ENCARDIO RITE
METASENSING FOR MEGA STRUCTURES

USERS MANUAL

NEXAWAVE TiltSense

Model EAN-95MW

Doc. # WI 6002.116 Rev. 06 | April 2026

TUNNELS | HYDROELECTRIC | CONSTRUCTION | STRUCTURAL | METRO & RAIL | BRIDGES | MINING

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1 INTRODUCTION

1.1 NexaWave TiltSense overview

Encardio Rite model EAN-95MW NexaWave TiltSense is suitable for long term monitoring of inclination and vertical rotation of structures. Continuous data logging and real-time monitoring helps to provide early warning in case of impending failure, allowing time for corrective action to be taken or if necessary for safe evacuation of the area.

Tilt changes in a structure may be caused by construction activity like excavation, tunneling or de-watering that may affect the ground supporting the structure. Change in tilt could also result from loading of the structure, such as loading of a dam during impoundment, loading of a diaphragm wall during excavation or loading of a bridge deck due to wind and traffic. Data from the tilt meter provides early warning of threatening deformation of the structures.

1.2 Tilt meter applications

EAN-95MW NexaWave TiltSense is widely used in the following applications:

- Monitoring vertical rotation of retaining walls.
- Monitoring inclination and rotation of dams, piers, piles and other structures.
- Monitoring stability of structures in landslide areas.
- Monitoring tunnels for convergence and other movement.
- Monitoring safety of structures around zones of excavation or tunnelling.
- Monitoring deflection in bridges and struts under different loading conditions.

1.3 Wireless network

Wireless sensors are vital in monitoring construction sites, large structures and landslide areas. They are extensively used in applications where geotechnical and other sensors are used for data collection and transfer it to a central server for access by multiple users. Encardio Rite offers an innovative network solution that allows real-time monitoring of not only wireless tilt meter but also other geotechnical and structural sensors in challenging conditions with reliable data transfer without any delay.

In an end-to-end wireless monitoring system from Encardio Rite, the tilt meters are interfaced with the long range, low power radio frequency network to **gateway**. The tilt meter sends recorded data to the gateway through the RF network with utmost reliability. The gateway then uploads the collected data from sensors to the central/cloud server.

The system operates on ISM sub 1 GHz operating frequency bands adjustable to requirement of each territory. The system can be adjusted to different frequency bands; for example:

Region	Frequency Band
India	865 – 868 MHz
Europe	868 MHz
USA / Canada / Singapore / Australia	903 – 927 MHz

A detailed reference for frequency bands allowed in different Countries:

Country	Frequency Plan	Frequency Range	TX Power
Aland Islands	EU863-870	863–870 MHz	14 dBm (25 mW)
Albania	EU863-870	863–870 MHz	14 dBm (25 mW)
Andorra	EU863-870	863–870 MHz	14 dBm (25 mW)
Angola	EU863-870	863–870 MHz	14 dBm (25 mW)
Argentina	AU915-928	915–928 MHz	14 dBm (25 mW)
Argentina	US902-928	902–928 MHz	20 dBm (100 mW)
Armenia	EU863-870	863–870 MHz	14 dBm (25 mW)
Australia	AU915-928	915–928 MHz	14 dBm (25 mW)
Austria	EU863-870	863–870 MHz	14 dBm (25 mW)
Bahamas	US902-928	902–928 MHz	20 dBm (100 mW)
Bahrain	EU863-870	863–870 MHz	14 dBm (25 mW)
Bangladesh	IN865-868	865–868 MHz	20 dBm (100 mW)
Belarus	EU863-870	863–870 MHz	14 dBm (25 mW)
Belgium	EU863-870	863–870 MHz	14 dBm (25 mW)
Bhutan	EU863-870	863–870 MHz	14 dBm (25 mW)
Bolivia	AS923-925	923–925 MHz	20 dBm (100 mW)
Bolivia	AU915-928	915–928 MHz	14 dBm (25 mW)
Bosnia	EU863-870	863–870 MHz	14 dBm (25 mW)
Botswana	EU863-870	863–870 MHz	14 dBm (25 mW)
Brazil	AU915-928	915–928 MHz	14 dBm (25 mW)
Brunei	AS923-925	923–925 MHz	20 dBm (100 mW)
Bulgaria	EU863-870	863–870 MHz	14 dBm (25 mW)
Burundi	EU863-870	863–870 MHz	14 dBm (25 mW)
Cabo Verde	EU863-870	863–870 MHz	14 dBm (25 mW)
Cambodia	AS923-925	923–925 MHz	20 dBm (100 mW)
Canada	AU915-928	915–928 MHz	14 dBm (25 mW)
Canada	US902-928	902–928 MHz	20 dBm (100 mW)
Chile	AS923-925	923–925 MHz	20 dBm (100 mW)
Chile	AU915-928	915–928 MHz	14 dBm (25 mW)
Chile	US902-928	902–928 MHz	20 dBm (100 mW)
Colombia	AU915-928	915–928 MHz	14 dBm (25 mW)
Colombia	US902-928	902–928 MHz	20 dBm (100 mW)
Congo (Democratic Republic)	EU863-870	863–870 MHz	14 dBm (25 mW)
Costa Rica	US902-928	902–928 MHz	20 dBm (100 mW)
Croatia	EU863-870	863–870 MHz	14 dBm (25 mW)
Cyprus	EU863-870	863–870 MHz	14 dBm (25 mW)
Czech Republic	EU863-870	863–870 MHz	14 dBm (25 mW)

Country	Frequency Plan	Frequency Range	TX Power
Denmark	EU863-870	863–870 MHz	14 dBm (25 mW)
Dominican Republic	AU915-928	915–928 MHz	14 dBm (25 mW)
Ecuador	AU915-928	915–928 MHz	14 dBm (25 mW)
Ecuador	US902-928	902–928 MHz	20 dBm (100 mW)
Egypt	IN865-868	865–868 MHz	20 dBm (100 mW)
Egypt	EU863-870	863–870 MHz	14 dBm (25 mW)
El Salvador	US902-928	902–928 MHz	20 dBm (100 mW)
Estonia	EU863-870	863–870 MHz	14 dBm (25 mW)
Finland	EU863-870	863–870 MHz	14 dBm (25 mW)
France	EU863-870	863–870 MHz	14 dBm (25 mW)
Germany	EU863-870	863–870 MHz	14 dBm (25 mW)
Greece	EU863-870	863–870 MHz	14 dBm (25 mW)
Guatemala	AS923-925	923–925 MHz	20 dBm (100 mW)
Guatemala	AU915-928	915–928 MHz	14 dBm (25 mW)
Guatemala	US902-928	902–928 MHz	20 dBm (100 mW)
Guyana	US902-928	902–928 MHz	20 dBm (100 mW)
Herzegovina	EU863-870	863–870 MHz	14 dBm (25 mW)
Holy See	EU863-870	863–870 MHz	14 dBm (25 mW)
Hong Kong	AS923-925	923–925 MHz	20 dBm (100 mW)
Hong Kong	IN865-868	865–868 MHz	20 dBm (100 mW)
Hungary	EU863-870	863–870 MHz	14 dBm (25 mW)
Iceland	EU863-870	863–870 MHz	14 dBm (25 mW)
India	IN865-868	865–868 MHz	20 dBm (100 mW)
Indonesia	AS923-925	923–925 MHz	20 dBm (100 mW)
Iran	EU863-870	863–870 MHz	14 dBm (25 mW)
Ireland	EU863-870	863–870 MHz	14 dBm (25 mW)
Italy	EU863-870	863–870 MHz	14 dBm (25 mW)
Jamaica	AU915-928	915–928 MHz	14 dBm (25 mW)
Jamaica	US902-928	902–928 MHz	20 dBm (100 mW)
Japan	AS920-923	920–923 MHz	20 dBm (100 mW)
Jordan	IN865-868	865–868 MHz	20 dBm (100 mW)
Kenya	EU863-870	863–870 MHz	14 dBm (25 mW)
Korea (Republic)	KR920-923	920–923 MHz	20 dBm (100 mW)
Kuwait	EU863-870	863–870 MHz	14 dBm (25 mW)
Laos	AS923-925	923–925 MHz	20 dBm (100 mW)
Laos	EU863-870	863–870 MHz	14 dBm (25 mW)
Latvia	EU863-870	863–870 MHz	14 dBm (25 mW)
Lebanon	EU863-870	863–870 MHz	14 dBm (25 mW)

Country	Frequency Plan	Frequency Range	TX Power
Lesotho	EU863-870	863–870 MHz	14 dBm (25 mW)
Liechtenstein	EU863-870	863–870 MHz	14 dBm (25 mW)
Lithuania	EU863-870	863–870 MHz	14 dBm (25 mW)
Luxembourg	EU863-870	863–870 MHz	14 dBm (25 mW)
Macedonia	EU863-870	863–870 MHz	14 dBm (25 mW)
Madagascar	EU863-870	863–870 MHz	14 dBm (25 mW)
Malawi	EU863-870	863–870 MHz	14 dBm (25 mW)
Malaysia	AS920-923	920–923 MHz	20 dBm (100 mW)
Malta	EU863-870	863–870 MHz	14 dBm (25 mW)
Mauritius	EU863-870	863–870 MHz	14 dBm (25 mW)
Mexico	AU915-928	915–928 MHz	14 dBm (25 mW)
Mexico	US902-928	902–928 MHz	20 dBm (100 mW)
Moldova	EU863-870	863–870 MHz	14 dBm (25 mW)
Monaco	EU863-870	863–870 MHz	14 dBm (25 mW)
Montenegro	EU863-870	863–870 MHz	14 dBm (25 mW)
Morocco	EU863-870	863–870 MHz	14 dBm (25 mW)
Mozambique	EU863-870	863–870 MHz	14 dBm (25 mW)
Myanmar	AS920-923	920–923 MHz	20 dBm (100 mW)
Namibia	EU863-870	863–870 MHz	14 dBm (25 mW)
Netherlands	EU863-870	863–870 MHz	14 dBm (25 mW)
New Zealand	AS920-923	920–923 MHz	20 dBm (100 mW)
New Zealand	AU915-928	915–928 MHz	14 dBm (25 mW)
New Zealand	IN865-868	865–868 MHz	20 dBm (100 mW)
Nicaragua	AU915-928	915–928 MHz	14 dBm (25 mW)
Nicaragua	US902-928	902–928 MHz	20 dBm (100 mW)
Niger	IN865-868	865–868 MHz	20 dBm (100 mW)
Nigeria	EU863-870	863–870 MHz	14 dBm (25 mW)
Norway	EU863-870	863–870 MHz	14 dBm (25 mW)
Oman	EU863-870	863–870 MHz	14 dBm (25 mW)
Pakistan	AU915-928	915–928 MHz	14 dBm (25 mW)
Pakistan	IN865-868	865–868 MHz	20 dBm (100 mW)
Panama	AS920-923	920–923 MHz	20 dBm (100 mW)
Panama	AU915-928	915–928 MHz	14 dBm (25 mW)
Panama	US902-928	902–928 MHz	20 dBm (100 mW)
Papua New Guinea	AS920-923	920–923 MHz	20 dBm (100 mW)
Papua New Guinea	AU915-928	915–928 MHz	14 dBm (25 mW)
Paraguay	AS920-923	920–923 MHz	20 dBm (100 mW)
Paraguay	AU915-928	915–928 MHz	14 dBm (25 mW)

Country	Frequency Plan	Frequency Range	TX Power
Paraguay	US902-928	902–928 MHz	20 dBm (100 mW)
Peru	AS920-923	920–923 MHz	20 dBm (100 mW)
Peru	AU915-928	915–928 MHz	14 dBm (25 mW)
Peru	US902-928	902–928 MHz	20 dBm (100 mW)
Philippines	EU863-870	863–870 MHz	14 dBm (25 mW)
Poland	EU863-870	863–870 MHz	14 dBm (25 mW)
Portugal	EU863-870	863–870 MHz	14 dBm (25 mW)
Puerto Rico	US902-928	902–928 MHz	20 dBm (100 mW)
Qatar	EU863-870	863–870 MHz	14 dBm (25 mW)
Romania	EU863-870	863–870 MHz	14 dBm (25 mW)
Russia	EU863-870	863–870 MHz	14 dBm (25 mW)
Rwanda	EU863-870	863–870 MHz	14 dBm (25 mW)
Samoa	EU863-870	863–870 MHz	14 dBm (25 mW)
San Marino	EU863-870	863–870 MHz	14 dBm (25 mW)
Saudi Arabia	EU863-870	863–870 MHz	14 dBm (25 mW)
Serbia	EU863-870	863–870 MHz	14 dBm (25 mW)
Seychelles	EU863-870	863–870 MHz	14 dBm (25 mW)
Singapore	AS920-923	920–923 MHz	20 dBm (100 mW)
Slovakia	EU863-870	863–870 MHz	14 dBm (25 mW)
Slovenia	EU863-870	863–870 MHz	14 dBm (25 mW)
South Africa	EU863-870	863–870 MHz	14 dBm (25 mW)
South Korea	KR920-923	920–923 MHz	20 dBm (100 mW)
Spain	EU863-870	863–870 MHz	14 dBm (25 mW)
Sri Lanka	AS920-923	920–923 MHz	20 dBm (100 mW)
Suriname	AS920-923	920–923 MHz	20 dBm (100 mW)
Suriname	AU915-928	915–928 MHz	14 dBm (25 mW)
Suriname	US902-928	902–928 MHz	20 dBm (100 mW)
Swaziland	EU863-870	863–870 MHz	14 dBm (25 mW)
Sweden	EU863-870	863–870 MHz	14 dBm (25 mW)
Switzerland	EU863-870	863–870 MHz	14 dBm (25 mW)
Taiwan	AS923-925	923–925 MHz	20 dBm (100 mW)
Tanzania	AS923-925	923–925 MHz	20 dBm (100 mW)
Tanzania	EU863-870	863–870 MHz	14 dBm (25 mW)
Thailand	AS923-925	923–925 MHz	20 dBm (100 mW)
Tonga	AS920-923	920–923 MHz	20 dBm (100 mW)
Tonga	AU915-928	915–928 MHz	14 dBm (25 mW)
Trinidad and Tobago	US902-928	902–928 MHz	20 dBm (100 mW)
Tunisia	EU863-870	863–870 MHz	14 dBm (25 mW)

Country	Frequency Plan	Frequency Range	TX Power
Turkey	EU863-870	863–870 MHz	14 dBm (25 mW)
Uganda	IN865-868	865–868 MHz	20 dBm (100 mW)
Uganda	AS923-925	923–925 MHz	20 dBm (100 mW)
Ukraine	EU863-870	863–870 MHz	14 dBm (25 mW)
United Arab Emirates (UAE)	EU863-870	863–870 MHz	14 dBm (25 mW)
United Kingdom (UK)	EU863-870	863–870 MHz	14 dBm (25 mW)
United States of America	AU915-928	915–928 MHz	14 dBm (25 mW)
United States of America	US902-928	902–928 MHz	20 dBm (100 mW)
Uruguay	AS923-925	923–925 MHz	20 dBm (100 mW)
Uruguay	AU915-928	915–928 MHz	14 dBm (25 mW)
Uruguay	US902-928	902–928 MHz	20 dBm (100 mW)
Vanuatu	IN865-868	865–868 MHz	20 dBm (100 mW)
Vatican City	EU863-870	863–870 MHz	14 dBm (25 mW)
Venezuela	AS923-925	923–925 MHz	20 dBm (100 mW)
Venezuela	US902-928	902–928 MHz	20 dBm (100 mW)
Vietnam	AS923-925	923–925 MHz	20 dBm (100 mW)
Zambia	EU863-870	863–870 MHz	14 dBm (25 mW)
Zimbabwe	EU863-870	863–870 MHz	14 dBm (25 mW)

The gateway also has provision to set the frequency band, depending upon the Country.

