoor)	T0006906 – Wall-Mount
Release Date:	September 05, 2024	

Contents

1 Product Description

1.1 Overview

The PELICAN device provides reliable asset tracking. It uses periodic BLE scanning to gather data from nearby BLE devices, figuring out its location or acting as a broadcasting BLE device itself.

This document provides comprehensive descriptions of each PELICAN variant, along with detailed guidance on their hardware capabilities. For insights into the functional operation and software behavior of each variant, please consult the Technical Reference Manual (TRM) document.

Table 1-1 presents all PELICAN supported functions as well as enclosure and mounting options.

Table 1-1: Capabilities of PELICAN

Feature	Device Variant
Product Name	PELICAN, Wall-Mount
	
Mounting	Wall
Operating Environment	Outdoor (IP67)
Battery	C-cell LTC
Battery Gauge	✓
BLE Rx	✓
BLE Tx	✓
Magnetic Sensor	✓
Accelerometer	✓
Activity LEDs	✓

1.2 Specifications

The PELICAN specifications are listed in Table 1-. The main sensing functions are described in the following subsections.

Table 1-2: PELICAN BLE Asset Tracker Specifications.

Parameter	Specification
Environmental Rating	IP67
Enclosures and Mounting	Custom design by TEKTELIC
Operating Temperature	-40°C to 70°C
Storage Temperature for Optimal Battery Life	-25° to 55°C
Operating Relative Humidity	5% - 95% non-condensing
Storage Relative Humidity	10% - 100% non-condensing
Dimensions	65 mm x 45 mm x 41 mm (with bracket) 65 mm x 43 mm x 41 mm (without bracket)
Weight	63.5 g enclosure + 56.5 g battery = 120 g total (without bracket)
Power Source	Battery-powered: 1x C-cell LTC (3.6 V)
Network technology/Frequency band	LoRaWAN in the following Global ISM bands: AS923, AU915, EU868, IN865, KR920, RU864, US915
Air Interface	LoRa, BLE
Maximum Tx Power	15 dBm, all bands
Sensing Elements	BLE transceiver, accelerometer, MCU thermometer, magnetic hall-effect sensor, battery gauge
Bluetooth Compatibility	BLE based on Bluetooth 5.3
LoRa RF Sensitivity	Up to -137 dBm (SF12, 125 kHz BW)
BLE Sensitivity (0.1% BER)	125 kbps: -103 dBm 500 kbps: -98 dBm 2 Mbps: -91 dBm
Accelerometer Sensitivity	Sample rate: 1, 10, 25, 50, 100, 200, 400 Hz Measurement range: ±2, ±4, ±8, ±16 *g* Precision: 16, 32, 64, 192 m*g*
LEDs	Green: Joining the network activity Red: LoRa Tx or Rx activity
Battery Gauge Features	Measures remaining capacity [%] and remaining lifetime [days]
Battery Lifetime	15+ years[1] 4.5 years[2] in Beacon mode

[1] With default settings operating at DR2. Applicable to NA region only.
[2] With default settings and no event-based reports,operating at DR2. Applicable to NA region only.

2 Installation

2.1 Included Product and Installation Material

The following items are shipped with each device:

- 1x device inside an enclosure with a 3.6 V C-cell LTC battery installed.
- 1x corresponding device Quick Start Guide.
- 1x mounting bracket.

NOTE: to ensure safe installation and maintenance, please read Safety Precautions.

2.2 Unpacking and Inspection

The following should be considered during the unpacking of a new device.

1. Inspect the shipping carton and report any significant damage to TEKTELIC.
2. Unpacking should be conducted in a clean and dry location.
3. Do not discard the shipping box or inserts as they will be required if a unit is returned for repair or re-configuration.

2.3 Commissioning

Each device has a set of commissioning information that must be entered into the network server for the device to be able to join the network and begin normal operation once activated. For instructions on how to do this please refer to the Network Server Quick Start Guide you get in the box with the device (also available online in the *Knowledge Base*).

2.4 Activation

The device is shipped in a secured enclosure with the battery preinstalled in a state of DEEP SLEEP.

To activate/reset the device:

1. Place the magnet for **3 to 10 seconds** at the magnetic activation site as shown in Figure 2-1 below.
2. Device activation will be displayed by **GREEN** and **RED** LEDs turning on.
3. Once activated, the device will automatically begin the join process.

