

# KIWI/CLOVER AGRICULTURE SENSOR



## USER GUIDE

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# 1 Product Description

## 1.1 Overview

The KIWI and CLOVER sensors are multi-purpose LoRaWAN IoT sensors intended for Agricultural use. The models differ as follows:

- The “KIWI” model supports the connection of up to two temperature and two moisture probes, allowing for remote capture of soil data.
- The “CLOVER” model includes two integrated metal probes for contact measurement of soil data.

**NOTE:** This User Guide applies to all CLOVER module revisions and KIWI module revision H1 and above. For KIWI module revision H0 or below, please refer to user guide v2.2 available on the TEKTELIC Knowledge Hub.

Table 1 Presents the Agriculture Sensor models and their corresponding RF information.

**Table 1: Agriculture LoRa IoT Sensor Models**

| Product Code    | Description                            | RF Region                                              | Tx Band (MHz)      | Rx Band (MHz)      |
|-----------------|----------------------------------------|--------------------------------------------------------|--------------------|--------------------|
| <b>T0005986</b> | AGRICULTURE SENSOR, KIWI MODULE        | US 902-928 MHz (ISM Band)<br>EU 863-870 MHz (ISM Band) | 923-928<br>863-870 | 902-915<br>863-870 |
| <b>T0005982</b> | AGRICULTURE SENSOR, SOIL CLOVER MODULE | US 902-928 MHz (ISM Band)<br>EU 863-870 MHz (ISM Band) | 923-928<br>863-870 | 902-915<br>863-870 |

**Table 2: IoT Sensor Probe Options**

| Product Code    | Description                                                     |
|-----------------|-----------------------------------------------------------------|
| <b>T0009194</b> | 2-Probe option: 1 Temperature probe + 1 Watermark probe (1.5 m) |
| <b>T0009199</b> | 4-Probe option: 2 Temperature probe + 2 Watermark probe (1.5 m) |
| <b>T0009344</b> | 1.5 m Extension cable between Kiwi and Probe for extension      |

**NOTE:** The probe options listed in Table 2 apply **only to the KIWI** and must be **ordered separately**.

The main features of the KIWI and CLOVER are listed below. Each feature is available on both sensor models unless otherwise noted.

- **Temperature & Relative Humidity Sensor:** Reports temperature and relative humidity of the ambient environment.

**NOTE:** placing the unit in direct sunlight will result in the sensor reporting case temperature and relative humidity instead of true ambient conditions. Place the unit out of the sun for more accurate ambient temperature and relative humidity readings.

- **Accelerometer:** High-sensitivity device that can measure any shock or movement events. The primary purpose is to detect orientation change and report orientation change alarm.
- **Light Sensor:** reports the ambient light intensity measured in units of lux. Please review the [ambient light measurement application note available on our website](#).
- **Current Sense:** provides accurate battery life estimation in percentage and days remaining.
- **Analog thermistor probe – KIWI only:** Option to measure temperature using up to two external probes interfaced with the sensor.
- **Watermark Sensor probe – KIWI only:** Option to measure soil water tension using up to two external probes interfaced with the sensor. The Watermark is a resistive device that responds to changes in soil moisture. Once planted in the soil, it exchanges water with the surrounding soil thus staying in equilibrium. Soil water is an electrical conductor thereby providing a relative indication of the soil moisture status. As the soil dries, water is removed from the sensor and the resistance measurement increases. Conversely, when the soil is rewetted, the resistance lowers. The relationship of ohms of resistance to centibars (cb) or kilopascals (kPa) of soil water tension is constant.

The Watermark is calibrated to report soil water tension or matric potential, which is the best reference of how readily available soil water is to a plant. The raw data reported by the sensor for the watermarks is a frequency that increases as the watermark gets more saturated. Please refer to the [KIWI/CLOVER Technical Reference Manual \(TRM\)](#) for information on how to convert the frequency to Soil Water Tension.

**NOTE:** The Watermark sensors need to be installed **wet** for best performance:

- immerse sensors halfway in water for 30 minutes in the morning, let dry until evening
- repeat the process in the evening: wet for 30 minutes, dry overnight
- wet again for 30 minutes the next morning, and let it dry until evening
- soak through the night and install **wet**

There are several things to note regarding installation depending on the use case for the Watermark sensor. Please review the installation and operations instructions available on our website: [CLOVER / KIWI - Application Notes](#).

- **CLOVER Probe – CLOVER only:** Option to measure soil moisture content and temperature. The probes work in a similar manner to the Watermark Sensor described above. There is no exchange of water with the surrounding soil. However, the probes simply measure how saturated and warm or cold the soil is and provides a frequency reading. Please refer to the [KIWI/CLOVER Technical Reference Manual \(TRM\)](#) for information on how to convert the frequency to Gravimetric Water Content.
- **MCU Temperature:** Reports temperature of the MCU.

## 1.2 Specifications

The KIWI and CLOVER specifications are listed in 3 below.

**Table 3: KIWI/CLOVER Specifications**

| Attribute                                    | Specification                                                                                                                                                           |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Use Environment                              | Indoor, Outdoor                                                                                                                                                         |
| Environmental Rating                         | IP67                                                                                                                                                                    |
| Operating Temperature                        | -20°C to 60°C                                                                                                                                                           |
| Storage Temperature for Optimal Battery Life | -40°C to 75°C                                                                                                                                                           |
| Operating Relative Humidity                  | 0%–100%, condensing                                                                                                                                                     |
| Storage Relative Humidity                    | 0%–100%, condensing                                                                                                                                                     |
| Size                                         | CLOVER Sensor: 120 mm x 90 mm x 58 mm<br>(H=161mm with probes)<br>KIWI Sensor: 120 mm x 90 mm x 47 mm                                                                   |
| Weight                                       | Soil CLOVER Sensor: 224g<br>KIWI Sensor: 220g (233g with mounting plate)                                                                                                |
| Power Source                                 | Battery powered: 1x C-cell Lithium Thionyl Chloride (LTC)<br>3.6V<br><br><b>NOTE:</b> If replacing the battery, please ensure it is inserted with the correct polarity. |
| Network technology/Frequency band            | LoRaWAN in multiple variants (see Table 1):<br>US 902-928 MHz, EU 863-870 MHz                                                                                           |
| Air Interface                                | LoRa                                                                                                                                                                    |

