Wireless Thermocouple Sensor -Type K/T/N

R718CK/CT/CN User Manual

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1. Introduction

R718CK: The detecting range of R718CK is -40 ℃~ +375℃.

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

R718CT: The detecting range of R718CT is -40 ℃~ +125℃.

R718CT is more stable when detecting the temperature range of -40℃~0℃.

R718CN: The detecting range of R718CN is -40 ℃~ +800℃.

R718CN (nickel-chromium-silicon-nickel-silicon-magnesium thermocouple): Its operating temperature is -40~+800℃. 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.

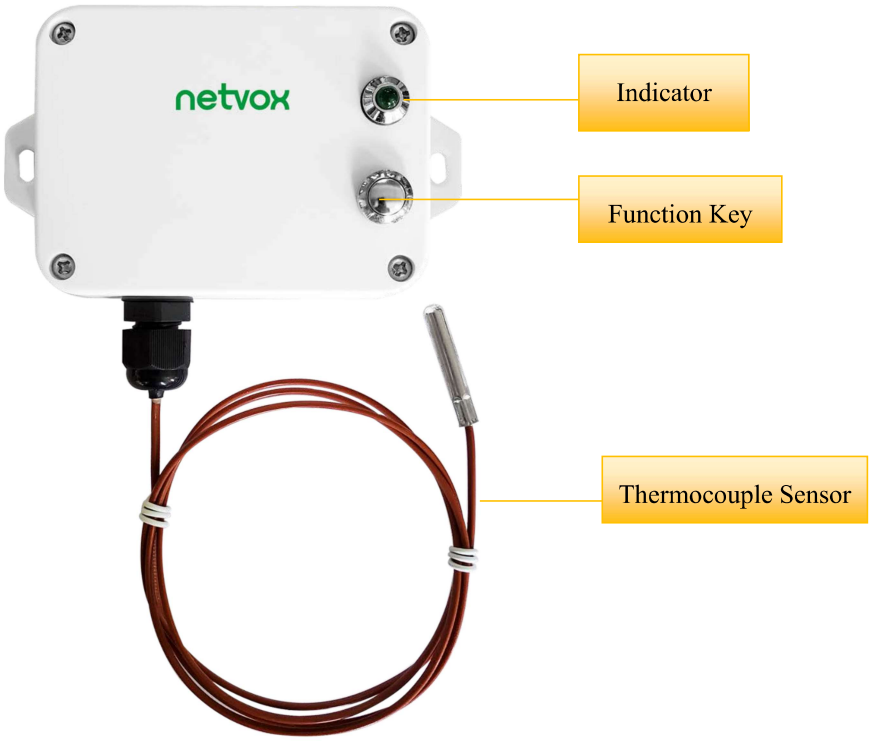
LoRa Wireless Technology:

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

- Apply SX1276 wireless communication module
- 2 section of ER14505 battery in parallel (AA size3.6V / section)
- R718CT IP rating: Main Body IP65/IP67, Thermocouple Sensor T-type IP67
- R718CK, R718CN IP rating: Whole Device IP50
- The base is attached with a magnet that can be attached to a ferromagnetic material object
- 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

  Battery Life:

  - Please refer to web: http://www.netvox.com.tw/electric/electric_calc.html
  - At this website, users can find battery lifetime for variety models at different configurations.

    1. Actual range may vary depending on environment.
    2. Battery life is determined by sensor reporting frequency and other variables.

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 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)	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	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 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 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:

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

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 0191000A0B202005200000, 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	**Device Type**	**Report Type**	**NetvoxPayLoadData**		
R718CK R718CT R718CN	0x91 0x92 0x93	0x01	Battery (1Byte,unit:0.1V)	Temperature (Signed2Bytes,unit:0.1°C)	Reserved (5Bytes,fixed 0x00)

Example 1 of R718CK uplink: 0191012401070000000000

1st byte (01): Version

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

3rd byte (01): ReportType

4th byte (24): Battery—3.6v , 24 Hex=36 Dec 36*0.1v=3.6v

5th 6th byte (0107): Temperature—26.3°C , 107 Hex=263 Dec 263*0.1°C =26.3°C

7th ~ 11th byte (0000000000): Reserved

Example 2 of R718CT uplink: 0192019FFFED0000000000

1st byte (01): Version

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

3rd byte (01): ReportType

4th byte (9F): Battery—3.1v , 1F Hex=31 Dec 31*0.1v=3.1v // Bit7 represent low battery Bit6-0 represent battery voltage

5th 6th byte (FFED): Temperature—-1.9°C , FFED(2's)=10000(Hex)-FFED(Hex)=13(Hex), 13(Hex)=19(Dec),