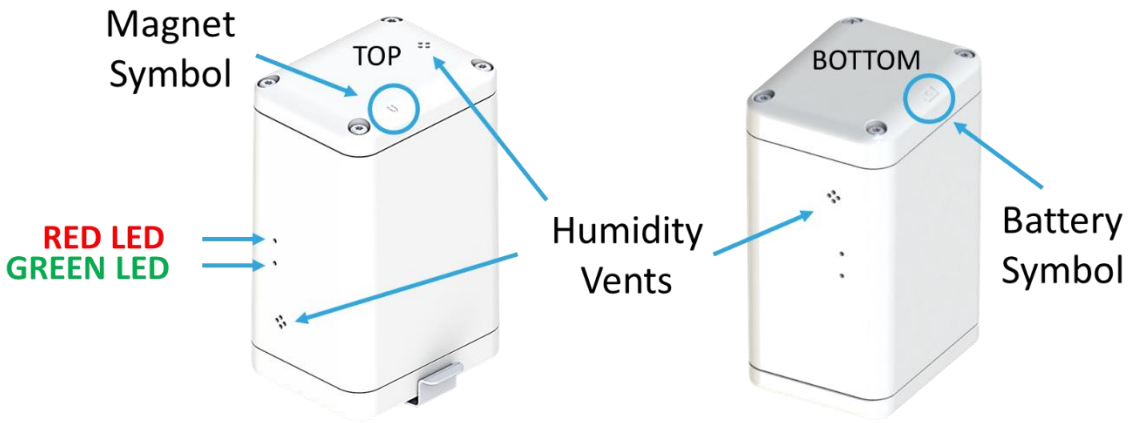

Figure 2-1 PELICAN Enclosures and External Interfacing

To return to Deep sleep there are two options:

1. Send a DEEP SLEEP command in a downlink on port 99
2. Apply the magnet for **3-10 seconds** while the device is in state of network search (process is indicated by **GREEN** LED active blinking).

2.5 Default Configuration

Table 2-1 lists the default reporting behaviour of the PELICAN. Reporting behaviour can be changed from default through OTA DL commands (see how to do it in Basic Downlinks section).

Table 2-1: Default Reporting Periods

Reported Data	PELICAN
Battery Data	24 hours
Discovered BLE devices	1 hour
Acceleration Vector	Disabled
MCU Temperature	Disabled

2.6 Battery Replacement

The battery cover is marked with a battery symbol and uses Phillips Head H1 screws. This cover needs to be removed to replace the battery.

1. Remove the battery cover by unscrewing the 4x Phillips head screws using a size #1 Phillips head screwdriver.

Figure 2-2: Removing the Battery Cover Screws

2. Remove the used battery and replace it with a new 3.6V XENO XL-145F battery **ONLY**. When inserting the new battery, insert the negative terminal side first. The battery contact on the battery cover is the positive contact and is marked with a plus-sign (**+**).

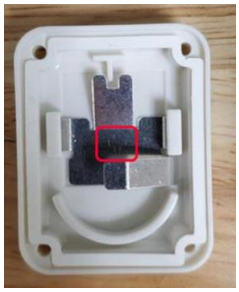

Figure 2-3: Polarity Marker and Battery Insertion

3. Before reattaching the battery cover, ensure the proper orientation of the cover by placing the battery symbol next to the mounting feature.as seen in Figure 2-4.

Figure 2-4: Proper Replacement Orientation of the Battery Cover

4. Reassemble the cover to the chassis by using the 4x Phillips head screws, using a #1 size screwdriver and up to 0.3 Nm of torque.

2.7 Reconfiguration

The PELICAN supports a full range of OTA configuration options. Specific technical details are available in the corresponding TRM documents. All configuration commands need to be sent OTA during the device's DL Rx windows.

2.8 Reset Function

To physically reset PELICAN perform same steps as to get in out of DEEP SLEEP state:

1. Place magnet against the enclosure at the magnetic activation site as in Figure 2-5.

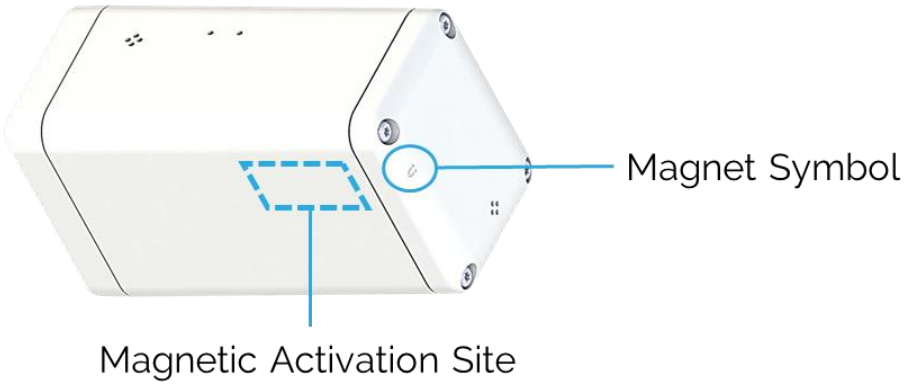

Figure 2-5: Magnetic Activation Site

2. Sustain magnet for **3 to 10 seconds**. Device activation will be displayed by **GREEN** and **RED** LEDs turning on.
3. Once activated, the device will automatically begin the join process.