|                                                  |                                                                                                                                                         |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Battery Lifetime</b>                          | At least 10 years with a baseline use case: transmission at maximum power every 15 minutes at room temperature                                          |
| <b>Maximum Tx Power</b>                          | Up to 22 dBm                                                                                                                                            |
| <b>LED</b>                                       | Green: Joining the network activity<br>Red: LoRa TX or RX activity                                                                                      |
| <b>Sensing Functions</b>                         | ambient temperature, ambient humidity, ambient light, accelerometer, battery level, water tension, soil moisture, soil temperature, MCU temperature     |
| <b>Ambient Temperature</b>                       | $\pm 0.2^{\circ}\text{C}$ within temperature measurement range of $-40^{\circ}\text{C}$ to $125^{\circ}\text{C}^*$<br>Resolution: $0.1^{\circ}\text{C}$ |
| <b>Relative Humidity</b>                         | $\pm 2\%$ RH within temperature measurement range of $-0\%$ – $100\%$ , condensing*<br>Resolution: $0.1\%$                                              |
| <b>Ambient Light Intensity</b>                   | 0 to 65,535 lux<br>Resolution: 1 lux                                                                                                                    |
| <b>MCU Temperature</b>                           | $\pm 5^{\circ}\text{C}$ within temperature measurement range of $-40^{\circ}\text{C}$ to $85^{\circ}\text{C}^*$<br>Resolution: $1^{\circ}\text{C}$      |
| <b>Soil Moisture, Input 1<sup>1</sup></b>        | $\pm 1$ kHz between 1322 kHz – 1402 kHz (120% GWC – 0% GWC)<br>Resolution: 1 kHz, 10% GWC                                                               |
| <b>Soil Temperature, Input 2<sup>1</sup></b>     | $\pm 2^{\circ}\text{C}$ within $-15^{\circ}\text{C}$ to $+60^{\circ}\text{C}$<br>Resolution: $0.1^{\circ}\text{C}$                                      |
| <b>Input 3 &amp; 4 as thermistor<sup>2</sup></b> | $\pm 2^{\circ}\text{C}$ within $-15^{\circ}\text{C}$ to $+60^{\circ}\text{C}$<br>Resolution: $0.1^{\circ}\text{C}$                                      |
| <b>Input 3 &amp; 4 as onewire<sup>2*</sup></b>   | $\pm 0.5^{\circ}\text{C}$ within $-10^{\circ}\text{C}$ to $+85^{\circ}\text{C}$<br>Resolution: $0.1^{\circ}\text{C}$                                    |
| <b>Watermark (Input 5 &amp; 6)<sup>2*</sup></b>  | $\pm 1$ kPa within 0 to 239 kPa<br>Resolution: 1 kPa                                                                                                    |

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<sup>1</sup> Applicable to CLOVER only

<sup>2</sup> Applicable to KIWI only

\*From the manufacturer datasheet.

## 2 Installation

### 2.1 Included Product and Installation Material

The following items are shipped with each sensor:

- LoRa IoT Agriculture Sensor
- LTC C-cell battery installed in the sensor
- KIWI cable assembly (if applicable)

**NOTE:** A magnet is required to wake up the sensor from state of DEEP SLEEP the sensor is shipped in. TEKTELIC does NOT provide this magnet in the sensor packaging.

Suggested magnet:

- Type: Sintered Ferrite Magnet
- Specification:
  - Residual Magnetic Flux Density = 3800-3900 Gauss
  - Grade:
    - Grade 5 (Grade Y30) or
    - Grade 8 (Grade Y30H-1)

### 2.2 Safety Precautions

The following safety precautions should be observed:

- The Agriculture Sensor is not a toy, PLEASE KEEP AWAY FROM CHILDREN.
- Use only the specified Lithium Thionyl Chloride (LTC) C-cell batteries.
- Do not exceed the maximum specified terminal voltages.
- All installation practices must be in accordance with the local and national electrical codes.
- Sensor inputs do not provide electrical isolation between each other.

### 2.3 Unpacking and Inspection

The following should be considered during the unpacking of a new Agriculture Sensor:

- Inspect the shipping carton and report any significant damage to TEKTELIC.
- Unpacking should be conducted in a clean and dry location.

- Do not discard the shipping box or inserts as they will be required if a unit is returned for repair or re-configuration.

## 2.4 Equipment Required for Installation

The following tools are required to install the Agriculture Sensor:

- Torx T10 screwdriver (8 x enclosure screws)

## 2.5 Commissioning

Each sensor has a set of commissioning information that must be entered into the network server for the sensor 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 available online in the [Knowledge Base](#).

You can find the commissioning keys inside the box. If you don't have the box, please raise a ticket in our support portal and provide the Tcode and serial number on the tag placed on the device.



Figure 1 Kiwi / Clover Commissioning Keys

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

## 2.6 Awakening Procedure from Deep Sleep Mode

**NOTE:** Early versions of the Agriculture Sensor were shipped with tape over the positive terminal of the battery. Therefore, if the wakeup pattern described below doesn't work, the battery should be checked, and tape removed if necessary.

The Agriculture Sensor is equipped with a magnetic reed switch. The reed switch can be operated by a magnet, and is used for the following purposes:



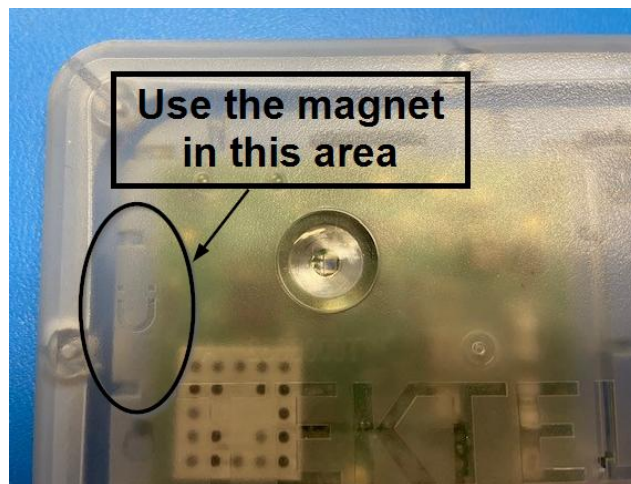
- 1) MCU reset upon observing a specified magnetic pattern:

**To activate/reset the device:**

- i. Place magnet for **3 to 10 seconds** against the enclosure at the magnetic activation site as shown in Figure 2 below.
- ii. Sensor activation will be displayed by **GREEN** and **RED** LEDs turning on.
- iii. Once activated, the sensor will automatically begin the join process.

