WISENMESHNET® L-Series RS-485 Interface Node User Manual

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Revision History and Clarification

Rev.	Issue Date	Revisions	Written By	Revised By
V1.0	01/11/2019	1st Issue	Xiaoyan Huang	Dr. Yan Wu

Document Definition:

It defines the specifications (i.e., introduction, technical features, deployment and maintenance methods) of the WISENMESHNET® RS-485 interface node, which is one of the key components in WISENMESHNET® Low Power, Intelligent, Wireless Sensor Network (WSN) system. It is responsible to:

- Sample data from external RS-485 sensors, such as wind speed and direction, rainfall level, gas density, soil moisture, air quality, etc.;
- Form a time-synchronized Wireless Sensor Network with others nodes in the system;
- Transmit the data packet to a gateway.

Scope:

Customer Site Project Managers and Engineers, Wisen Service Engineers, etc.

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1. Product Introduction

The WISENMESHNET® RS-485 Interface Node is one of the key products in our patented WISENMESHNET® geotechnical safety monitoring system. Working together with the WISENMESHNET® gateway product and the specified RS-485 type sensors, it intelligently delivers the real-time data of RS-485 type sensors to the information centre.

The WISENMESHNET® RS-485 Interface Node operates using our core technology, i.e., the WISENMESHNET® Low Power, Intelligent, Wireless Sensor Network protocol, together with its internal RS-485 module and power unit. This interface node is compatible with various RS-485 sensors after the matched Wisen program upgrade. This product satisfies the three fundamental identities of the system:

A. Network Life Span: to maximise battery life across the mesh network as a whole;

B. Network Data Arrival Rate: to minimise data packet loss;

C. Single Node Environmental Coverage: to maximise radio coverage.

Our product has IP66 and is designed to work in a tough environment. It is small in size, reliable in performance, easy for maintenance, has high precision during sampling, and has strong immunity to radio-interference.

Figure 1. The RS-485 Overview in Photos.