NOTE: Shutting down or resetting the sensor will cause all unsaved user configurations to be lost. Save the desired configuration to the sensor flash before powering off or resetting.

2.9 RF LED Behaviour

The LEDs are normally off and the main patterns are summarized Table 2-2. The detailed sequence and timings for each are described in the following subsections.

Table 2-2: Summary of LED Patterns

LED Pattern	Meaning
GREEN blinking rapidly and single **RED** flash every 10 s	JOIN mode; attempting to join the network
Single **RED** flash	UpLink sent
Single **GREEN** flash	DownLink received
3 quick **RED** flashes	Entering DEEP SLEEP
Three **GREEN** blinks	Exiting DEEP SLEEP

2.9.1 Power-On and Network Join Patterns

When the device is activated or reset:

Condition	Green LED	Red LED	Duration	Notes
Initial activation/reset	OFF	OFF	0.5 sec	Both LEDs are off upon activation/reset.
Power-On Self Test (POST) starts	ON	ON	-	Both LEDs turn on signaling the start of POST.
POST ends	OFF	OFF	~2 sec	LEDs turn off after POST completes.
POST pass	Blink 3 times	OFF	-	Green blinks 3 times if POST is successful.
POST fail	OFF	Blink 3 times	-	Red blinks 3 times if POST fails, and the process restarts.
JOIN mode	Actively blinks	Flashes twice per cycle	Until device joins. Will timeout after 1-hour	Green actively blinks; Red flashes twice: once after sending JOIN REQUEST, and once after receiving JOIN ACCEPT. Normal operation begins after JOIN ACCEPT.
Unsuccessful network join after 1 hour	OFF	Flash twice	Every 8 s	Green stops blinking; Red flashes twice every 8 seconds during join back-off to conserve power.

2.9.2 Normal Operation Patterns

After the Device has joined the network:

a. **RED** flashes after transmitting an uplink.

b. **GREEN** flashes after receiving a downlink

3 Functions

3.1 Magnetic Sensor

The PELICAN variants are equipped with a magnetic hall-effect sensor included to address these purposes:

1. To wake the device from DEEP SLEEP as described in Section 2.4.
2. To put the device to DEEP SLEEP.
3. To reset the device.
4. To force a LoRaWAN UpLink.

The position on the exterior of the enclosure on which the magnet must be placed on a Magnetic Activation Site to activate the reed switch is shown in Figure 3.1 below.

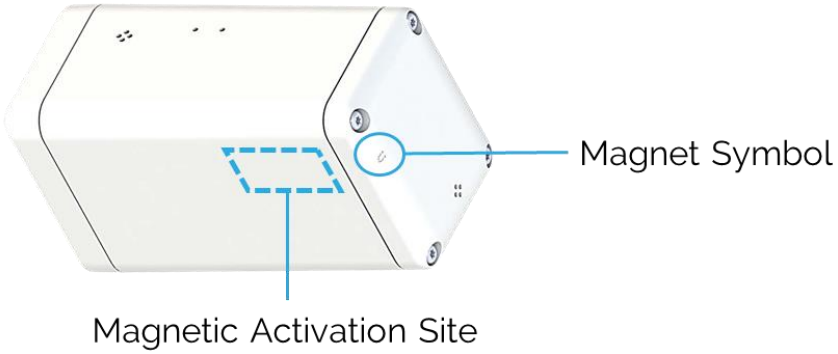

Figure 3-1: Magnetic sensor

For more information on how to use the magnetic sensor, please refer to the TRM document.

3.2 Bluetooth Low-Energy (BLE) Transceiver

BLE operation is the main function of the PELICAN. To collect information for indoor positioning/asset tracking device can operate in 1 of 2 BLE *modes*:

- **Tracker Mode (default)**: The device conducts BLE Rx scanning to discover nearby BLE peripherals, determine their signal strengths, and relay this information via LoRaWAN UL to the NS.
- **Beacon Mode**: The device broadcasts BLE Tx advertisements so it is discoverable to nearby BLE scanning devices. The device supports BLE as specified by Bluetooth 5.0 and uses only the 3 default advertising channels: 37, 38, and 39.

