Wireless 2-Gang Thermocouple Sensor for K/T/N Type

R718CK2/CT2/CN2
User Manual

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1. Introduction

R718CK2 (nickel-chromium-nickel silicon thermocouple):

Its use temperature is **-40 ~ +375℃**, with good linearity, large thermoelectromotive force, high sensitivity, stability, can not be used directly at high temperature for sulfur, reducing or reducing It is not recommended for use in weak oxidizing atmospheres in oxidizing alternating atmospheres and in vacuum.

R718CT2 (copper-copper-nickel thermocouple):

Its use temperature is **-40 ~ +125℃**, it is used in the temperature range of -40~0℃, and the stability is better.

R718CN2 (nickel-chromium-silicon-nickel-silicon-magnesium thermocouple):

Its use temperature is **-40 °C~ +800°C**, the N-type thermocouple has good linearity, large thermoelectromotive force, high sensitivity, and good stability and uniformity. It has strong oxidation resistance and is not affected by short-range ordering.

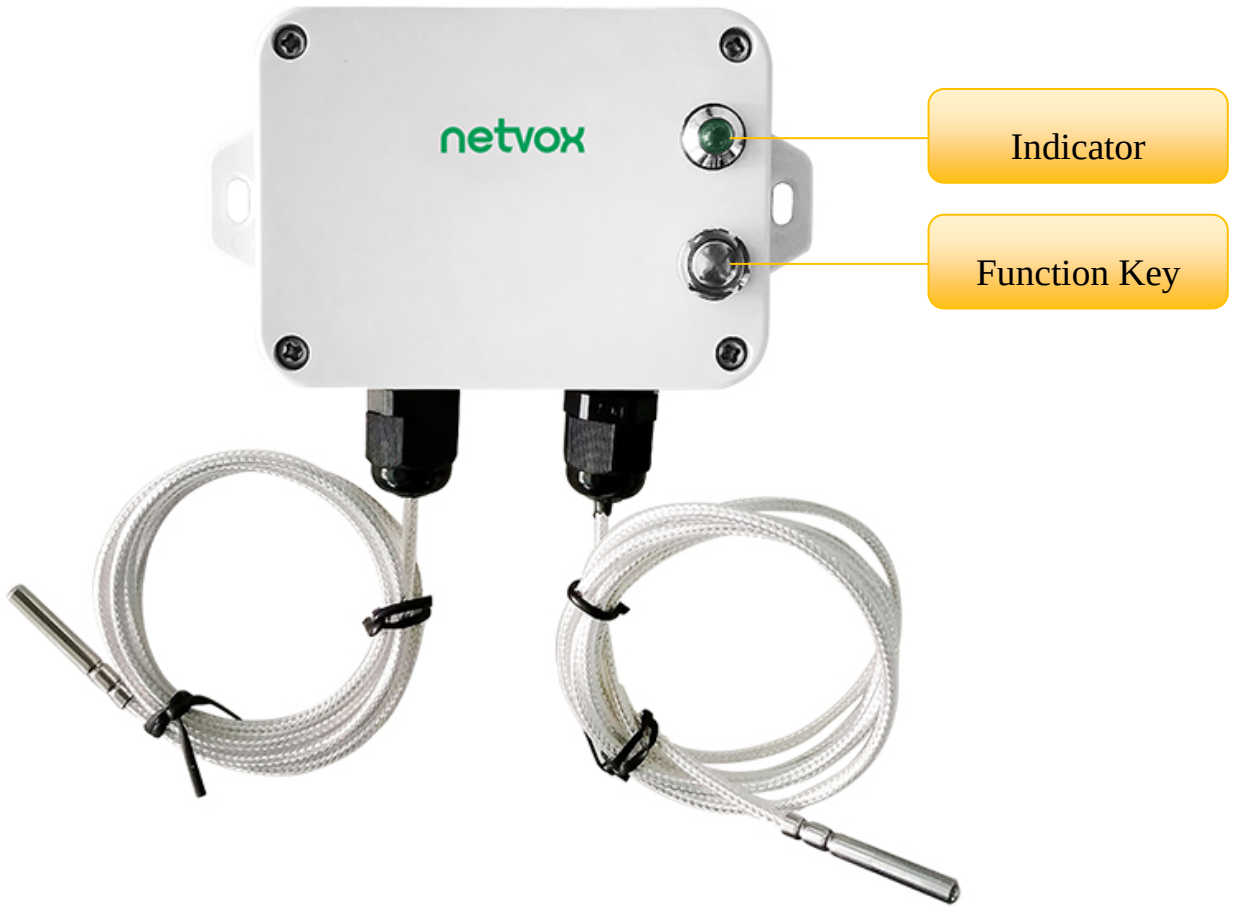
LoRa Wireless Technology:

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 Features

- Adopt SX1276 wireless communication module
- 2 ER14505 battery AA size (3.6V / section) parallel power supply
- Main body protection class IP65/IP67
- External thermocouple sensor protection class:

  K-type thermocouple IP50

  T-type thermocouple IP67

  N-type thermocouple IP50
- The base is attached with a magnet that can be attached to a ferrous object
- 2-way thermocouple detection
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum
- Configuration parameters can be configured via a third-party software platform
- Applicable to third-party platforms: Actility/ThingPark, TTN, MyDevices/Cayenne
- Low power consumption, longer battery life support:

  Battery life is determined by sensor reporting frequency and other variables,

  please refer to http://www.netvox.com.tw/electric/electric_calc.html

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

4. Set up Instruction

On/Off

Power on	Insert batteries. (User may need a screwdriver to open)
Turn on	Press and hold the function key for 3 seconds till the green indicator flashes once.
Turn off (Restore to factory setting)	Press and hold the function key for 5 seconds till green indicator flashes for 20 times.
Power off	Remove Batteries.
Note:	1. Remove and insert the battery; the device is at off state by default. 2. On/off interval is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. At 1st-5th second 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 mode)	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
Fail to join the network (when the device is on)	Suggest to check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold for 5 seconds	Restore to factory setting / Turn off The green indicator flashes for 20 times: success The green indicator remains off: fail
Press once	The device is in the network: green indicator flashes once and sends a report The device is not in the network: green indicator remains off

Sleeping Mode

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

Low Voltage Warning

Low Voltage	3.2V

5. Data Report

The device will immediately send a version package report and a report data with temperature and voltage values.

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: 0x00064 (10°C)

Note:

(1) The real data sending cycle will be programmed before shipment.

(2) The interval between two reports must be the minimum time

Please refer 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 following:

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	Can not 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 the devicetype

NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

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 0116000A0B202005200000, 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			
R718CK2 R718CT2 R718CN2	0x16 0x17 0x18	0x01	Battery (1Byte, unit:0.1V)	Temperature1 (Signed2Bytes,unit:0.1°C)	Temperature2 (Signed2Bytes,unit:0.1°C)	Reserved (3Bytes,fixed 0x00)

Example 1 of Uplink: 0116012400FD0109000000

1st byte (01): Version

2nd byte (16): DeviceType 0x16－R718CK2

3rd byte (01): ReportType

4th byte (24): Battery, $24H_{ex}$=36 D_{ec}, 36x0.1v = 3.6v

5th6th byte (00FD): Temperature1, 00FD H_{ex}=253 D_{ec}, 253x0.1°C = 25.3°C

7th8th byte (0109): Temperature2, 0109 H_{ex}=265 $D_{ec,}$ 265x0.1°C = 26.5°C

9th-11th byte (000000): Reserved

Example 2 of Uplink: 0117019FFF39FEC5000000

1st byte (01): Version

2nd byte (17): DeviceType 0x17－R718CT2

3rd byte (01): ReportType

4th byte (9F): Battery, 1F H_{ex} = 31 D_{ec}, 31x0.1v=3.1v // low battery

5th6th byte (FF39): Temperature1, FF39 H_{ex}= -199 D_{ec},-199 x 0.1°C = -19.9°C

7th8th byte (FEC5): Temperature2, FEC5 H_{ex}= -315 $D_{ec,}$ -315 x 0.1°C = -31.5°C

