

# **WISENMESHNET® 2-Channel 4-20mA/1-5V Interface Node User Manual**

**Wuxi Wisen Innovation Co., Ltd.**

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## Revision History and Clarification

Rev.	Issue Date	Revisions	Written By	Revised By
V1.0	19/11/2020	1 <sup>st</sup> Issue	Xiaoyan Huang	Dr. Yan Wu
V1.1	26/02/2021	Minor wording changes.	Xinhu Nie	Dr. Yan Wu

### Document Definition:

It defines the specifications (i.e., introduction, technical features, deployment and maintenance methods) of the WISENMESHNET® 2-Channel 4-20mA/1-5V 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 4-20mA/1-5V sensors, such as temperature, humidity, illumination, 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® 2-Channel 4-20mA/1-5V Interface Node is one of the key products in our patented WISENMESHNET® geotechnical safety monitoring system. Working together with the WISENMESHNET® gateway product and node products, it intelligently delivers the real-time data from all different sensors outputting 4-20mA/1-5V signal to the information centre.

The WISENMESHNET® 2-Channel 4-20mA/1-5V Interface Node operates using our core technology, i.e., the WISENMESHNET® Low Power, Intelligent, Wireless Sensor Network protocol, together with its internal high precision mA/V sampling module and power unit. 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. 2-Channel 4-20mA/1-5V Interface Node Overview.

2-Channel 4-20mA/1-5V Interface Node is compatible with all different types of 4-20mA/1-5V sensors of 12VDC and  $\leq 300\text{mA}$  power supply, hence it can be applied to all the corresponding monitoring projects.

