SENSE NODE USER MANUAL

Temperature and Relative Humidity Monitoring Device

Abstract

Sense Node is the latest device designed by PTS Technologies for Poultry and Farm Data Monitoring. This device utilizes the LORAWAN Communication Protocol for transmitting Temperature and Relative Humidity Measurements.

UM0001
Document Code

Contents

1. Document overview

1.1. Introduction

This document and the contents hereof are considered proprietary and confidential information of PTS Technologies Pte Ltd. Disclosure to unauthorized individuals or dissemination, publication, or copying is prohibited without the prior written consent of PTS Technologies Pte Ltd.

1.2. Version History

Version	Date	Description
1.0	22-04-2019	Initial release
1.1	28-12-2020	Remove QR Code Update Specifications

1.3. Purpose

The purpose of this document is to guide users on how to use and deploy LoRaWAN Sense Nodes.

1.4. Scope

This document will mainly focus on LoRaWAN Sense Node and its implementation as a Poultry and Livestock Data Monitoring device.

1.5. Definitions, Acronyms, and Abbreviation

Term	Description
LoRaWAN™	A MAC protocol for high capacity, long-range star network that the LoRa Alliance is standardizing for Low Power Wide Area Networks (LPWAN).
LoRa® Gateway	Designed to be used in long-range star network architectures and are utilized in a LoRaWAN™ system. Also known as LoRa® Concentrator.
TRH Sensor	Temperature and Relative Humidity sensing component integrated into the LoRaWAN Sense Node.
OTAA	Over-the-Air activation method.
DevEUI	Device EUI is the unique ID of the LoRaWAN sense node.
AppEUI	Application EUI is the unique ID of the Application Server.
AppKey	The AppKey is the encryption key between the source of the message (behind the DevEUI) and the destination of the message (behind the AppEUI).

2. Product Description

2.1. General Description

The PTS LoRaWAN Sense Node is a device that measures Temperature & Relative Humidity and transmits the data to a Gateway through LoRaWAN Communication Protocol. This device can be paired with an existing LoRaWAN network.

The device transmits the data measured from the TRH (Temperature and Relative Humidity) sensor at a fixed interval. This device will greatly help the users that need to remotely monitor the environmental conditions of their poultry sheds.

2.2. System Operation

The entire system is composed of the following:

Hardware:

1. LoRaWAN Sense Node – collects temperature measurement and transmits the data to the gateway periodically.
2. Gateway – receives the data from LoRaWAN Sense Node. This gateway can receive data from any LoRaWAN enabled device.

Software:

1. Network Server – authenticates data received by the gateway. If data is addressed to Network Server, data is processed and will be forwarded to Application Server.
2. Application Server – decrypts the data from Network Server.
3. Web Dashboard – a visual representation of the data decrypted by the Application Server.
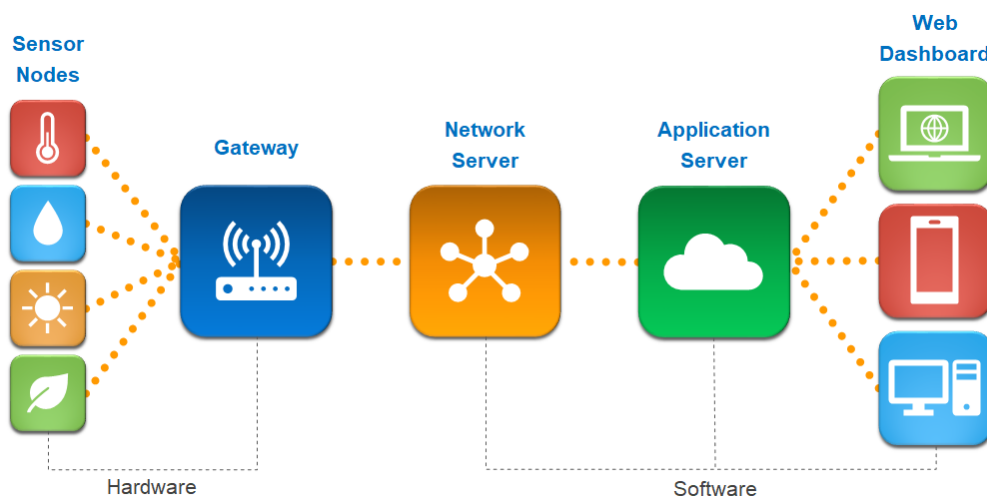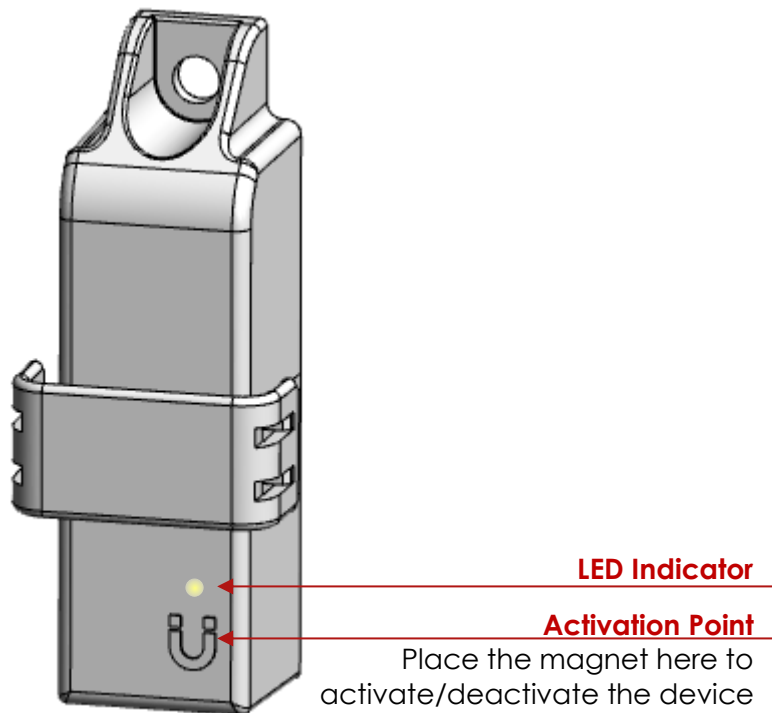

Figure 1. LoRaWAN™ System

2.3. Enclosure

LED Indicator

Activation Point
Place the magnet here to
activate/deactivate the device

2.4. Technical Specifications

Parameters	Value
Frequency Band	868 MHz (Europe)
Operating Temperature Range	-40°C to 85°C
Temperature Accuracy	±0.2°C (typical)
Relative Humidity Operating Range	20% to 80% RH (recommended)*
Relative Humidity Accuracy	±2% (typical)
Transmission Interval	15 minutes
Enclosure Protection Rating	T.B.A.
Communication Range	5 km**
Battery Life	2 years
Pollution Degree	Pollution Degree 3 (Farming area)

Long-term exposure to conditions outside the recommended range, especially at high humidity, may temporarily offset the RH signal.

**Communication range was tested in a rural area. Obstructions can cause the communication range to be shorter due to signal interference.*

3. Product Operation

3.1. Standby Mode

When the device is shipped, it will be on Sleep Mode. The power consumption at this mode will be minimal. At sleep mode, the device will not be measuring and transmitting temperature and relative humidity data.

It is recommended to store the device in Standby Mode to prolong the battery lifespan.

3.2. Active Mode

Before using the device, it should be switched to Active Mode first. During active mode, the device will be measuring and transmitting the temperature and relative humidity data periodically.

There is an LED indicator in the device to show the following status:

Status	LED Blinking Pattern
Device Activated	Fast Blinking 5x
Join Request Procedure Success	Fast Blinking 5x (after device activation)
Data Transmission	Blink 1x

3.3. Device Reset

If a problem occurs (e.g. no data received from the device), the device can be reset by placing the magnet near the device again. The LED will blink 3 times indicating that the device is deactivated and will return to Standby Mode. Place the magnet near the activation point to activate the device again.