**NOTE:** The sensor may take a few minutes to join the network for the first time due to the new battery firing up for the first time. This delay should not exceed 10 minutes.

The magnet sign is illustrated in Figure 2 below:



**Figure 2: Reed switch location**

- 2) Triggering the Agriculture Sensor to uplink by briefly applying a magnet to a magnet sign for up to 2 seconds.

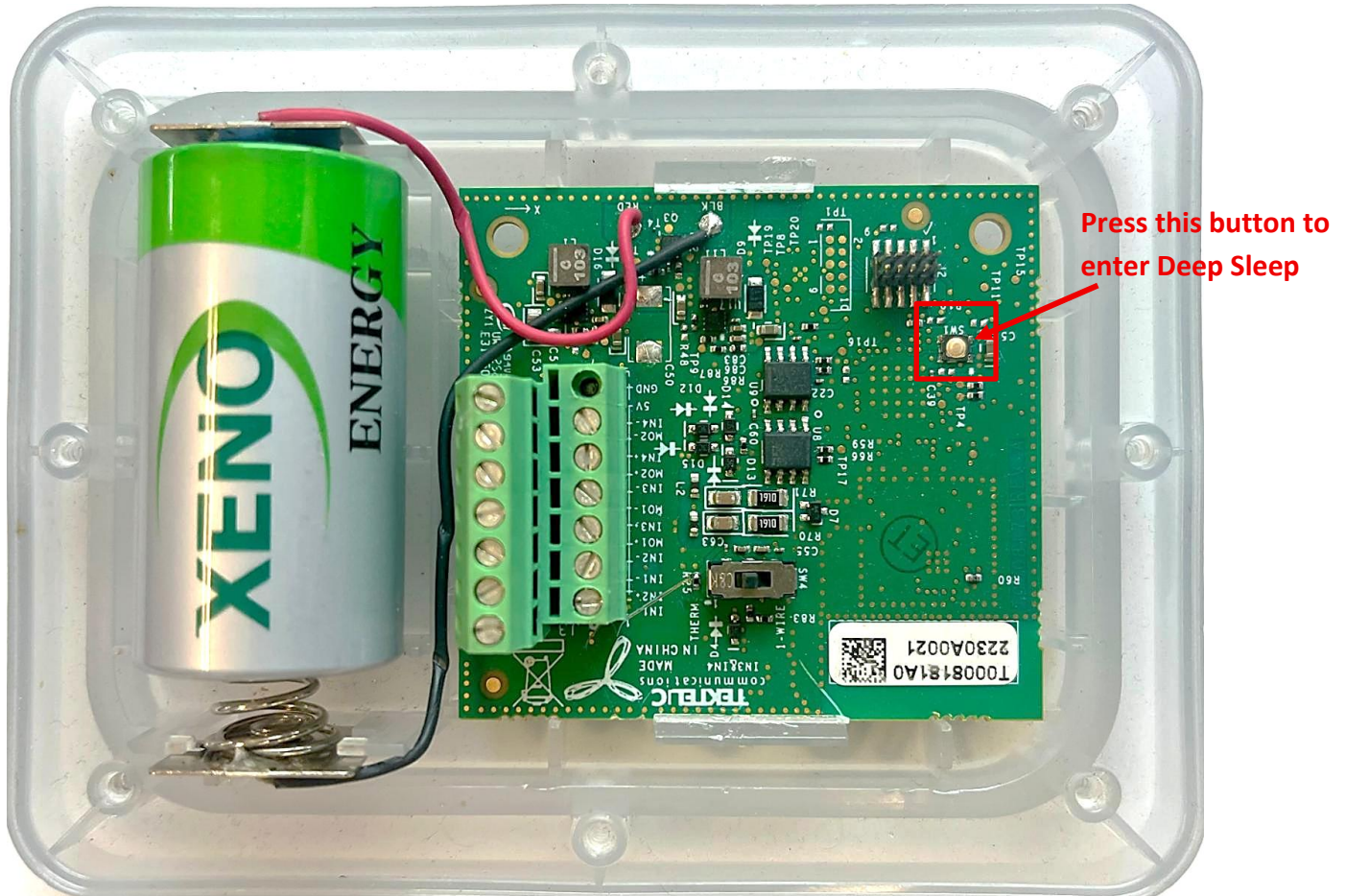
This is used to get the LoRaWAN Class-A Agriculture Sensor to open a receive window so it can receive DL commands from the NS, or simply to trigger the Agriculture Sensor to uplink some desired transducer data.

**NOTE:** Replacing the batteries does not cause the Agriculture Sensor to go to DEEP SLEEP. Once new battery is inserted, Sensor boots up and tries to join a LoRaWAN network.

## 2.7 Enter Deep Sleep Mode

To place the Agriculture Sensor into **Deep Sleep mode**, follow the steps below:

- 1) Remove the eight screws securing the enclosure lid and carefully open it to access the internal components.
- 2) Locate the **SW1** button on the **PCBA**, as shown in **Figure 3**.



**Figure 3: SW1 location**

- 3) Press and release the **SW1** button to enable **Deep Sleep Mode**.
- 4) Reattach the lid and secure it with the eight screws removed earlier.

## 2.8 KIWI Sensor Mounting

There is a mounting bracket on the bottom of the KIWI as seen in Figure . These mounting holes can be used to screw the enclosure to a solid surface. The recommended mounting screw size is M3 or #6. Mounting screws are not provided with the sensor.

