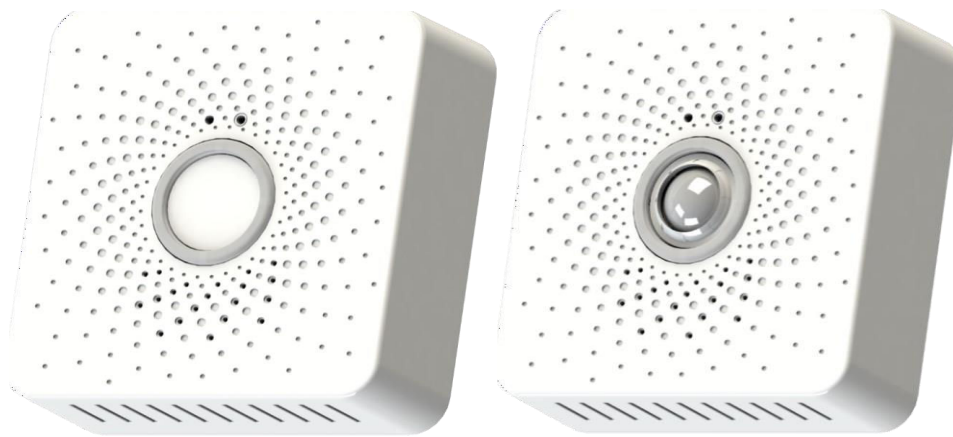


Breeze/Breeze-V



User Guide

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PROPRIETARY:

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1 Product Description

1.1 Overview

The Breeze/Breeze-V is a multi-purpose sensor packed into a very small form factor. The Sensor is ideal for monitoring and reporting CO₂ concentration, human motion (Breeze-V only), temperature, humidity, light, and barometric air pressure in an indoor environment.

The Sensor communicates with a 2.9" wireless e-Ink BLE Display, as shown in Figure 1, that allows to view real-time measurements including CO₂, temperature, humidity and the remaining battery capacity of the Sensor and Display.



Figure 1: Breeze with Display

Both variants are LoRaWAN-capable devices supporting Tx/Rx in the following frequency bands as specified in the LoRaWAN Regional Parameters: AS923, AU915, EU868, IN865, KR920, RU864, and US915. Devices operate in the 2.4 GHz band according to the BLE 5.2 specification.

Table 1-1 presents the features available in both functional variants (Breeze and Breeze-V).

Table 1-1: Transducers in Breeze/Breeze-V

Sensing Function	Sensor Model	
	Breeze (T0007838)	Breeze-V (T0007806)
Temperature	✓	✓
Relative Humidity	✓	✓
Light	✓	✓
Barometer	✓	✓
CO ₂	✓	✓
PIR		✓

Figure 2 illustrates the Breeze, Breeze-V enclosure.

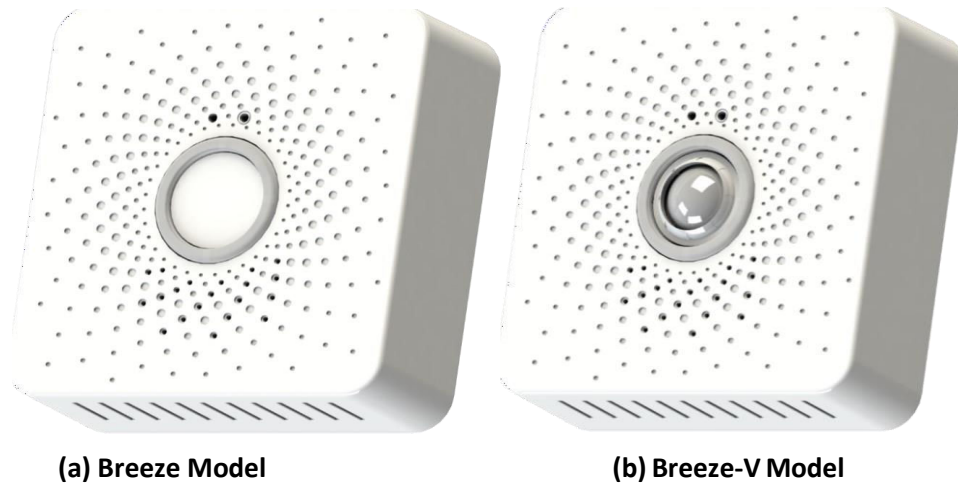


Figure 2: Breeze/Breeze-V Enclosures

Figure 3 shows the enclosure external interfaces for each model. Four indicator LEDs are present underneath the circular light pipe on the front of the enclosures. There are two push buttons accessible by pin through holes on the front of the enclosures. There are also air vents on the front of the enclosures and on two sides of the enclosure to provide adequate airflow for the CO₂ transducer. The enclosures are kept closed with 4 screws at the back. The PIR transducer is surrounded by a PIR mask located at the center of the enclosure for Breeze-V.