2. System Structure Layout

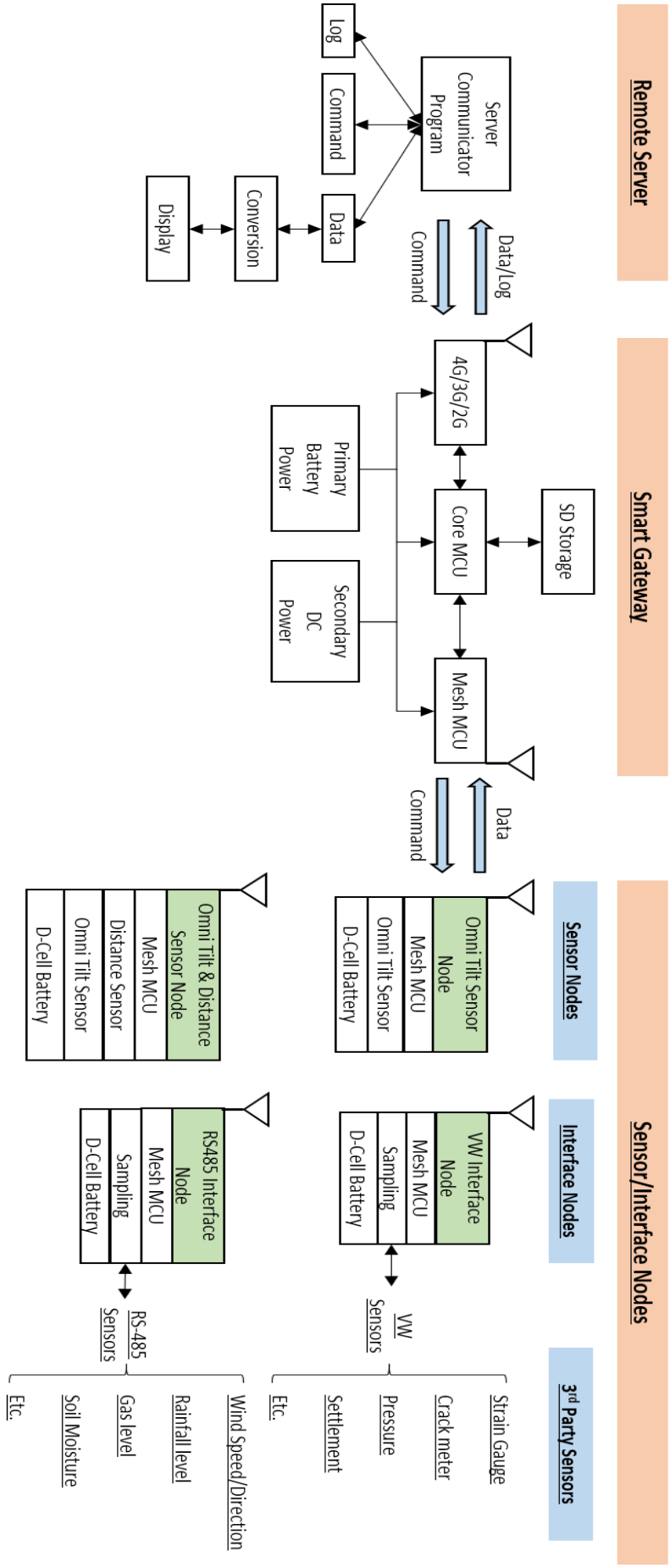

Figure 2. System Structure Layout.

3. Node & Radio Features

Node Features:

Basics	
Battery Power	Qty. x 1 (3.6V Lithium primary D-Cell ER34615)
Accuracy Stop Voltage	2.7VDC
Mesh Stop Voltage	2.1VDC
Battery Connection	Standard Aluminium Battery Holder
Working Current (DC)	Max. 160mA (Typ. 100mA)
Local Storage	Min. 450 Messages during Meshing
L x W x H	Interface Node: 100 x 100 x 60mm
Node Weight	0.45kg
Standard System Parameter	
Temperature	Range: -40 to 85°C; Accuracy: +/-1°C; Resolution: 0.1°C
Voltage	Accuracy: +/-0.1V
WSN Interface	
WSN Protocol	WISENMESHNET® Protocol
Re-Calibration Method	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)
Industrial Standard	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-40 to 85°C

Radio Features:

	FCC 915MHz System	**CE 868MHz System**
Radio Band	902-928MHz	865-868MHz
Central Frequency (**Default**)	**905**/910/915/920/925MHz	**865.75**/866.25/866.75/867.25MHz
Default Transmit Power	18dBm	14dBm
Receive Sensitivity	-112dBm	
Bandwidth	500kHz	
Transmission Speed	19.2kb/s	

No. of Mesh Hop* Supported	6 Hops	
Sampling Interval	1-60mins	
Antenna Description	Mesh Antenna	Omni-directional (20cm in length) or Customised
	2/3/4G-Antenna	Omni-directional 3.5dBi (20cm in length) or Customised
	Antenna Connector	SMA (M)

* E.g., the radio link from a gateway to the 1st layer node is called the 1st hop.