4. Payload

4.1. Payload Decoding

The payload contains the temperature data from the sensor. It is encoded into hexadecimal format. The data length is 4 bytes. The first 2 bytes are for the temperature data. The last 2 bytes are for relative humidity. Below is an example of a payload decoder.

```javascript
function Decoder(payload) {

  var decoded = {};

  // Decode bytes to integer
  var temperatureInt = (payload [0] << 8) | payload [1];
  var humidityInt = (payload [2] << 8) | payload [3];

  // Decode integer to float
  decoded.temperature = temperatureInt / 100;   // Temperature in °C
  decoded.humidity = humidityInt / 10;   // Humidity in %

  return decoded;
}
```

In the example above, if payload = 09 9D 02 AB, the decoded value will be:
```
"humidity": 68.3,
"temperature": 24.61
```

5. Deployment Procedure

When requesting for Sense Node only (no gateway and network server), the user/client should already have an existing LoRaWAN System on their site.

The device is set to OTAA (Over-the-Air Activation) mode and it has pre-defined Device EUI (DevEUI), Application EUI (AppEUI), and Application Key (AppKey).

NOTE: If the client requests for the sensor device only, it is assumed that they know how to add/register the device to their Network Server.

5.1. Check the Device Information

PTS will provide the following information:

1. PTS Device Serial Number
2. DevEUI
3. AppEUI
4. AppKey

5.2. Register the Device to the Network Server

Add/register the device into the network server using the keys provided in section 5.1. Use Over-the-Air Activation in registering the device.

Example:

Activation Method	OTAA
Device EUI	34 31 37 32 66 36 6F 0E
Application EUI	70 B3 D5 7E D0 00 BF 3C
App Key	DF 93 F6 39 E4 80 C4 04 50 D1 D5 43 7F 14 1C 52

5.3. Activate the Device

The device is shipped in Standby Mode to conserve battery power.

Activation is done by placing a magnet near the marked part of the device. Please refer to section 2.3.

When a magnet is first placed near the device activation point, it will activate the device. LED will blink 5 times to indicate device activation.

The LED will blink again 5 times to indicate that the Join Request Procedure is done, and the device is ready to transmit measurement data.

NOTE: *When the Join Request Procedure is done, it will be connected to the Network Server through shared keys. Modifying the device registration in the Network Server will cause the device to be disconnected from the network because the shared keys will be void. Reset the device as instructed in section 5.5.*

Sometimes the Join Request Procedure fails. When this happens, the user has 2 options:

1. Wait for the device to automatically re-try the Join Request Procedure after 3 minutes.
2. Reset the device as described in section 5.5.

5.4. Check if the Device is Transmitting

Here are the recommended ways to check if the device is transmitting:

1. Check in the Network Server if the payload is received from the device.
2. Check your dashboard if the temperature data is posted.

5.5. Reset the Device (optional)

If the join procedure failed or no data is received from the device, the first option is to reset it.

To reset the device, place the magnet near the activation point. The LED will blink 3 times to indicate that the device is deactivated. This means the device is in standby mode.

Activate the device again by doing the activation procedure in section 5.3.

6. Manufacturer Contact

Name: PTS Technologies

Address: 2 Kaki Bukit Avenue 1, #04-05, 417938

Ph Number: +65 67494474

7. Compliance

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.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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 or more 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.

FCC RF Radiation Exposure Statement

Caution: To maintain compliance with the FCC's RF exposure guidelines, place

the unit at least 20cm from nearby persons.

8. Warranty

Warranty claims only be valid If the instruction in the manuals have been correctly followed.

The warranty may be rendered invalid if the product is incorrectly used and maintained.

9. Warning

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

10. Disposal

The symbol on the product shows that this product must not be treated as household waste. It must be taken to a collection point for recycling electrical and electronics equipment.

By ensuring correct disposal of the product, you will help to prevent negative consequences for the environment and health that around your society.