1.4 Conventions used in this manual

WARNING! Warning messages calls attention to a procedure or practice that if not properly followed could possibly cause personal injury.

CAUTION: Caution messages calls attention to a procedure or practice, that if not properly followed may result in loss of data or damage to equipment.

NOTE: Note contains important information and is set off from the regular text to draw the users' attention.

1.5 How to use this manual

This users' manual is intended to provide you with sufficient information for making optimum use of tilt meters in your applications.

To make the manual more useful we invite valuable comments and suggestions regarding any additions or enhancements. We also request to please let us know of any errors that are found while going through the manual.

NOTE: Installation personnel must have a background of good installation practices and knowledge of fundamentals of geotechnics. Novices may find it very difficult to carry on installation work. The intricacies involved in installation are such that even if a single essential but apparently minor requirement is ignored or overlooked, the most reliable of instruments will be rendered useless.

A lot of effort has been made in preparing this instruction manual. However best of instruction manuals cannot provide for each condition in field that may affect performance of the sensor. Also,

blindly following the instruction manual will not guarantee success. Sometimes, depending upon field conditions, installation personnel will have to consciously depart from written text and use their knowledge and common sense to find solution to a particular problem.

Installation of a tilt meter requires expertise. It is recommended that potential users themselves practice all the operations laid down in this manual by repeated installations.

NOTE: The sensor is normally used to monitor site conditions and will record even a minor change that may affect behaviour of structure being monitored. Some of these factors amongst others, are, seasonal weather changes, temperature, rain, barometric pressure, nearby landslides, earthquakes, traffic, construction activity around site including blasting, tides near sea coasts, fill levels, excavation, sequence of construction and changes in personnel etc. These factors must always be observed and recorded as they help in correlating data later on and also may give an early warning of potential danger or problems.

2 GENERAL DESCRIPTION

2.1 Model EAN-95MW NexaWave TiltSense

Model EAN-95MW NexaWave TiltSense combines high precision Micro-Electro-Mechanical System (MEMS) sensor with radio transmission network to provide accurate tilt data. The unit is mounted inside a compact weatherproof enclosure. The tilt sensor provides a 20-bits digital output proportional to the sine of tilt angle measured by the beam. The sensor can measure tilt in all the 3-axes (X, Y and Z). Tilt sensor measurement range is ± 30°. The output of any axis is zero for a truly horizontal position. The unit has a built-in thermistor to measure temperature. Temperature is measured using 24-bit ADC which provides accurate temperature within ± 0.1°C.

The measured values are transmitted through the long range, low power radio frequency network to the gateway without any signal degradation. Each unit is individually calibrated to provide high system accuracy and repeatability.

The NexaWave TiltSense measures change in tilt of a structure to which it is attached. The tilt meter can be fixed to any vertical surface, horizontal floor or ceiling by means of suitable mounting accessories consisting of anchors (and brackets – optional). These are available separately when ordered.

2.2 Model EWG-01 NexaWave Hub

Encardio Rite model EWG-01 wireless gateway is used as a main networking hardware, which uploads data gathered from all the tilt meters (or other geotechnical sensors) to the remote server. The gateway enabled with wireless network provides reliable data transfer over long distances, without any delay. The wireless system eliminates the need for running lengthy cables. This is especially useful at locations where sensors are distributed over a wide area and running cables to long distances can be tricky and risky.

The data is accessible 24 x 7 to all the stakeholders. With Proqio, a cloud-hosted data management and configuration software, the system can be programmed to generate automatic reports and provide automated alerts over SMS or email for any reading crossing the pre-defined alert levels.

With the real-time data collected from wireless tilt meters and gateway, information about the slightest of change taking place at specific location is available. This allows timely decisions, increased safety and cost effectiveness.

2.3 System components

Provided by Model EAN-95MW- Wireless tilt meter with antenna

- Model EWG-01 Gateway with antenna
- Gateway and Node mounting accessories
- RS-232 Bluetooth modem/USB to RS-232 FTDI cable
- Application software for Android Smartphone

To be arranged by Client:

- Android Smartphone
- Activated data SIM card – 1 no. for Gateway
- D-Cell Li-SOCl2 3.6 V 14.5 Ah batteries - 4 no (2 no. each for tilt meter and Gateway)
- Power supply unit 9-30 V, 1 A for Gateway (12 V, 1 A power supply easily available can be used)

3 TECHNICAL SPECIFICATION

Basic			
Internal Battery	2X3.6V Li-Ion Battery (D-cell ER34615M)		
External Power	9V Standard adaptor or EBS-01(available on order)		
Operating Current	25 mA (max)		
Dimension	120X100X81(LXWXH) without antenna 159X100X187(LXWXH) with antenna		
Weight	0.807 Kg (Without Battery) 1.0045 Kg(With Battery)		
Storage	3 Million data points		
Primary Sensor			
Sensor Type	MEMS Accelerometer		
No. of axis	3-Axes (X, Y and Z)		
Accuracy	± 0.1% FS		
Resolution	20 bit		
Sensitivity	± 10 arc seconds		
Range	±30 deg		
Temperature Sensor			
Sensor Type	3K thermistor		
Accuracy	0.1°C		
Range	-20°C to +70°C		
Enclosure			
Material	Aluminum-Alloy Die casting 12(Epoxy Polyester Powder Coating)		
Fireproof	Approved		
Protocol			
ER Protocol	Proprietary Encardio Protocol		
Radio			
LoRa Chipset	SX1276		
Frequency	**EU**	**US**	**ROA**
	863-870 MHz	903-927 MHz	920-928 MHz
Transmit Power	863-870 MHz (EU)	903-927 MHz(US)	920-928 MHz(ROA)
	14 dBm	13.51 dBm	20 dBm
Baud Rate	9600 bps (Max)		
Receiver Sensitivity	-132 dBm		
Transmission Distance	(1 ~ 15 KM)*		

* 800 meters in urban areas

Antenna	
Frequency	868MHz
Bandwidth	848-888MHz
Gain	3dBi
SWR	≤1.5
Polarization	Vertical
Radiation Direction	Omnidirectional
Input Impedance	50Ω
Power Capacity	20W
Height	200mm
Total Weight	21g
Coat Material	TPEE
Interface	SMA-J (SMA inner screw thread and inner needle)
Working Temperature	-40℃～+85℃
Storage Temperature	-40℃～+85℃

4 PRE-INSTALLATION PREPARATIONS

4.1 Pre-installation checks

- Before installation, please check the tilt meter and gateway for any physical damage.
- Open the tilt meter and gateway box to check if the internal wirings are intact.

4.2 Selecting location for Gateway and Tilt meter

Selecting correct locations for Gateway and tilt meter is important, especially in case more than one tilt meter are being installed at site and connected to single gateway.

The first step is to install the Gateway at a location that is in line of sight with all the installed tilt meters or in line of sight with most tilt meters. The best location will have to be determined at the site itself. For best results, the link between the gateway and the tilt meter should be strong, preferably better than -100 dBm. Please note, the stronger the link better the results will be.

4.3 Setting up the Gateway & Tilt meter

It is recommended that the setting up and configuration of tilt meter and gateway is done before mounting the sensors and gateway at respective installation location.

The gateway configuration needs to be done before tilt meter. For setting up and configuring the gateway, refer to User's Manual # WI6002.117 on Gateway. Configuration of tilt meter is discussed in Section 5 of this manual.

For convenience, a "Quick Start Guide" is included in Section **Error! Reference source not found.** to give a brief and quick idea.

4.4 Sampling Interval for Tilt meter node

When configuring the Encardio Rite wireless system, it is crucial to select appropriate sampling intervals to ensure the network operates smoothly without any data loss. The table below provides guidance on sampling interval selection based on the network size.

The wireless tilt meter (RF) with in-built node:

Number of nodes	Minimum Sampling interval (Minutes)
1	4
10	7
50	20
100	37
150	53
200	70

The General formula to calculate Sampling interval for Tilt meter node is:

*Sampling Interval (Seconds) = (20*No. Tilt meter Node) + 180*

Please note that these recommended sampling intervals serve as general guidelines. Depending on specific project requirements, environmental conditions, and data collection needs, adjustments to the sampling intervals may be necessary. It is advisable to consult with the Encardio Rite technical support team for further guidance on fine-tuning the sampling intervals for your network setup.

5 CONFIGURING TILT METER

5.1 Setting up Tilt meter

- Open the top cover with screwdriver. Description of each part of the tilt meter is given in the figure 5-1.

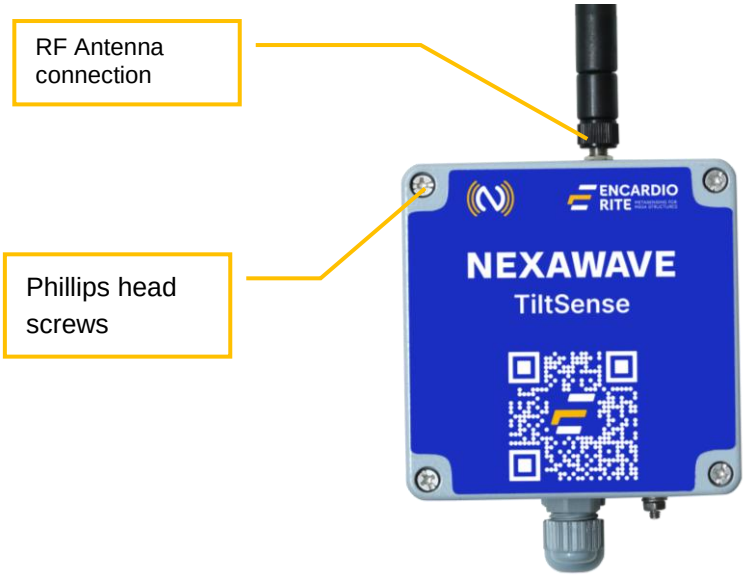


Figure 5-1

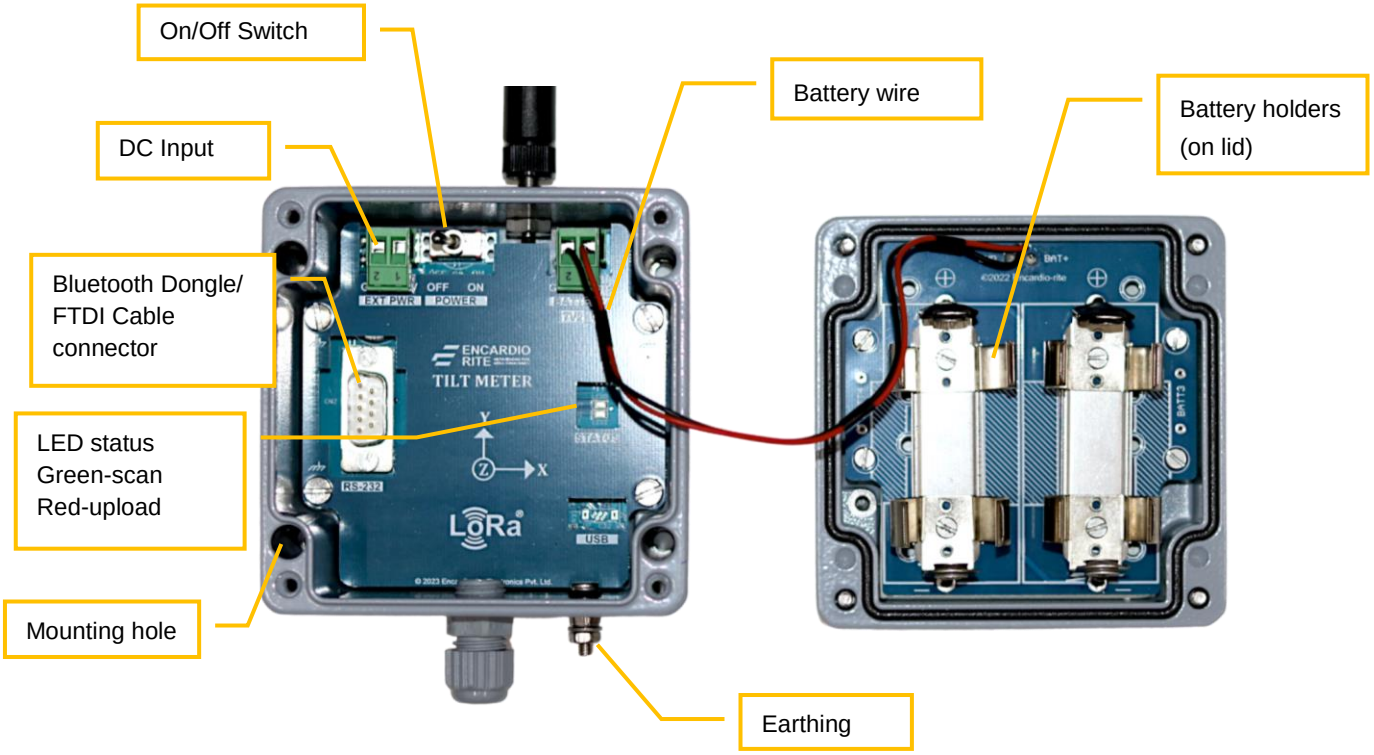


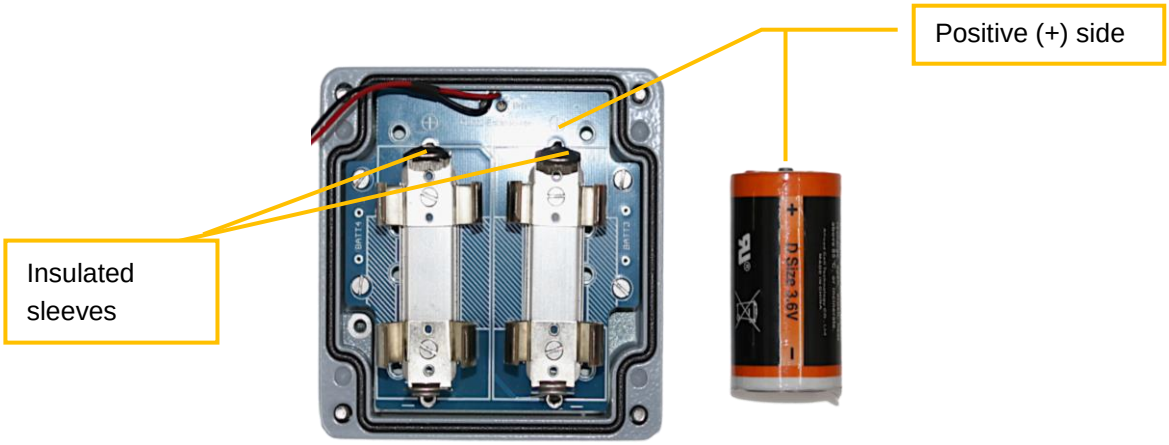
Figure 5-2 Wireless tilt meter details

- Connect the RF antenna (provided with supply) to the tilt meter properly.

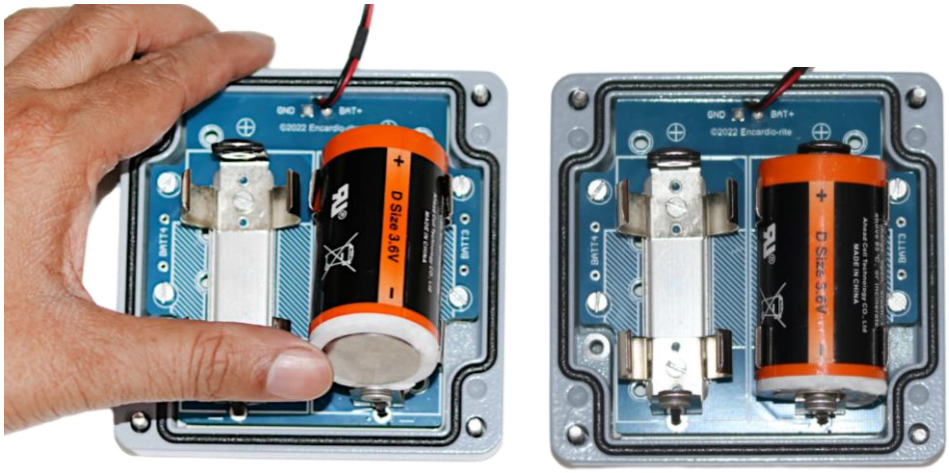
5.2 Battery Installation

- Open the device by unscrewing the four Phillips head screws on the front of the enclosure.

