Wireless Temperature and Humidity Sensor for Low Temperature Environment

R718A User Manual

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1. Introduction

R718A, mainly used to detect the temperature and humidity at low temperature environment such as the freezer air. It collects data over LoRa network and sends it to devices to be shown, fully compatible with LoRa protocol.

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. Features

- Detect the ambient temperature and humidity
- Simple and easy installation
- 2* ER14505 lithium batteries in parallel
- IP65
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum
- Applicable to third-party platforms: Actility/ThingPark, TTN, MyDevices/Cayenne
- Low power consumption and long battery life

Note: Please visit http://www.netvox.com.tw/electric/electric_calc.html for more information about battery life.

4. Setup Instructions

On / Off

Power on	Insert batteries. (Users may need a screwdriver to open the battery cover.)
Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off / Factory Reset	Press and hold the function key for 5 seconds until the green indicator flashes 20 times.
Power off	Remove Batteries.
Note	1. Remove and insert the battery, the device is off by default. 2. On/off interval should be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. 5 seconds after power on, the device will be in engineering test mode.

Network Joining

Never joined the network	Turn on the device to search the network to join. The green indicator stays on for 5 seconds: Success The green indicator remains off: Fail
Had joined the network (not at factory setting)	Turn on the device to search the previous network to join. The green indicator stays on for 5 seconds: Success The green indicator remains off: Fail

Function Key

Press and hold for 5 seconds	Factory Reset / Turn off The green indicator flashes for 20 times: Success The green indicator remains off: Fail
Press once	The device is in the network: the green indicator flashes once and sends a report The device is not in the network: the green indicator remains off

Sleep Mode

The device is on and in the network	Sleeping period: Min Interval. When the reportchange exceeds the setting value or the state changes: send a data report according to Min Interval.

Low Voltage Alarm

Low Voltage	3.2V

5. Data Report

The device will immediately send a version packet report along with an uplink packet including temperature, humidity, and battery voltage.

The device sends data in the default configuration before any configuration is done.

Default setting:

Max Interval: 0x0384 (900s)

Min Interval: 0x0384 (900s)

Battery Change: 0x01 (0.1V)

Temperature Change:0x0064 (1°C)

Humidity Change:0x0064 (1%)

Note:

a. The device report interval will be programmed based on the default firmware which may vary.

b. The interval between two reports must be the minimum time.

c. Please visit Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver http://cmddoc.netvoxcloud.com/cmddoc to resolve uplink data.

Data report configuration and sending period are as follows:

Min Interval (Unit: second)	Max Interval (Unit: second)	Reportable Change	Current Change ≥ Reportable Change	Current Change ＜ Reportable Change
Any number between 1–65535	Any number between 1–65535	Cannot be 0	Report per Min Interval	Report per Max Interval

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 to the devicetype

NetvoxPayLoadData– Fixed bytes (Fixed = 8 Bytes)

Tips

1. Battery Voltage

The voltage value is bit 0 ~ bit 6, bit 7=0 is normal voltage, and bit 7=1 is low voltage.

Battery=0xA0, binary=1010 0000, if bit 7= 1, it means low voltage.

The actual voltage is 0010 0000 = 0x20 = 32, 32*0.1v =3.2v

2. Version Packet

When Report Type=0x00 is the version packet, such as 010B000A0B202005200000, the firmware version is 2020.05.20

3. Data Packet

When Report Type=0x01 is data packet.

4. Signed Value

When the temperature is negative, 2's complement should be calculated.