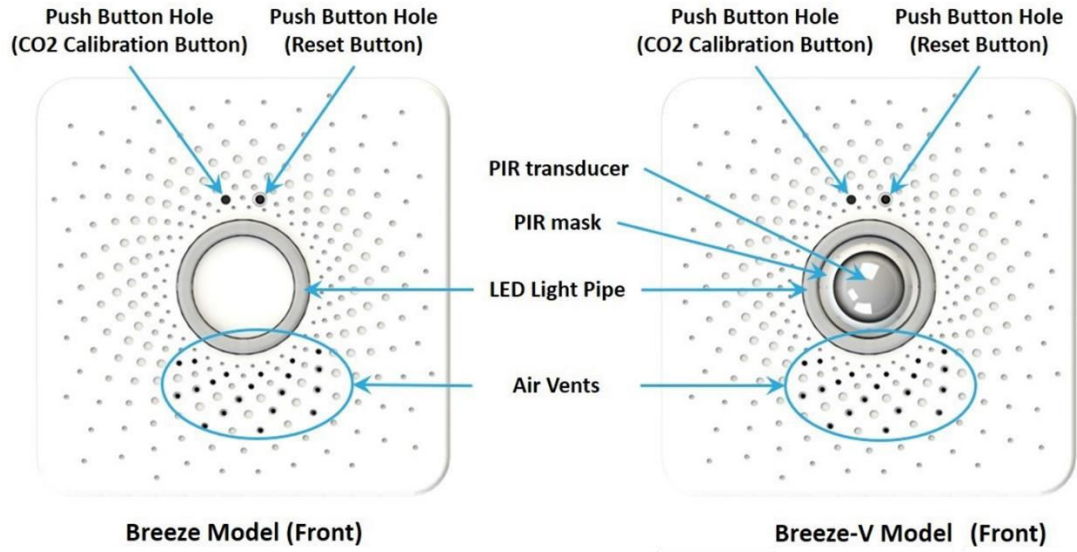
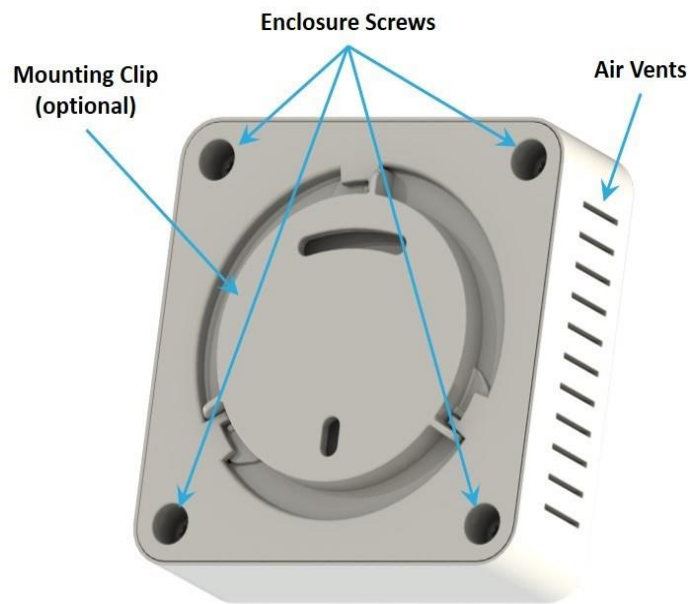


Figure 3: Breeze/Breeze-V External Interfaces



1.2 Specifications

The Breeze/Breeze-V specifications are listed in Table 1-2.

Table 1-2: Breeze/Breeze-V Specifications

Parameter	Specification
Use environment	Indoor commercial/residential only
Operating temperature	0°C to 60°C
Storage temperature	-40°C to 60°C
RH	5%–95%, non-condensing
Size	80 mm x 80 mm x 26 mm (without mounting clip) 80 mm x 80 mm x 30 mm (with mounting clip)
Weight	128 g (with battery)
Power source	Battery operated (2xAA), with diode-based reverse polarity protection.
Network technology/Frequency band	LoRaWAN with different regional variants and BLE operating in 2.4 GHz ISM frequency bands
Air interface	LoRa and BLE
Sensor Lifetime	With optimum settings and baseline use case: ¹ <ul style="list-style-type: none"> Breeze model > 6.0 years with 2xAA (3.6V) LTC batteries Breeze-V model > 5.0 years with 2xAA (3.6V) LTC batteries
Maximum transmit power	LoRa: 15 dBm BLE: 0 dBm
Number of indicator LEDs	4 (2 green, 1 yellow, and 1 red)
Measurement sensing functions	Temperature, humidity, light, pressure, CO2
Detection sensing functions	Human movement
Temperature measurement accuracy	< ±0.3°C between 0°C and 5°C ±0.2°C between 5°C and 60°C
Humidity measurement accuracy	< ±4% between 0% and 100% ±2% between 20% and 80%
Light sensitivity	Detects weak light to typical work light conditions (5 lux to 1000 lux) ² Peak sensitivity at 550 nm
Pressure measurement accuracy	< ±2.5 hPa between 300 hPa and 1100 hPa ±1.5 hPa at 750 hPa and 25°C
CO2 concentration measurement accuracy	±30 ppm +3% of reading between 400 ppm and 5000 ppm Extended range ±10% of reading for an extended range of up to 10,000 ppm ³
Motion detection	Pyroelectric infrared sensor Ceiling mount: <ul style="list-style-type: none"> X-angle: 104° (no mask) Y-angle: 104° (no mask) Height: 3 m (no mask)

