

Wireless PM2.5 / Temperature / Humidity Sensor

R72616A User Manual

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1. Introduction

R72616A is a ClassA type device based on the LoRaWAN™ protocol of Netvox and is compatible with the LoRaWAN protocol.

R72616A can connect with the detector of PM2.5, temperature, and humidity, and report the collected values to the corresponding gateway.

LoRa Wireless Technology:

LoRa is a wireless communication technology dedicated to long distance and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation method greatly increases to expand the communication distance.

Widely used in long-distance, low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, industrial monitoring. Main features include small size, low power consumption, transmission distance, anti-interference ability and so on.

LoRaWAN:

LoRaWAN uses LoRa technology to define end-to-end standard specifications to ensure interoperability between devices and gateways from different manufacturers.

2. Appearance



3. Main Feature

- PM2.5, temperature, and humidity detection
- Adopt SX1276 wireless communication module
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum technology
- Configuration parameters can be configured through third-party software platforms, data can be read and alarms can be set via SMS text and email (optional)
- Applicable to the third-party platforms: Actility/ ThingPark, TTN, MyDevices/Cayenne
- Low power consumption and long battery life
- Note:

Battery life is determined by the sensor reporting frequency and other variables, please refer to

http://www.netvox.com.tw/electric/electric_calc.html

On this website, users can find battery life of various models in different configurations.

4. Set up Instruction

On/Off

Power On	Connect to the battery pack
Turn On	Connect to the battery pack to turn on directly
Restore to Factory Setting	Press and hold the function key for 5 seconds, and the green indicator flashes 20 times
Power Off	Remove the batteries
Note	<ol style="list-style-type: none"> 1. The engineering test requires to write the engineering testing software separately. 2. The interval between on and off is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components.

Network Joining

Never Join the Network	<p>Turn on the device to search the network.</p> <p>The green indicator keeps on for 5 seconds: success.</p> <p>The green indicator remains off: fail</p>
Had joined the network (Not in the original setting)	<p>Turn on the device to search the previous network.</p> <p>The green indicator keeps on for 5 seconds: success.</p> <p>The green indicator remains off: fail.</p>
Fail to Join the Network	Suggest checking the device registration information on the gateway or consulting your platform server provider if the device fails to join the network.

Function Key

Press and Hold for 5 Seconds	<p>Restore to the original setting / Turn off</p> <p>The green indicator flashes 20 times: success</p> <p>The green indicator remains off: fail</p>
Press once	<p>The device is in the network: the green indicator flashes once and the device sends a data report</p> <p>The device is not in the network: the green indicator remains off</p>

Low Voltage Threshold

Low Voltage Threshold	6.8 V
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Threshold Restore to Factory Setting

Description	<p>R72616A has the function of the power-down saving the memory of network-joining information. This function acquiesces in turn off, that is, it will rejoin every time when it is power on. If the device is turned on by the ResumeNetOnOff command, the last network-joining information will be recorded</p>
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	when every time it is power on. (including saving the network address information that it is assigned, etc.) If users want to join a new network, the device needs to perform the original setting, and it will not rejoin the last network.
Operation Method	<ol style="list-style-type: none"> 1. Press and hold the binding button for 5 seconds and then release (release the binding button when the LED flashes), and the LED flashes 20 times. 2. The device automatically restarts to rejoin the network.

5. Data Report

After power on, the device will send a version packet report and the data report including the temperature, humidity, PM2.5 and voltage.

The device sends data according to the default configuration before any other configuring.

Default setting:

ReportMaxTime: 8400s (140 minutes) // Subject to factory settings

ReportMinTime: 30s (US915, AU915, KR920, AS923, IN865)

120s (EU868)

ReportType count = 1

* MaxTime and MinTime rules, configured by formula: **MaxTime \geq ReportType count * ReportMinTime + 10**

* MinTime configuration is invalid. But due to software limitations, it is required to comply with the above formula and not equal to 0.

* The MinTime setting of EU868 cannot be less than 120s, and the MaxTime cannot be less than 370s.

Note:

(1) The cycle of the device sending the data report is according to the default.

(2) The interval between two reports must be the MaxTime.

(3) ReportChange is not supported by R72616A (Invalid configuration). The data report is sent according to ReportMaxTime as a cycle. (The first data report is the start to the end of a cycle.)