Device	DeviceType	ReportType	NetvoxPayLoadData			
R718A	0x0B	0x00	SoftwareVersion (1 Byte) e.g. 0x0A—V1.0	Hardware Version (1 Byte)	DateCode (4 Bytes, e.g. 0x20170503)	Reserved (2 Bytes, fixed 0x00)
		0x01	Battery (1 Byte, unit: 0.1V)	Temperature (Signed 2 Bytes, unit: 0.01°C)	Humidity (2 Bytes, unit: 0.01%)	Reserved (3 Bytes, fixed 0x00)

Example 1 of Uplink: 010B012406701A9E000000

1st byte (01): Version

2nd byte (0B): DeviceType 0x0B — R718A

3rd byte (01): ReportType

4th byte (24): Battery — 3.6V, 24(Hex) = 36(Dec), 36x0.1v=3.6v

5th 6th byte (0670): Temperature — 16.48 °C , 0670(Hex)=1648(Dec), 1648x0.01=16.48°C

7th 8th byte (1A9E): Humidity — 68.14%, 1A9E(Hex)=6814(Dec), 6814x0.01=68.14%

9th -11th byte (000000): Reserved

5.2 Example of Report Configuration

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	Cmd ID	Device Type	NetvoxPayLoadData				
ConfigReport Req	R718A	0x01	0x0B	MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	BatteryChange (1 Byte, unit: 0.1v)	TemperatureChange (2 Bytes, unit: 0.01℃)	HumidityChange (2 Bytes, unit: 0.01%)
ConfigReport Rsp		0x81		Status (0x00_success)	Reserved (8 Bytes, fixed 0x00)			
ReadConfig ReportReq		0x02		Reserved (9 Bytes, Fixed 0x00)				
ReadConfig ReportRsp		0x82		MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	BatteryChange (1 Byte, unit: 0.1v)	TemperatureChange (2 Bytes, unit: 0.01℃)	HumidityChange (2 Bytes, unit: 0.01)

(1) Command Configuration

MinTime = 0x003C (1min), MaxTime = 0x003C (1min), BatteryChange = 0x01 (0.1v), TemperatureChange = 0x0064 (1℃), HumidityChange = 0x0064 (1%)

Downlink: 010B003C003C0100640064 003C (Hex) = 60 (Dec), 64(Hex) = 100 (Dec)

Response: 810B000000000000000000 (Configuration success)

810B010000000000000000 (Configuration failure)

(2) Read Configuration

Downlink: 020B000000000000000000

Response:820B003C003C0100640064 (Current configuration)

5.3 Example of GlobalCalibrateCmd

FPort: 0x0E

Description	CmdID	Sensor Type	PayLoad (Fix = 9 Bytes)				
SetGlobal CalibrateReq	0x01	See below	Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Multiplier (2 Bytes, unsigned)	Divisor (2 Bytes, unsigned)	DeltValue (2 Bytes, signed)	Reserved (2 Bytes, fixed 0x00)
SetGlobal CalibrateRsp	0x81		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Status (1 Byte, 0x00_success)	Reserved (7 Bytes, fixed 0x00)		
GetGlobal CalibrateReq	0x02		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Reserved (8 Bytes, fixed 0x00)			
GetGlobal CalibrateRsp	0x82		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Multiplier (2 Bytes, unsigned)	Divisor (2 Bytes, unsigned)	DeltValue (2 Bytes, signed)	Reserved (2 Bytes, fixed 0x00)
ClearGlobal CalibrateReq	0x03	Reserved (10 Bytes, fixed 0x00)					
ClearGlobal CalibrateRsp	0x83	Status (1 Byte, 0x00_success)	Reserved (9 Bytes, fixed 0x00)				

SensorType: 0x01_Temperature Sensor;
0x02_Humidity Sensor

Channel: 0x00_Temperature;
0x01_Humidity

(1) Device reports 28.15℃ when the actual temperature is 38.15℃. → Calibration should increase 10℃ (unit: 0.01℃).

SetGlobalCalibrateReq:

SensorType = 0x01; Channel = 0x00; Multiplier =0x0001; Divisor = 0x0001; DeltValue = 0x03E8

Downlink: 01010000010000103E80000

Response: 810100000000000000000

GetGlobalCalibrateReq

Downlink: 02010000010000103E80000

Response: 82010000010000103E80000

(2) Device reports 28.15℃ when the actual temperature is 18.15℃. → Calibration should decrease 10℃ (unit: 0.01℃).