¹ Baseline use case assumes room temperature, LoRa Tx power of 15 dBm, LoRa SF 10, and LoRa BW of 125 kHz. Optimal battery settings use the default report settings and with dynamic reporting mode enabled. (Only after the device receives a timestamp from the Network Server, it will begin operating in dynamic reporting mode). PIR motion detection is assumed to be very frequent during active hours (Device reports every 5 minutes from 9AM-5PM, Monday to Friday) and very infrequent during inactive hours (Device reports once an hour, 5PM-9AM, Monday to Friday as well as all day

Saturday and Sunday).

If the device does not receive a timestamp within 15 minutes of being turned on, the device will not enter dynamic reporting mode, so by default it will report every 5 minutes, regardless of time and day.

² The sensor provides light intensity measurements, that not calibrated in lux. See the [TRM Document](#) for more details.

³ No data available from manufacturer on performance outside the range of 15°C to 35°C and 0% to 80% RH.

1.3 Transducer Details

1.3.1 Temperature/Humidity Transducer

The Breeze/Breeze-V includes a combination temperature/humidity transducer, and operates from 0% to 100% RH and -40°C to 125°C with a typical accuracy of $\pm 2\%$ RH and $\pm 0.2^\circ\text{C}$. The typical and maximum accuracies specified across the operating relative humidity and temperature range of the sensor are shown in Figure 4 and Figure 5, respectively.

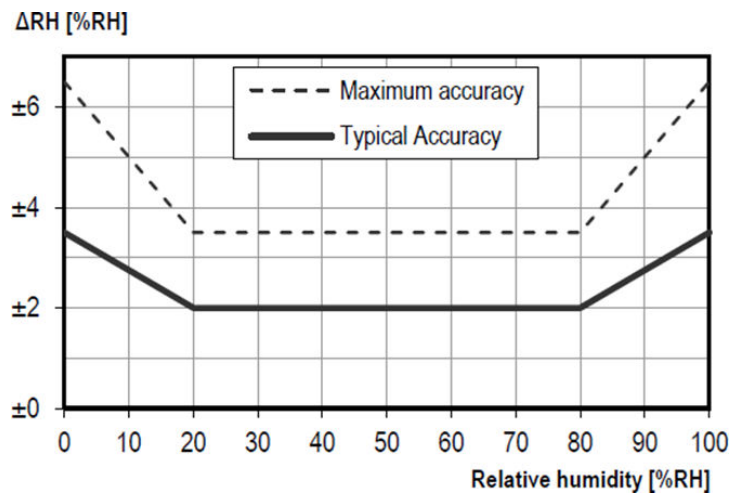


Figure 4: The typical and maximal tolerance for %RH at 25°C

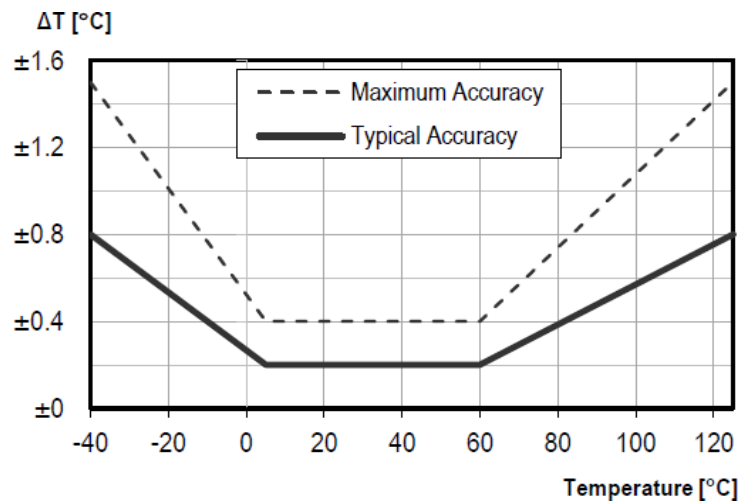


Figure 5: The typical and maximal tolerance for the temperature transducer at 25°C

1.3.2 Ambient Light Transducer

A phototransistor and bias resistor form a light detection transducer on the Breeze/Breeze-V. The light sensor provides a sufficient window of detection to allow detection of desired light levels; includes a light filter to give a response similar to the human eye and is capable of detecting weak light to typical work light conditions.

1.3.3 Barometer

A barometer is included in the Breeze/Breeze-V in order to measure the barometric air pressure, supports low power applications while providing highly accurate measurements. The barometer can operate over a range of 10 hPa to 1200 hPa. The typical pressure accuracy of the barometer is given as ± 1.5 hPa at 25°C and 750 hPa, while the error band (representing the worst-case accuracy) is ± 2.5 hPa between 300 hPa and 1100 hPa while operating between -20°C and 85°C. The barometer supplies measurements to the CO₂ transducer in order to pressure compensate the CO₂ concentration for improved accuracy to the current environmental conditions.