## 2. System Structure Layout

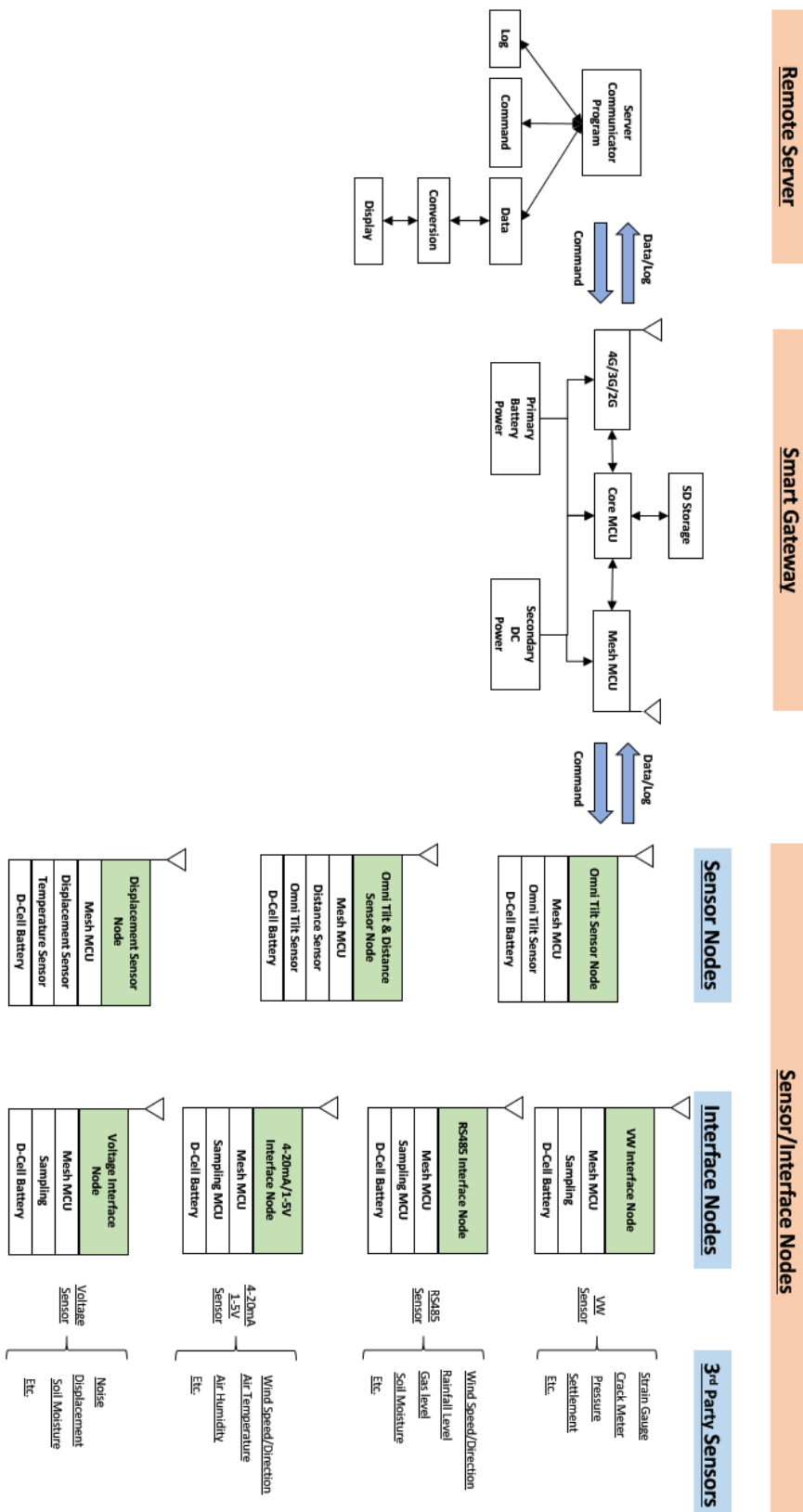


Figure 2. System Structure Layout.

### 3. Node & Radio Features

#### Node Features:

Basics	
Battery Power	Qty. x 4 (3.6V Lithium primary D-Cell ER34615)
Alternative DC Input	12 - 32VDC @ Min. 1A
DC Output	12VDC±0.3V @max. 0.3A (Note: confirm against the sensor specification)
Power On Time to External Sensor	2s to reach stable reading (Note: confirm the sensor stable time before use)
Accuracy Stop Voltage	5.9VDC
Mesh Stop Voltage	4.0VDC
Working Current	external sensor specific
Battery Connection	Standard Aluminium Battery Holder
Local Storage	Min. 450 Messages during Meshing
L x W x H	180 x 140 x 60mm
Weight	1.5kg
External Sensor Size and Weight	Depending on the specific sensor connected (external cable length ≤ 4.5m)
Cable Gland	Qty. 2 x EMC-CMA12 for external sensor connections Qty. 1 x EMC-CMA12 for external DC input power connection
Wire Connection	Spring type wiring terminal
Externally Connected Sensor	
Sensor Type	4-20mA / 1-5V Sensor Type
No. of Inputs	2 Channels
Sensor Connection	DC_Out, IN, GND
Parameter	mA / V (Use "4-20mA to 1-5V hardware switch" for each channel on the PCB to change the sampling parameter.)
Range	4.0000 to 20.0000mA / 1.0000V to 5.0000V
Accuracy	0.1% at Any Reading
Resolution	0.0003mA or 0.0001V
Standard System Parameter	

Temperature	Range: -40 to 85°C, Accuracy: $\pm 2^{\circ}\text{C}$
Voltage	Accuracy: $\pm 0.1\text{V}$
<b>Re-Calibration Method</b>	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)
<b>WSN Interface</b>	
WSN Protocol	WISENMESHNET® Protocol
<b>Industrial Standard</b>	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	$\geq \text{IP66}$
Operating Temperature	-40 to 85°C

**Radio Features:**

Radio Band	2405-2480MHz	
Central Frequency ( <b>Default</b> )	2405/2410/2415/2420/2425/2430/2435/2440/2445/2450/2455/2460/2465/2470/2475/ <b>2480</b>	
Default Transmit Power	<2dBm	
Receive Sensitivity	-90dBm	
Bandwidth	2.8MHz	
Transmission Speed	250kb/s	
No. of Mesh Hop*	10 Hops	
Supported		
Sampling Interval	1-60mins	
Antenna Description	Mesh Antenna	Omni-directional (20cm in length) or Customised
	Antenna Connector	SMA (M)

\* E.g., the radio link from a gateway to the 1<sup>st</sup> layer node is called the 1<sup>st</sup> hop.