SetGlobalCalibrateReq:

SensorType = 0x01; Channel = 0x00; Multiplier =0x0001; Divisor = 0x0001; DeltValue = 0xFC18

Downlink: 010100000010001FC180000

Response: 810100000000000000000

GetGlobalCalibrateReq

Downlink: 020100000000000000000

Response: 82010000010001FC180000

(2) Reported temperature back to 28.15℃

ClearGlobalCalibrateReq:

Downlink: 030000000000000000000

Response: 830000000000000000000

5.4 Example of Set/GetSensorAlarmThresholdCmd

FPort: 0x10

CmdDescriptor	CmdID (1 Byte)	Payload (10 Bytes)			
SetSensorAlarmThresholdReq	0x01	Channel (1 Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 Byte, 0x00_Disable ALL SensorthresholdSet 0x01_Temperature, 0x02_Humidity,	SensorHighThreshold (4 Bytes, unit: 0.01℃_temperature; 0.01%_humidity	SensorLowThreshold (4 Bytes, unit: 0.01℃_temperature; 0.01%_humidity
SetSensorAlarmThresholdRsp	0x81	Status (0x00_success)	Reserved (9 Bytes, fixed 0x00)		
GetSensorAlarmThresholdReq	0x02	Channel (1 Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 Byte, 0x00_Disable ALL SensorthresholdSet 0x01_Temperature, 0x02_Humidity,	Reserved (8 Bytes, fixed 0x00)	
GetSensorAlarmThresholdRsp	0x82	Channel (1 Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 Byte, 0x00_Disable ALL SensorthresholdSet 0x01_Temperature, 0x02_Humidity,	SensorHighThreshold (4 Bytes, unit: 0.01℃_temperature; 0.01%_humidity	SensorLowThreshold (4 Bytes, unit: 0.01℃_temperature; 0.01%_humidity

SensorHighThreshold = 0x00000BB8 (30℃); SensorLowThreshold = 0x000007D0 (20℃)

(1) SetSensorAlarmThresholdReq:

Downlink: 01000100000BB8000007D0

Response: 810000000000000000000000

(2) GetSensorAlarmThresholdReq:

Downlink: 020001000000000000000

Response: 82000100000BB8000007D0

SensorTypr = 0x00

ClearSensorAlarmThresholdReq:

Downlink: 010000000000000000000

Response: 81000000000000000000

Note: Set SensorHighThreshold or SensorLowThreshold as 0xFFFFFFFF to disable the threshold.

5.5 Example of NetvoxLoRaWANRejoin

(NetvoxLoRaWANRejoin command is to check if the device is still in the network. If the device is disconnected, it will automatically rejoin back to the network.)

Fport: 0x20

CmdDescriptor	CmdID (1 Byte)	Payload (5 Bytes)	
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 Bytes, unit: 1s 0XFFFFFFFF Disable NetvoxLoRaWANRejoinFunction)	RejoinThreshold (1 Byte)
SetNetvoxLoRaWANRejoinRsp	0x81	Status (1 Byte, 0x00_success)	Reserved (4 Bytes, fixed 0x00)
GetNetvoxLoRaWANRejoinReq	0x02	Reserved (5 Bytes, fixed 0x00)	
GetNetvoxLoRaWANRejoinRsp	0x82	RejoinCheckPeriod (4 Bytes, unit:1s)	RejoinThreshold (1 Byte)

(1) Configure parameters

RejoinCheckPeriod = 0x00000E10 (60 min); RejoinThreshold = 0x03 (3 times)