1.3.4 CO₂ Transducer

The Breeze/Breeze-V measure the CO₂ concentration using non-dispersive infrared (NDIR). It can measure in the range of 400 ppm to 5000 ppm with an accuracy of up to ± 30 ppm +3% of the reading. This sensor also features an extended range of up to 10000 ppm with a projected accuracy of extended range $\pm 10\%$ of the reading.

1.3.5 PIR Transducer

A motion detection feature on the Breeze/Breeze-V is implemented with a PIR sensor sensitive enough to detect small movements with a wide field of view of 104° x 104°.

2 Installation

2.1 Included Product and Installation Material

The following items are included with each sensor:

- A Breeze, Breeze-V
- e-Ink Display (if one is ordered with the Sensor)
- Mounting Bracket
- Quick start guide

2.2 Unpacking and Inspection

The following should be considered during the unpacking of a new Breeze/Breeze-V:

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 Breeze/Breeze-V Mounting

The Breeze/Breeze-V is supplied with mounting bracket. The bracket can be attached using two M3 screws appropriate for the material being mounted to or using double-sided tape when mounting within 2 m of the floor. (This ensures the device can endure a fall from that height in case the tape weakens over time) When mounting on a vertical surface, ensure that the Sensor will not be orientated with the case enclosure screws towards the ceiling. This could cause the Sensor to accidentally slip off the mount and fall. There are no orientation concerns when the Sensor is mounted to a horizontal surface.

2.4 Power Up/Down Procedure

Once the sensor information has been added to the Network Server, pull out the battery tabs to engage the battery. The batteries must be removed to turn off the device, but the external reset button can be pushed by a pin, such as a paper clip to simply reset the device; see [Section 4.4.2](#) for the description of the reset function.

3 Operations, Alarms, and Management

3.1 Configuration

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

3.2 Dynamic Reporting Configuration

If dynamic reporting mode is enabled, the default configuration of the Breeze/Breeze-V is as shown in Table 3-1. If dynamic reporting mode is not enabled, the Sensor will act as if it is exclusively in active mode. Dynamic reporting mode is not enabled by default. It is enabled if the device receives a timestamp from the network server less than 15 minutes after the device has been turned on. If not, the device will disable dynamic reporting.

Table 3-1: Breeze/Breeze-V Default Dynamic Reporting Behavior

Parameter	Report Destination	Default Reporting Frequency	
		During Active Mode	During Inactive Mode
Remaining Battery Capacity of the Sensor	NS and Display	Every 5 minutes	Every 1 hour
Remaining Battery Capacity of the Display	NS and Display	Every 5 minutes	Every 1 hour
Ambient Temperature	NS and Display	Every 5 minutes	Every 1 hour
Ambient Relative Humidity	NS and Display	Every 5 minutes	Every 1 hour
CO2 Concentration	NS and Display	Every 5 minutes	Every 1 hour
Pressure	NS only	Every 5 minutes	Every 1 hour
Motion (Breeze-V only)	NS only	Report motion after 1 PIR event Clear motion after 5 minutes of no motion	Report motion after 1 PIR event Clear motion after 5 minutes of no motion

3.3 LED Behavior

The Breeze/Breeze-V is equipped with four LEDs: two green (**G1** and **G2**), one yellow (**Y1**), and one red (**R1**). Figure 6 shows the placements of each LED relative to a user facing the Sensor for reference.

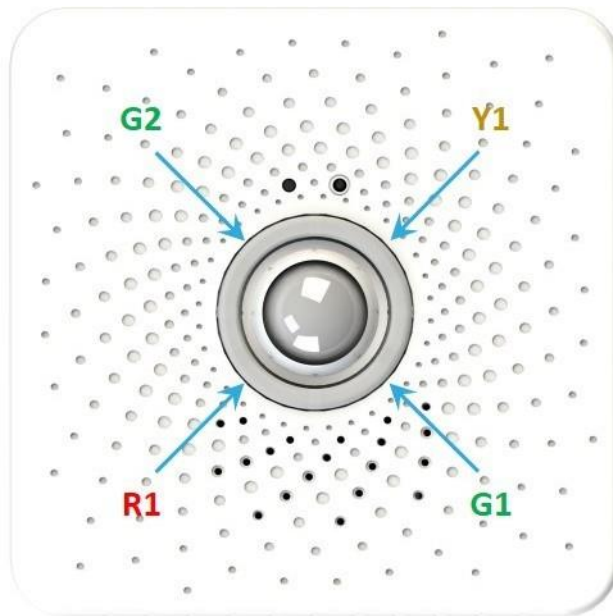


Figure 6: Breeze/Breeze-V With Marked LED Positions

During the join procedure:

- After the Sensor started the join procedure **Y1** will blink continuously until the sensor has joined a network.

