

Wireless Thermocouple Sensor Type K/T/N/R

R718CK/CT/CN/CR User Manual

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1. Introduction

R718CK (Ni-Cr / Ni-Si): The detecting range of R718CK is -40°C to 375°C .

R718CK has the characteristics of good linearity, bigger thermal electromotive force, high sensitivity, and stability.

R718CT (Cu / Cu-Ni): The detecting range of R718CT is -40°C to 125°C .

R718CT is more stable when detecting the temperature range of -40°C to 0°C .

R718CN (Ni-Cro-Sil / Ni-Si-Mg): The detecting range of R718CN is -40°C to 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.

R718CR (noble metal thermocouple): The detecting range of R718CR is 0°C to 1400°C .

The R-type thermocouple gets accurate results, operates stably, and has a long lifespan. With good chemical and physical performance, it can be used in oxidizing and inert gas.

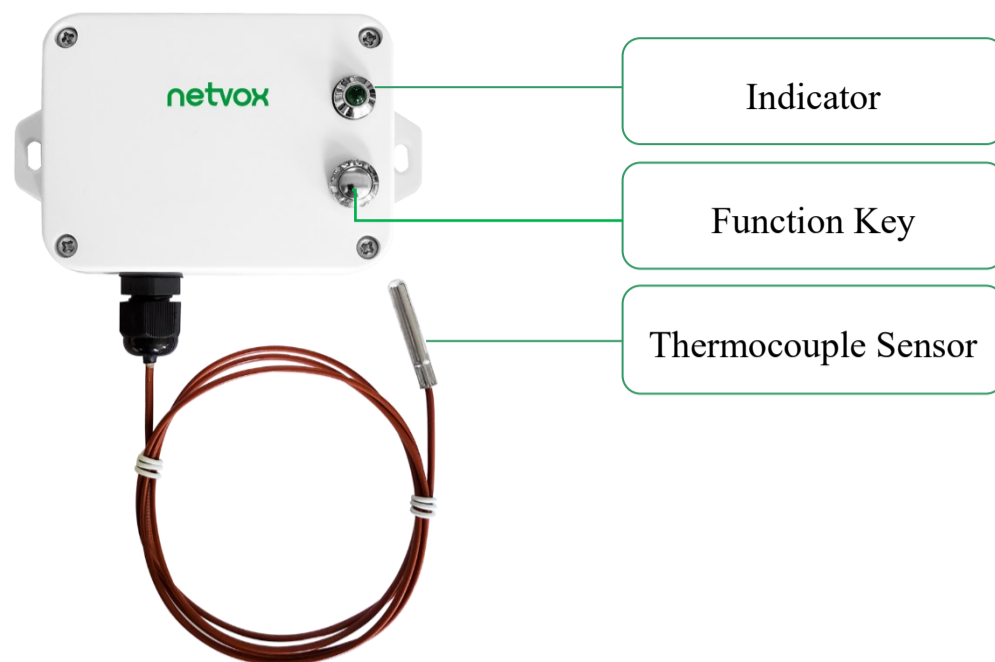
LoRa Wireless Technology

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



R718CT



R718CK



R718CN



R718CR

3. Features

- SX1276 wireless communication module
- 2 x ER14505 battery in parallel (AA size 3.6V / section)
- IP rating:
 - R718CT main body IP65/IP67; T-type thermocouple sensor IP67
 - R718CK and R718CN IP50 (whole device)
 - R718CR R-type thermocouple sensor IP60
- Magnet base
- Thermocouple detection
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum
- Applicable to third-party platforms: Actility/ThingPark, TTN, MyDevices/Cayenne
- Improved power management for longer battery life

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

4. Set up Instruction

On/Off

Power on	Insert batteries. (Users may need a screwdriver to open)
Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off (Reset to factory setting)	Press and hold the function key for 5 seconds until the green indicator flashes 20 times.
Power off	Remove Batteries.
Note	<ol style="list-style-type: none"> 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.