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

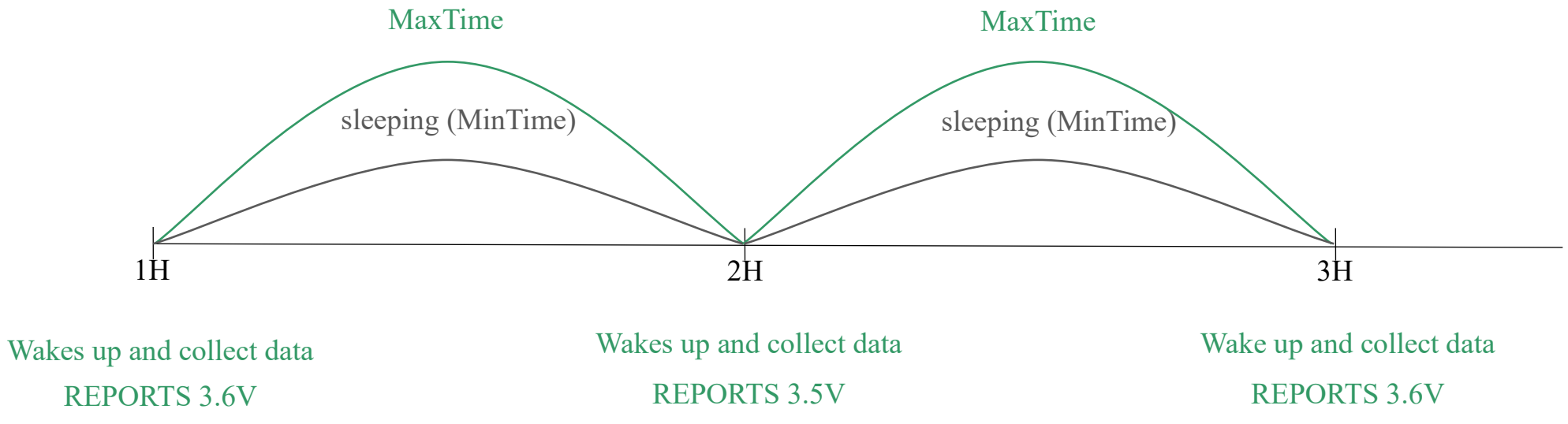
Note: a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

b. The last configuration would be kept as user reset the device back to the factory setting.

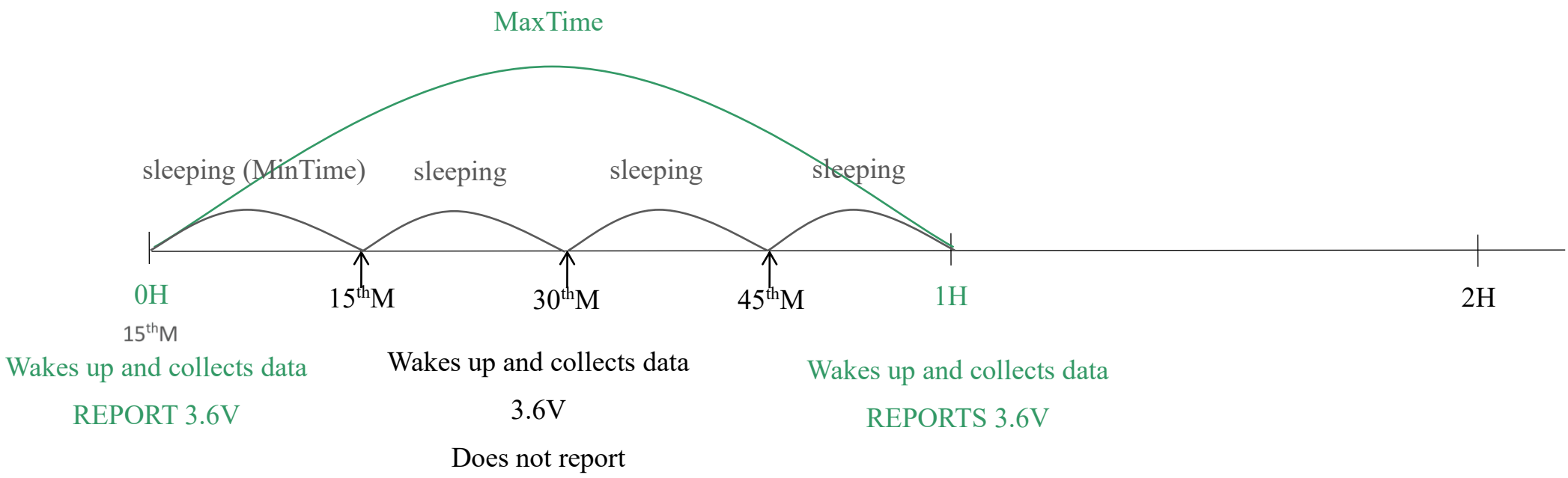
c. Default setting: RejoinCheckPeriod = 2 (hr) and RejoinThreshold = 3 (times)