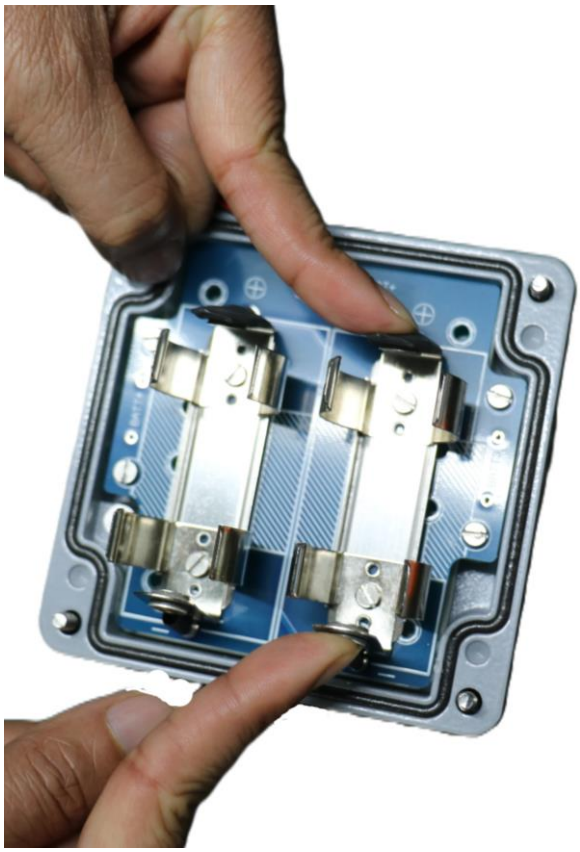
- Align the positive (+) side of the batteries with the + indicator in the battery holder.



- Slide the positive end of the battery inside the compartment first. Installing the positive end first allows the battery to slide into the compartment more easily. Just push the positive end of the battery into the lever, flattening it down into the holder. Apply a bit more pressure, if necessary, to snap the negative end of the battery securely into place.



- Check for any looseness in the positive and negative clip terminals of the holder. If they are loose, press them down to ensure proper contact with the battery.



- In case fast scanning is required, connect any standard DC power adaptor (9 V, 1 A) to "DC Input".
- Or, Encardio rite make solar battery charger can also be used (available against order).

After power up, wait for 30 seconds as during this time tilt meter performs internal operations.

5.3 Connecting tilt meter to phone

Install the file (provided with the supply) for "EWA-01" app on the phone. App shortcut will be available in the list of application software, as shown in figure 5-3. Open the application and allow all the permissions required for proper functioning.

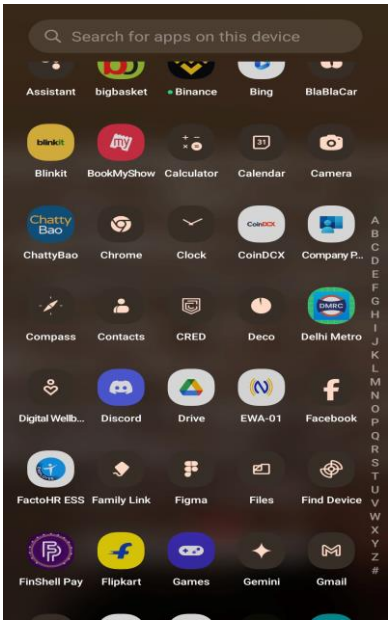


Figure 5-3

5.3.1 Connection using Bluetooth

The tilt meter node can be connected with mobile by using Bluetooth. Plug Bluetooth modem (provided with supply) at 9 pins D-sub connector of the Node. Make sure that modem must be configured for 115200 baud rate and hardware flow must be OFF. Verify DIP switch settings with following figure 5-4.

Figure 5-4: Bluetooth modem DIP switch settings

- Turn-on the Bluetooth modem by pressing ON/OFF switch located near modem's battery compartment. The power indicator of Bluetooth modem will glow in GREEN colour to ensure that Bluetooth modem is ON.
- Turn on Bluetooth of the android phone and go to Bluetooth settings. Click on "scan" button. Phone will show the list of Bluetooth devices found. Find the Node Name and serial number on phone screen and click for pairing the phone with Node. Once pairing button is pressed it will ask to enter passkey for authentication.
- Enter pairing code "6982698076" and then press OK. On successful authentication, it will show that device is paired. Now phone is paired with Node.

5.3.2 Connection using OTG

- Switch on the tilt meter node and connect it to the Smartphone using the FTDI to OTG adaptor provided with supply, as shown in figure 6-5 below.

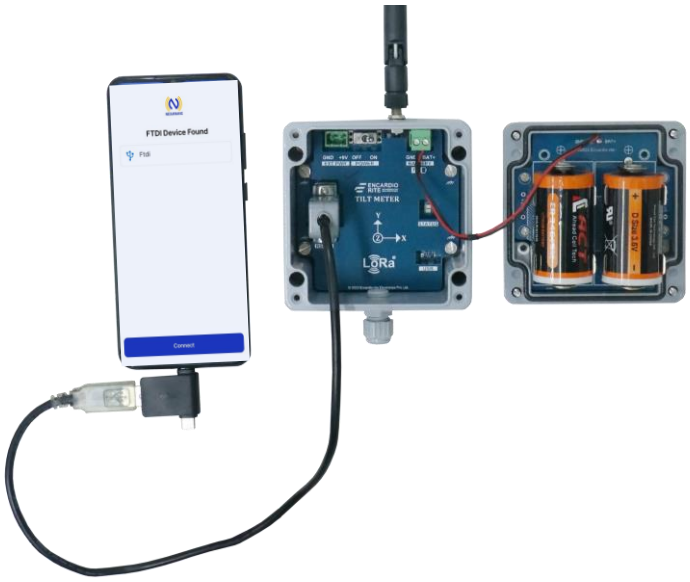


Figure 5-5 Tilt meter connected to Android phone with FTDI cable via OTG adaptor

- Once connected a prompt window will appear as shown in the figure 5-6 . Click on the FTDI button, home screen of tilt meter node will appear.

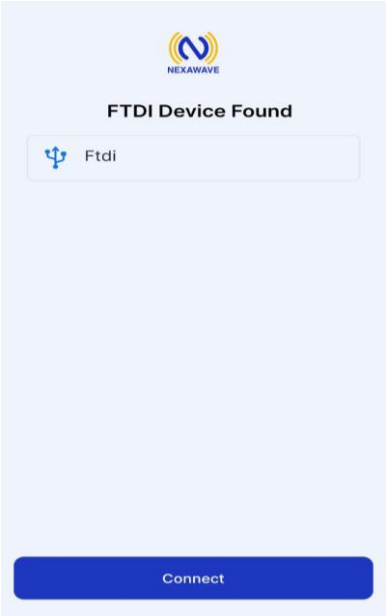


Figure 5-6

5.4 EWA-01 App Get Started Screen

When the EWA-01 app is launched, the Get Started screen (version 2.0 and later) presents a five-step commissioning overview along with two shortcut options for devices that are already configured.

Screen Element	Description
Commissioning overview	Displays five key steps with blue checkmarks: Pair & Configure Your Hub → Pair & Configure Your Node(s) → Connect Node(s) to the Hub → Test Node(s) and Hub Connection → Transmit Data to Your Cloud Platform.
Start button	Begins the guided commissioning flow for new or unconfigured devices.
View Data	Direct shortcut to browse previously downloaded CSV records — for devices already set up.
Upload Data	Direct shortcut to push downloaded files to the cloud server — for devices already set up.

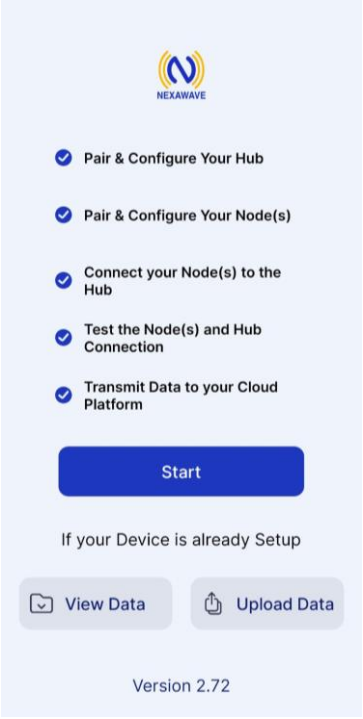


Figure 5-7 EWA-01 App Get Started Screen (v2.72)

5.5 Selecting a Device & Firmware Update

After tapping Start, the app displays the Paired Devices screen listing all Bluetooth-paired nodes and gateways. Tap the desired device name to connect. A circular progress dialog shows the connection progress.

> **NOTE** The device naming convention in the Paired Devices list: ERB-01 XXXXXXX, EWG-01_XXXXXXX (gateways).

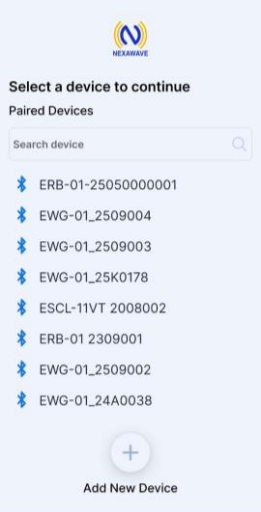


Figure 5-8 Paired Devices list

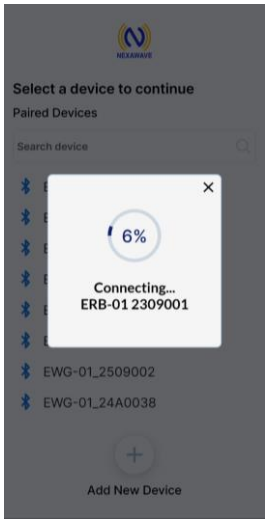


Figure 5-9 Connecting to ERB-01

5.5.1.1 Over-the-Air (OTA) Firmware Update

When the app connects to a node, it automatically checks whether a newer firmware version is available. If an update exists, a notification dialog is displayed before the Home Screen opens.

Dialog / Screen	Description
Firmware notification dialog	Shows: current firmware on the device (e.g. v02.01), latest available firmware version and release date (e.g. v02.10, 28/03/2026), and a brief changelog under 'About This Version'. Two action buttons: SKIP and UPDATE FIRMWARE.
Installing Firmware... (0–100%)	Circular progress indicator shown while the firmware binary is transferred to the device over Bluetooth. Do not disconnect or power off the device during this stage.
Rebooting the Device... (0–100%)	After firmware transfer completes, the device reboots automatically to apply the new firmware. The app tracks the reboot progress.
Connecting... (0–100%)	Once the device has rebooted, the app automatically re-establishes the Bluetooth connection. The Home Screen opens when reconnection is complete.

> **NOTE** If a firmware update is available, it is strongly recommended to apply it before proceeding with commissioning or configuration. Updated firmware may include bug fixes, new features, or calibration improvements.

Figure 5-10 New firmware available

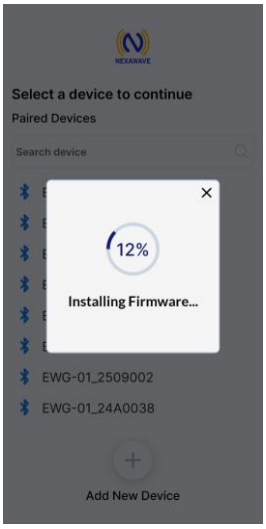


Figure 5-11 Installing Firmware...

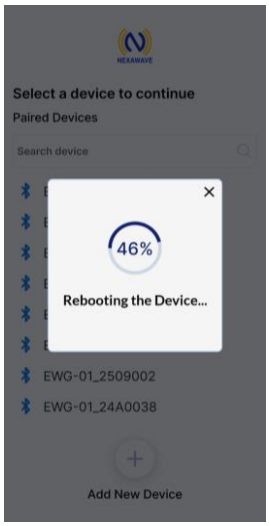


Figure 5-12 Rebooting the Device...

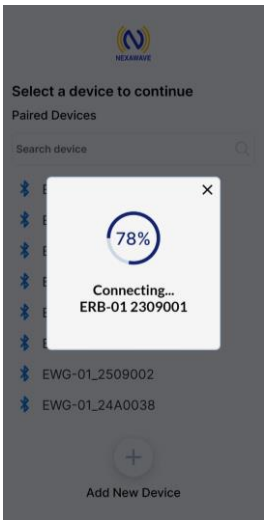


Figure 5-13 Connecting after Reboot...

WARNING	Do not power off the device or close the app during firmware installation or reboot. Interrupting the process may leave the device in an unrecoverable state requiring factory service.

5.5.1.2 Step-by-Step — OTA Firmware Update

Connect to device — From the Paired Devices list, tap the target device (e.g. ERB-01 2309001). The connection progress dialog appears.

Review firmware notification — If a new firmware version is available, the notification dialog displays the current version, the latest version, its release date, and the changelog (fig 5-10).

Choose action — Tap UPDATE FIRMWARE to proceed with the update or tap SKIP to continue with the existing firmware.

Monitor installation — The 'Installing Firmware...' progress dialog counts from 0% to 100% (fig 5-11). Keep the phone within Bluetooth range and do not close the app.

Monitor reboot — After installation completes, the 'Rebooting the Device...' dialog appears (fig 5-12). Wait for it to be completed.

Reconnection — The app automatically reconnects (fig 5-13). Once complete, the TiltSense Home Screen opens with the updated firmware active.

5.6 TiltSense Node Configuration

The TiltSense node is configured using the EWA-01 Android application. Ensure the Hub (Gateway) is configured and powered on before configuring TiltSense nodes. Configuration can be done via Bluetooth or USB OTG.

Open the EWA-01 app on the phone. It will show the list of paired Nodes. Select the node from the list; if a firmware update is available, it will be offered at this point (see Section 5.5). The Home Screen will then open.

5.6.1 Home Screen Overview

After connecting to the TiltSense node via Bluetooth or OTG, the TiltSense Home Screen opens. It displays the device title ('TiltSense'), the Node ID and Serial Number at the top, and four function tiles arranged in a 2×2 grid. The battery voltage is shown at the bottom of the screen (Internal and External).

Home Screen Element	Description
Node ID	Unique alphanumeric identifier of the connected node (e.g. 23K0065-EAN-95MW). Truncated in the tile; full ID visible in the Information screen.
Serial No.	Factory serial number of the device (e.g. 23K0065).
i button (Information)	Opens the Information screen showing full node details across five tabs: TiltSense, Sensor, Sampling, Battery, and Bluetooth. Tap the 'i' icon to the right of the Node ID / Serial No. row.
⋮ (Three-dot menu)	Opens the Advanced Settings menu with two options: Reset TiltSense to Factory Default and Erase Node Memory. Located at the top-right corner of the screen.
Quick Setup tile	Launches the four-stage commissioning wizard for new or re-configured nodes.
Edit Configuration tile	Opens the configuration editor for reviewing or modifying node settings after initial commissioning.
Diagnostic & Records tile	Provides post-commissioning tools: hub connection test, live sensor reading, and data record management.
Configure Connected Devices tile	Opens the network topology view for managing the hub and other connected nodes.
Device Battery Volt.	Live battery voltage display at the bottom: Internal (e.g. 7.37V) and External (e.g. 0.00V if no external power connected).