During normal operation:

- **G1** will blink when the Sensor transmits or receives a LoRa packet.
- **G2** will begin to blink while the Sensor attempts to communicate with the Display.
 - **G2** will blink twice if the connection was successful.
 - **R1** will blink twice if the connection was unsuccessful.
- **Y1** will blink after the CO₂ calibration push-button is pressed and released.
 - **G2** blinks three times if any CO₂ calibration was successful.
 - **R1** blinks three times if any CO₂ calibration was unsuccessful.

3.4 Push-Button Functions

The Sensor includes two push buttons: one to manually calibrate the CO₂ transducer, and one to reset the Sensor. Figure 7 shows the location of the CO₂ calibration and reset buttons relative to a user facing the Sensor.

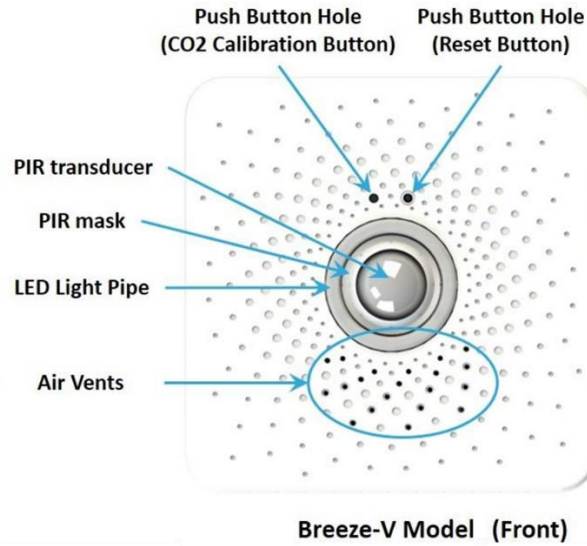


Figure 7: Breeze/Breeze-V With Marked LED Positions

3.4.1 CO₂ Calibration Button

The Sensor features a push-button that can be used to manually calibrate the CO₂ transducer when it is exposed to fresh air. The CO₂ calibration button must be pressed for 2 to 10 seconds, and 30 seconds after the button is released, the Sensor performs a background CO₂ calibration with a target of 400 ppm.

For optimal results, users should ensure that the Sensor is exposed to fresh air for several minutes before the calibration occurs. It is also recommended that users move away from the Sensor after pressing the button so as to reduce the risk of an inaccurate calibration. More information on how to calibrate the CO₂ transducer can be found in the [Technical Reference Manual](#).

3.4.2 Reset Button

There is a reset button on the device, that can be lightly pushed by a pin, such as a paper clip. The reset is instant, i.e., the button does not need to be kept pushed. The reset restarts the microprocessor. All the Firm ware load and configuration parameters in the Flash memory are remembered during the reset.

4 Applications

4.1 Breeze Application

This application is to track the level of CO2 in the facility and visualize the parameters without the need to check the display.

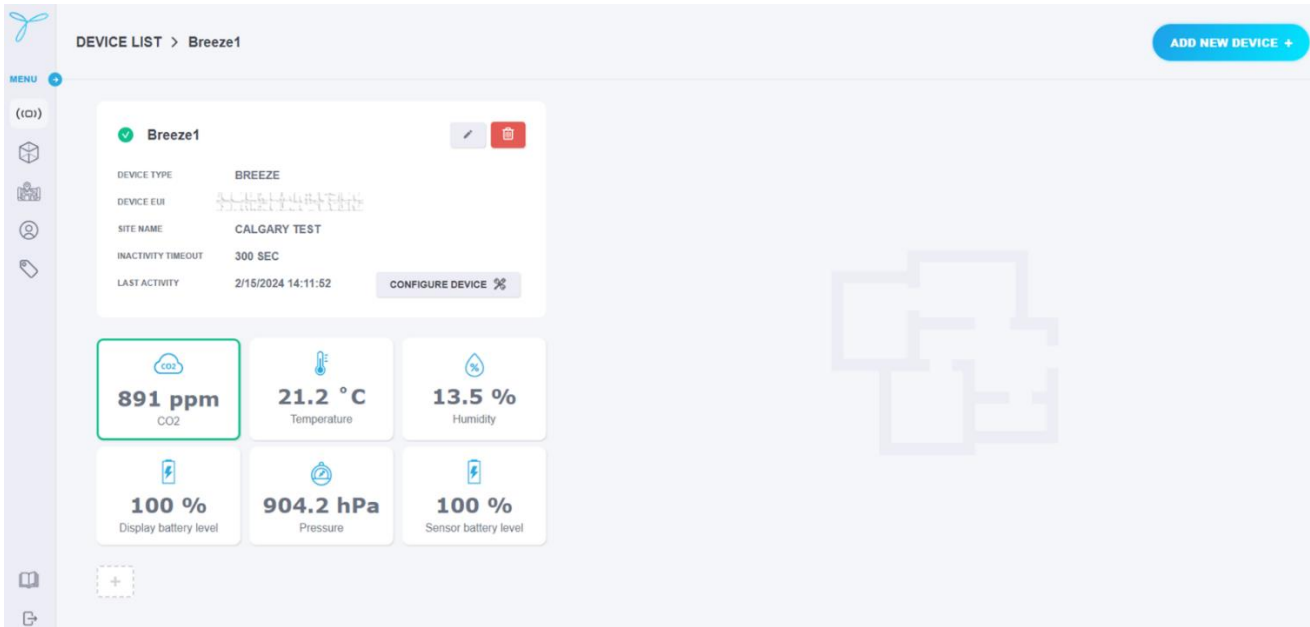


Figure 8 Breeze Web App

4.2 Basic Downlinks

Breeze uses a "tick" system for reporting data. Generally, the sensor will report most important data every tick. A tick is 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 (you can get it on [Google Play](#) or [App Store](#)): write number 1 in the field minutes between reports, then click on save changes.