5.6 Example for MinTime/MaxTime logic

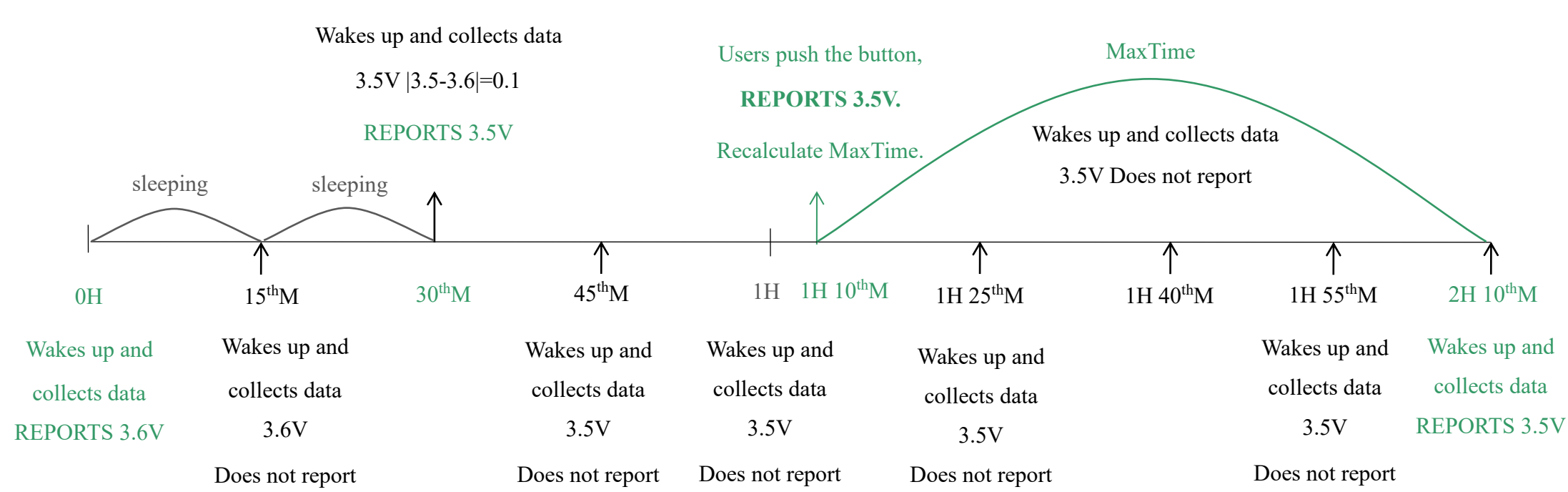
Example#1 based on MinTime = 1 Hour, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange=0.1V



Example#2 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.



Example#3 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.



Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

Notes:

(1) The device only wakes up and performs data sampling according to MinTime Interval. When it is sleeping, it does not collect data.

(2) The data collected is compared with the last data reported. If the data variation is greater than the ReportableChange value, the device reports according to MinTime interval. If the data variation is not greater than the last data reported, the device reports according to MaxTime interval.

(3) We do not recommend to set the MinTime Interval value too low. If the MinTime Interval is too low, the device wakes up frequently and the battery will be drained soon.

(4) Whenever the device sends a report, no matter resulting from data variation, button pushed or MaxTime interval, another cycle of MinTime/MaxTime calculation is started.