The device is LoRaWAN-backhauled. That is, sending device data in LoRaWAN ULs, being reconfigured through LoRaWAN DLs and all other sensor functions are accessible in either beacon or tracker mode.

3.2.1 Tracker Mode

In Tracker Mode, the BLE only receives (Rx) but doesn't broadcast, making it not visible to other BLE devices.

During each scan, the tracker finds nearby advertising BLE devices and saves their info (MAC address and signal strength) for later reporting in a LoRaWAN data report UL. This report usually happens right after the scan, but might wait due to LoRaWAN duty cycle limitations[3].

You can adjust how often reports happen and decide whether to scan for BLE when motion is detected or cleared via the Accelerometer Assist (which is on by default). Each BLE scan lasts for a set time, split into intervals for scanning on different BLE channels.

NOTE: By default, a BLE scan and report is conducted every 60 min in tracker mode**.**

In the scan interval, BLE scanning occurs only during the configurable scan window, which is a percentage of the total interval called duty cycle. A 100% duty cycle means continuous scanning throughout the interval, maximizing the chance of finding nearby BLE packets. Lowering the duty cycle reduces power usage but might miss some signals.

You can turn off BLE scanning completely in tracker mode, and it's passive, meaning the tracker only listens to beacons without sending requests for more info.

At the end of each scan duration, the tracker reports the amount of discovered BLE devices and their signal strengths over LoRaWAN.

You can set up to 4 ranges to filter discovered BLE devices by MAC address.

NOTE: The BLE and LoRa radio activity are mutually exclusive. If any LoRaWAN reporting is due at the same time as a BLE scan, the reporting will be done after the BLE scan is complete.

See the TRM for more details about tracker mode operation and configuration.

[3] If a new BLE scan occurs before the results of the previous scan have been sent, the old scan results will be discarded.

3.2.2 Beacon Mode

NOTE: tracker mode is default for sensor, so it must be switched into beacon mode.

In beacon mode, the BLE only transmits (Tx). It regularly sends out small packets of data called BLE advertisements, detectable by other PELICANs in tracker mode and any BLE-scanning device. You can adjust the transmission power level.

Once a device joins the LoRaWAN network, it starts broadcasting BLE advertisements continually in the background. The user can set the interval between these transmissions.

Each BLE advertisement consists of three separate packet transmissions, increasing the chance of detection by devices scanning on any of these channels.

The BLE advertising packet format supports three major BLE standards: iBeacon, Eddystone UID, and Eddystone TLM. By default, only iBeacon is enabled.

NOTE: BLE advertisement and LoRa radio transmission are mutually exclusive. If LoRaWAN reporting is due the BLE advertisements are paused while the LoRa activity is occurring.

See the TRM for more details about tracker mode operation and configuration.

3.3 Temperature and Relative Humidity Sensor

The PELICAN can measure and report the MCU temperature. This is a temperature measurement using a sensor located in the device microprocessor.

3.4 Accelerometer Sensor

The PELICAN integrates a 3-axis accelerometer for motion sensing, with optional disabling. It generates customizable acceleration alarms triggered by defined thresholds within a specified period.

Detected motion can prompt transitions between geolocation update periods with enabled by default Accelerometer Assist, ensuring timely tracking.

The accelerometer's output acceleration vector can also be periodically polled for orientation-based applications.

4 Basic Downlinks

The PELICAN uses a "tick" system for reporting data. Generally, the device will report the most important data every tick. A tick can be measured in seconds.

There are two sets of settings that must be configured in conjunction - "Core reporting tick in seconds" and "Ticks per [data/report]".

"Core reporting tick in seconds" will determine the interval between ticks. For example, you may set it to 30 seconds or 180 seconds (3 minutes) for each tick.

"Ticks per [data/report]" determines how many ticks it will take before the sensor reports any data. For example, if you set "Ticks per Battery report" to 2, it will take 2 ticks before the sensor reports battery data.

To Change the Core Report Frequency to Every Minute

With ATLAS: check the box for Core report tick in seconds and Tick per Temperature report. Write the values shown in the Figure 4-2 and click send.