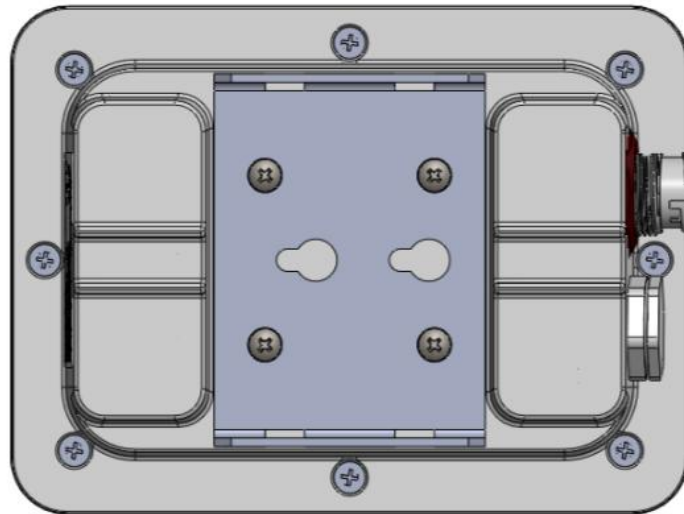


Figure 4: KIWI model showing the mounting holes.

The mounting surface must be capable of holding > 2 kg [4.5 lbs]. Clearance must be provided for the module's connector and input cable.

**NOTE:** To prevent **water ingress due to capillary action**, always install the device **above the probe**. This placement ensures **reliable and consistent performance** of the sensor.

## IMPORTANT: Preventing Water Ingress due to Capillary Action

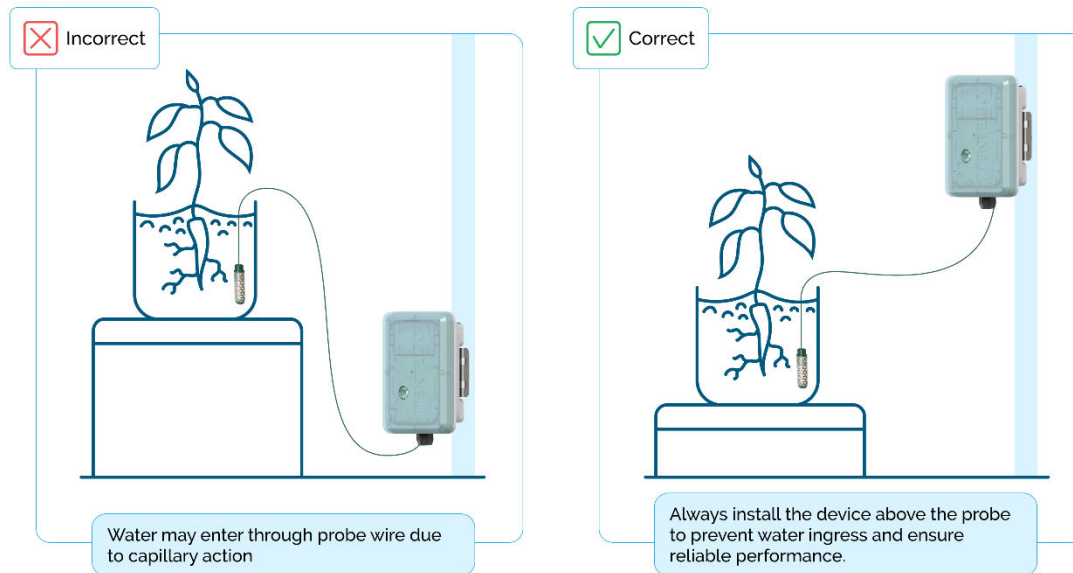


Figure 5: Preventing Water Ingress due to Capillary Action

## 2.9 Cable Installation

The KIWI Sensor enclosure has a connector compatible with the probe cable assemblies offered by TEKTELIC.

1. **Align the Notches:** Match the connector plug with the socket by aligning the key notches (Refer to Figure 6 and 7 for the connector notches).
2. **Insert Firmly:** Push the connectors straight together until fully seated. Do not twist during insertion.
3. **Secure the connection:** Rotate the outer locking ring (Spinning collar) clockwise until it clicks or tightens securely.
4. **Verify connection:** Gently tug to confirm its locked in place – it should not pull apart easily.



**Figure 6: Compatible Connector for Probe Cable**



**Figure 7: Probe Cable End**



**Figure 8: Probe Cable**

## 2.10 Default Configuration

### 2.10.1 Default Configuration for CLOVER

The default configuration of the **CLOVER** Sensor for reporting transducer readings includes the following:

**Table 4: Default Configuration - CLOVER**

| Parameter                             | Value         |
|---------------------------------------|---------------|
| Seconds per Core Tick                 | 900 (15 min)  |
| Ticks per battery voltage measurement | 96 (24-hours) |
| Ticks per Ambient Temperature         | 1 (15 min)    |
| Ticks per Ambient Relative Humidity   | 1 (15 min)    |
| Ticks per Soil Moisture               | 1 (15 min)    |
| Ticks per Soil Temperature            | 1 (15 min)    |
| Ticks per Ambient Light               | 1 (15 min)    |

### 2.10.2 Default Configuration for KIWI

The default configuration of the **KIWI** Sensor for reporting transducer readings includes the following:

**Table 5: Default Configuration - KIWI**

| Parameter                             | Value         |
|---------------------------------------|---------------|
| Seconds per Core Tick                 | 900 (15 min)  |
| Ticks per battery voltage measurement | 96 (24-hours) |
| Ticks per Watermark 1                 | 1 (15 min)    |
| Ticks per Watermark 2                 | 1 (15 min)    |
| Ticks per Ambient Light               | 1 (15 min)    |