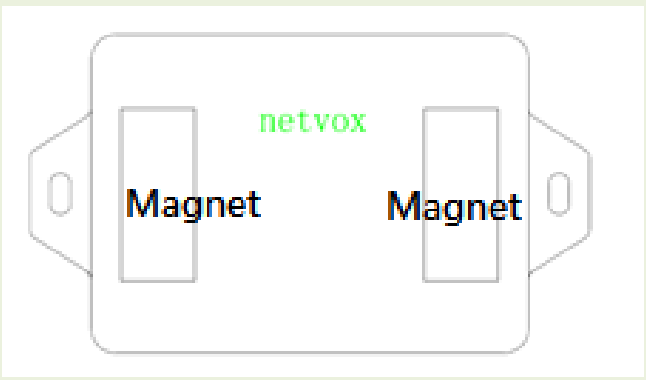
6. Installation

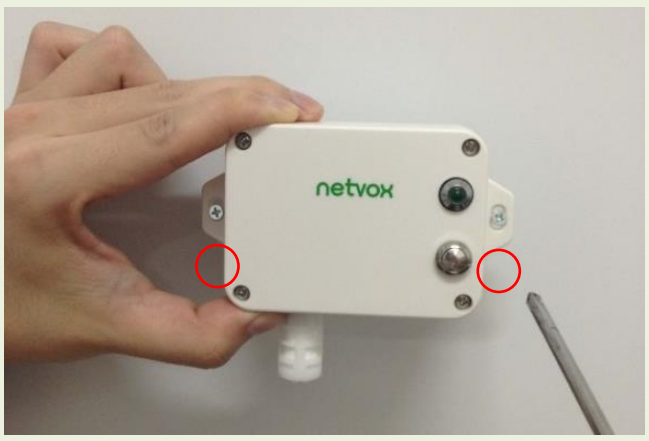
The waterproof breathable membrane inside the product is not resistant to vapor.

To prevent water vapor from condensing inside the body, please do not use the product in high humidity and steam environment.

1. The Wireless Temperature and Humidity Sensor (R718A) has a built-in magnet. When installed, it can be attached to the surface of an object with iron which is convenient and quick. To make the installation more secure, use screws (purchased) to secure the unit to a wall or other surface.

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.





Screw hole diameter: Ø4mm

2. Compared to the last reported values, when the temperature change is exceeded 1°C (default) or the humidity change is exceeded 1%(default), it reports current values.

3. Recommended installation height :1 to 2 m

4. Installation ambient temperature: -40C° to 55°C

5. Recommended installation direction:

Place the temperature and humidity downward and face the logo toward user.

Applications:

- Restaurant (refrigerator or freezer)
- Shopping mall supermarket (freezer)
- Engine room
- Environmental monitoring
- Smart city and intelligent building
- Storage and transportation of food and medicine
- Flowers and other perishable foods
- Wall or logistics refrigerator