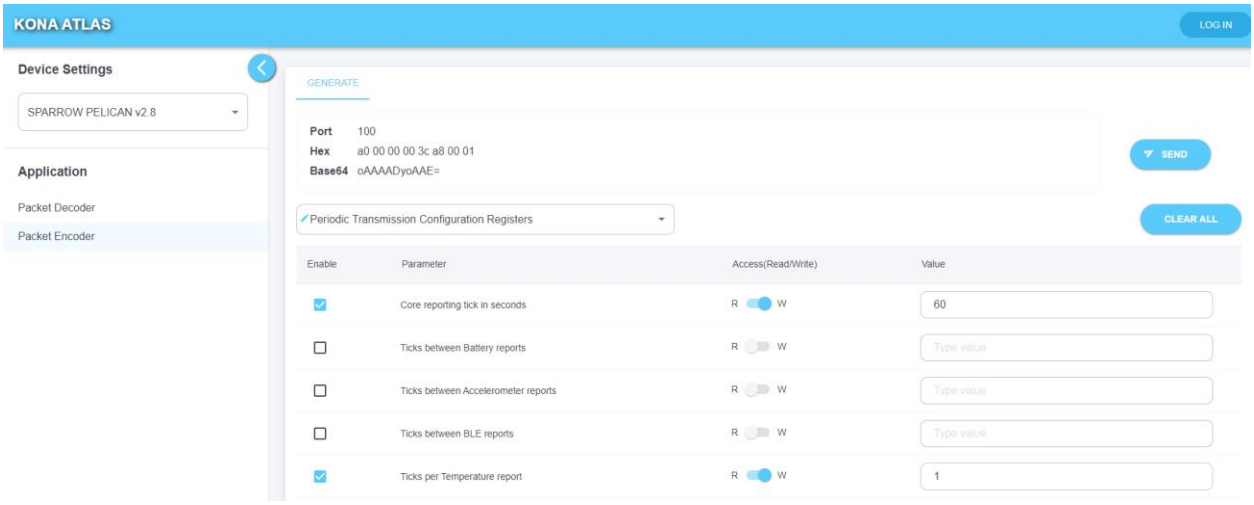

Figure 4-2: ATLAS

Examples Of Uplinks

Example 1


```
{
    "data": {
        "raw": "00 D3 25 00 BD 00 9E 00 67 00 DC",
        "fPort": 10,
        "rem_batt_capacity": 37,
        "rem_batt_days": 158,
        "temperature": "22.0"
    },
    "errors": [],
    "warnings": []
}
Example 2
{
    "data": {
        "raw": "0A 24 D2 93 49 C7 6F BB 72 51 7E 70 93 57 BA EC
0C 1D C4 9A 3E B6 61 61 CE FF 62 88 B2 C8 AF 28 20 7A 18 B2 4D
36 29 96 34 8D B1 4C 87 5D 78 56 87 B1 62 2C 97 68 87 5D B0",
        "fPort": 25,
        "basic_report": [
            {
                "BD_ADDR_0": "24 d2 93 49 c7 6f",
                "RSSI_0": -69
            },
            {
                "BD_ADDR_0": "72 51 7e 70 93 57",
                "RSSI_0": -70
            },
            {
                "BD_ADDR_0": "ec 0c 1d c4 9a 3e",
                "RSSI_0": -74
            },
            {
                "BD_ADDR_0": "61 61 ce ff 62 88",
                "RSSI_0": -78
            },
            {
                "BD_ADDR_0": "c8 af 28 20 7a 18",
                "RSSI_0": -78
            },
            {
                "BD_ADDR_0": "4d 36 29 96 34 8d",
```

```
                "RSSI_0": -79
            },
            {
                "BD_ADDR_0": "4c 87 5d 78 56 87",
                "RSSI_0": -79
            },
            {
                "BD_ADDR_0": "62 2c 97 68 87 5d",
                "RSSI_0": -80
            }
        ]
    },
    "errors": [],
    "warnings": []
}
```


View from Leapx

5 Device Configuration with ATLAS

To perform more configuration and read the data of the PELICAN device you can use TEKTELIC's complementary service ATLAS at www.atlas.tektelic.com.

There are two ways to access ATLAS:

1) using in Offline mode

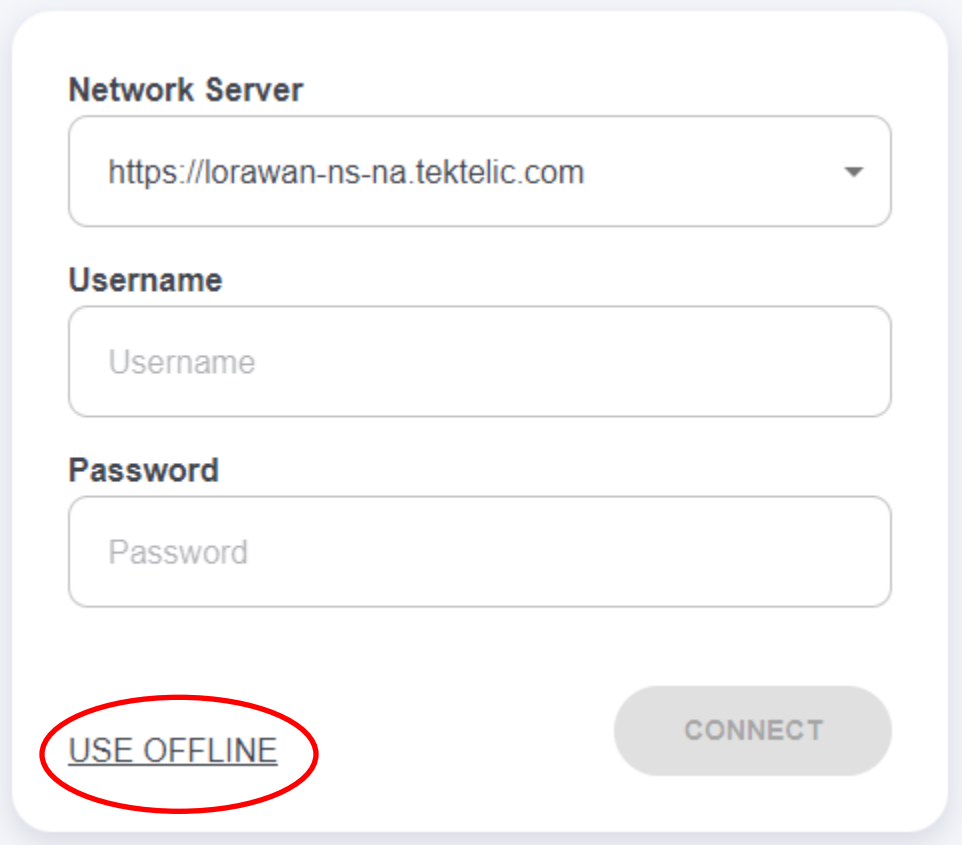

Figure 5-1 Login as offline mode

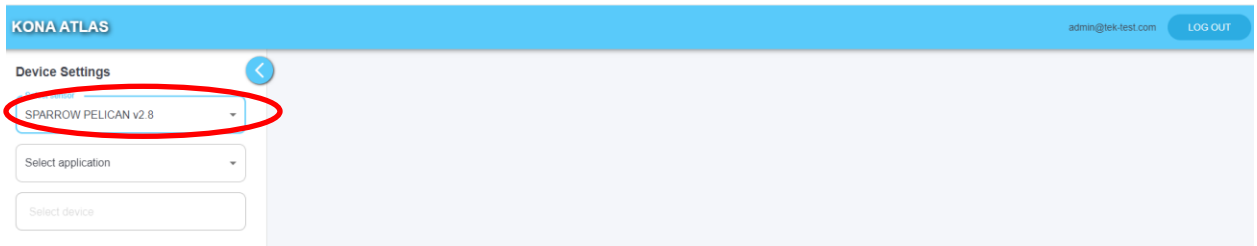

Figure 5-2 Select PELICAN decoder

2) with your TEKTELIC Network Server Credentials

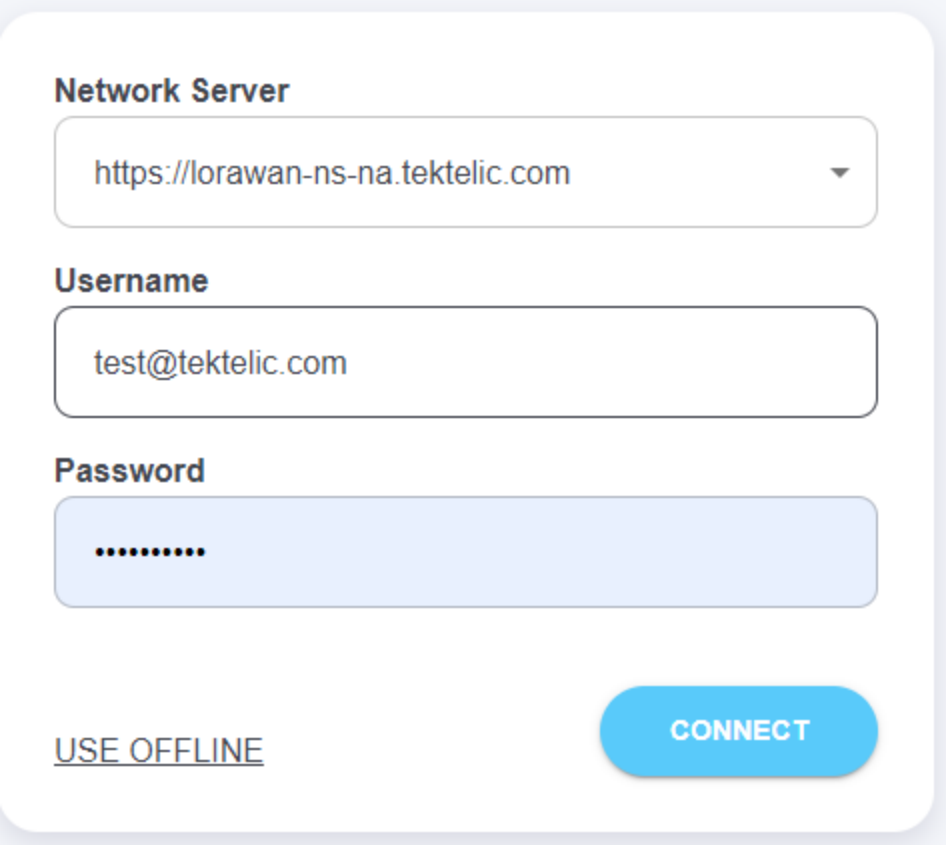

Figure 5-3 Login with Network server credentials

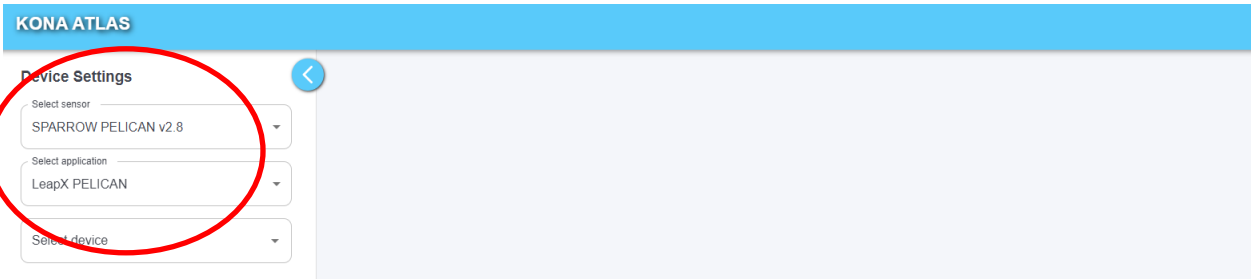

Figure 5-4 Select PELICAN Decoder, application and the device

6 Data converters

Please follow this link: https://github.com/TektelicCommunications/data-converters/tree/master for the data converters that are to be used on TEKTELIC & other Network Server for TEKTELIC Sensors. These data converters can be used as a reference for other platforms.

TEKTELIC's data converters conform to the LoRa Alliance Payload Codec Specification and can be used with any 3rd party Network Server / Application Server that supports this specification.

https://resources.lora-alliance.org/technical-specifications/ts013-1-0-0-payload-codec-api

7 Troubleshooting

Question	Answer
Why is the System LED rapidly blinking on my sensor?	While a sensor is not joined to a network it will continuously blink the System LED to indicate its unconnected status to the user. Ensure your LoRaWAN gateway is connected to your Network Server and verify the DevEUI, AppEUI and AppKey for the device.
Why does my LoRa LED blink periodically?	The LoRa LED indicates LoRa traffic being sent or received by the device. A short blink indicates the sensor has just transmitted, while a longer blink indicates the sensor has received a message.