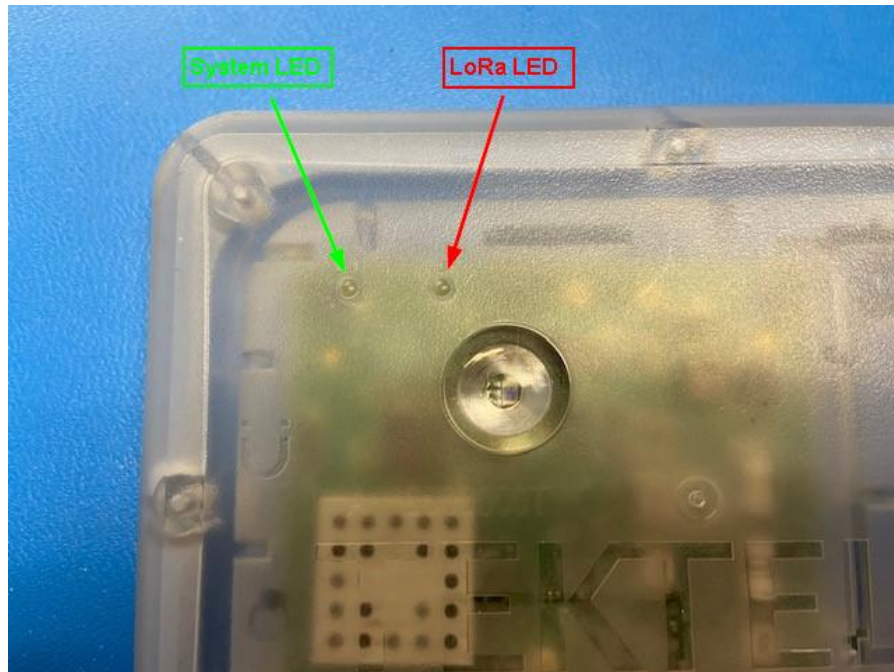
## 2.11 Reconfiguration

The KIWI and CLOVER support a full range of Over-the-Air (OTA) configuration options. Specific technical details are available in the [KIWI/CLOVER Technical Reference Manual \(TRM\)](#). All configuration commands need to be sent OTA during a sensor's downlink windows.

## 2.12 LED Behaviour

The LEDs are located on the top of the Agricultural Sensor.





**Figure 9: LED Location**

**Table 6: LED Behaviour**

| Situation            | LED Status                        | Description                                                                                                                                                                                                                                |
|----------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| During boot and join | Both LEDs briefly on              | Both LEDs come on briefly when power is first applied.                                                                                                                                                                                     |
|                      | LEDs turn off, one blinks briefly | After a small delay (< 1 second), the LEDs will turn off, and one of them will blink briefly.                                                                                                                                              |
|                      | System (green) LED blinks         | If the System (green) LED blinks, then all health checks on the board have passed.                                                                                                                                                         |
|                      | LoRa LED (red) blinks             | If the LoRa LED (red) blinks, then one of the health checks has failed. Consider replacing the battery, or moving the sensor to an environment within the temperature range.                                                               |
|                      | System LED blinks continuously    | Immediately after the delay, the join procedure will begin. During this time, the System LED will blink continuously until the sensor joins a network. Note that the device may take longer to join for the first wake-up from deep sleep. |
|                      | LoRa LED blinks for LoRa activity | The LoRa LED will now blink whenever LoRa activity occurs on the sensor (transmitting or receiving packets).                                                                                                                               |
|                      | LoRa LED blinks for LoRa activity | The LoRa LED will blink whenever LoRa activity occurs on the sensor (transmitting or receiving packets).                                                                                                                                   |

|                         |                     |                                                                      |
|-------------------------|---------------------|----------------------------------------------------------------------|
| During normal operation | System LED activity | The System LED can be controlled via the downlink command interface. |
|-------------------------|---------------------|----------------------------------------------------------------------|

## 2.13 Battery Replacement

Open up the Agriculture Sensor using a #10 Torx screwdriver. The Agriculture Sensor has 8x enclosure Torx screws at the bottom. Be careful not to misplace the silicone cover gasket from the top lid.

Replace the battery. The Agriculture Sensor accepts C-size, 3.6 V, LTC batteries. The allowed replacement batteries are as follows:

- Xeno Energy, part number: XL-145F
- Tadiran Battery, part number TL-4920/S
- Tadiran Battery, part number TL-5920/S

Once the Agriculture Sensor is powered and tries to join (see Table 6 in previous section for LED behavior), replace the cover and gasket. Make sure that the gasket is properly seated in the cover before placing on the Agriculture Sensor housing. Tighten the 8 cover screws to 2.5 lbf-in (30 N-cm).



### 3 Agriculture Sensors Types Functions

#### 3.1 CLOVER Enclosure

An illustration of the CLOVER Sensor in the enclosure can be seen Figures 10 and 11 below. The CLOVER Sensor houses two PCBA's which provide all the functionality required by the product.

**NOTE:** Ensure that the **humidity vent located on the side of the enclosure** is **not blocked** and that the device is installed in an area with **adequate airflow**.

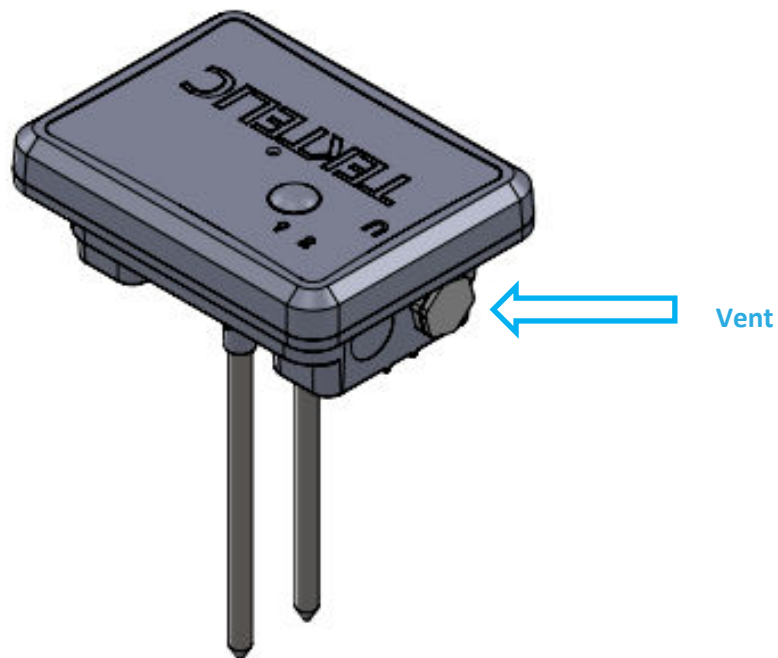


Figure 10: CLOVER Module - Exterior view

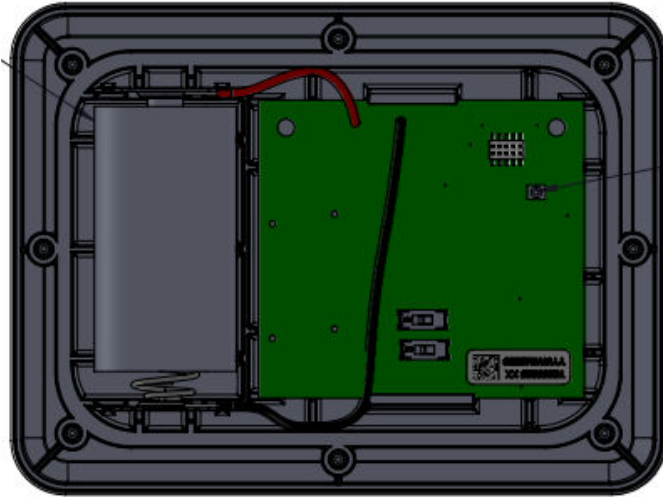


Figure 11: CLOVER Module – interior view

### 3.2 KIWI Enclosure

An illustration of the KIWI Sensor in the enclosure can be seen in Figures 12 and 13 below. The KIWI Sensor houses one PCBA which provides all the functionality required by the product.