9th-11th byte (000000): Reserved

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	Cmd ID	Device Type	NetvoxPayLoadData				
ConfigReport Req	R718CK2 R718CT2 R718CN2	0x01	0x16 0x17 0x18	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	BatteryChange (1byte Unit:0.1v)	TemperatureChange (2byte Unit:0.1℃)	Reserved (2Bytes,Fixed 0x00)
ConfigReport Rsp		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)	BatteryChange (1byte Unit:0.1v)	TemperatureChange (2byte Unit:0.1℃)	Reserved (2Bytes,Fixed 0x00)

(1) Configure R718CK2 report parameters:

MinTime = 1min、MaxTime = 1min、BatteryChange = 0.1v、TemperatureChange = 1°C (10*0.1°C)

Downlink： 0116003C003C01000A0000 3C(Hex) =60(Dec) 0A(Hex) = 10(Dec)

Response：

8116000000000000000000 (Configuration success)

8116010000000000000000 (Configuration failure)

(2) Read Configuration:

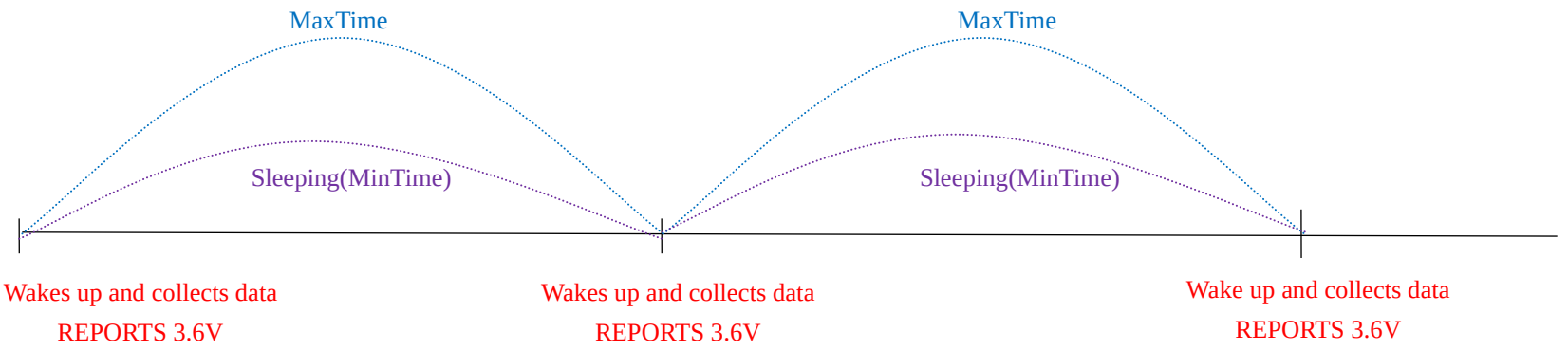
Downlink： 0216000000000000000000

Response：

8216003C003C01000A0000 (Current configuration)