How do I add my sensor to a Network Server?	Provisioning a sensor on a Network Server will vary based on your Network Server provider. An example of how to perform this on the TEKTELIC Network Server is available in your sensor's user manual. Most network server providers will require you to enter the DevEUI, AppEUI and AppKey of your device on their service.
What version of LoRaWAN do the sensors implement?	All TEKTELIC Sensor products run LoRaWAN 1.0.2
The serial numbers on my case are different from the serial numbers on the circuit board. Did my order get mixed up?	All TEKTELIC products have multiple serial numbers so we can track the devices at each stage of production. It is normal that your sensor board and sensor assembly have different numbers.
What can I find the commissioning values for my sensors? (DEVEUI, APPEUI and APPKEY)	We keep the commissioning values for each sensor secure on our own server. We send the commissioning values for each sensor sent with a shipment but if this was misplaced, please send the serial number the revision and the Tcode of the sensor and we can get the information for you.
Why is my sensor sending more packets than the Network Server receives?	This occurs when the channel plan does not reflect the number of channels accepted by the gateway. By default, all sensors come up in 64 channel mode which results in lost packets if a gateway with less than 64 channels is used. If you have an 8-channel gateway for example, ensure this is configured in the device settings in the Network Server. In the TEKTELIC NS under the "advanced network settings" tab change the configuration of the "default channel mask" to reflect the number of channels used by the gateway used.