**NOTE:** Ensure that the **humidity vent located on the side of the enclosure is not blocked** and that the device is installed in an area with **adequate airflow**.

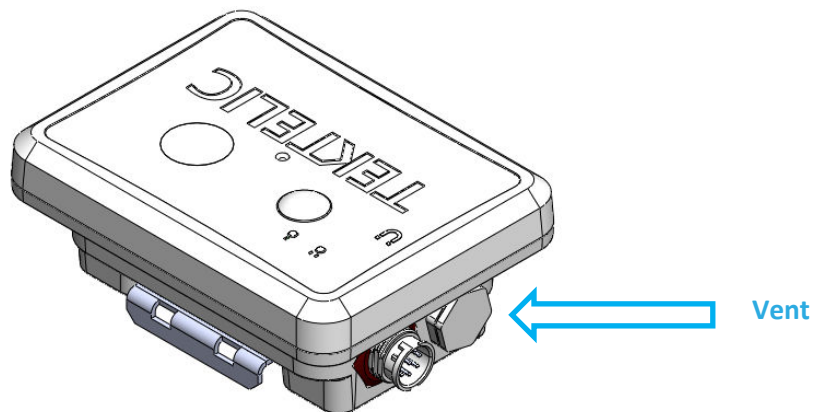
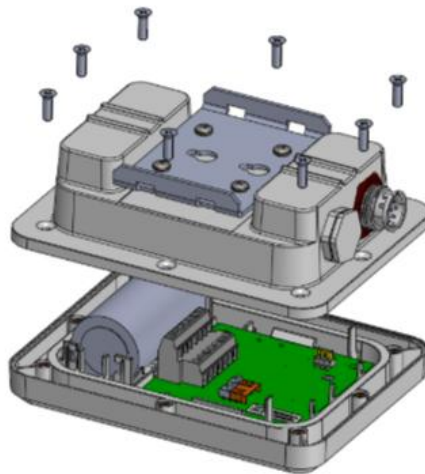


Figure 12: KIWI model – External View



**Figure 13: KIWI model – Internal View**

The enclosure, measured at 120 mm x 90 mm x 58 mm (H=161mm with probes) for the CLOVER model and 120 mm x 90 mm x 47 mm for the KIWI model, is a custom design by Tektelic. It is a water-tight enclosure that is modified to add a humidity vent, as well as a water-tight connector for external transducers.

The case is opened by removing the eight Phillips screws in the bottom of the enclosure and opening the lid allowing access to the power and input terminals.

The battery holder is adhered to the inside of the case lid and is a standard C-cell holder for an LTC battery. Replacement of the battery is accomplished by opening the lid as described above, replacing the cell in the holder, and securing the lid to the enclosure again.

## 4 Basic Downlinks

Agriculture Sensor uses a "tick" system for reporting data. Generally, the sensor will report 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 60 seconds or 180 seconds 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 To Every Minute

With LeapX application (available on [Google Play](#) or [App Store](#)): write number 1 in the field minutes between reports, then click on save changes.

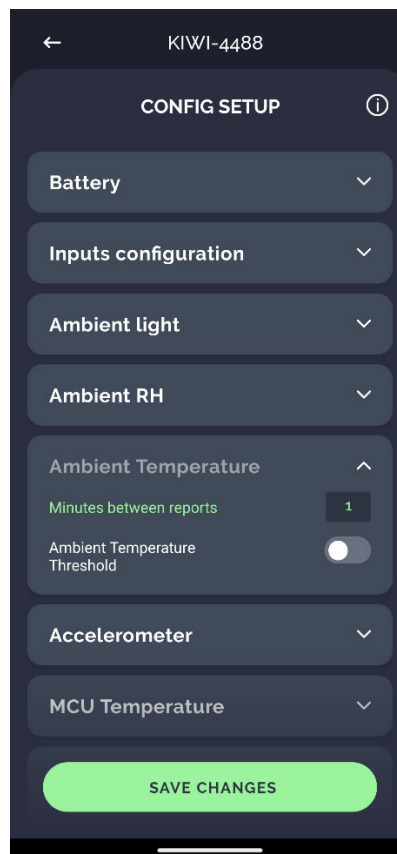


Figure 14: LeapX application

With ATLAS: check the box for Core report tick in seconds and ticks between ambient temperature reports. Write the values shown in the Figure 15 and click send.

**KONA ATLAS** LOG IN

**Device Settings**

KIWI CLOVER v2.0

**Application**

Packet Decoder

Packet Encoder

**GENERATE**

Port: 100

Hex: a0 00 00 00 3c a2 00 01

Base64: oAAADyiAAE=

SEND

✓ Ticks Configuration for Periodic Tx SAVE SETTINGS CLEAR ALL

| Enable                              | Parameter                                         | Access(Read/Write)                      | Value      |
|-------------------------------------|---------------------------------------------------|-----------------------------------------|------------|
| <input checked="" type="checkbox"/> | Sets the core tick in seconds for periodic events | R <input checked="" type="checkbox"/> W | 60         |
| <input type="checkbox"/>            | Ticks between Battery reports                     | R <input type="checkbox"/> W            | Type value |
| <input checked="" type="checkbox"/> | Ticks per Ambient Temperature                     | R <input checked="" type="checkbox"/> W | 1          |