## 4. Terminologies



Figure 3. 2-Channel 4-20mA/1-5V Interface Node Internal Configuration Terminologies, where:

No.	Terminology
1	Mesh Antenna
2	On/Off Switch
3	Mode Switch: 4-20mA to 1-5V

## 5. Operation Procedures






### 5.1. System Deployment Notifications

- 1) Location: The deployment location of a 2-Channel 4-20mA/1-5V Interface Node is usually determined by the desired monitoring or inspection location;
- 2) Before any 2-Channel 4-20mA/1-5V Interface Node is switched on, a gateway must be deployed, powered on and proven to be working properly. Otherwise, the nodes will need to be switched off and on again after a gateway is switched on. So simply speaking, the rules to follow when deploying and turning on a WISENMESHNET system are:

**Gateway first, then nearby nodes, then further nodes.**

- 3) All the Serial Numbers of the 2-Channel 4-20mA/1-5V Interface Node must be recorded against their site references;
- 4) All the node should have its antenna point upwards/downwards.

### 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;
- 3) Antenna Installation: screw the antenna tightly onto the node;
- 4) Sensor Installation: To ensure a customer chosen 4-20mA/1-5V 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 3 wires from the cable are DC\_Out, GND and IN1/IN2. Please refer to the sensor datasheet to identify the purpose of the stripped wires.

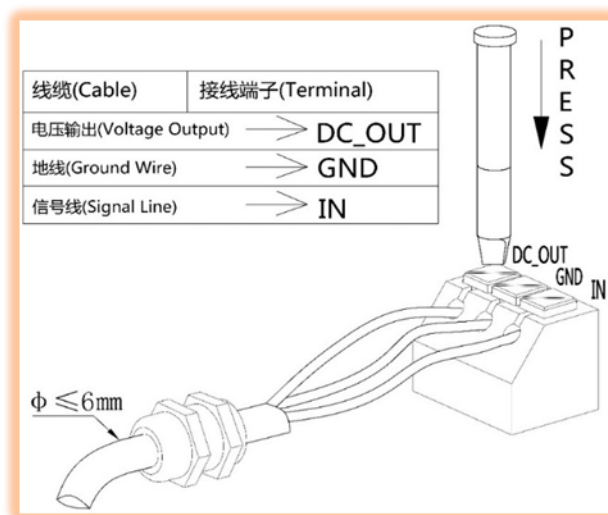


Figure 4. Individual 4-20mA/1-5V Sensor Wire Connections

- C. Untighten the gland cover, insert cable through the gland, then connect the 3 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 Interface Node is 8mm.

Notice 2: All the 3 wires must be connected, to minimise electrical interference and possible loss of precision.

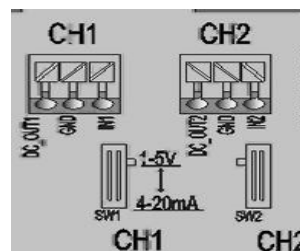
Notice 3: Within any electrically noisy environment, nodes with sensors must be  $\geq 0.3\text{m}$  away from the source of the noise.

#### 6) 4-20mA/1-5V Selection:

Depending on the sensor, SW1/SW2 is used for select the option of 4-20mA/1-5V.

#### Special Notice on data format corresponding to the 4-20mA/1-5V Hardware Switch

Switch Status	CH1 Reading	CH2 Reading
00	1-5V	1-5V
01	4-20mA	1-5V
02	1-5V	4-20mA
03	4-20mA	4-20mA



- 7) Power On: switch on the node by On/Off Switch. Now you should be able to see 3 LEDs flashing 3 times, this means the node is on. Then switch off the node to save power if the gateway is off;
- 8) Tighten the 4 Cap-Hex-Head screws of the lid to secure the enclosure IP rating;
- 9) To validate the sensor data, please visit Wisen Visualisation Platform for further details.

### 5.3. Mounting Options

The node fixings must be rigid for the sensor to measure accurate data. Movement in the fixings will affect the readings.

## 6. General Maintenance and Notification



- 1) Once a 4-20mA/1-5V Interface 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 5.0V, 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 shown 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 the 4-20mA/1-5V Interface 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.

#### Notices :

- i. Case One: If any change has been made from the list above, please inspect the data from 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® 2-Channel 4-20mA/1-5V Interface Node	180x140x60	1
2	Mesh Antenna	200	1
3	Cap-Hex-Head Screw	M6x14	4
4	User Manual*	Downloadable from Wisen 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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