19*(-0.1°C)= -1.9°C

7th ~ 11th byte (0000000000): Reserved

Example 3 of R718CN uplink: 0193012200DB0000000000

1st byte (01): Version

2nd byte (93): DeviceType 0x93 — R718CN

3rd byte (01): ReportType

4th byte (22): Battery—3.4v , 22 Hex=34 Dec 34*0.1v=3.4v

5th 6th byte (00DB): Temperature—21.9°C , DB Hex=219 Dec 219*0.1°C =21.9°C

7th ~ 11th byte (0000000000): 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)

ConfigReport Req	R718CK R718CT R718CN	0x01	0x91 0x92 0x93	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	BatteryChange (1byte Unit:0.1v)	Temperature Change (2byte Unit:0.1°C)	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)	Temperature Change (2byte Unit:0.1°C)	Reserved (2Bytes,Fixed 0x00)

(1) Configure R718CK report parameters:

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

Downlink： 0191003C003C01000A0000 3C(Hex) =60(Dec) 0A(Hex) = 10(Dec)

Response： 819100000000000000000 (Configuration success)

819101000000000000000 (Configuration failure)

(2) Read Configuration:

Downlink： 029100000000000000000

Response： 8291003C003C01000A0000 (Current configuration)

5.3 Example of Temperature Calibration

Port:0x0E

Description	CmdID	SensorType	PayLoad (Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	0x01	Channel(1Byte) 0_Channel1, 1_Channel2,etc	Multiplier (2bytes, Unsigned)	Divisor (2bytes, Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
SetGlobal CalibrateRsp	0x81		Channel(1Byte) 0_Channel1, 1_Channel2,etc	Status (1Byte,0x00_ success)	Reserved (7Bytes,Fixed 0x00)		
GetGlobal CalibrateReq	0x02		Channel (1Byte,0_Channel1 ,1_Channel2,etc)	Reserved (8Bytes,Fixed 0x00)			
GetGlobal CalibrateRsp	0x82		Channel(1Byte) 0_Channel1, 1_Channel2,etc	Multiplier (2bytes, Unsigned)	Divisor (2bytes, Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
ClearGlobal CalibrateReq	0x03	Reserved (10Bytes,Fixed 0x00)					
ClearGlobal CalibrateRsp	0x83	Status (1Byte,0x00_success)	Reserved (9Bytes,Fixed 0x00)				

SensorType **:** Temperature 0x01

(1) Temperature calibration:

If the temperature the R718Cx detects is 16° and the actual temperature is 17°, it means the calibration we want to make is +1°

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

Downlink：01010000010001000A0000 // 0A H_{ex}=10D_{ec}, 10*0.1°C=1°

Response：

81010000000000000000 (Configuration success)

81010001000000000000 (Configuration failure)

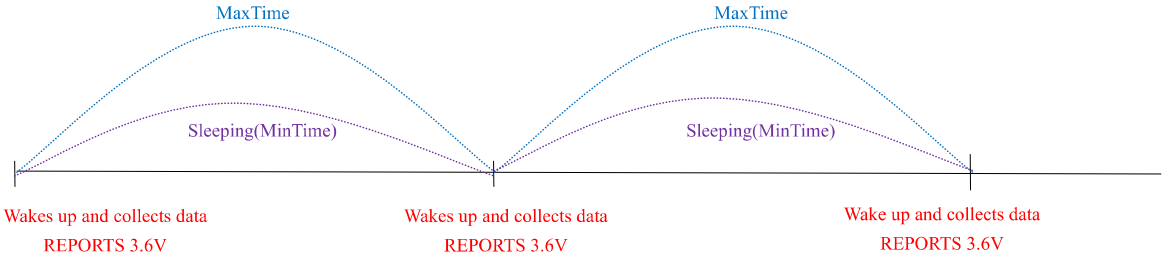
(4) Check whether the temperature calibration