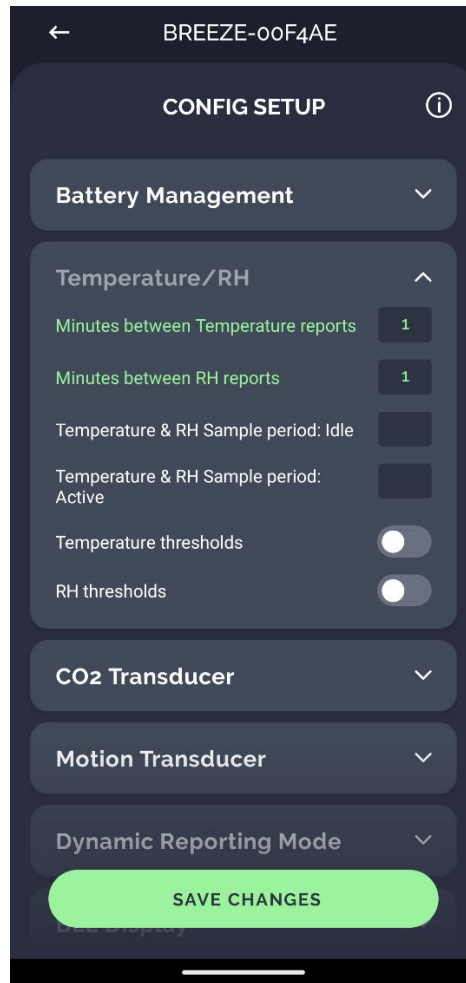


Figure 9 LeapX application

With [ATLAS](http://www.atlas.tektelic.com) (www.atlas.tektelic.com): check the box for Core report tick in seconds and ticks per temperature reports. Write the values shown in the Figure 10 and click send.