Network Joining

Never joined the network	<p><u>Turn on the device to search the network to join.</u></p> <p>The green indicator stays on for 5 seconds: success</p> <p>The green indicator remains off: fail</p>
Had joined the network (not at factory setting)	<p><u>Turn on the device to search the previous network to join.</u></p> <p>The green indicator stays on for 5 seconds: success</p> <p>The green indicator remains off: fail</p>
Fail to join the network	Please check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold for 5 seconds	<p><u>Restore to factory setting / Turn off</u></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: green indicator flashes once and sends a report</p> <p>The device is not in the network: green indicator remains off</p>

Sleeping Mode

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

Low Voltage	3.2V
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5. Data Report

Data report configuration and sending period are as follows:

The device will immediately send a version packet report along with an uplink packet including temperature 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)

BatteryChange: 0x01 (0.1V)

TemperatureChange:0x0064 (10°C)

Note:

- (1) The device report interval will be programmed based on the default firmware which may vary.
- (2) The interval between two reports must be the minimum time.
- (3) Please refer Netvox *LoRaWAN Application Command document* and *Netvox Lora Command Resolver* <http://cmddoc.netvoxcloud.com/cmddoc> to resolve uplink data.

Min Interval (Unit: second)	Max Interval (Unit: second)	Reportable Change	Current Change\geq 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 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 0192000A02202108160000, the firmware version is 2021.08.16.

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	Device Type	Report Type	NetvoxPayLoadData			
R718CK	0x91	0x00	SoftwareVersion (1Byte) Eg.0x0A— V1.0	HardwareVersion (1Byte)	DateCode (4Bytes, eg 0x20170503)	Reserved (2Bytes, fixed 0x00)
R718CT R718CN /R718CR	0x92 0x93	0x01	Battery (1Byte, unit: 0.1V)	Temperature (Signed 2 Bytes, unit: 0.1°C)	ThresholdAlarm (1Byte) Bit0_LowTemperatureAlarm, Bit1_HighTemperatureAlarm, Bit2-7: Reserved	Reserved (4 Bytes, fixed 0x00)

Example 1 of R718CK uplink: 0191012301900200000000

1st byte (01): Version

2nd byte (91): DeviceType 0x91 — R718CK

3rd byte (01): ReportType

4th byte (23): Battery—3.5v 23Hex=35, 35*0.1v=3.5v

5th 6th byte (0190): Temperature—40°C , 0190 Hex = 400 Dec 400*0.1°C =40°C

7th byte (02): Threshold Alarm—High Temperature Alarm

0000 0010

8th – 11th byte (00000000): Reserved

Example 2 of R718CT uplink: 0192019F01220100000000

1st byte (01): Version

2nd byte (92): DeviceType 0x92 — R718CT

3rd byte (01): ReportType

4th byte (9F): Battery—3.1v (**Low voltage**), 9F&7F=1F, 1F Hex=31, 31*0.1v=3.1v

5th 6th byte (0122): Temperature—29.0°C , 0122 Hex = 290 Dec 290*0.1°C =29.0°C

7th byte (01): Threshold Alarm—Low Temperature Alarm

0000 0001

8th – 11th byte (00000000): 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	R718CK R718CT R718CN / R718CR	0x01	0x91 0x92 0x93	MinTime (2 bytes Unit: s)	MaxTime (2 bytes Unit: s)	BatteryChange (1 byte Unit: 0.1v)	Temperature Change (2 bytes Unit: 0.1°C)	Reserved (2 bytes, Fixed 0x00)
ConfigReport Rsp		0x81		Status (0x00_success)		Reserved (8 bytes, Fixed 0x00)		
ReadConfigReportReq		0x02		Reserved (9 bytes, Fixed 0x00)				
ReadConfigReportRsp		0x82		MinTime (2 bytes Unit: s)	MaxTime (2 bytes Unit: s)	BatteryChange (1 byte Unit: 0.1v)	Temperature Change (2 bytes Unit: 0.1°C)	Reserved (2 bytes, Fixed 0x00)