(4) Data pocket: PM2.5, temperature, and humidity.

(5) The device also supports the TxPeriod cycle configuration instructions of Cayenne. Therefore, the device can perform the report according to the TxPeriod cycle. The particular report cycle is ReportMaxTime or TxPeriod depending on which report cycle was configured last time.

(6) It would **take 45 seconds** for R72616A to send report information either after powered on or be manually turned on.

The device reported data parsing please refer to *Netvox LoraWAN Application Command document* and *Netvox Lora Command Resolver* <http://loraresolver.netvoxcloud.com:8888/page/index>

5.1 Example of ReportDataCmd

FPort: 0x06

Bytes	1	1	1	Var(Fix=8 Bytes)
	Version	DeviceType	ReportType	NetvoxPayLoadData

Version– 1 byte –0x01—the Version of NetvoxLoRaWAN Application Command Version

DeviceType– 1 byte – Device Type of Device

The devicetype is listed in Netvox LoRaWAN Application Devicetype doc

ReportType – 1 byte –the presentation of the NetvoxPayLoadData, according the devicetype

NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

Device	Device Type	Report Type	NetvoxPayLoadData				
R72616A	0x6A	0x01	Battery (1Byte, unit:0.1V)	Temperature (Signed2Bytes,unit:0.01°C)	Humidity (2Bytes,unit:0.01%)	PM2.5 (2Byte 1ug/m ³)	Reserved (1Byte, fixed 0x00)

Example 1 of Uplink: 016A014806701A9E000300

1st byte (01): Version

2nd byte(6A): DeviceType—R72616A

3rd byte (01): ReportType

4th byte (48): Battery—7.2V, 48(HEX)=72(DEC),72*0.1v=7.2v

5th6th byte (0670): Temperature—16.48 °C , -0670(HEX)=1648(DEC),1648*0.01°C =16.48°C

7th8th byte (1A9E): Humidity—68.14%, 1A9E(HEX)=6814(DEC),6814*0.01%=68.14%

9th10th byte (0003): PM2.5—3 ug/m³

11th byte (00): Reserved

Example 2 of Uplink: 016A0148FF391A9E000300

1st byte (01): Version

2nd byte(6A): DeviceType—R72616A

3rd byte (01): ReportType

4th byte (48): Battery—7.2V, 48(HEX)=72(DEC),72*0.1v=7.2v

5th6th byte (FF39): Temperature—-1.99°C, FF39(HEX)=-199(DEC),-199*0.01°C= -1.99°C

7th8th byte (1A9E): Humidity—68.14%, 1A9E(Hex)=6814(Dec), 6814x0.01=68.14%

9th10th byte (0003): PM2.5—3 ug/m³

11th byte (00): Reserved

Note: Negative values use the 2's complement

5.2 Example of ConfigureCmd

FPort: 0x07

Bytes	1	1	Var (Fix =9 Bytes)
	CmdID	DeviceType	NetvoxPayloadData

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

NetvoxPayloadData– var bytes (Max=9bytes)

Description	Device	CmdID	DeviceType	NetvoxPayloadData		
Config ReportReq	R72616A	0x01	0x6A	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit: s)	Reserved (5Bytes, Fixed 0x00)
Config ReportRsp		0x81		Status (0x00_success)	Reserved (8Bytes, Fixed 0x00)	
ReadConfig ReportReq		0x02		Reserved (9Bytes, Fixed 0x00)		
ReadConfig ReportRsp		0x82		MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	Reserved (5Bytes, Fixed 0x00)

(1) Configure R72616A device parameters MinTime = 120s, MaxTime = 3600s (3600 > 120 * 1 + 10)

Downlink: 016A00780E100000000000

Device Return:

816A0000000000000000000 (configuration success)

816A1000000000000000000 (configuration failure)

(2) Read R72616A device parameter

Downlink: 026A000000000000000000

Device Return:

826A00780E100000000000 (device current parameter)

Note:

1. The ReportMaxTime should be greater than (ReportType count * ReportMinTime + 10; Unit: second).
2. The Report data of R72616A is temperature, humidity, and PM2.5. ReportType count = 1
3. The MinTime setting of EU868 cannot be less than 120s, and the MaxTime cannot be less than 370s.