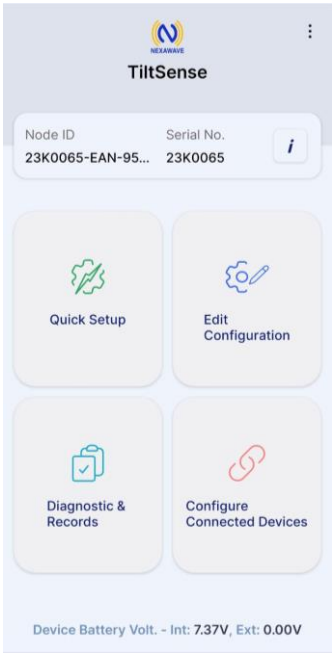


Figure 5-14 TiltSense Home Screen

5.6.1.1 Information Screen (i Button)

Tapping the 'i' button on the Home Screen opens the Information screen. This is a read-only reference panel displaying the complete node identity, network, and system status. It is organized into five scrollable tabs.

> *Access path: Home Screen → Tap i button (top-right of Node ID row)*

Tab	Information Displayed
TiltSense	Node ID, Serial No., Model No. (EAN-95MW), Installation Date, Calibration Date, Connection Status (Connected / Disconnected), Hub Reg. Status (Registered / Not Registered), Frequency Plan, Network ID, LoRa Mac Address, Latitude, Longitude, Firmware Version, Firmware Rev. Date.
Sensor	Active sensor parameter names, engineering units, and enabled/disabled status for each measurement parameter (AXIS-X, AXIS-Y, AXIS-Z, TEMP).
Sampling	Configured scan interval and next scheduled scan start time as set on the hub.
Battery	Detailed battery voltage readings — internal battery level and external power supply voltage.
Bluetooth	Bluetooth modem details: Bluetooth Name (e.g. ERB-01 2309001), Bluetooth MAC Address (e.g. 00:01:95:98:A2:30), and Status (Connected / Disconnected).
Phone	Details about the connected Android phone running the EWA-01 application.

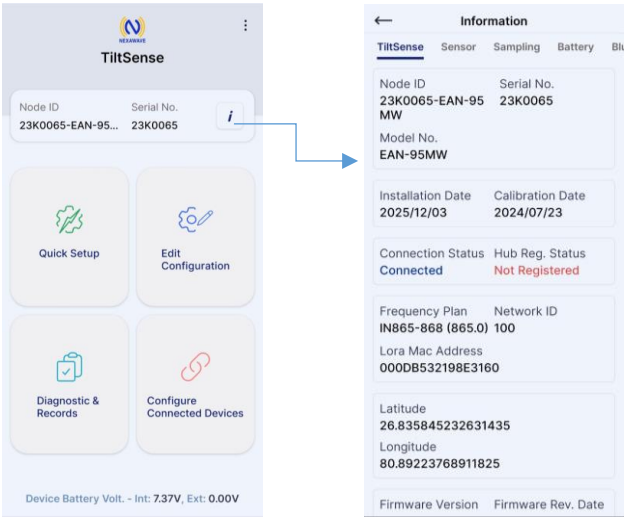


Figure 5-15 Information Screen — TiltSense tab

NOTE	Hub Reg. Status shows 'Not Registered' (in red) if the node has not yet completed Stage 4 of Quick Setup, or if the node has been deregistered. Run **Quick Setup** Stage 4 or directly go to System setup In **Edit Configuration** option to register the node with the hub.
NOTE	The Information screen is read-only. To modify any displayed value, use Quick Setup or Edit Configuration.

5.6.1.2 Advanced Settings (Three-Dot Menu ⋮)

Tapping the three-dot menu (⋮) at the top-right corner of the Home Screen opens the Advanced Settings panel, which provides two destructive operations. Use these with caution.

> *Access path: Home Screen → Tap ⋮ (top-right corner)*

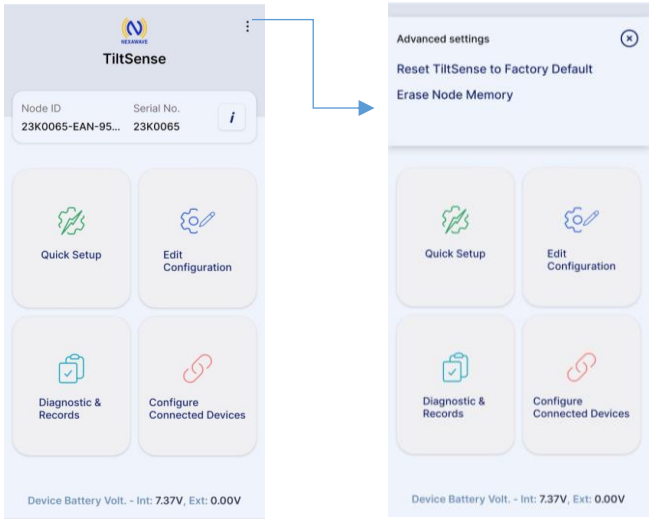


Figure 5-16 Advanced Settings (⋮ menu)

Reset TiltSense to Factory Default

Restores the TiltSense node to its original factory configuration, permanently erasing all user-defined settings and data. Any settings configured at the factory will be retained. This reset is useful for troubleshooting or preparing the device for a new installation.

> **CAUTION** All user-generated data will be permanently erased. Back up any critical data before performing a factory reset. When prompted, enter the reset password "**4TfZ9q7X**" and tap OK to confirm.

Erase Node Memory

Clears all previously stored data logs onto the TiltSense node, freeing up on-device storage. This does not affect the node's configuration settings — only the logged measurement records are deleted.

> **CAUTION** Erasing node memory is irreversible. All stored measurement records on the device will be permanently deleted. Ensure all necessary logs have been downloaded to the phone (via Diagnostic & Records → Records → Download) before proceeding.

5.6.2 Quick Setup

The Quick Setup wizard commissions a TiltSense node through four sequential stages: setting device configuration, selecting measurement parameters, verifying sensor readings, and confirming wireless connectivity with the hub.

Access path: Home Screen → Tap Quick Setup

> *Access path: Home Screen → Tap Quick Setup*

STAGE 1 Set the Configuration

Stage 1 captures the core identity, network, location, and time parameters required for the node to operate on the LoRa RF network. All fields must be correctly set before proceeding to Stage 2.

Field	Description	Status
TiltSense ID	The node ID is a customizable alphanumeric identifier that can be set by the user for easier recognition. By default, it is set to the node name "TiltSense"	Required
Installation Date	Date of physical installation at site (yyyy/mm/dd).	Required
Relay Hops	Number of intermediate relay nodes between this node and the gateway. Select 'No Relay' for direct connection.	Required
Frequency Plan	LoRa frequency band for the deployment region. Must match the gateway frequency plan.	Required

Network ID	LoRa network identifier. Must match the gateway configuration.	Required
Latitude / Longitude	GPS coordinates of the node installation point. Enter manually or tap 'Select on map'.	Required
Device Date & Time	Internal clock of the node. Tap 'Sync with phone' to align with smartphone time.	Required

NOTE Always tap 'Sync with phone' during first-time installation to prevent timestamp errors in the cloud platform.

NOTE The Frequency Plan selected here must exactly match the gateway setting, otherwise the node will fail to transmit data.

5.6.2.1 Step-by-Step Procedure — Stage 1

Open Quick Setup — From the Home Screen, tap the Quick Setup tile. The wizard opens at Stage 1 — Set the Configuration.

TiltSense ID — Verify the pre-populated Node ID. The node ID is customizable.

Installation Date — Confirm or adjust the installation date using the calendar icon.

Relay Hops — Select 'No Relay' for direct gateway connection or choose the appropriate relay count.

Frequency Plan — Use 'Filter by Country' & tap the dropdown to select the correct LoRa frequency band.

Network ID — Select or enter the Network ID that matches the gateway configuration.

Location — Tap 'Select on map' to capture coordinates automatically via phone GPS, or enter manually.

Device Date & Time — Tap 'Sync with phone' to synchronize the node's internal clock.

Save & Next — Tap Save & Next to write all settings to the node. An 'Updating...' progress dialog (0–100%) is displayed while the settings are written to the device. Once complete, the wizard advances automatically to Stage 2.

Skip — Tap Skip only if Stage 1 was previously configured and no changes are needed — this bypasses the save and moves directly to Stage 2.

Figure 5-17 Stage 1: Set the Configuration

STAGE 2 Select the Parameter

Stage 2 defines the measurement parameters that the TiltSense node will report. When Stage 2 opens, the app reads the current parameter configuration from the device — a 'Fetching...' progress dialog is shown during this retrieval. Once complete, each row shows a parameter with its parameter name, unit dropdown, and enable checkbox.

Ch.	Default Name	Default Unit	Description
X	AXIS-X	deg	Tilt on the X-axis. Default unit: degrees (deg).
Y	AXIS-Y	deg	Tilt on the Y-axis. Default unit: degrees (deg).
Z	AXIS-Z	deg	Tilt on the Z-axis. Default unit: degrees (deg).
T	TEMP	deg C	Temperature in degree Celsius.

NOTE	Default units shown above reflect the device factory defaults. Parameter X, Y and Z default to degrees (deg). The unit dropdown for each axis also offers Sin A, mm/mtr. Select the unit required by the project specification.
NOTE	Parameter names can be customized by tapping the name field. Use meaningful names that match the site monitoring plan (e.g. matching project tag numbers) to aid data identification in the cloud platform.
NOTE	When Stage 2 opens, an 'Updated successfully!!' confirmation toast may appear at the bottom — this confirms that Stage 1 settings were successfully written to the device.

5.6.2.2 Step-by-Step Procedure — Stage 2

Wait for Fetching — When Stage 2 opens, a 'Fetching...' progress dialog appears while the app reads current parameter settings from the device. Wait for it to be completed.

Review Parameters — Four measurement parameters are displayed: X (AXIS-X), Y (AXIS-Y), Z (AXIS-Z), and T (TEMP).

Edit parameter name — If required, tap the name field of any parameter and enter a custom label.

Select unit — Tap the unit dropdown for each active parameter and choose the engineering unit required by the project.

Enable/Disable — Use the checkbox on the right of each row to enable (checked) or disable (unchecked) individual parameters. Disabled parameters will not be transmitted.

Save & Next — Tap Save & Next to store the parameter configuration on the node and advance to Stage 3. A 'Sensor parameter updated successfully!!' toast confirms the save.

Figure 5-18 Stage 2: Select the Parameter

STAGE 3 TiltSense Reading

Stage 3 acquires a live measurement from the sensor to confirm that all configured parameters are producing valid output before the node is registered to the network. The screen title is 'TiltSense Reading'. Before a reading is taken, all parameter value fields display dashes.

5.6.2.3 Stage 3 — TiltSense Reading: Sample Values

The table below shows representative live values. Actual readings will vary depending on how the device is physically oriented during commissioning.

Parameter	Example Value	Unit	Interpretation
AXIS-X	0	deg	Tilt angle about X-axis is **0°**, meaning the sensor is **level along X** (no tilt in that direction).
AXIS-Y	0.5817	deg	Non-zero degree value Indicates the sensor is **slightly inclined** in this direction.
AXIS-Z	-90.0000	deg	Z-axis is **aligned with gravity (vertical)**. For most tiltmeters, ~±90° indicates the sensor is **lying flat on a horizontal surface**. The negative sign depends on axis orientation.
TEMP	28.24	deg C	Temperature measured **inside the TiltSense enclosure**. It generally reflects ambient conditions but may differ slightly due to device heating and enclosure effects.

NOTE	Before tapping Take Reading, all parameter value fields display dashes (— — — —). This is normal — values populate only after the reading is triggered.
NOTE	The values displayed in Stage 3 reflect the current physical orientation of the device at the time of the reading. The zero-reading baseline is established after final mounting — see Section 6.1.
NOTE	If any parameter remains dashed after Take Reading, verify the Bluetooth connection is still active and the node is powered on. Retry once.

5.6.2.4 Step-by-Step Procedure — Stage 3

Review Parameters — Confirm that all expected parameters(AXIS-X, AXIS-Y, AXIS-Z, TEMP) are listed with their configured units.

Take Reading — Tap Take Reading. The node acquires a live sample. Dashes are replaced by numerical values within a few seconds. The button changes to 'Stop Reading'.

Verify values — Confirm all four parameters return a numerical value and that TEMP is within the expected site ambient range. The exact axis values will depend on device orientation at this stage. **Adjust Offset (optional) —** If a tilt parameter reading needs to be zeroed or aligned to a known reference, tap "Adjust Offset >" on that parameter. A dialog opens showing the Tilt Parameter name, the Last Reading, and an editable "Enter Offset Value" field. Enter the desired offset (e.g., -90 to null out a 90.0000° reading). Read the warning carefully — an incorrect offset will shift all future readings and may require re-adjustment. Tap "Confirm & Set" to apply, or "Cancel" to discard. Repeat for any other parameter that requires correction. **Re-read after Offset —** If an offset was applied, tap "Take Reading Again" and verify the adjusted parameter now reflects the expected value.

Stop Reading — Tap Stop Reading to end the live reading session once values are verified.

Advance — Tap Next (or the navigation arrow) to proceed to Stage 4 to test hub connectivity.

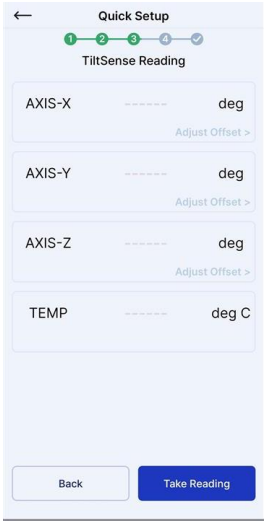


Figure 5-19 Stage 3: TiltSense Reading — awaiting

Figure 5-20 Stage 3: Live values acquired

Figure 5-21 Stage 3: Adjust Offset

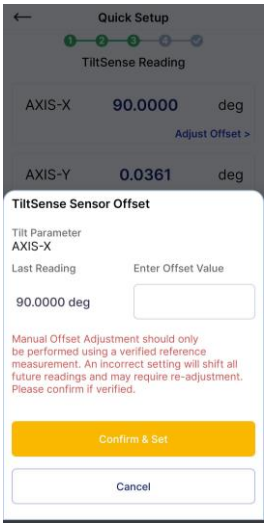


Figure 5-22 Sensor Offset

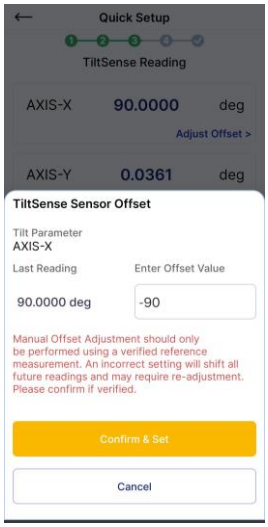


Figure 5-23 Stage 3: Enter Offset value

STAGE 4 Test Hub & TiltSense Connection

Stage 4 verifies the wireless LoRa link between the TiltSense node and the hub (gateway). The screen displays the active network parameters, real-time signal strength (RSSI and power) for both the node and hub, and a packet success rate. A successful test confirms the node is ready for hub registration.

Parameter / Indicator	Description
Network ID	The LoRa RF network the node is registered on (set in Stage 1).
Frequency	Operating radio frequency in MHz. Confirms the frequency plan is applied correctly.
Tx Power	Transmit power in dBm and mW. Higher values extend range but consume more battery.

RSSI (TiltSense & Hub)	Received Signal Strength Indicator. Higher absolute RSSI (closer to zero) indicates a stronger link.
dBm (TiltSense & Hub)	Signal power in decibel-milliwatts. Values between -30 dBm and -90 dBm are generally acceptable; below -100 dBm may indicate poor link quality.
GOOD to Go!	Status displayed when the link quality is sufficient for reliable data transmission.
Test Packet Status	Number of test packets received and percentage pass rate. 100% Pass confirms a reliable link.