(1) Configure R718CK report parameters

MinTime = 1min, MaxTime = 1min, BatteryChange = 0.1v, TemperatureChange = 0.1°C

Downlink: 0191003C003C0100010000 3C(Hex) =60(Dec)

Response: 81910000000000000000 (Configuration success)

8191010000000000000000 (Configuration failure)

(2) Read Configuration

Downlink: 02910000000000000000

Response: 8291003C003C0100010000 (Current configuration)

5.3 Set/GetSensorAlarmThresholdCmd

FPort: 0x10

CmdDescriptor	CmdID (1 byte)	Payload (10 bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1 byte) 0x00_Channel 1	SensorType (1 byte) 0x00_Disable ALL SensorthresholdSet 0x01_Temperature	SensorHighThreshold (4 bytes, unit: 0.1°C)	SensorLowThreshold (4 bytes, unit: 0.1°C)
SetSensorAlarm ThresholdRsp	0x81	Status (0x00_success)		Reserved (9 bytes, Fixed 0x00)	
GetSensorAlarm ThresholdReq	0x02	Channel (1 byte) 0x00_Channel 1	SensorType (1 byte) 0x00_Disable ALL SensorthresholdSet 0x01_Temperature	Reserved (8 bytes, Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1 byte) 0x00_Channel 1	SensorType (1 byte) 0x00_Disable ALL SensorthresholdSet 0x01_Temperature)	SensorHighThreshold (2 bytes, unit: 0.1°C)	SensorLowThreshold (2 bytes, unit: 0.1°C)

Default: Channel = 0x00_Temperature

(1) SetSensorAlarmThresholdReq

Configure Channel = 0x00 (Temperature), HighThreshold = 0x0000012C (30°C), and LowThreshold = 0x00000064 (10°C)

Downlink: 0100010000012C00000064

Response: 810000000000000000000000

(2) GetSensorAlarmThresholdReq

Downlink: 020001000000000000000000

Response: 8200010000012C00000064

(3) Clear all thresholds (Set SensorType = 0)

Downlink: 010000000000000000000000

Response: 810000000000000000000000

5.4 Example of Temperature Calibration

Port:0x0E

Description	CmdID	SensorType	PayLoad (Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	Temperature 0x01	Channel (1 byte) 0_Channel 1	Multiplier (2 bytes, Unsigned)	Divisor (2 bytes, Unsigned)	DeltValue (2 bytes, Signed)	Reserved (2 bytes, Fixed 0x00)
SetGlobal CalibrateRsp	0x81		Channel (1 byte) 0_Channel 1	Status (1 byte,0x00_success)		Reserved (7 bytes, Fixed 0x00)	
GetGlobal CalibrateReq	0x02		Channel (1 byte) 0_Channel1	Reserved (8 bytes, Fixed 0x00)			
GetGlobal CalibrateRsp	0x82		Channel (1 byte) 0_Channel 1	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)		

(1) Temperature calibration

If the temperature the R718Cx detects is 16°C and the actual temperature is 17°C, the calibration needs to increase by 1°C.

SensorType =0x01, Channel 1= 0x00, Multiplier = 0x0001, Divisor =0x0001, DeltValue= 0x000A

Downlink: 01010000010001000A0000

Response:

81010000000000000000 (Configuration success)

81010001000000000000 (Configuration failure)

(2) Check whether the temperature calibration

Downlink: 02010000000000000000

Response: 82010000010001000A0000 (Current configuration)

5.5 Example of NetvoxLoRaWANRejoin

Fport:0x20

(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.)