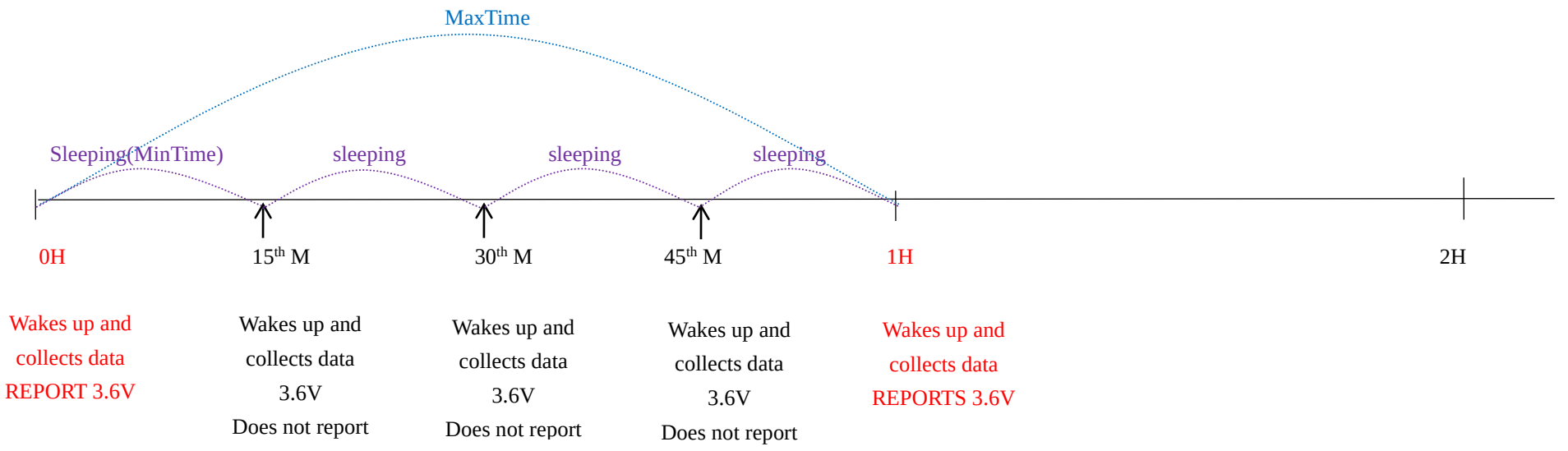
5.3 Example for MinTime/MaxTime logic

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

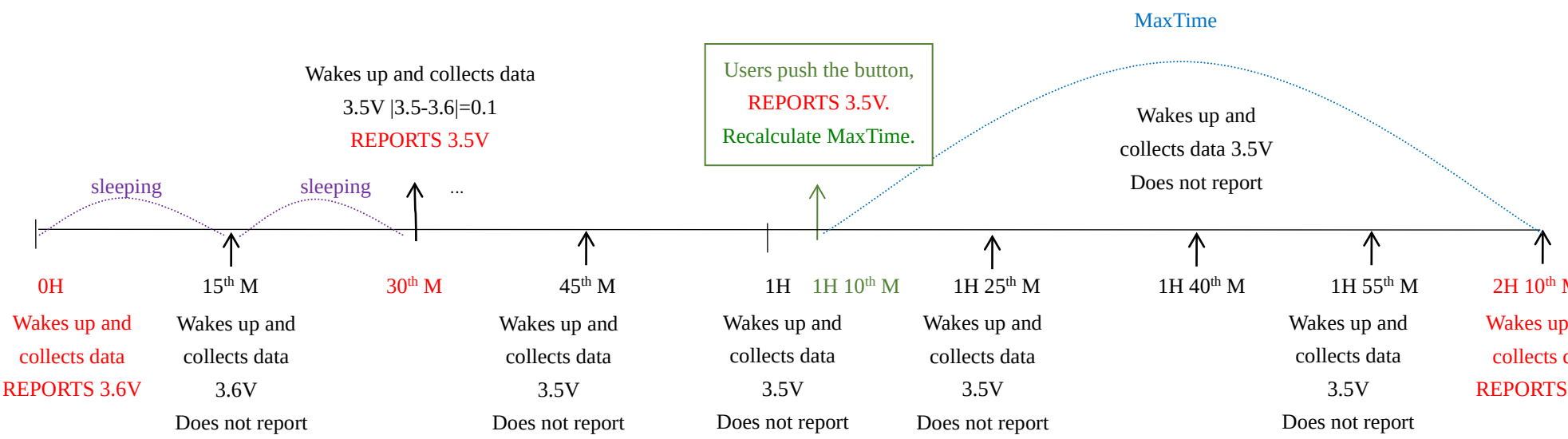


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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.



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.