4. Terminologies

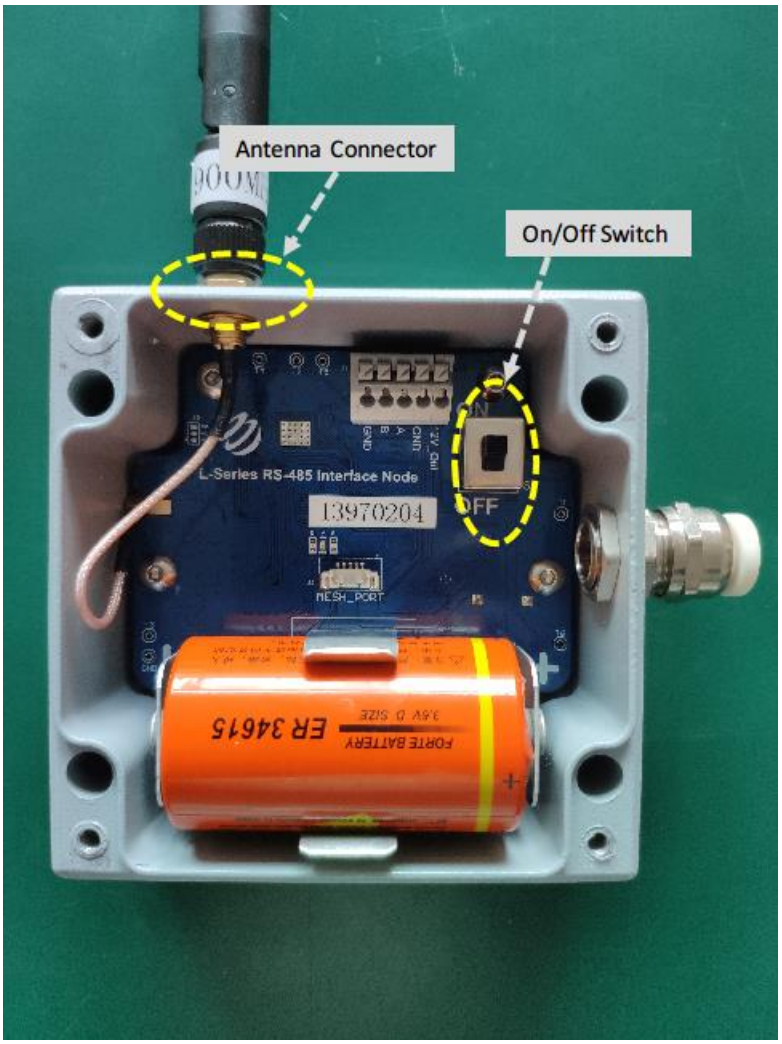

Figure 4. RS-485 Interface Node Internal Configuration Terminologies

5. Operation Procedures

5.1. System Deployment Notifications

1) Location: The deployment location of a RS-485 Interface Node is usually determined by the required monitoring or inspection location;
2) Before any RS-485 Interface Node is switched on, two tasks will need to be carried out:
   A. Unlike the Tilt Node which has a MEMS tilt sensor embedded in the node, the RS-485 sensors chosen by the customer must be connected to the RS-485 Interface Node;
   B. A gateway must be deployed, powered on and proven to be working properly. Otherwise, the nodes will need to be switched off, then switched on again after a gateway is switched on. So simply speaking, the rules to follow to correctly deploy a WISENMESHNET system are:
      1) Gateway first;
      2) then nearby nodes with the RS-485 sensors connected;
      3) then further nodes with the RS-485 sensors connected.
3) During deployment, the Serial Number, i.e., SN of a node and the orientation of the RS-485 sensors deployed against their site references must be recorded;
4) The connections between a customer chosen RS-485 sensor and a Wisen RS-485 W Interface Node must strictly follow the rules stated in this document;
5) All the node should have its antenna point upwards.

5.2. Deployment Procedures

1) Open the box: Take the node out of the package and open its lid;
2) Insert Battery: By default, a node does not contain a D-Cell battery. Therefore the battery needs to be inserted. Notice: +ve and –ve orientation must be correct, otherwise, the internal circuit may be damaged, special attention must be paid to avoid shorting the battery by the battery holder.
3) Antenna Installation: screw the antenna tightly onto the node;
4) Sensor Installation: To ensure a customer chosen RS-485 sensor is deployed onto a structure correctly, please strictly follow the corresponding manufacturer sensor instructions.

5) Sensor connections to Node:

   A. Strip the cable sleeve back by 8mm.

   B. The 5 wires from the cable are 12V_Out, GND, A, B and GND. Please refer to the sensor datasheet to identify the purpose of the stripped wires.

   C. Untighten the gland cover, insert cable through the gland, then connect the 5 wires accordingly.

   D. Once the wires are connected, please tighten the gland cover firmly to ensure its IP rating on that channel.

Notice 1: The cable gland diameter of the RS-485 Interface Node is 8mm.

Notice 2: All the 5 wires must be connected, to minimise electrical interference and possible loss of precision.

Notice 3: Within any electrically noisy environment, nodes with sensors must be >= 0.3m away from the source of the noise.