NOTE	A 'GOOD to Go!' status with 100% packet pass rate indicates the node-hub RF link is healthy. Proceed with hub registration only after this confirmation.
NOTE	If RSSI values are below -100 dBm or packet pass rate is below 80%, reposition the node or hub antenna and repeat the test.

5.6.2.5 Step-by-Step Procedure — Stage 4

- **Review network parameters —** Confirm Network ID (e.g. 250), Frequency (e.g. 868.0 MHz), and Tx Power (e.g. 20dBm/100mW) match the planned site configuration. Tap 'Network Info' for full hub details.
- **Start Test —** Tap Start Test. The node transmits test packets to the hub. The signal bar charts change from grey to green and RSSI, dBm, and power values populate for both the TiltSense and Hub panels.
- **Monitor signal —** Watch the bar charts fill green. The 'GOOD to Go!' status (in green) appears above the signal panels when the link quality is sufficient.
- **Confirm GOOD to Go! —** Verify: 'GOOD to Go!' is displayed; Test Packet Status shows packets received (e.g. 5 Received pkt.); the pass bar shows 100% Pass / Fail 0%.
- **Stop Test —** Tap Stop Test once the pass rate has stabilised. The button area changes to show 'Test Again', 'Cancel', and 'Finish Setup'.
- **Finish Setup —** Tap Finish Setup to complete the commissioning wizard. The Setup Complete screen is displayed.
- **Test Again —** If signal quality was unsatisfactory, tap Test Again to re-run the link test after adjusting antenna position.
- **Register With Hub —** Once the link is confirmed, tap Register With Hub. A progress dialog (0–100%) is displayed during registration. Wait for the process to complete without interrupting the Bluetooth connection.

Figure 5-24 Stage 4: Test Hub & TiltSense Connection

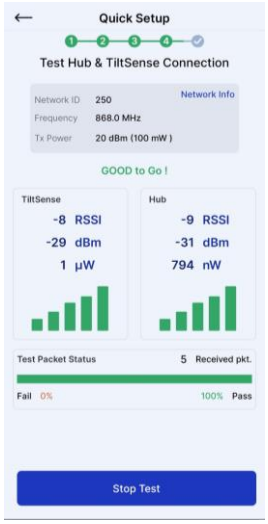


Figure 5-25 Stage 4: GOOD to Go! (green bars) Link Test Passed

Figure 5-26 Stage 4: Register With Hub

5.6.2.6 Setup Complete

When the node is successfully registered to the gateway, the Setup Complete screen is displayed showing the NexaWave logo. The node is now fully commissioned and will begin transmitting sensor data at the scheduled interval.

Button	Action
Back to the Setup Home	Returns to the TiltSense Home Screen for the current node. Use to access diagnostics, edit configuration, or connected device management.
Setup Another Device	Restarts the Quick Setup wizard to commission an additional TiltSense node. Useful for batch commissioning of multiple nodes on the same site visit.

NOTE Log in to the cloud monitoring portal and verify the node appears online with incoming data before leaving the site.

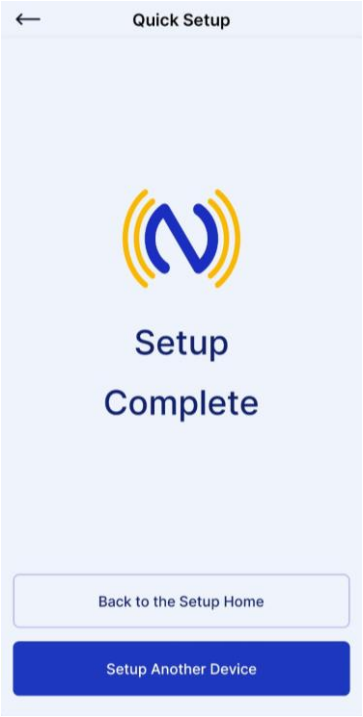


Figure 5-27 Setup Complete Screen

5.6.2.7 *Quick Setup — Stage Summary*

Stage	Screen Title	Purpose	Next Action
1	Set the Configuration	Set Node ID, installation date, relay hops, frequency plan, network ID, GPS location, and device time.	Save & Next
2	Select the Parameter	Define measurement parameter names, engineering units, and enable/disable individual parameters.	Save & Next
3	TiltSense Reading	Acquire live AXIS-X/Y/Z and TEMP readings to confirm if Sensor is working Properly.	Next
4	Test Hub & TiltSense Connection	Confirm LoRa RF link quality (RSSI, packet pass rate); register node with the hub gateway.	Finish Setup
✓	Setup Complete	Node is commissioned and transmitting. Return to Home Screen or set up another device.	—

5.6.3 Edit Configuration

The Edit Configuration screen allows users to review and modify the node's operating parameters after initial commissioning. It presents two tabs: TiltSense (node identity and network settings) and System Setup (sensor parameter definitions). Changes take effect after tapping Edit and saving.

> *Access path: Home Screen → Tap Edit Configuration*

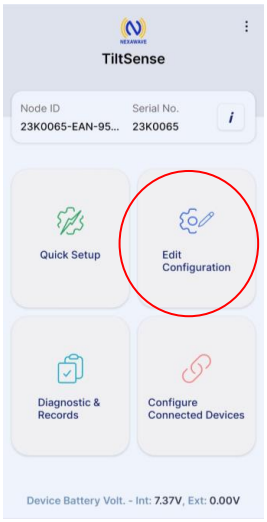


Figure 5-28 Home Screen: Edit Configuration Tile

5.6.3.1 *Tab 1 — TiltSense*

The TiltSense tab displays the current node configuration in read-only view. All fields mirror those set during the Quick Setup wizard. Tap Edit to modify. Tap Cancel to exit without changes.

Field	Description	Status
TiltSense ID	The node ID is a customizable alphanumeric identifier that can be set by the user for easier recognition. By default, it is set to the node name "TiltSense"	Editable
Installation Date	Date the node was physically installed at site. Can be updated if relocated.	Editable
Relay Hops	Number of wireless relay nodes between this node and the gateway.	Selectable
Frequency Plan	LoRa frequency band in use. Must match the gateway. Changing requires re-registration.(use **filter by Country** to get bands available in your country)	Selectable
Network ID	LoRa network identifier. Must match the hub configuration.	Selectable
Latitude / Longitude	GPS coordinates of the node installation point. Update if the node is physically relocated.	Editable
Device Date & Time	Current timestamp stored in the node's internal clock.	Editable

CAUTION Changing the Frequency Plan or Network ID after commissioning may disconnect the node from the network. Re-run Stage 4 of Quick Setup to re-register the node with the hub if these values are changed.

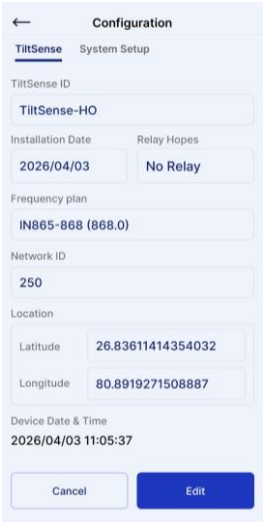


Figure 5-29 Edit Configuration: TiltSense tab — read-only view (Cancel / Edit)

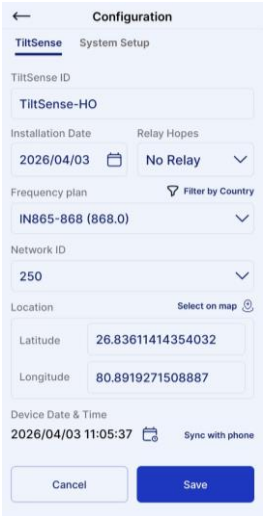


Figure 5-30 Edit Configuration: TiltSense tab — edit mode (Save / dropdowns active)

5.6.3.2 Tab 2 — System Setup

The System Setup tab shows the Sensor Parameter configuration — the same parameter settings defined in Stage 2 of the Quick Setup wizard. The table displays all measurement parameters with their current parameter names, engineering units, and enabled/disabled status.

Ch.	Parameter Name	Unit	Enabled	Description
X	AXIS-X	deg	✓	Tilt on X-axis (sine of angle)
Y	AXIS-Y	deg	✓	Tilt on Y-axis (degrees)
Z	AXIS-Z	deg	✓	Tilt on Z-axis (degrees)
T	TEMP	deg C	✓	Ambient temperature

NOTE Tap the pencil (edit) icon at the top-right of the Sensor Parameter card to enable editing. Disabling a parameter stops that measurement from being transmitted to the hub.

WARNING The 'Deregister with Hub' button permanently removes this node from the hub's registered device list. Use this function only when intentionally decommissioning or relocating the node. Re-registration via Quick Setup Stage 4 will be required to resume operation.

Figure 5-31 Edit Configuration: System Setup tab — read-only (pencil edit icon)

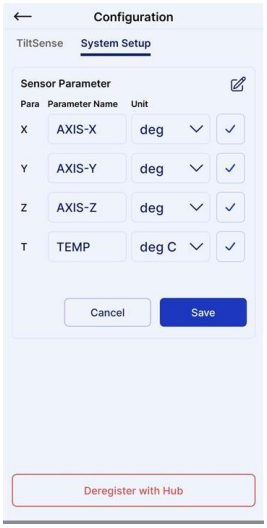


Figure 5-32 Edit Configuration: System Setup tab — edit mode (Cancel / Save)

5.6.4 Diagnostic & Records

The Diagnostic & Records section provides field engineers with a suite of post-commissioning tools to verify node health, test sensor outputs, and manage on-device data records. It presents four functions: Test Hub & TiltSense Connection, Test Reading, and Records.

> *Access path: Home Screen → Tap Diagnostic & Records*

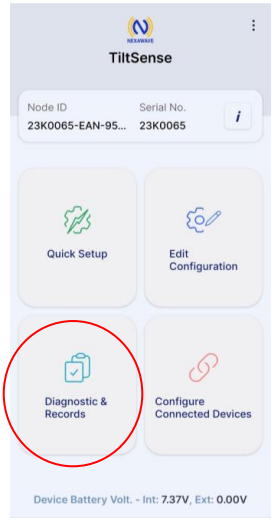


Figure 5-14 Home Screen: Diagnostic & Records Tile

Function	Description
Test Hub & TiltSense Connection	Re-runs the RF link test between the node and the hub to verify wireless connectivity and signal quality at any time after commissioning.
Test Reading	Triggers an on-demand live sensor reading to verify that all measurement parameters (AXIS-X/Y/Z, TEMP) are producing valid output.
Records	Manages on-device data records — download records from the node, upload records to a server, and view stored data in tabular format.

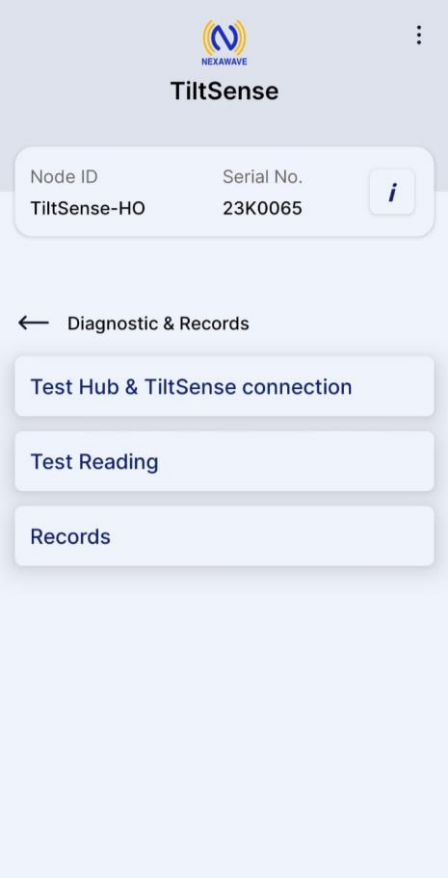


Figure 5-34 Diagnostic & Records — Main Menu

5.6.4.1 Test Hub & TiltSense Connection

This screen is identical in function to Stage 4 of the Quick Setup wizard. It allows the field engineer to re-test the wireless link between the TiltSense node and the hub at any time — for example, after node relocation, antenna adjustment, or to troubleshoot data transmission issues.

5.6.4.2 Step-by-Step Procedure

Open Test — From the Diagnostic & Records menu, tap Test Hub & TiltSense Connection.

Review network info — Confirm Network ID, Frequency, and Tx Power match the site configuration.

Start Test — Tap Start Test. The node transmits test packets to the hub.

Monitor signal bars — Watch the bar charts fill. Wait for 'GOOD to Go!' status.

Check packet status — Verify Test Packet Status shows 100% Pass.

Stop Test — Tap Stop Test once the result is confirmed.

Troubleshoot if needed — If signal is poor, reposition node or hub antenna and tap Start Test again.

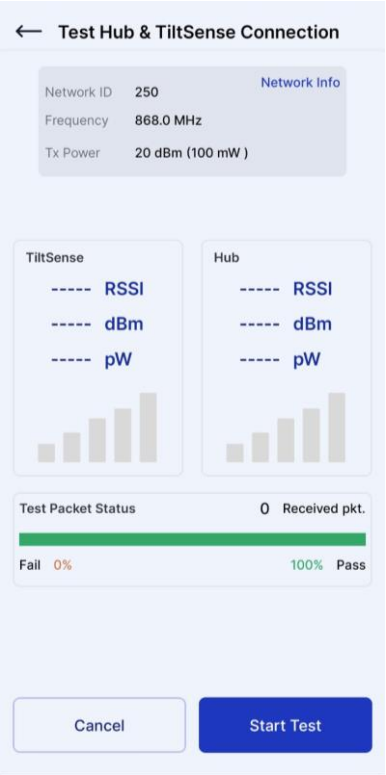


Figure 5-35 Hub & TiltSense Connection — Ready to Start

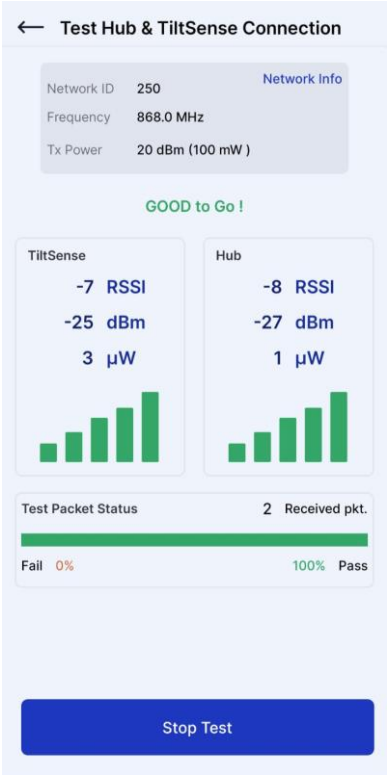


Figure 5-36 Hub & TiltSense Connection — GOOD to Go! (100% Pass)

5.6.4.3 Test Reading

The Test Reading screen triggers an on-demand measurement from the TiltSense node. All measurement parameters are displayed. Use this to confirm the sensor is operating correctly, to verify readings after re-installation, or to spot-check data without waiting for the next scheduled transmission.

5.6.4.4 Step-by-Step Procedure

Open Test Reading — From the Diagnostic & Records menu, tap Test Reading.

Verify parameters — Confirm all parameters (AXIS-X, AXIS-Y, AXIS-Z, TEMP) are listed with their configured names and units.

Take Reading — Tap Take Reading. The node acquires a live sample. Values replace the dashes within a few seconds.

Verify values — Check: AXIS-Z ≈ ±1.0 (near-vertical); TEMP within expected ambient range.

Adjust Offset (optional) — If a tilt parameter reading needs to be zeroed or aligned to a known reference, tap "Adjust Offset >" on that parameter. A dialog opens showing the Tilt Parameter name, the Last Reading, and an editable "Enter Offset Value" field. Enter the desired offset (e.g., -90 to null out a 90.0000° reading). Read the warning carefully — an incorrect offset will shift all future readings and may require re-adjustment. Tap "Confirm & Set" to apply, or "Cancel" to discard. Repeat for any other parameter that requires correction. **Stop Reading —** Tap Stop Reading to end the live reading session once values are verified. **Re-read after Offset —** If an offset was applied, tap "Take Reading Again" and verify the adjusted parameter now reflects the expected value.