Figure 15: ATLAS

## Examples Of Uplinks

- 0x 00 D3 5A 00 BD 0A 0A

0x 00 D3 (Remaining Battery Capacity) = (0x 5A) = 90 x 1% = 90%

0x 00 BD (Remaining Battery Days) = (0x 0A 0A) = 2570 x 1day = 2570days

0x 01 04 05 79 02 02 02 D5

0x 01 04 (Soil Moisture) = 0x 05 79 = 1401 x 1kHz = 1401 kHz

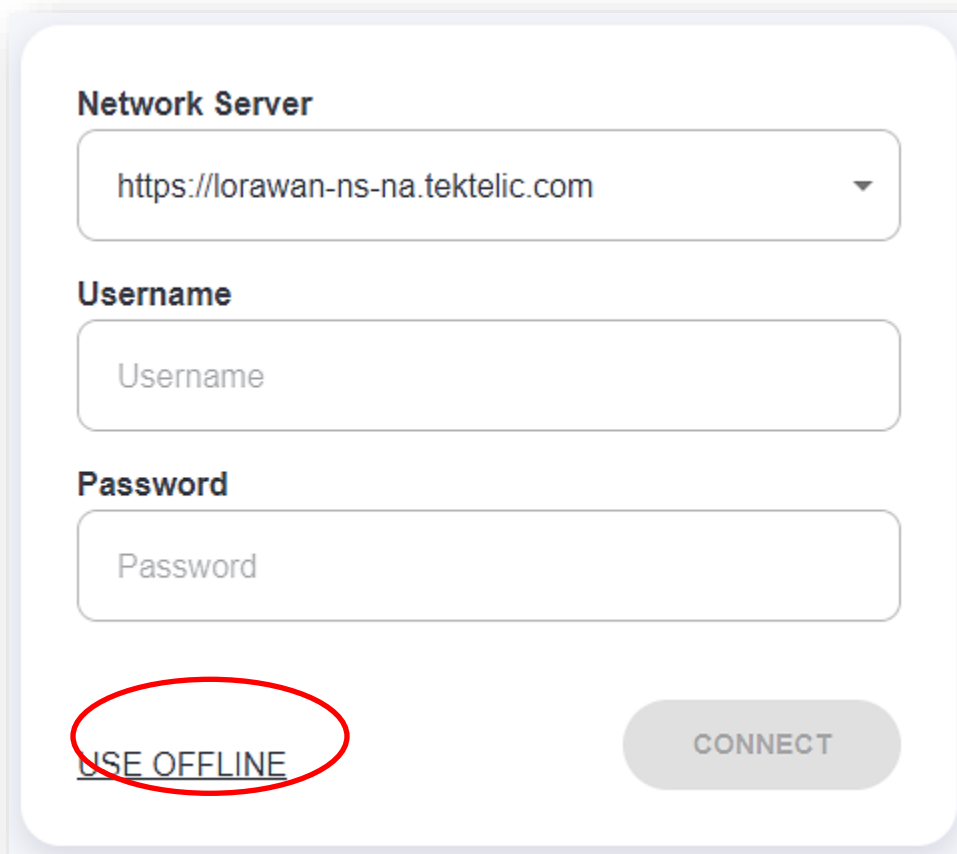
0x 02 02 (Soil Temperature) = 0x 02 D5 = 725 x 0.001V = 0.725 V

## 5 Device Configuration with ATLAS

To perform more configuration or read the data of device you can use TEKTELIC's complementary service, [ATLAS](http://www.atlas.tektelic.com) at [www.atlas.tektelic.com](http://www.atlas.tektelic.com).

There are two ways to access ATLAS:

1) Using in Offline mode



The screenshot shows a login form for the ATLAS service. It includes a 'Network Server' dropdown menu with the value 'https://lorawan-ns-na.tektelic.com'. Below this are input fields for 'Username' and 'Password'. At the bottom left, the text 'USE OFFLINE' is underlined and circled in red. To its right is a grey 'CONNECT' button.