6. Installation

This product does not have a waterproof function. After the network joining is completed, please place it indoor.

- (1) Environmental sensor - temperature and humidity _PM2.5 (R72616A) and battery box are fixed by screws at the factory for transportation reasons. Before installation, the screws need to be unscrewed (red circle below).



- (2) Environmental sensor - temperature and humidity _PM2.5 (R72616A) battery box with built-in lithium battery, users need to unscrew the four corners of the battery box. Insert 8 ER14505 3.6V batteries into the battery compartment, 4 sections on the front and 4 sections on the back side. After loading the battery, install the battery PCB board face up and attach it to the top cover of the case. As shown in Figure 1.

Note:

The direction of the battery is divided into positive (+) and negative (-) according to the adhesion mark in the battery slot to prevent the positive and negative electrodes from being reversed.

The top cover battery PCB board has a component on the front side, and the front side faces the lower cover, which cannot be reversed, otherwise the lower cover of the outer casing cannot be closed.

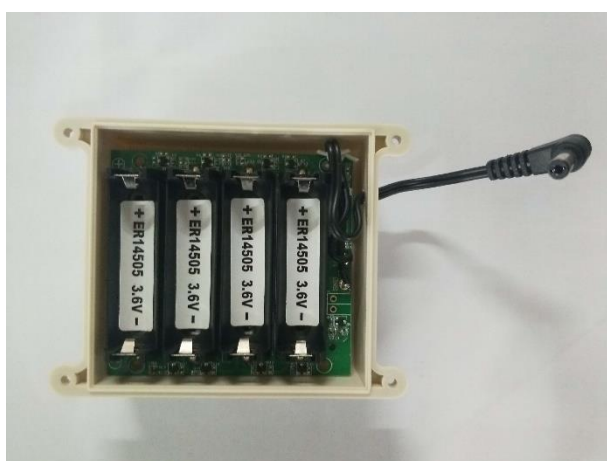


Figure 1. Battery PCB front

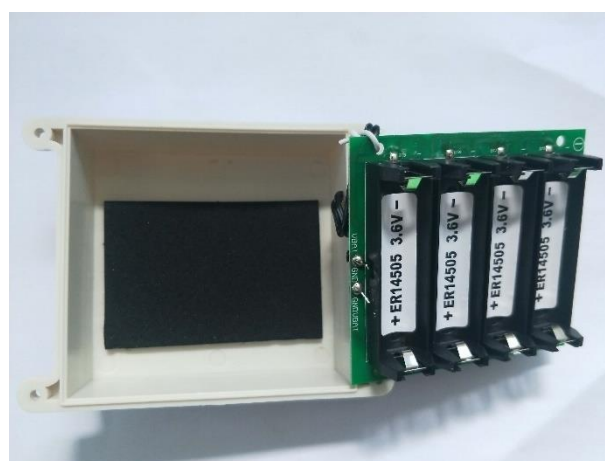
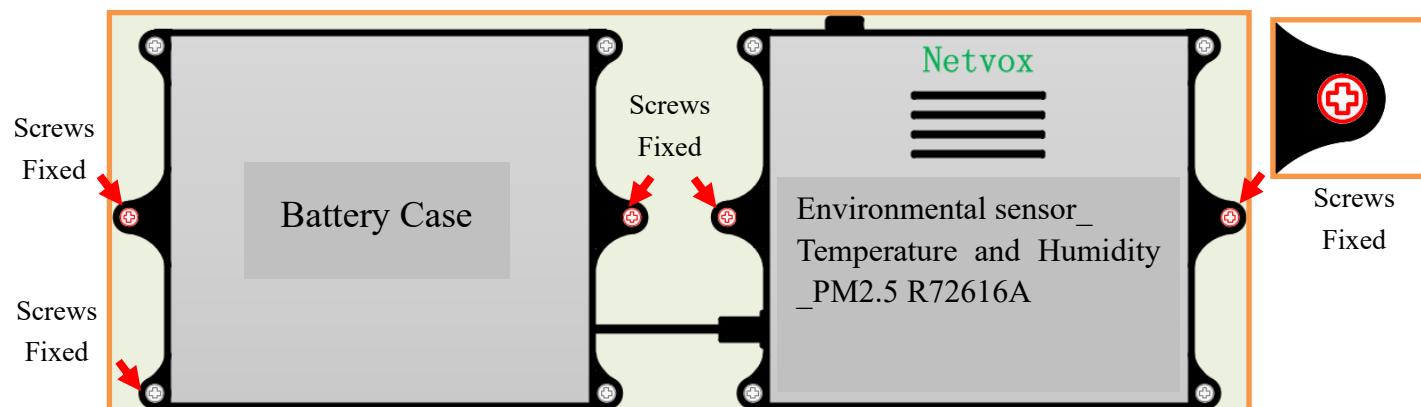