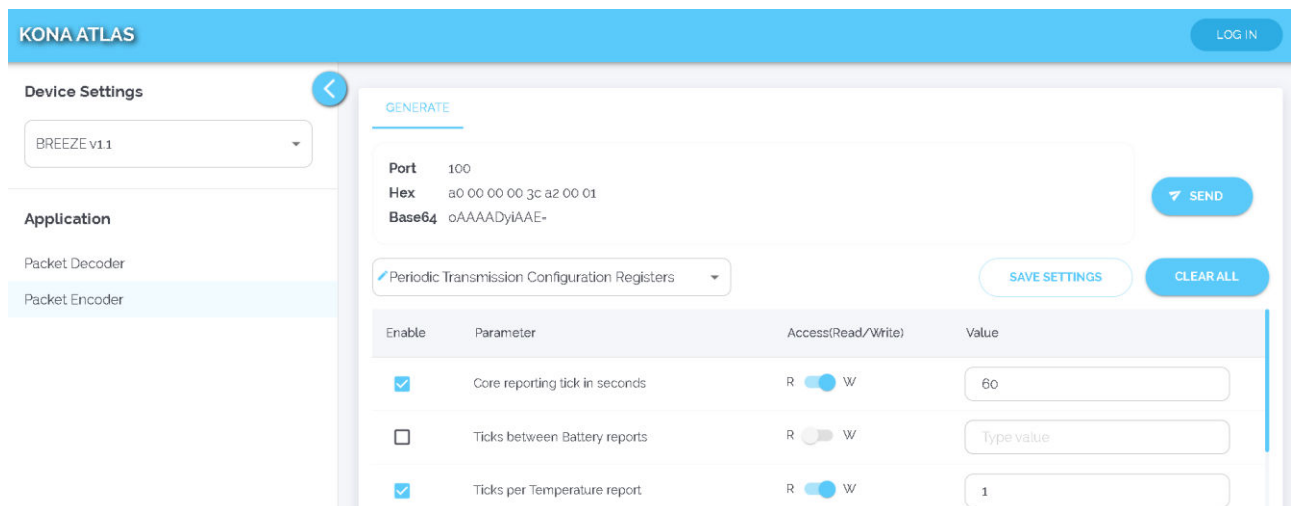


Figure 10 ATLAS

Examples Of Uplinks

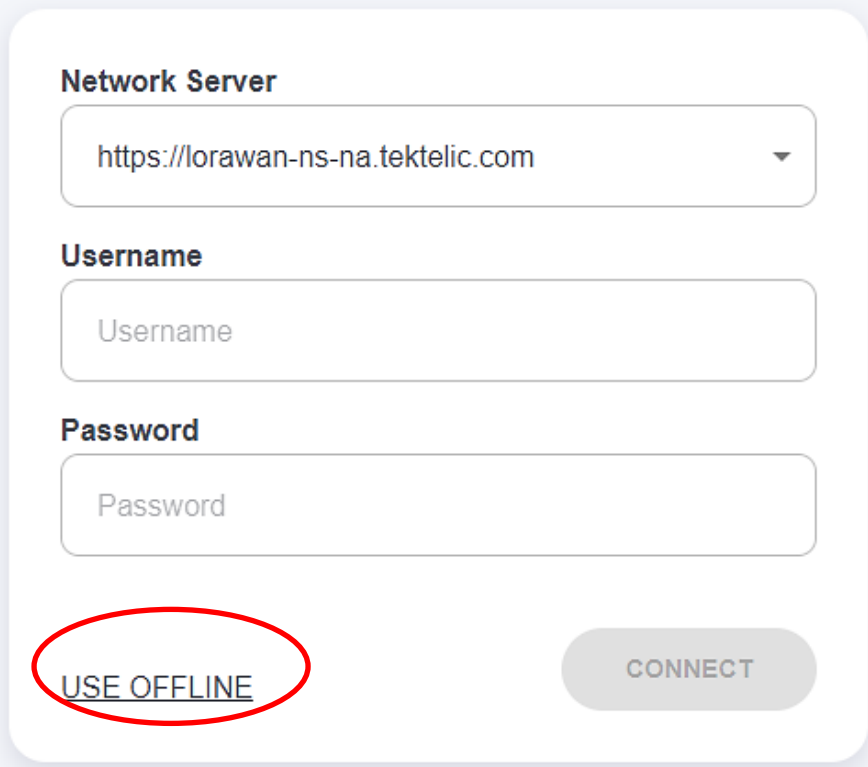
```
"data": {  
  "raw": "03 67 00 DA 04 68 3A 0B E4 01 B6 0C 73 23 36 00 BA 0E 54 00 D3 5C 11 D3 5C",  
  "fPort": 10,  
  "temperature": "21.8",  
  "relative_humidity": "29.0",  
  "co2_pressure_compensated": 438,  
  "barometric_pressure": "901.4",  
  "battery_voltage": "3.668",  
  "rem_batt_capacity_sensor": 92,  
  "rem_batt_capacity_display": 92
```

Device Configuration with ATLAS

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

There are two ways to access ATLAS:

1) Using Offline mode



The screenshot shows a login form for the ATLAS service. It includes a 'Network Server' dropdown menu with the URL 'https://lorawan-ns-na.tektelic.com'. Below this are input fields for 'Username' and 'Password'. At the bottom, there are two buttons: 'USE OFFLINE' and 'CONNECT'. The 'USE OFFLINE' button is circled in red, indicating the recommended method for access.

Figure 11 Login as offline mode

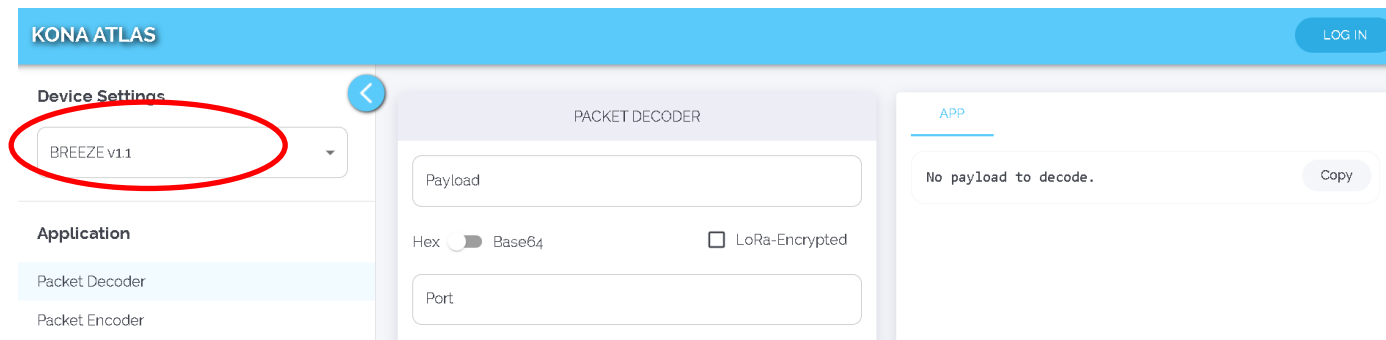


Figure 12 Select Breeze decoder

2) With your TEKTELIC Network Server Credentials

The image shows a login form for the TEKTELIC Network Server. It has three main input fields: 'Network Server' with the value 'https://lorawan-ns-na.tektelic.com', 'Username' with the value 'test@tektelic.com', and 'Password' which is masked with dots. Below the password field, there is a 'CONNECT' button and a link labeled 'USE OFFLINE'.