Figure 16 : Login as offline mode

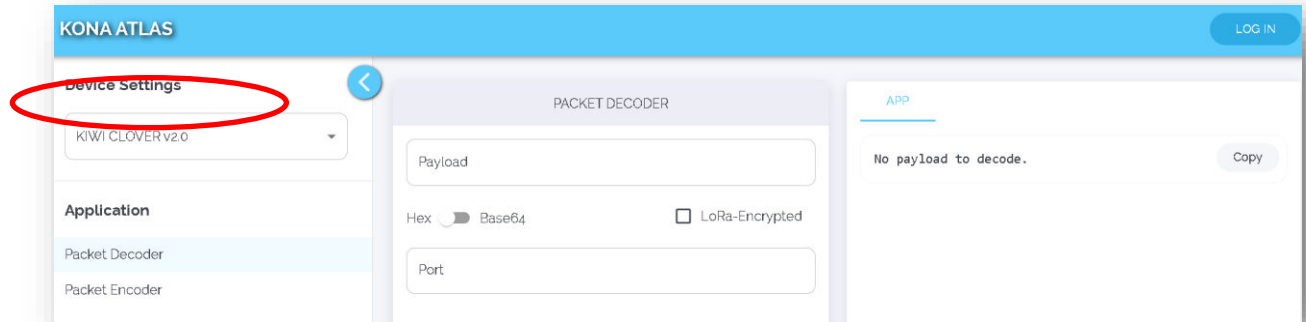


Figure 17: Select KIWI/CLOVER decoder

2) with your TEKTELIC Network Server Credentials

**Network Server**

https://lorawan-ns-na.tektelic.com

**Username**

test@tektelic.com

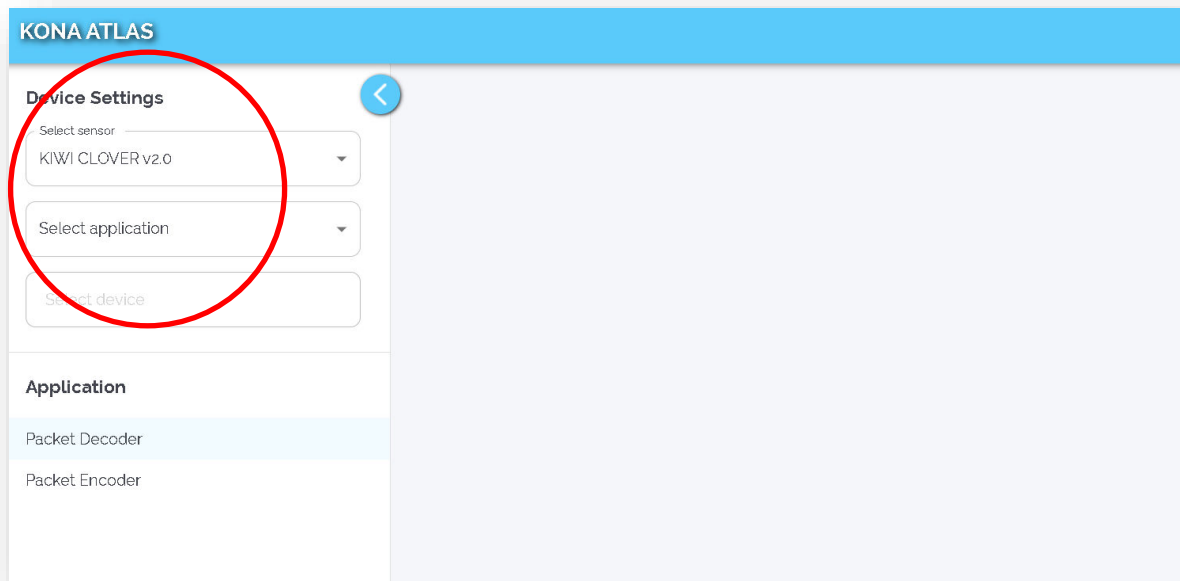
**Password**

.....

USE OFFLINE

CONNECT

Figure 18: Login with Network server credentials



**Figure 19: Select KIWI/CLOVER Decoder, application and the device**

For more information follow this link <https://knowledgehub.tektelic.com/kona-atlas>



## 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 3<sup>rd</sup> 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Why is the System LED rapidly blinking on my sensor?</b>                                                    | 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.                                                                                                                                                                                                                                                                                     |
| <b>Why does my LoRa LED blink periodically?</b>                                                                | 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.                                                                                                                                                                                                                                                                                                                                             |
| <b>How do I add my sensor to a Network Server?</b>                                                             | 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.                                                                                                                                                                                                                    |
| <b>What version of LoRaWAN do the sensors implement?</b>                                                       | The KIWI and CLOVER sensors use LoRaWAN 1.0.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>The serial numbers on the case and the circuit board don't match. Does this mean my order was mixed up?</b> | 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.                                                                                                                                                                                                                                                                                                                                                      |
| <b>Where can I find the commissioning values for my sensors? (DEV EUI, APP EUI and APP KEY)</b>                | 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.                                                                                                                                                                                                                                                       |
| <b>Why is my sensor sending more packets than the Network Server receives?</b>                                 | 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.       |
| <b>How do I power off the Agriculture Sensor (KIWI or CLOVER)?</b>                                             | <p>The sensor can only be completely powered off by removing the battery. However, the recommended method is to place the device into Deep Sleep mode instead of removing the battery when you wish to turn it off.</p> <p>Removing the battery resets the battery gauge, which may cause the sensor to treat the same battery as a new one when reinserted.</p> <p>To put the Agriculture Sensor into Deep Sleep mode, open the enclosure to access the internal sleep button (labeled SW1) on the PCBA, then press and release the button.</p> |

## 8 Compliance Statements

### Federal Communications Commission

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

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

- (1) This device may not cause interference.
- (2) 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 :

- a. L'appareil ne doit pas produire de brouillage.
- b. 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 utilisé à une distance minimale de 0.2 m du corps humain.

### **Proposition 65**

 **WARNING:** This product can expose you to chemicals including lead, nickel & carbon black, which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

## Document Revision

| Issue No. | Issue Date         | Status            | Author                     | Editor Comments                                                                                                                                                                                       |
|-----------|--------------------|-------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.1       | June 4, 2019       | Initial Draft     | Emma Tholl                 | First draft.                                                                                                                                                                                          |
| 0.2       | January 28, 2020   | Draft             | Mark Oevering              | Numerous updates<br>Updated part numbers in Table 1.                                                                                                                                                  |
| 0.3       | April 6, 2020      | Release candidate | Mark Oevering              | Updated document to new template.<br>Update to Compliance statement.                                                                                                                                  |
| 1.0       | April 16, 2020     | Release           | Mark Oevering              | Changes to naming convention for modules.                                                                                                                                                             |
| 1.1       | April 16, 2020     | Release           | Conor Karperien            | Updated table for default configuration.                                                                                                                                                              |
| 1.2       | April 20, 2020     | Release           | Mark Oevering              | Added note about using the sensor in direct sunlight.<br>Changed default configuration in Tables 3 & 4 as a result.<br>Added more detail about how soil moisture is measured between the two modules. |
| 1.3       | May 14, 2020       | Release           | Mark Oevering              | Refined statement about direct sunlight in overview section.<br>Change to magnetic wake-up pattern.                                                                                                   |
| 1.4       | May 27, 2020       | Release           | Zenon Herasymiuk           | Added battery polarity statement on Section 1.3                                                                                                                                                       |
| 1.5       | July 7, 2020       | Release           | Mark Oevering              | Added Watermark information in Overview section                                                                                                                                                       |
| 1.6       | July 22, 2020      | Release           | Mark Oevering              | Clarifications to table for Figure 3, Page 9                                                                                                                                                          |
| 1.7       | September 28, 2020 | Release           | Mark Oevering              | Added note regarding tape over battery for early versions of the Agriculture Sensor                                                                                                                   |
| 1.8       | December 16, 2020  | Release           | Mark Oevering              | Corrections to Table 2                                                                                                                                                                                |
| 1.9       | April 5, 2021      | Release           | Mark Oevering              | Added ALS range to Table 2                                                                                                                                                                            |
| 2.0       | May 05, 2023       | Release           | Adedolapo Adegboye         | Added Note on input 3 and 4 switches and possible delay after first wake up                                                                                                                           |
| 2.1       | 16 November 2023   | Release           | Adedolapo Adegboye         | Added disclaimer note in section 2.1 regarding activation magnet                                                                                                                                      |
| 2.2       | 28 June 2024       | Release           | Adedolapo Adegboye         | Added a section detailing basic downlinks<br>Added section for Kona Atlas<br>Added section for converters                                                                                             |
| 2.3       | November 11, 2025  | Draft             | Shania Stewart<br>Anu Kala | Updated Table references, and TRM links across the document<br>Added note in Section 1.1, 2.7, 2.8 and 3.2<br>Included Probe models in Table 2<br>Updated pictures in Sections 2.7, 2.8, 2.9, 3.2     |