Figure 2. The reverse side of the battery PCB

(3) The environmental sensor body and the battery case are fixed by screws (purchased by users), and the battery case and the device are respectively fixed to the surface of the wall or other objects (as shown in the following figure).

Note: Do not install the device in a metal shielded box or in an environment with other electrical equipment around it to avoid affecting the wireless transmission of the device.



(4) When the ambient sensor - temperature and humidity _PM2.5 (R72616A) regularly reports data according to Max Time - temperature, humidity and PM2.5 concentration value, the default Max Time are 180 seconds.

Note: Max Time can be modified by the downlink command, but it is not recommended to set this time too small to avoid excessive battery drain.

(5) Environmental Sensor - Temperature and Humidity _PM2.5 (R72616A) is suitable for the following scenarios:

- Construction site
- Environmental monitoring

7. Information about Battery Passivation

Many of Netvox devices are powered by 3.6V ER14505 Li-SOCl₂ (lithium-thionyl chloride) batteries that offer many advantages including low self-discharge rate and high energy density.

However, primary lithium batteries like Li-SOCl₂ batteries will form a passivation layer as a reaction between the lithium anode and thionyl chloride if they are in storage for a long time or if the storage temperature is too high. This lithium chloride layer prevents rapid self-discharge caused by continuous reaction between lithium and thionyl chloride, but battery passivation may also lead to voltage delay when the batteries are put into operation, and our devices may not work correctly in this situation.

As a result, please make sure to source batteries from reliable vendors, and it is suggested that if the storage period is more than one month from the date of battery production, all the batteries should be activated.

If encountering the situation of battery passivation, users can activate the battery to eliminate the battery hysteresis.

ER14505 Battery Passivation:

7.1 To determine whether a battery requires activation

Connect a new ER14505 battery to a resistor in parallel, and check the voltage of the circuit.

If the voltage is below 3.3V, it means the battery requires activation.

7.2 How to activate the battery

- a. Connect a battery to a resistor in parallel
- b. Keep the connection for 5~8 minutes
- c. The voltage of the circuit should be ≥ 3.3 , indicating successful activation.

Brand	Load Resistance	Activation Time	Activation Current
NHTONE	165 Ω	5 minutes	20mA
RAMWAY	67 Ω	8 minutes	50mA
EVE	67 Ω	8 minutes	50mA
SAFT	67 Ω	8 minutes	50mA

Note:

If you buy batteries from other than the above four manufacturers, then the battery activation time, activation current, and required load resistance shall be mainly subject to the announcement of each manufacturer.

8. Important Maintenance Instruction

The device is a product with superior design and craftsmanship and should be used with care.

The following suggestions will help you use the warranty service effectively.

- Keep the equipment dry. Rain, moisture and various liquids or water may contain minerals that can corrode electronic circuits. In case the device is wet, please dry it completely.
- Do not use or store in dusty or dirty areas. This way can damage its detachable parts and electronic components.
- Do not store in excessive heat place. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store in excessive cold place. Otherwise, when the temperature rises to normal temperature, moisture will form inside which will destroy the board.
- Do not throw, knock or shake the device. Treating equipment roughly can destroy internal circuit boards and delicate structures.
- Do not wash with strong chemicals, detergents or strong detergents.
- Do not paint the device. Smudges can make debris block detachable parts up and affect normal operation.
- Do not throw the battery into the fire to prevent the battery from exploding. Damaged batteries may also explode.

All the above suggestions apply equally to your device, batteries and accessories.

If any device is not operating properly, please take it to the nearest authorized service facility for repairing.