Return — Tap Cancel or the back arrow to return to the Diagnostic & Records menu.

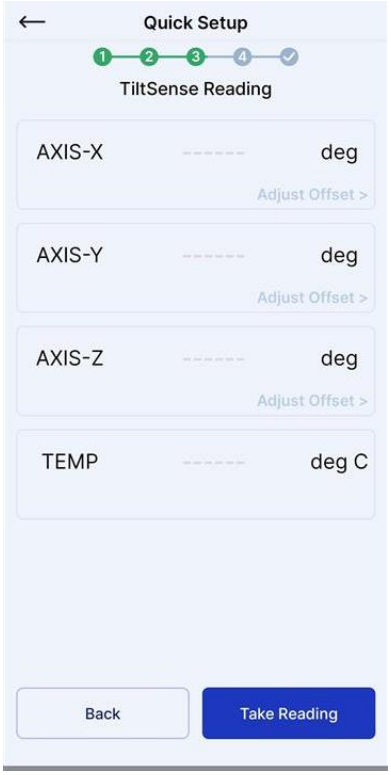


Figure 5-15 Test Reading — Before (dashes)

Figure 5-16 Test Reading — Live Values populated

5.6.4.5 Records

The Records screen manages the data log files stored on the TiltSense node. It provides three tabs — Download, Upload, and View — covering the complete data management workflow.

5.6.4.6 Tab 1 — Download

The Download tab shows the number of un-downloaded records on the node and provides a button to retrieve them to the connected phone.

Field / Control	Description
Records Since Last Download	Count of new data records stored on the node since the last successful download.
Records Since Last Upload	Count of records stored on the node since the last server upload.
Refresh	Tap to query the node for the latest record counts.
Download Records	Initiates transfer of all new records from the node to the phone's local storage as a CSV file. Do not disconnect Bluetooth during download.

NOTE Keep Bluetooth active throughout the download process. Interrupting the connection mid-transfer may result in incomplete or corrupted files.

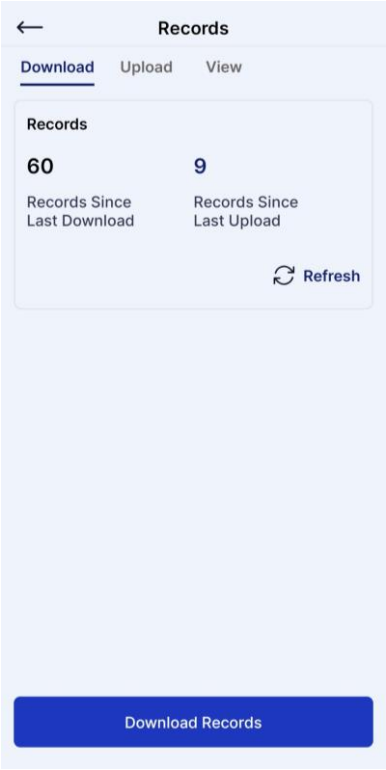


Figure 5-39 Records: Download — pending record counts

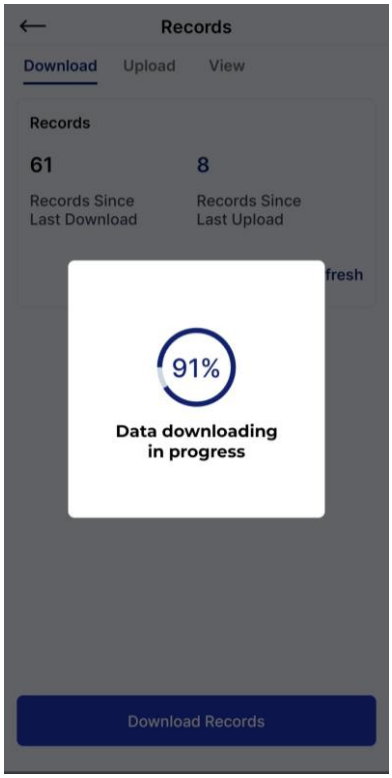


Figure 5-40 Records: Download in progress..

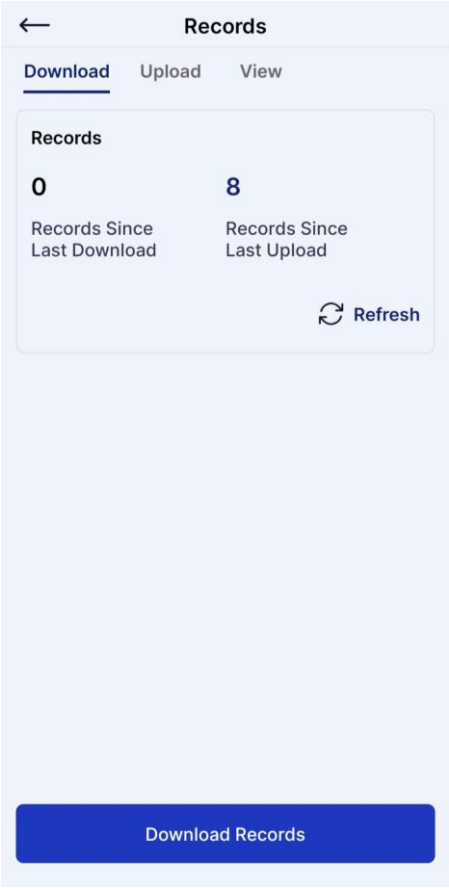


Figure 5-41 Records: Download complete — count resets to 0

5.6.4.7 Tab 2 — Upload

The Upload tab allows previously downloaded CSV files to be pushed from the phone to a configured data server over the network.

Field / Control	Description
Server IP Address	IP address of the destination data server. Tap the edit icon to enter or update the address.
Port	Network port number for the server connection. Must match the server's configured listening port.
Select Files	Displays a list of all CSV record files available on the phone. Tap the checkbox beside each file to select for upload.
Proceed	Initiates the upload of all selected files to the configured server. Requires active mobile data or Wi-Fi.

NOTE The Server IP Address and Port must be configured before the first upload. Obtain these values from the system administrator or cloud platform documentation.

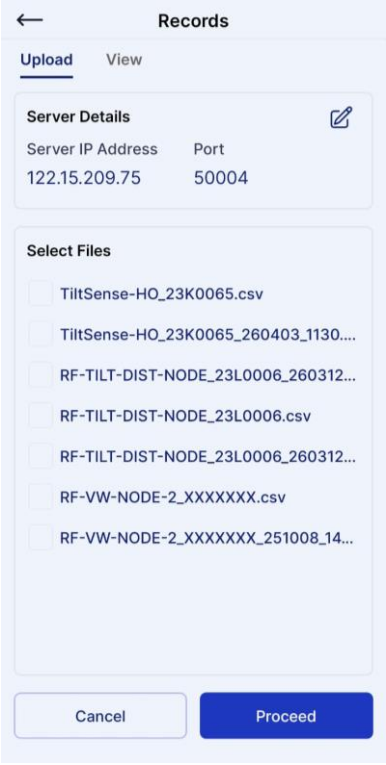


Figure 5-42 Records: Upload — Select Files

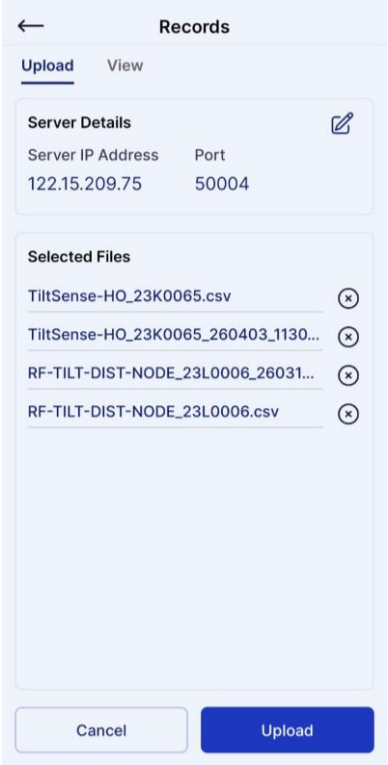


Figure 5-43 Records: Upload — Selected files confirmed

5.6.4.8 Tab 3 — View

The View tab allows the engineer to inspect the contents of a downloaded CSV record file directly on the phone. Select a file from the dropdown, then choose a specific parameter parameter for display.

Field / Control	Description
File selector (dropdown)	Lists all CSV record files available on the phone.
Parameter selector (dropdown)	Lists all measurement parameters stored in the selected file. Select the parameter to display.
File Date Range	Displays the earliest and latest timestamp in the selected file.
Data table (Date / Time / Value)	Tabular listing of all records for the selected parameter. Scroll vertically to browse all records.
-nan values	Indicates the sensor returned a not-a-number result for that timestamp, typically due to an out-of-range reading or communication error.

NOTE -nan entries indicate invalid or missing readings. A small number of -nan entries in a long record is generally acceptable. If widespread, investigate the sensor connection and node power supply.

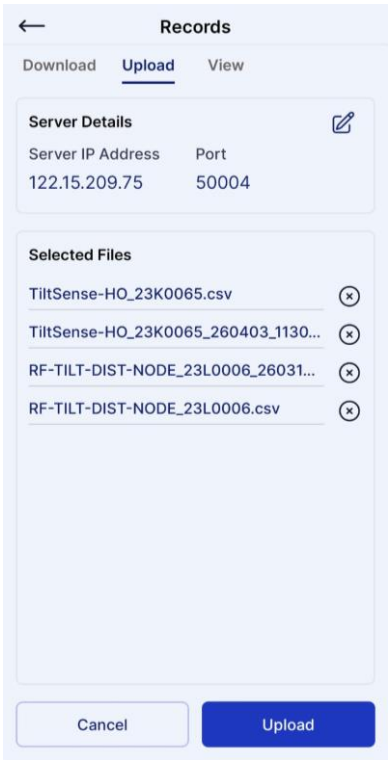


Figure 5-44 Records: View — tabular data (BATTV)

Figure 5-45 Records: View — BATTV trend graph

5.6.4.9 Diagnostic & Records — Function Summary

Function	When to Use	Key Action
Test Hub & TiltSense Connection	After node relocation, antenna adjustment, or troubleshoot data gaps.	Start Test → confirm GOOD to Go! and 100% Pass.

Test Reading	To verify sensor health, after re-installation, or for spot-check readings.	Take Reading → verify AXIS-Z ≈ ±1.0, TEMP within range.
Records — Download	Periodically to retrieve stored data from node to phone.	Download Records → verify count resets to zero.
Records — Upload	To push downloaded CSV files to the data server.	Configure server IP/port → select files → Proceed.
Records — View	To inspect record contents directly on the phone.	Select file & parameter → scroll table or use graph view.

5.6.5 Configure Connected Devices

The Configure Connected Devices section provides a network-level view of all devices associated with the TiltSense node's LoRa network. From here the engineer can view the full device topology, inspect and configure the hub (gateway), and manage communication appointments for individual sensor nodes.

> *Access path: Home Screen → Tap Configure Connected Devices*

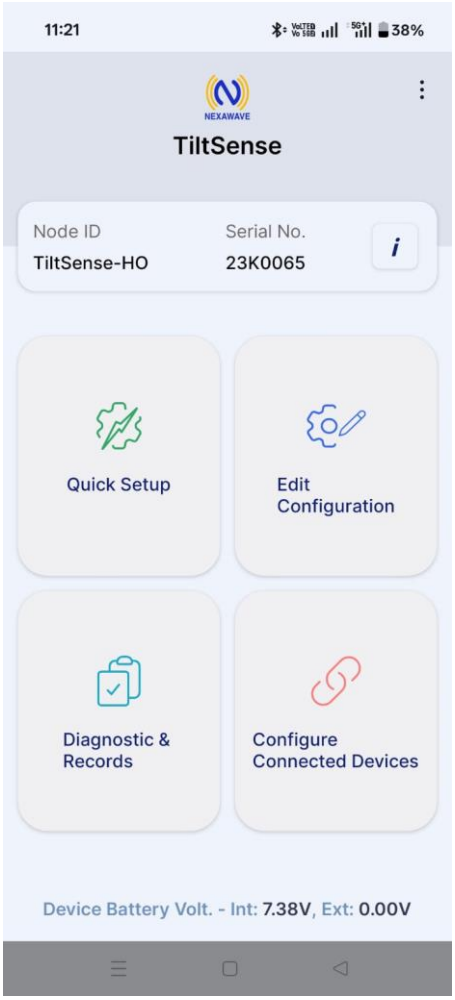


Figure 5-46 TiltSense Home Screen — four main function tiles

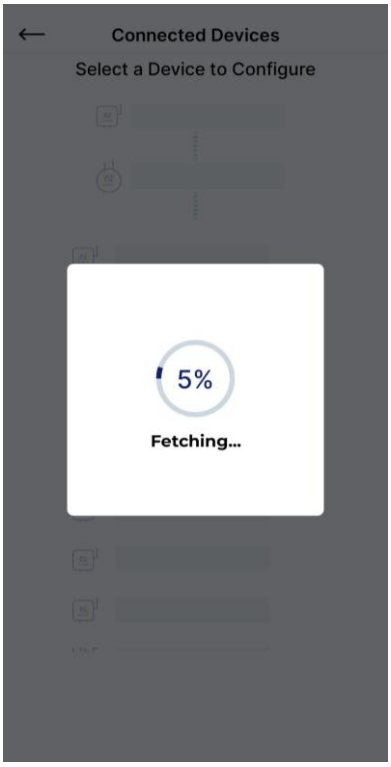


Figure 5-47 Connected Devices — Fetching... (5%)

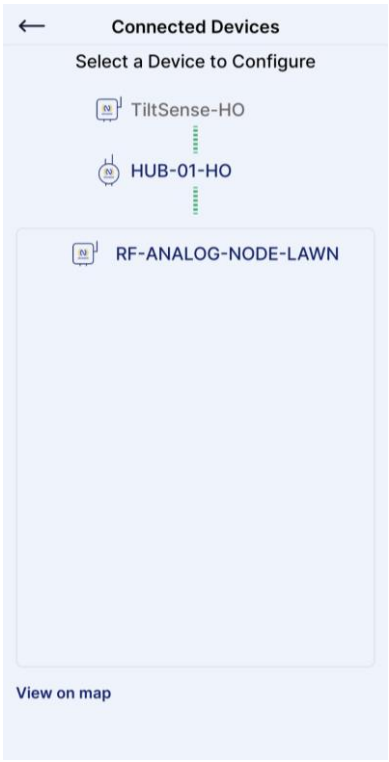


Figure 5-48 Connected Devices — device hierarchy loaded

5.6.5.1 Connected Devices — Device List

On opening, the app fetches the connected device list from the hub. Once loaded, the screen shows the full device hierarchy: the TiltSense node at the top of the chain, connected to the RF-GATEWAY hub, which in turn has one or more additional sensor nodes registered to it.

Element	Description
RF-TILT-NODE (top)	The currently connected TiltSense node (the device you are configuring via Bluetooth). Shown in grey as it is the origin of the view.
RF-GATEWAY	The LoRa hub/gateway that the TiltSense node is registered to. Displayed in blue as a selectable/configurable item.
RF-VW-NODE (listed below gateway)	Additional sensor nodes (e.g. vibrating wire nodes) registered to the same gateway. Tap any node to view its details.
Dashed lines	Visual representation of the LoRa communication links between devices in the network hierarchy.
View on map	Tap to open a map view showing the GPS coordinates of all connected devices in the network.