CmdDescriptor	CmdID (1 byte)	Payload (5 bytes)	
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 bytes, Unit: 1s)	RejoinThreshold (1Byte)
SetNetvoxLoRaWANRejoinRsp	0x81	Status (1 byte, 0x00_success)	Reserved (4Bytes,Fixed 0x00)
GetNetvoxLoRaWANRejoinReq	0x02	Reserved (5 bytes, Fixed 0x00)	
GetNetvoxLoRaWANRejoinRsp	0x82	RejoinCheckPeriod (4 bytes, Unit: 1s)	RejoinThreshold (1Byte)

Note:

- Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.
- The last configuration would be kept as user factory resets the device.
- Default setting: RejoinCheckPeriod = 2 (hr) and RejoinThreshold = 3 (times)

(1) Configure parameters

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

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

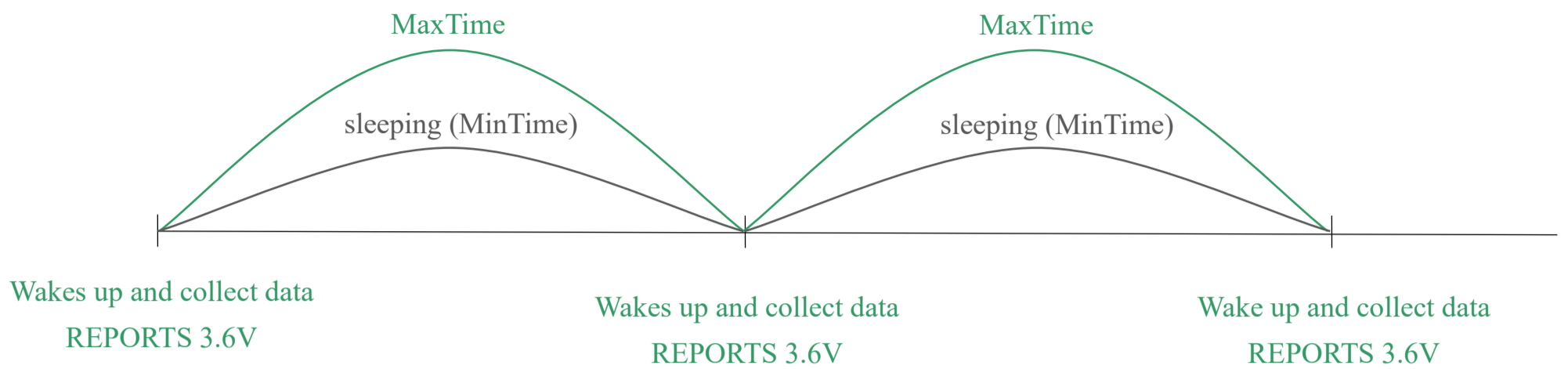
(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