8 Compliance Statements and Safety Precautions

8.1 Compliance Statements

Federal Communications Commission:

This device complies with Part 15 of the FCC Rules. Operation is subject to following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

To comply with FCC exposure limits for general population / uncontrolled exposure, this device should be installed at a distance of 20 cm from all persons and must not be co-located or operating in conjunction with any other transmitter.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an industrial installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Innovation, Science and Economic Development Canada (Industry Canada):

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s) [8]. Operation is subject to the following two conditions:

i. This device may not cause interference, and

ii. This device must accept any interference, including interference that may cause undesired operation of the device.

This device should be installed and operated with minimum distance 0.2 m from human body.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) L'appareil ne doit pas produire de brouillage.

(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet appareil doit être installé et utilise à une distance minimale de 0.2 m du corps humain.

California Proposition 65:

⚠ **WARNING:** This product can expose you to chemicals including lead, nickel, and carbon black, which are known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

8.2 Safety Precautions

The following safety precautions should be observed for all sensor variants:

- All installation practices must be in accordance with the local and national electrical codes.
- Replace only with approved batteries
- The following sensor variants are intended for indoor use only: T0006779, T0007380.
- The sensor contains a single LTC C-cell battery. When used correctly, lithium batteries provide a safe and dependable source of power. However, if they are misused or abused, leakage, venting, explosion, and/or fire can occur. The following are recommended safety precautions for battery usage.
  - **Keep batteries out of the reach of children.**
  - **Do not allow children to replace batteries without adult supervision.**
  - **Do not insert batteries in reverse.**
  - **Do not short-circuit batteries.**
  - **Do not charge batteries.**
  - **Do not force discharge batteries.**
  - **Do not mix batteries.**
  - **Do not leave discharged batteries in equipment.**
  - **Do not overheat batteries.**
  - **Do not weld or solder directly to batteries.**
  - **Do not open batteries.**
  - **Do not deform batteries.**
  - **Do not dispose of batteries in fire.**
  - **Do not expose contents to water.**
  - **Do not encapsulate and/or modify batteries.**
  - **Store unused batteries in their original packaging away from metal objects.**
  - **Do not mix or jumble batteries**

List of Acronyms

BER ..... Bit Error Rate
BLE..... Bluetooth Low-Energy
CNR..... Cahiers des charges sur les Normes Radioélectriques (RSS)
DL ..... DownLink
EOS ..... End Of Service
EU ..... European Union
FCC..... Federal Communications Commission
FW ..... FirmWare
HW ..... HardWare
IoT ..... Internet of Things
IP ..... Ingress Protection
ISM ..... Industrial, Scientific, and Medical
LED ..... Light-Emitting Diode
LoRa ..... Long-Range
LoRaWAN..... Long-Range Wide-Area Network
LoS..... Line-of-Sight
LTC..... Lithium-Thionyl Chloride
MCU ..... MicroController Unit
NA ..... North America
NS ..... Network Server
OTA ..... Over The Air
PCB ..... Printed Circuit Board
PCBA..... Printed Circuit Board Assembly
Rev ..... Revision
RF ..... RadioFrequency
RSS..... Radio Standards Specifications (CNR)
RSSI ..... Received Signal Strength Indicator
Rx ..... Receive, receiver, etc.
SW..... SoftWare
TRM..... Technical Reference Manual
Tx..... Transmit, Transmitter, etc.
UG ..... User Guide
UL ..... UpLink
US ..... United States
v..... Version

Document Revision

Revision	Issue Date	Status	Editor	Comments
0.1	May 4, 2021	Obsolete	Carter Mudryk	Initial draft based on full BLE Gen2 UG (including ATEX) T0006940_UG_v0.1
0.2	June 1, 2021	Obsolete	Maheeka Wijesinghe	Updated Lighthouse variants T0007296 and T0007381 to be indoor use only (non-IP67) as per CSA results.
1.0	June 11, 2021	Obsolete	Carter Mudryk	Corrected the default battery UL interval for Tundra sensors to 1 hour.
1.1	August 10, 2022	Released	Shawn Morrison	Corrected model T-code (T00006909 should be T00006906)
2.0	December 5, 2023	Draft	Carter Mudryk	• Updated to include only information relating to PELICAN and TUNDRA variants to reflect updated mechanical design. • Updated specifications. • Added information about the probe function. • Minor grammatical and formatting changes.
2.1	December 8, 2023	Released	Carter Mudryk	• Updated photos to reflect actual enclosure. • Minor grammatical and formatting changes.