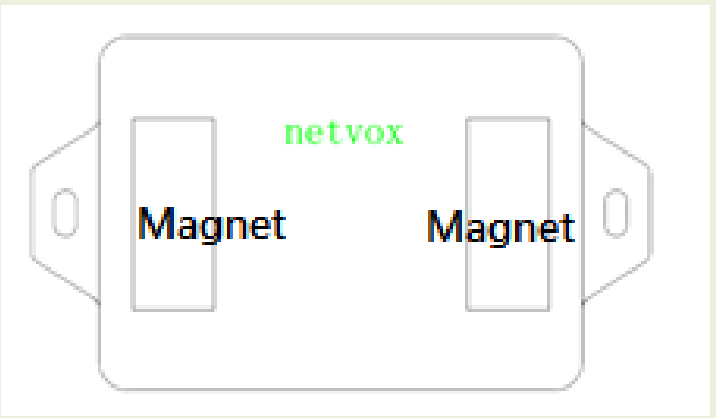
4) Whenever the device sends a report, no matter resulting from data variation, button pushed or MaxTime interval, another cycle of MinTime/MaxTime calculation is started.

6. Installation

1. The Wireless Thermocouple Sensor 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:

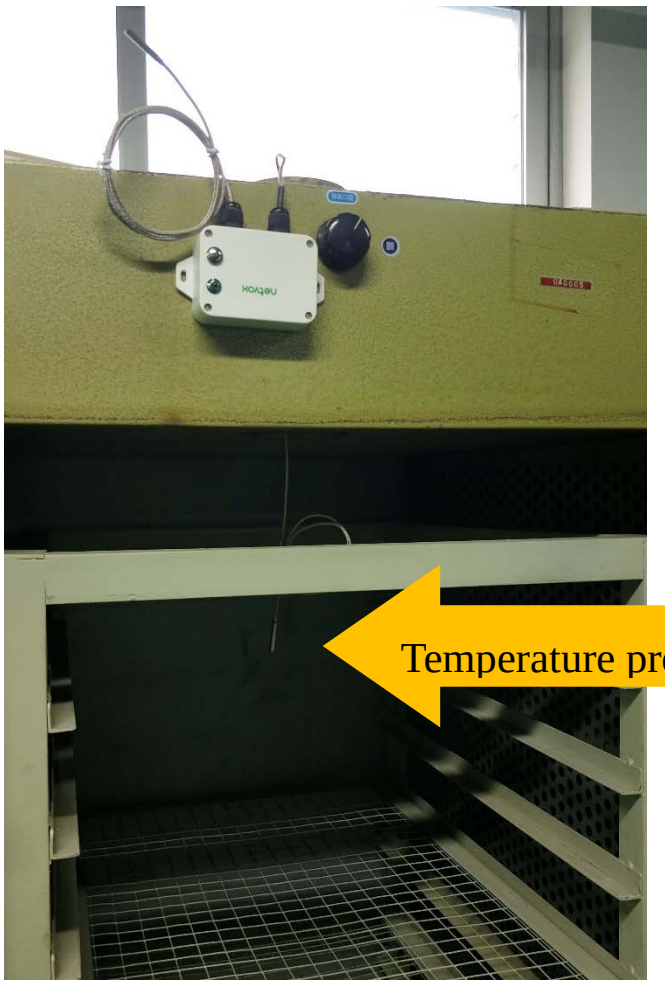
Do not install the device in a metal shielded box or in an environment with other electrical equipment around it to avoid affecting the wireless transmission of the device.



2. When Wireless Thermocouple Sensor is compared with the last reported values, the temperature change is exceeded 10°C (default), it will report values at the MinTime interval. If does not exceeded 10°C (default), it will report values at the MaxTime interval.

R718CK2/CT2/CN2 is suitable below scenarios:

- Oven
- Industrial control equipment
- Semiconductor industry



Note:

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

Do not touch the waterproof gasket, LED indicator light, function keys when replacing the batteries. Please use 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:

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

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

• Keep the device dry. Rain, moisture, or any liquid might contain minerals and thus corrode electronic circuits. If the device gets wet, please dry it completely.

• Do not use or store the device in dusty or dirty environment. It might damage its detachable parts and electronic components.

• Do not store the device under excessive heat condition. High temperature 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 to normal temperature, moisture will form inside, which will destroy 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 in 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 working properly, please take it to the nearest authorized service facility for repair.