Figure 13 Login with Network server credentials

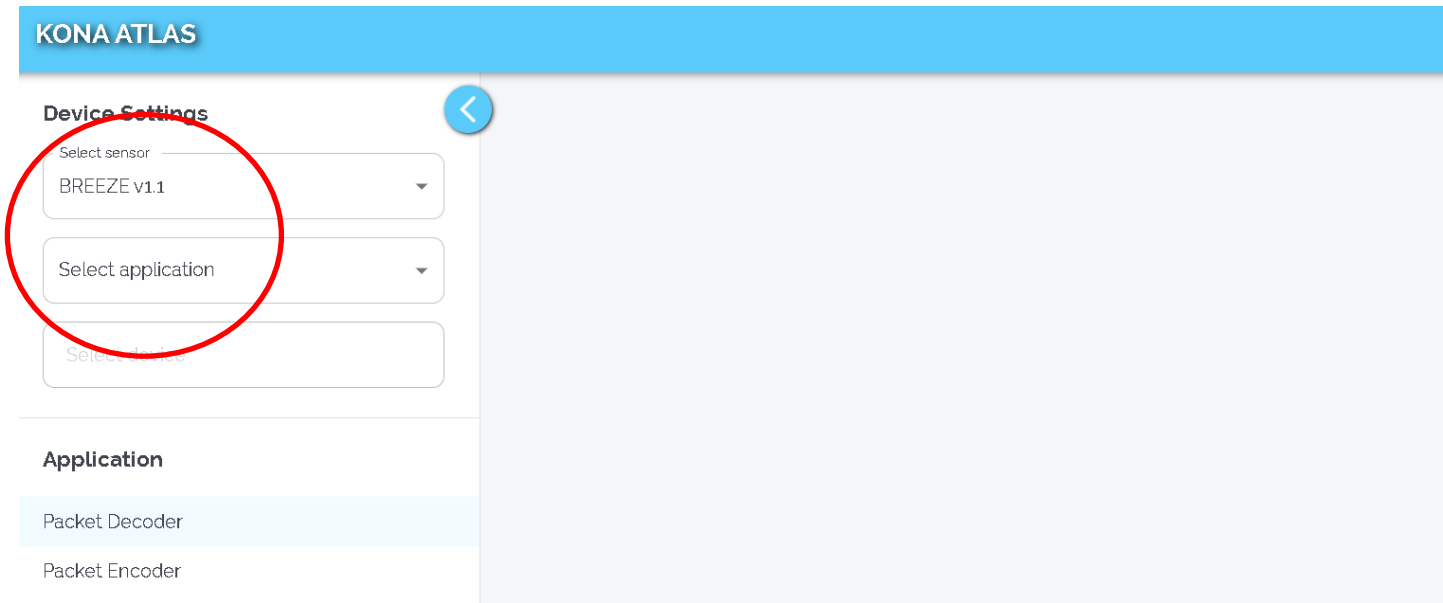


Figure 14 Select TUNDRA Decoder, application and the device

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

5 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>

6 Compliance Statements and Safety Precautions

6.1 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 B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential 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 licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-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:

- (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 utilisé 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.

6.2 Safety Precautions

The following safety precautions should be observed:

- The Breeze/Breeze-V is intended for indoor use only.
- The Breeze/Breeze-V contains lithium batteries.
- NEVER allow small children near batteries: if a battery is swallowed, immediately seek medical attention.
- To reduce risk of fire, explosion or chemical burns: replace only with approved 2xAA LTC batteries; DO NOT recharge, disassemble, heat above 100°C (212°F) or incinerate battery.

7 List of Acronyms

BLE	Bluetooth Low Energy
CO₂	Carbon Dioxide
EU	European Union
FCC	Federal Communications Commission
I²C or P²C	Inter-Integrated Circuit
IoT	Internet of Things
IP	Ingress Protection
ISM	Industrial, Scientific, and Medical
LoRa	Long-Range
LoRaWAN	Long-Range Wide-Area Network
LPWAN	Low-Power Wide Area Network
LTC	Lithium Thionyl Chloride
MCU	Microcontroller Unit
NA	North American
NS	Network Server
RF	Radio Frequency
Rx	Receive
SPI	Serial Peripheral Interface
Tx	Transmit

Document Revision

Revision	Issue Date	Status	Editor	Comments
1.0	March 16, 2022	Release	Shania Stewart	Release based on T0007525_UG_ver1.0.
1.1	March 22, 2022	Release	Shania Stewart	Removed "Confidential" from footers.
1.1	March 24, 2022	Release	Shania Stewart	Updated the product marketing name throughout the document.
1.3	August 5, 2022	Release	Shania Stewart	<ul style="list-style-type: none"> • Minor typo fixes. • Updated sensor mounting information. • Updated citations.
1.4	August 16, 2022	Release	Shania Stewart	Added mounting screw information
1.5	January 12, 2023	Release	Shania Stewart	<ul style="list-style-type: none"> • Minor corrections on technical information. • Added proposition 65 warning. • Updated citations
1.6	June 28, 2024	Release	Emma Tholl	<ul style="list-style-type: none"> • Added latest pictures • Added a section detailing basic downlinks • Added section for Kona Atlas • Added section for converters