Downlink：02010000000000000000

Response：82010000010001000A0000（Current configuration）

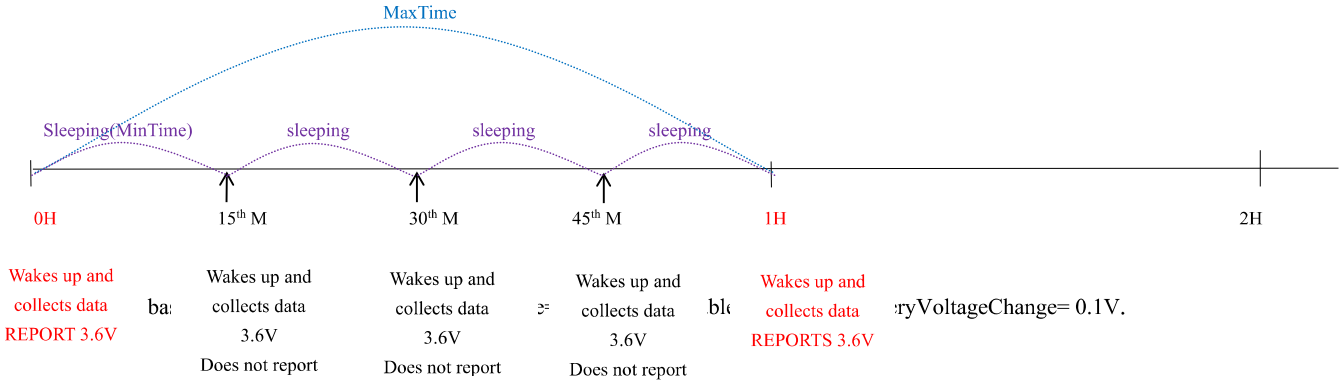
5.4 Example for MinTime/MaxTime logic

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

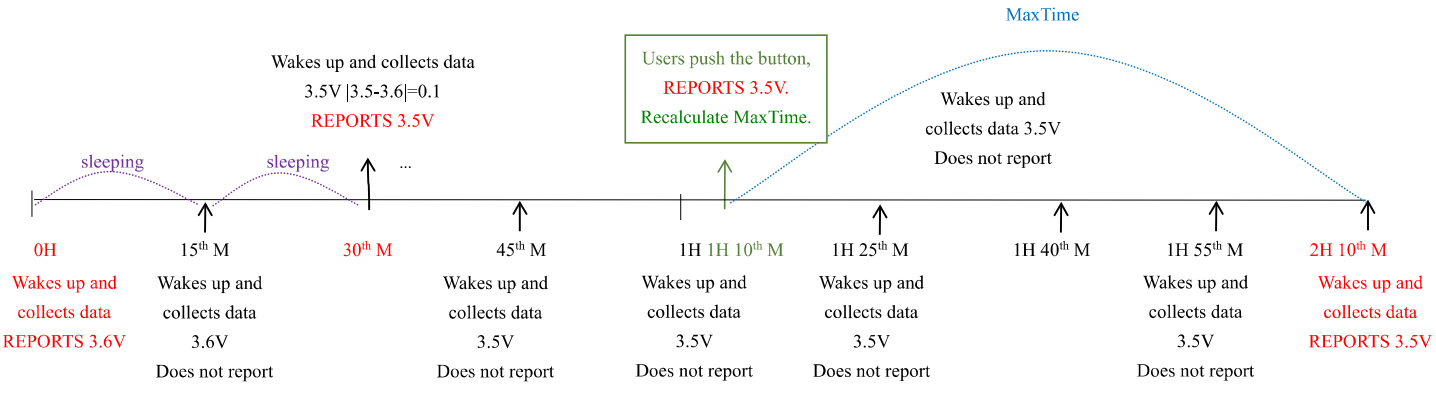


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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.

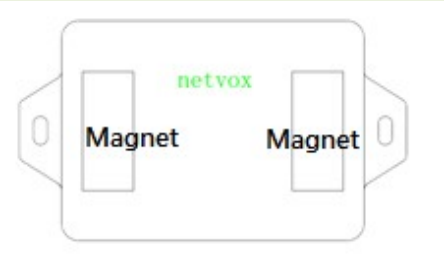
6. Installation

1. The Wireless Thermocouple Sensor (R718CK/T/N) has a built-in magnet (see Figure 1 below). 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 (see Figure 2 below).

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.

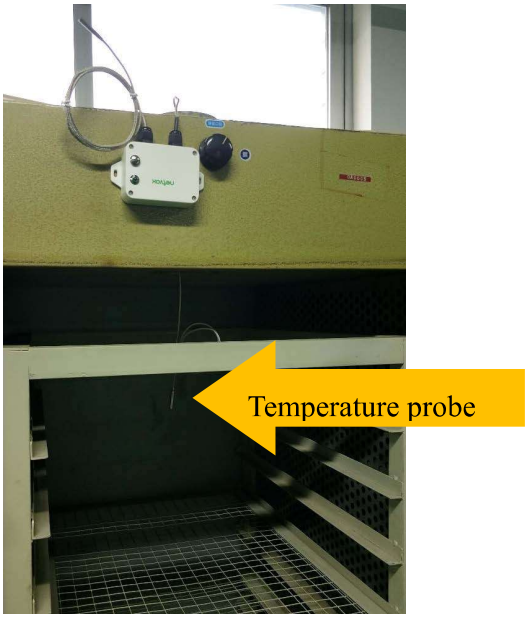


2. When R718CK/T/N is compared with the last reported values, the temperature change is exceeded 10°C (default),it will report values at the MinTime interval.

If does not exceeded 10°C (default) ,it will report values at the MaxTime interval.

R718CK/T/N 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.