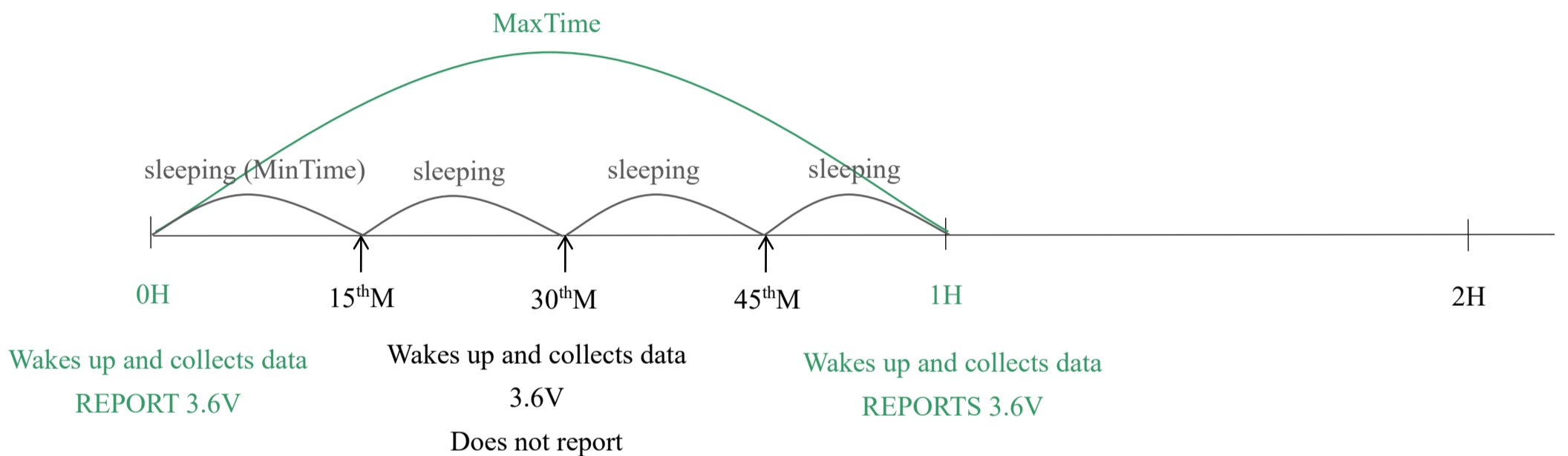
5.6 Example for MinTime/MaxTime logic

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

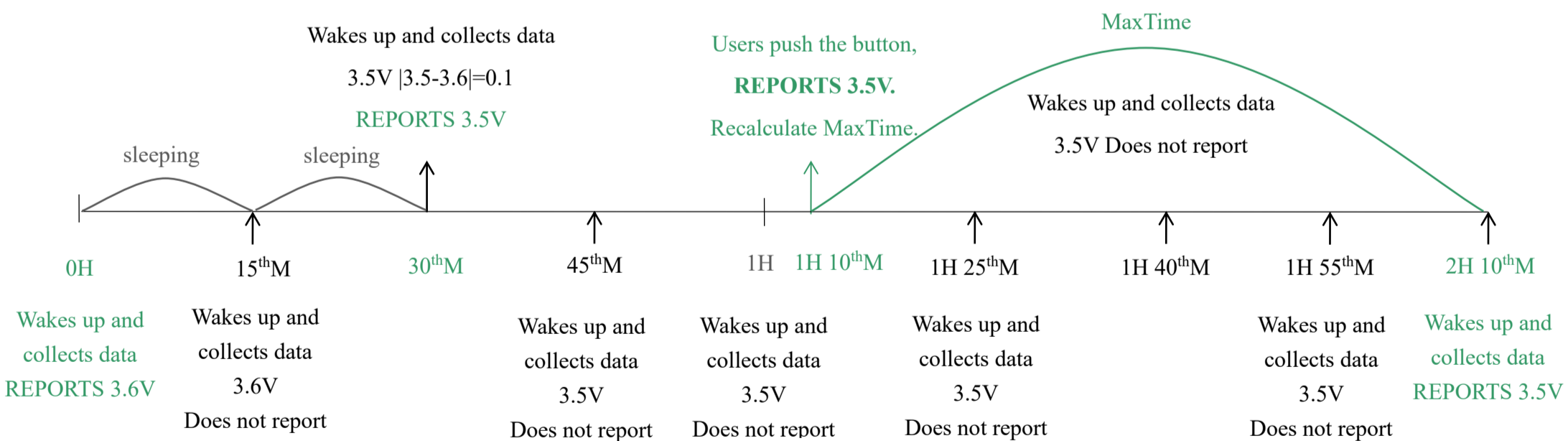


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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.