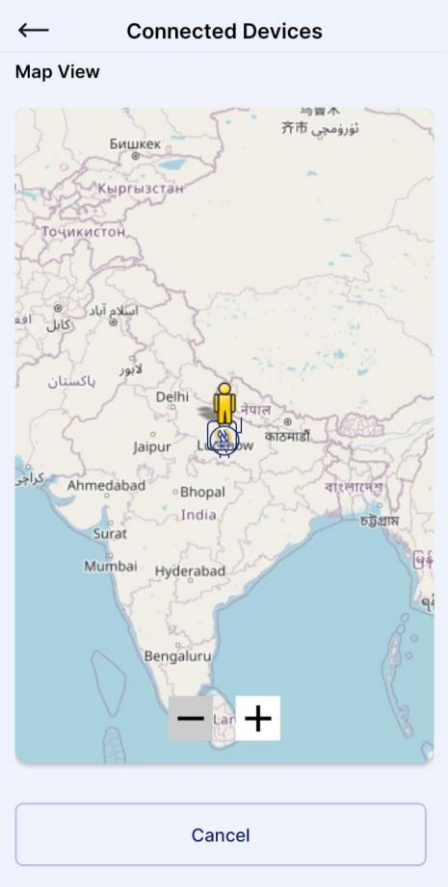


Figure 5-49 Connected Devices — Map View showing node GPS locations

5.6.5.2 Hub (RF-GATEWAY) — Details & System Setup

Tapping RF-GATEWAY opens the HUB detail screen — a read-only summary of the gateway's identity and network parameters with a count of all registered nodes.

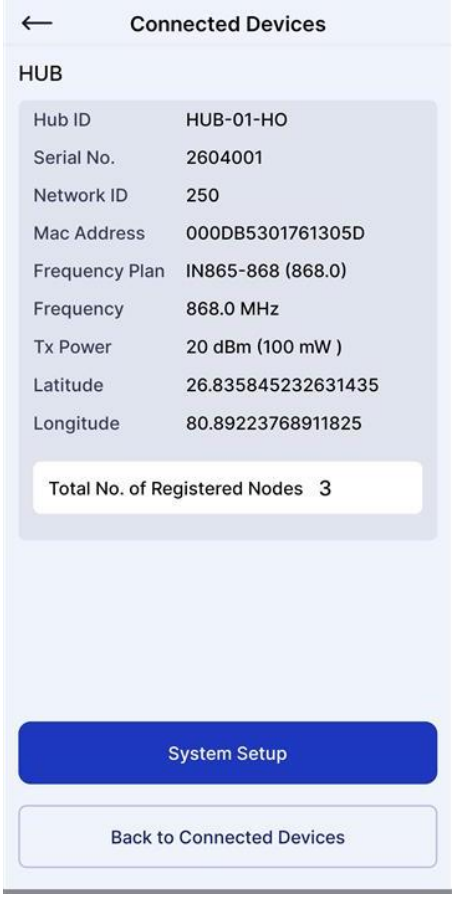


Figure 5-50 Hub (RF-GATEWAY) Details — identity and registered node count

5.6.5.3 Hub System Setup

Tapping System Setup on the Hub Details screen allows the engineer to set the hub's logging schedule and synchronize the hub clock.

Field / Control	Description
Next Scan Start Time	The scheduled time at which the hub will begin its next data collection scan (HH:MM format).
Scan Interval	The time interval between successive hub scan cycles (HH:MM format).
Device Date & Time	Current date and time stored in the hub's internal clock. Tap 'Sync with phone' to synchronize.
Erase Gateway memory	Permanently deletes all data records stored on the hub. Cannot be undone.
Save	Writes the updated Next Scan Start Time and Scan Interval values to the hub.

NOTE The Scan Interval determines how frequently the hub collects readings from all registered nodes. Setting a very short interval on battery-powered nodes will significantly reduce battery life.

WARNING Erase Gateway memory permanently removes all stored records from the hub. Ensure all records have been downloaded from the hub before using this function.

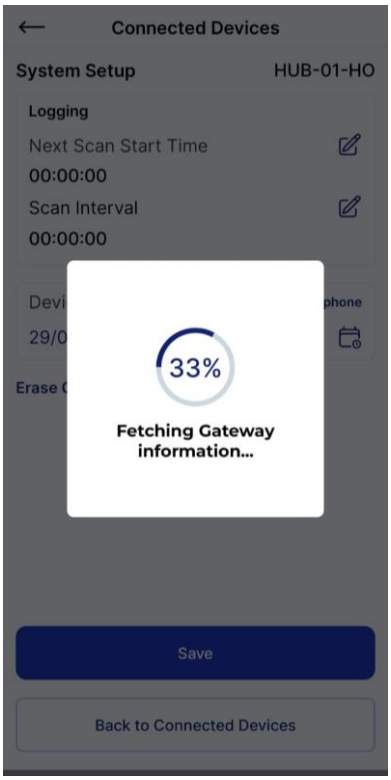


Figure 5-51 Hub System Setup — Fetching Gateway information (33%)

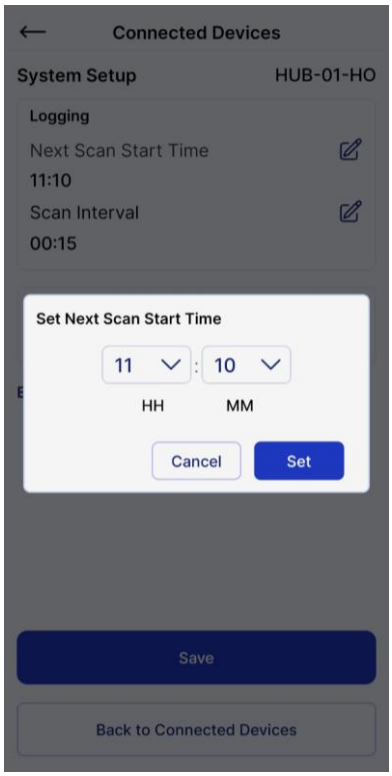


Figure 5-52 Hub System Setup — Set Next Scan Start Time dialog

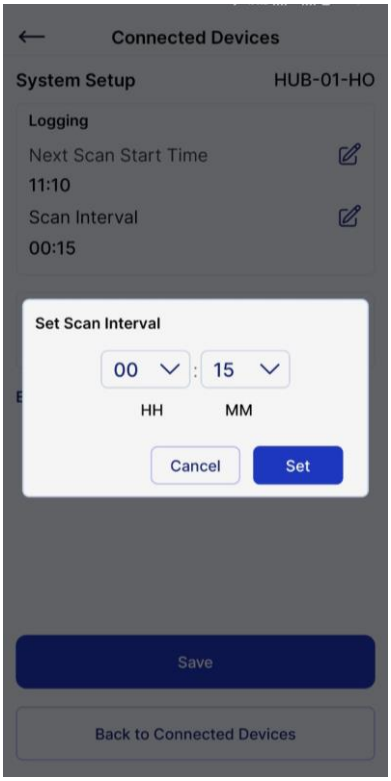


Figure 5-53 Hub System Setup — Set Scan Interval dialog

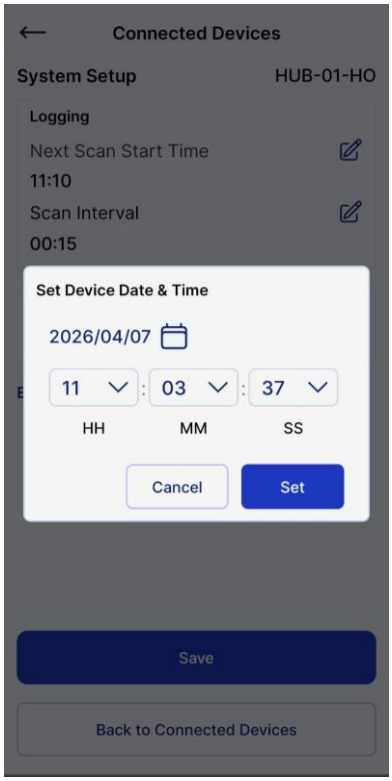


Figure 5-54 Hub System Setup — Set Device Date & Time dialog

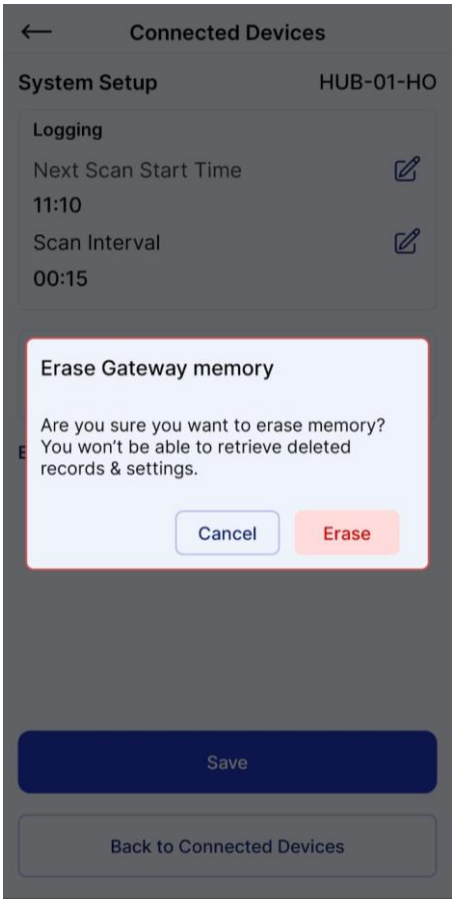


Figure 5-55 Hub System Setup — Erase Gateway memory confirmation

5.6.5.4 Sensor Node — Details & Appointment Management

Tapping any sensor node in the Connected Devices list opens the node detail screen. This screen displays the node's identity parameters and provides the Appointment management interface.

5.6.5.5 Understanding Appointments

An Appointment is a reserved time slot during which the hub will attempt to communicate directly with a specific node. This is used when a node needs to receive a configuration update or when the hub needs to poll the node outside of the normal scan schedule.

Indicator	Status	Meaning
● (Red)	Not Booked	No appointment is currently scheduled for this node. Tap Get Appointment to request a time slot.
● (Yellow)	Waiting	An appointment has been booked. The hub has allocated a time slot, and the countdown is in progress.
● (Green)	Active	The appointment is in progress — the hub is actively communicating with the node.

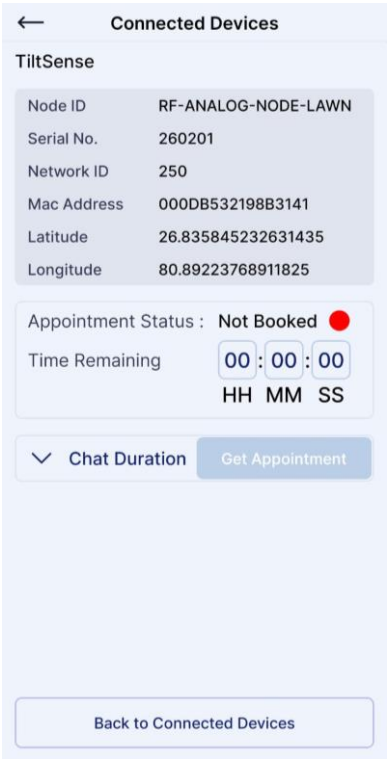


Figure 5-56

Sensor Node Detail — Appointment Status: Not Booked

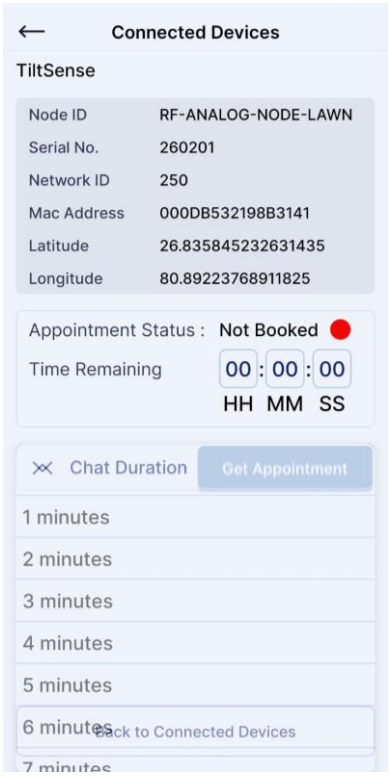


Figure 5-57

Sensor Node Detail — Chat Duration dropdown open

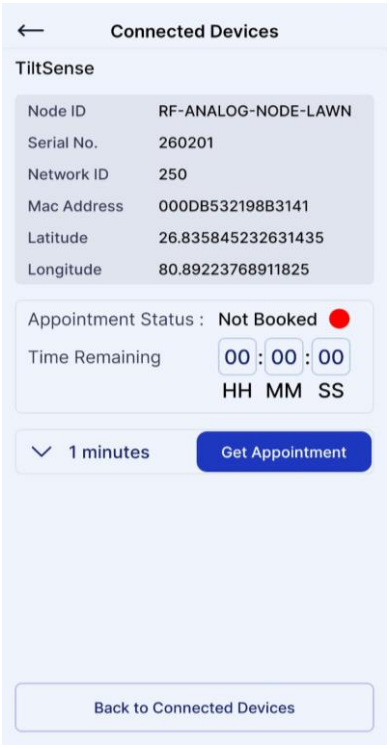


Figure 5-58

Sensor Node Detail — 1 minute selected, ready to book

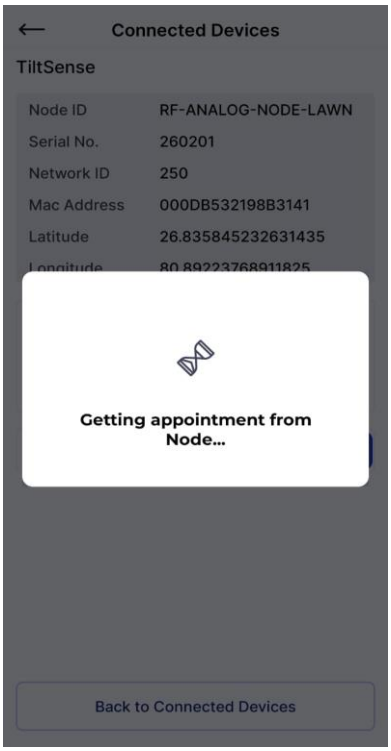


Figure 5-59

Getting appointment from Node... progress dialog

5.6.5.6 Step-by-Step — Get Appointment

Select node — From the Connected Devices list, tap the target node. The node detail screen opens showing Appointment Status: Not Booked.

Select Chat Duration — Tap the Chat Duration dropdown and select the required communication window duration.

Get Appointment — Tap Get Appointment. The status changes to Waiting and the Time Remaining countdown begins.

Monitor countdown — Observe the countdown timer. The node will communicate with the hub before the timer reaches zero.

Return — Tap Back to Connected Devices to return to the device list. The appointment remains active in the background.

5.6.5.7 Configure Connected Devices — Summary

Screen	What You Can Do	Key Controls
Connected Devices List	View full network topology. Navigate to hub or node details. Open map view.	Tap device to drill in | View on map
Hub Details (RF-GATEWAY)	View hub identity, frequency, power, registered node count.	System Setup | Back to Connected Devices
Hub System Setup	Set scan schedule. Sync hub clock. Erase gateway memory.	Edit icons | Sync with phone | Save
Node Detail	View node identity and GPS. Check appointment status. Book or cancel appointment.	Chat Duration | Get Appointment | Cancel Appointment

6 INSTALLATION PROCEDURE

6.1 Tilt meter installation

The model EAN-95MW tilt meter (biaxial) is used to measure rotation of structures in the plane parallel as well as perpendicular to the surface/wall on which the tilt meter is mounted.

The tilt meter can be mounted on a vertical (wall, column, pier, etc) or horizontal plane (floor, ceiling, etc), depending on the application and monitoring requirement.

- Tilt meter enclosure has mounting holes for fixing it on any place surface.