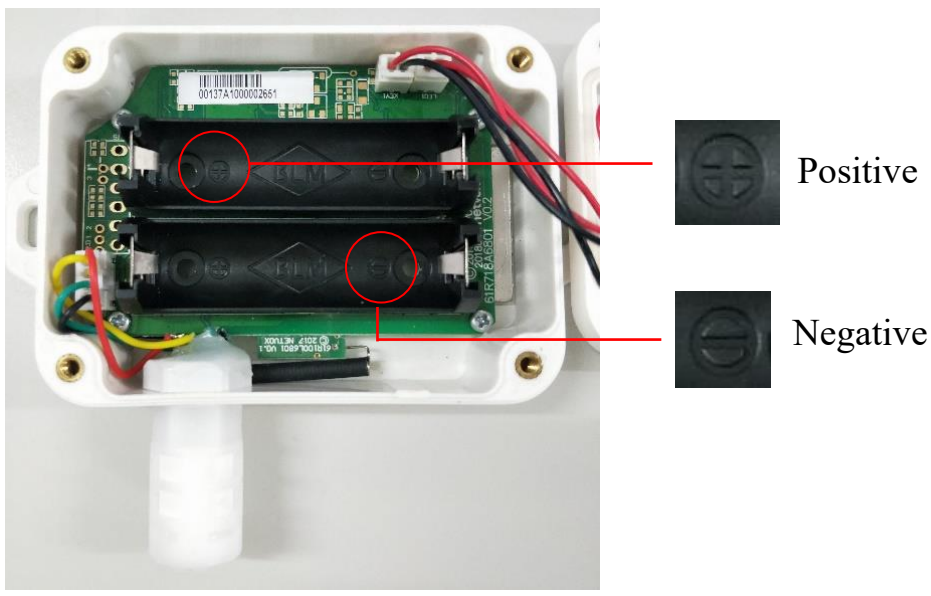
Battery Installation

Step 1.

Unscrew the four corners of the device with a screwdriver.

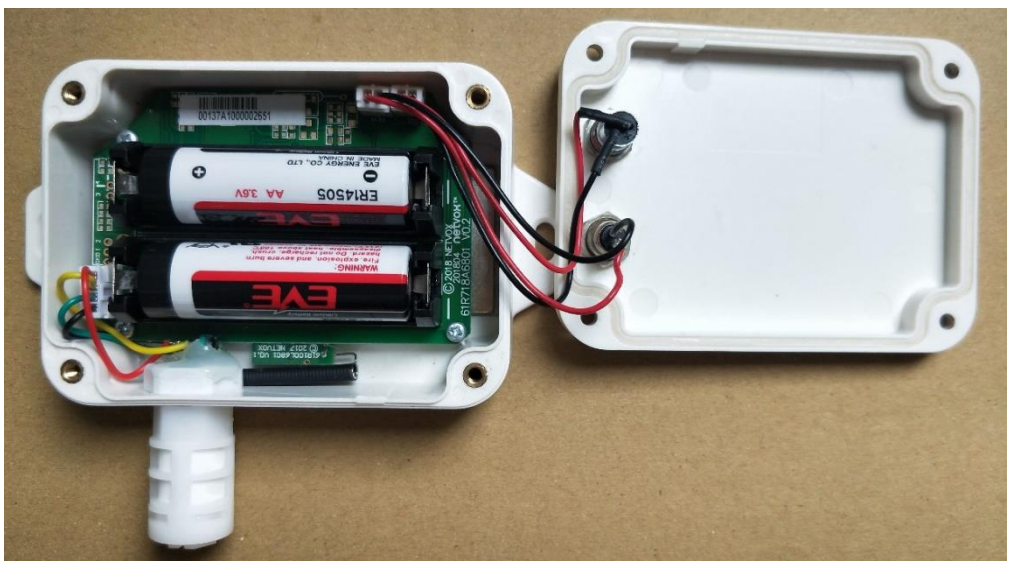
Step 2.

Put 2 ER14505 batteries into the case.



Step 3.

After inserting the batteries, put the lid back and tighten the four screws.



Note:

a. Please do not disassemble the device unless it is required to replace the batteries.

b. Do not touch the waterproof gasket, LED indicator light, or function keys when replacing the batteries.

c. Please use a suitable screwdriver to tighten the screws (if using an electric screwdriver, it is recommended to set the torque as 4kgf) to ensure the device is impermeable.

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:

A. 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.

B. 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 Instructions

Kindly pay attention to the following to achieve the best maintenance of the product:

- Do not use or store the device in a dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under extremely hot conditions. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store the device in places that are too cold. Otherwise, when the temperature rises, moisture that forms inside the device will damage the board.
- Do not throw, knock, or shake the device. Rough handling of equipment can destroy internal circuit boards and delicate structures.
- Do not clean the device with strong chemicals, detergents, or strong detergents.
- Do not apply the device with paint. Smudges might block the device and affect the operation.
- Do not throw the battery into the fire, or the battery will explode. Damaged batteries may also explode.

All of the above applies to your device, battery, and accessories. If any device is not operating properly, please take it to the nearest authorized service facility for repair.