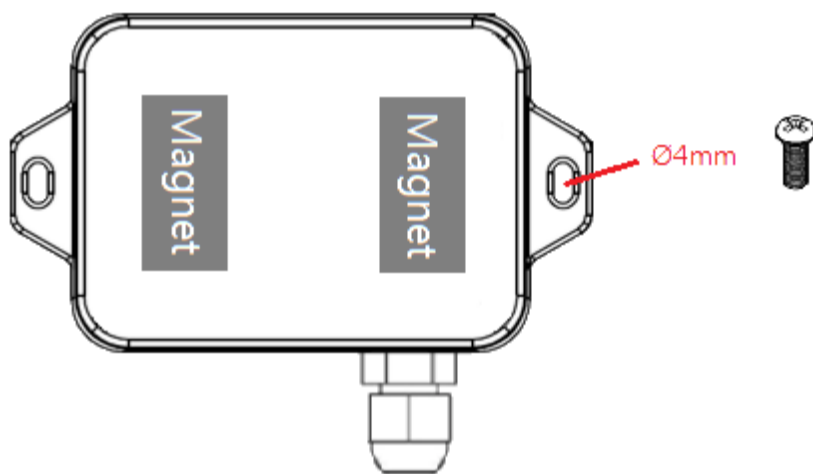
6. Installation

1. The Wireless Thermocouple Sensor (R718CK/T/N/R) 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.

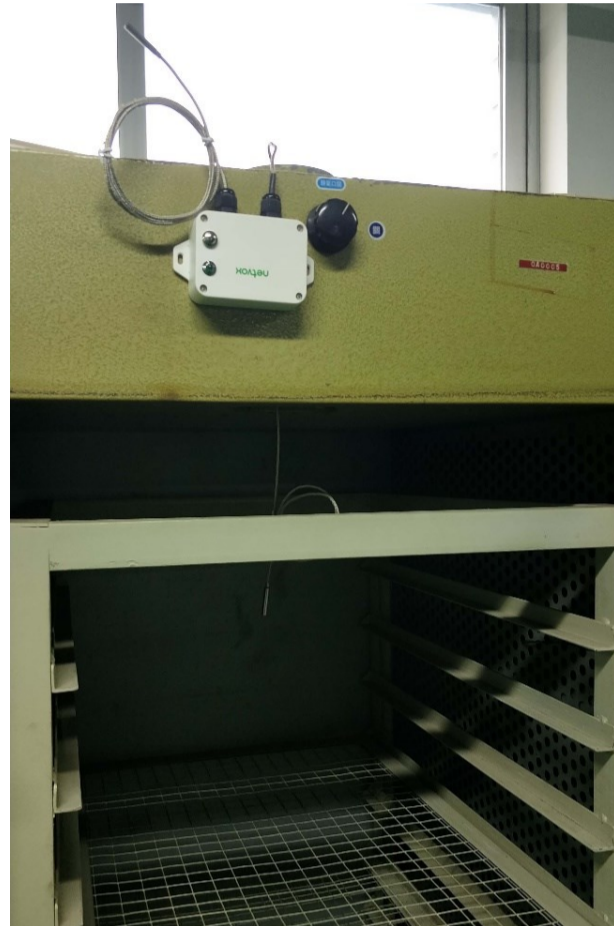


Screw hole diameter: Ø4mm

2. When R718CK/T/N/R 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.

Applications:

- 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.

3. Do not put the whole stainless probe into the liquid. Sinking the probe into the liquid could damage the sealing compound and thus cause the liquid to get inside the PCB.



Note: Do not sink the probe into chemical solutions, such as alcohol, ketone, ester, acid, and alkali.

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 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 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.

9. Precautions for Outdoor Installation

According to the Enclosure Protection Class (IP code), the device is compliant to GB 4208-2008 standard, which is equivalent to IEC 60529:2001 degrees of protection provided by enclosures (IP Code).

IP Standard Test Method:

IP65: spray the device in all directions under 12.5L/min water flow for 3min, and the internal electronic function is normal.

IP65 is dustproof and able to prevent damage caused by water from nozzles in all directions from invading electrical appliances.

It can be used in general indoor and sheltered outdoor environments. Installation in extreme weather conditions or direct exposure to sunlight and rain could damage the components of the device. Users may need to install the device under an awning (fig. 1) or face the side with an LED and function key downwards (fig. 2) to prevent malfunction.

IP67: the device is immersed in 1m deep water for 30 minutes, and the internal electronic function is normal.



Fig 1. Install under an awning



Fig 2. Install with LED and function key faced downwards