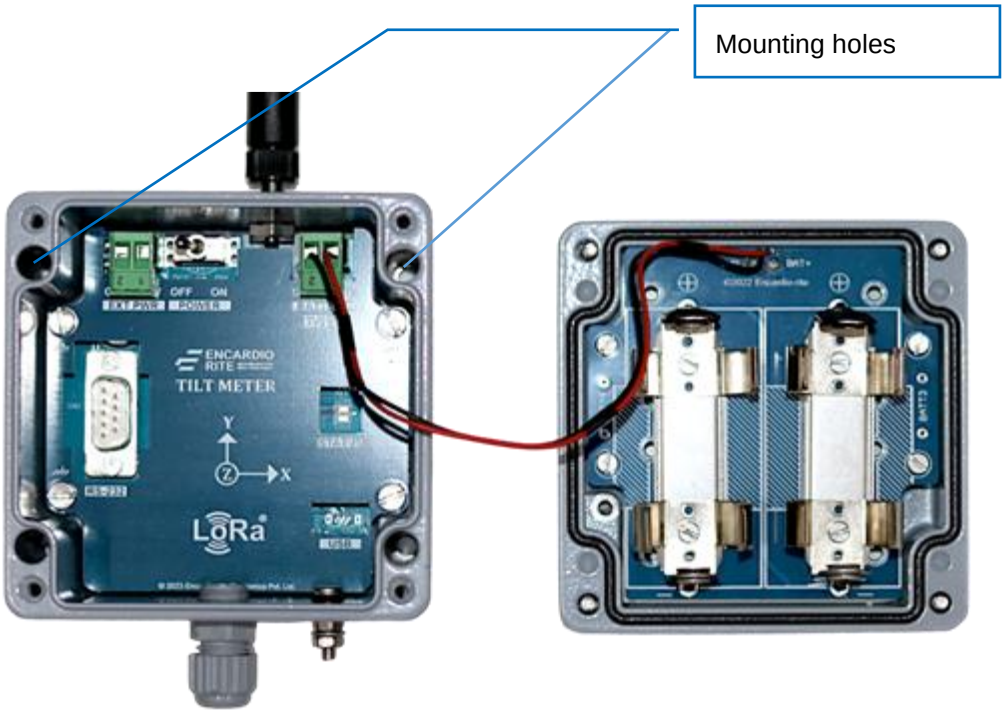


Figure 6-1

- Mark the locations of four mounting holes.
- Ensure that position of the holes are aligned correctly. For vertical mounting, use a spirit level.

- Drill holes depending on the mounting fasteners being used for fixing the tilt meter.
- Fix the tilt meter on plane surface. Be careful of the orientation of the tilt meter while mounting on a horizontal or vertical plane. Refer to the section 6.3 for more details.
- After the tilt meter is fixed to the structure, it is adjusted to the zero reading (initial reading). Subtracting the initial tilt reading from the subsequent tilt reading gives change in tilt of structure over a period of time.

CAUTION: Install tilt meter on a structural member of a building and not on the façade or boundary wall which may behave in a different manner than the main building. Do not install it at a location having vibrations, for example caused by heavy rotary machinery. Avoid installing at location where it can be vandalized or get hit by pedestrians.

6.2 Protection of tilt meter

Avoid installation of tilt meter in parts of the structure exposed to direct sunlight. If this is not feasible, a box made from thermocol or similar heat insulating material should be installed covering the tilt meter and protecting it from direct sunlight.

If certain degree of mechanical protection is also required, wooden or fiberglass protection boxes may be considered. Heat insulating tape can be fixed to the inner surface of such boxes for thermal insulation.

6.3 Sign convention

Carefully orient the tilt meter during installation.

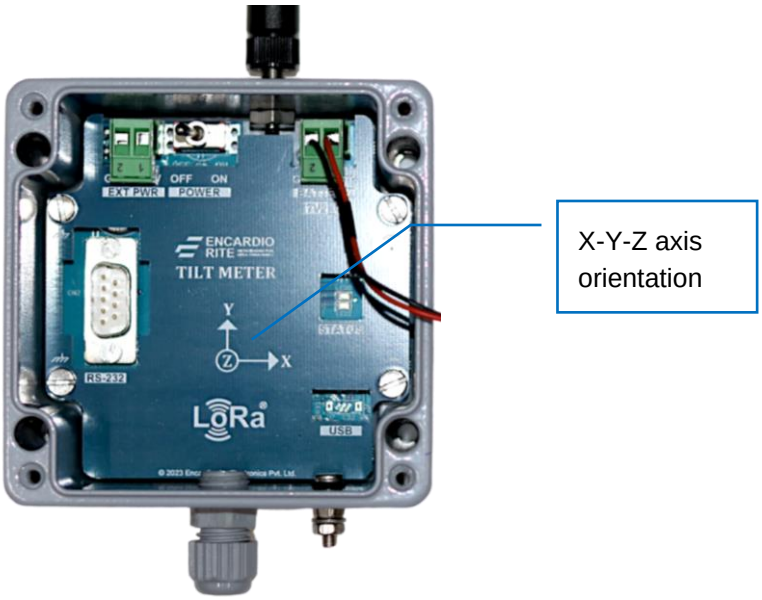


Figure 6-2

6.3.1 Vertical plane

- Movement parallel to plane – Clockwise movement will show increase in X-axis readings (positive sign), while anti-clockwise movement will show decrease in X-axis readings (negative sign)
- Movement perpendicular to plane – Clockwise movement will show increase in Z-axis readings (positive sign), while anti-clockwise movement will show decrease in Z-axis readings (negative sign)

6.3.2 Horizontal plane

- Movement parallel to plane – Clockwise movement will show increase in X-axis readings (positive sign), while anti-clockwise movement will show decrease in X-axis readings (negative sign)
- Movement perpendicular to plane – Clockwise movement will show increase in Y-axis readings (positive sign), while anti-clockwise movement will show decrease in Y-axis readings (negative sign)

6.4 Environmental factors

Several factors can influence the behavior of the structure being monitored for change in tilt using the tilt meter. Having knowledge of the factors influencing the behavior of the structure is essential for analyzing the tilt meter data. Data related to factors such as rain fall, tidal or reservoir levels, excavation or fill levels, construction activities nearby the structure, movement of traffic near the structure and its type, wind, ambient temperature, barometric pressure etc. should also be observed and collected along with the tilt meter data.

7 TROUBLESHOOTING

7.1 Unable to connect Node over Bluetooth

- Android phone's Bluetooth may not be enabled.
- Bluetooth modem may be out of Bluetooth range from android phone.
- Bluetooth modem may not be paired with android phone.
- Check Bluetooth modem baud rate settings. It must be configured for 115200 and hardware flow control should be OFF.
- Turn OFF the Node and then turn ON again.
- Remove the power from node, wait for 30 seconds and then connect the power again. Now try to connect.

7.2 Unable to connect Node with FTDI-OTG Cable

- RS232 interface connector may be loose.
- Check the interface cable's connector for damage.
- RS232 interface cable may be broken.
- Node battery may be discharged.
- Remove the batteries, wait for 30 seconds and then mount the batteries. Now try to connect.

7.3 Unable to communicate with Gateway

- Check the antennafor loose connection.
- Antenna to RF modem connecting cablemay be damage.
- Antenna itself may be damaged try with another antenna
- Node battery may be discharged.

8 SAFETY AND WARNINGS

8.1 Operation Safety

- Before taking any action, please read the users manual carefully,.
- Ensure that all the procedures and installations are correctly carried out.
- The case and mountings should be grounded, where practicable.
- This product has been designed to meet a certain water-proof level. However, it becomes vulnerable to water ingress when the lid screws are not tightened properly, or if the cable gland has not been sealed properly.
- This product must not be disassembled under any circumstances. If done, it will void the warranty and may leave the product in a dangerous state.

8.2 Battery caution & warning

- To install the battery into a holder, please follow the "+" (positive) and "-" (negative) signs carefully. Wrong orientation of a battery could potential cause unit damage.
- If battery is incorrectly replaced, there may be danger of explosion.
- Use only with the type recommended by the manufacturer. Observe any warnings specified by the battery manufacturer.
- The battery has a relatively high capacity, so please take special care during storage and usage.
- When disposing of the batteries please contact your local authorities or dealer and ask for the correct method of disposal.

When disconnecting the battery, please take special care not to apply excessive force, otherwise the battery holder and the nearby circuitry can get damaged. If the above safety precaution and warnings are not followed, the manufacturer cannot be held responsible for any damage and injury caused to the users.

9 WARNING & RADIATION EXPOSURE

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

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.

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

10 ENVIRONMENTAL RESPONSIBILITY DECLARATION

Encardio Rite Group ("**Encardio**") is committed to ensuring full compliance with environmental responsibilities under all applicable Indian environmental statutes, collectively referred to herein as the **"Law(s)"**. This declaration is applicable to all products manufactured and marketed by Encardio.

1. **Scope:** This declaration binds and guides every stakeholder involved in the product's lifecycle including individuals, institutions, organizations, or entities hereinafter referred to collectively as the **"User(s)"**.
2. **Waste Segregation and Handling:** All Users are required to manage the product and any waste generated from its use in accordance with the law, including proper segregation of waste at the source into biodegradable, recyclable, and hazardous categories; authorized disposal of all end-of-life products, electronic components, batteries, and packaging materials only through government-authorized collection, recycling, or refurbishing systems; and ensuring that products bearing the crossed-out wheeled bin symbol are not mixed with general household or municipal waste streams.
3. **E-Waste Disposal and Battery Waste Management:** All electronic and electrical equipment and components manufactured or sold by Encardio must be disposed of only through authorized recycling or refurbishing facilities as per applicable law, ensuring no harm to human health or the environment; users shall ensure that all used items are returned to designated collection points and shall also maintain proper documentation and adhere to return, reporting, or record-keeping obligations; products nearing end-of-life must not be discarded along with general household waste, as improper disposal of e-waste may lead to toxic chemical release and pollution.
4. **Plastic Waste Management:** Users must not discard plastic components or packaging into unsorted municipal waste; instead, they should separate and hand over such plastic waste to authorized waste processors and ensure that no banned plastic items, as notified under law, are used or circulated.
5. **Industrial and Hazardous Waste:** If the User operates any facility where industrial, hazardous, or biomedical waste may arise due to the installation, maintenance, or testing of the product, all necessary consents and permits must be obtained and renewed from competent authorities; adequate protective measures must be taken to ensure no harm is caused to the environment or human health; and such waste must be stored, treated, and disposed of in accordance with the law.
6. **Pollution Control:** Users operating manufacturing, repair, or testing premises must not emit air or water pollutants beyond prescribed limits, must operate only after securing applicable consents under the law, and must maintain environmental records and submit reports as required
7. **Record Keeping and Reporting:** All Users associated with Encardio must maintain comprehensive records of production, sales, collection, and disposal in accordance with applicable Law(s) and submit timely reports to regulatory authorities.
8. **Contact and Support:** Encardio urges all Users to act responsibly and support sustainable environmental practices by adhering to this declaration and the Law. For safe disposal and further compliance assistance, Users are encouraged to contact their local municipal waste authorities, or authorized recyclers. Non-compliance with the above obligations may constitute a violation of Indian environmental laws and attract penalties under the relevant Law(s). Users can contact Encardio at:

Contact Number: +91 522 2661039-42

Website**:** https://www.encardio.com/

11 WARRANTY

The Company warrants its products against defective workmanship or material for a period of 12 months from date of receipt or 13 months from date of dispatch from the factory, whichever is earlier. The warranty is however void in case the product shows evidence of being tampered with or shows evidence of damage due to excessive heat, moisture, corrosion, vibration or improper use, application, specifications or other operating conditions not in control of Encardio-Rite. The warranty is limited to free repair/replacement of the product/parts with manufacturing defects only and does not cover products/parts worn out due to normal wear and tear or damaged due to mishandling or improper installation. This includes fuses and batteries.

If any of the products does not function or functions improperly, it should be returned freight prepaid to the factory for our evaluation. In case it is found defective, it will be replaced/repaired free of cost.

A range of technical/scientific instruments are manufactured by Encardio Rite, the improper use of which is potentially dangerous. Only qualified personnel should install or use the instruments. Installation personnel must have a background of good installation practices as intricacies involved in installation are such that even if a single essential but apparently minor requirement is ignored or overlooked, the most reliable of instruments will be rendered useless.

The warranty is limited to as stated herein. Encardio Rite is not responsible for any consequential damages experienced by the user. There are no other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and of fitness for a particular purpose. Encardio Rite is not responsible for any direct, indirect, incidental, special or consequential damage or loss caused to other equipment or people that the purchaser may experience as a result of installation or use of the product. The buyer's sole remedy for any breach of this agreement or any warranty by Encardio Rite shall not exceed the purchase price paid by the purchaser to Encardio Rite. Under no circumstances will Encardio Rite reimburse the claimant for loss incurred in removing and/or reinstalling equipment.

A lot of effort has been made and precaution for accuracy taken in preparing instruction manuals and software. However best of instruction manuals and software cannot provide for each and every condition in field that may affect performance of the product. Encardio Rite neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damage or loss that results from use of Encardio Rite products in accordance with the information contained in the manuals or software.

Products described in Encardio Rite's catalogs are subject to modification and improvement as dictated by subsequent developments. Encardio Rite reserves the right to modify, change or improve products, to discontinue them or to add new ones without notice.

12 RECOMMENDATION OF BATTERIES

We recommend to use any of the following batteries in all Encardio-rite products (Dataloggers, Wireless Nodes and Gateway). These batteries can be sourced locally.

SN	Manufacturer	Mfr Part No.	Battery type	Datasheet	Photo	Example Links to buy
1	ACT	ER34615M	LI-SOCL2 (Power Type)	https://actsales04.en.ec21.com/ACT_ER34615M_3.6volts_Lithium_Battery--8201912_8271376.html		actsales
2	SAFT	LSH 20	LI-SOCL2 (Power Type)	https://www.saft.com/products-solutions/products/ls-lsh-lsp?text=&tech=84&market=&brand=764&sort=newest&submit=Search		Digikey Atbatt.com Potensa Batteryexperts.com

3	SAFT	LSH 20 HTS	LI-SOCL2 (Power Type)	https://www.saft.com/products-solutions/products/ls-lsh-lsp?text=&tech=84&market=&brand=764&sort=newest&submit=Search		Tteckai.com indiamart patareid Aliexpress.com globalbat
4	Ultra Life	ER34615M	LI-SOCL2 (Power Type)	https://www.ultralifeindia.com/wp-content/uploads/2020/01/TDS_ER34615M.pdf		mouser
5	FANSO	ER34615M	LI-SOCL2 (Power Type)	https://www.texim-europe.com/product/battery-and-power-supplies/batteries/primary-batteries/lithium-li-socl2/detail/er34615m-fso		texim-europe tme.com ecocell.com batterydirect.com
6	RAMWAY	ER34615M	LI-SOCL2 (Power Type)	http://en.ramwaybat.com/product_46/		Alibaba.com Lazada zgqjnyw.mobi

7	Bex Batteries	ER34615M	LI-SOCL2 (Power Type)	batteryExperts		batteryExperts
8	PKCELL	ER34615M	**LI-SOCL2 (Power Type)**	Pkcellpower.com		Pkcellpower.com electronicworld Amazon Alibaba
9	HCB	ER34615M	LI-SOCL2 (Power Type)	https://www.enhcb.com/products/li-socl2-lithium-thionyl-chloride-cylindrical-battery/		Enhcb.com
10	FORTE	ER34615M	LI-SOCL2 (Power Type)	Fortebattery		Fortebattery zinchu ozon

11	EVE	ER34615M	LI-SOCL2 (Power Type)	https://microchip.ua/battery/er34615m.pdf		Jm.pl repairnspares
12	TekCell	ER34615M	LI-SOCL2 (Power Type)	https://www.tme.eu/Document/69a4b065e0660fedf2cdae1c1c0fb8d4/BAT-ER34615M.pdf		tme