6) Power On: once all the RS-485 sensors are connected, turn the switch on. Now you should be able to see 3 LEDs flashing 3 times, that means the node is on. Then switch off the node to save power if the gateway is off;

7) Tighten the 4 Cap-Hex-Head screws of the lid to secure the enclosure IP rating;

8) To validate the sensor data, please visit WISENMESHNET® Visualisation Platform for further details.

5.3. Mounting Options

RS-485 Interface Node can be deployed with various methods. However, the priciple is to make sure it is firmly attached to the installation surface.

6. General Maintenance and Notification

1) Once RS-485 Node is installed in the field, please minimise any man-made disturbance so that data quality can be maintained;

2) Radio communication will be impaired if the antenna is covered by metal or very moist soil material;

3) Due to the discharge characteristics of the recommended battery, a battery replacement should be carried out when a node reported voltage reaches 2.7V, at which point you have approximately 3 weeks to change the battery;

4) Our product will use all the possible capacity in a battery down to a stop (minimum) voltage, which has been specified in the Features table. When this occurs, our WISENMESHNET protocol will send you a warning then it

will enter a deep sleep mode until a new battery is installed;

5) If the data from nodes are showing unexpected results or are not being sent back to the Wisen gateway, then please carry out investigation using the following two stage procedure:

A. Remote Inspection of historical data, to identify the following:

a) Whether the heart-beat message has been sent back successfully at each time interval;

b) Whether the battery voltage is too low, if yes, please change the battery unit;

c) Whether the signal strength has become significantly weaker than it was previously. If yes, please check the antenna has been screwed on firmly.

B. On-site Inspection: If all the above are good, please arrange an on-site inspection to check:

a) Whether a Node has visible external damage;

b) Check the box lid to see if it is firmly tightened;

c) Whether the antenna is bent or damaged and that the node is not blocked by new construction, e.g., hoardings;

d) When it is possible, check that the signal strength is normal by using a spectrum analyser;

e) Open the lid, to see whether the battery is firmly attached to its holder;

f) Use a multi-meter to measure the battery voltage. If it is below the stop (minimum) voltage, replace the battery.

g) Make sure the 5 wires are connected properly, if necessary, please disconnect the wires to inspect.

Notices:

i. Case One: If any change has been made from the list above, please inspect the data at the remote server;

ii. Case Two: If all the actions from the list above have not cured the problem, please contact Wisen. We will be happy to help.

7. Package and Accessories

Standard:

No.	Items	Dimension (mm)	Qty.
1	WISENMESHNET® RS-485 Interface Node	100x100x60	1

2	Mesh Antenna	200	1
3	Cap-Hex-Head Screw	M6x14	4
4	User Manual*	Downloadable from WISENMESHNET® Visualisation Platform.	
5	Inspection Report*		

8. Safety and Warning


Warning: Please read the following instructions carefully.

1) Operation Safety

- Before taking any action, please read all the information provided carefully, and keep the guidance documents safe;
- Ensure that any procedures and installations are correctly carried out. The communication cable and the case must be grounded.
- This product has been designed to meet a certain water-proof level. However, it becomes water vulnerable when the lid is open or if the cable gland has not been sealed properly.

2) Electric Safety

- To install the battery into a holder, please follow the "+" (positive) and "-" (negative) signs in any Wisen product. Wrong orientation of a battery could potential cause unit damage. Notice: The orientation of battery can vary among products.
- When disconnecting the battery, please take special care not to apply excessive force, otherwise the battery holder and the nearby circuitry may be damaged.

3) Warning

- The battery in the product has a relatively high capacity, so please take special care during storage and usage.
- This product must not be disassembled under any circumstances, to do so will void the warranty and may leave the product in a dangerous state;
- If all the above are not followed, the manufacturer cannot be held responsible for any damage and injury caused to the users.

4) Caution

- Danger of explosion if battery is incorrectly replaced. Replace only with the type recommended by the manufacturer.
- When disposing of the batteries, please contact your local authorities or dealer and ask for the correct method of disposal.

9. Contact

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