
Wireless Temperature Sensor

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R718B Series User Manual

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1. Introduction

The R718B series is a wireless resistance temperature detector for Netvox Class A type devices based on the LoRaWAN open protocol and is compatible with the LoRaWAN protocol. It connects an external resistance temperature detector (PT1000) to measure the temperature.

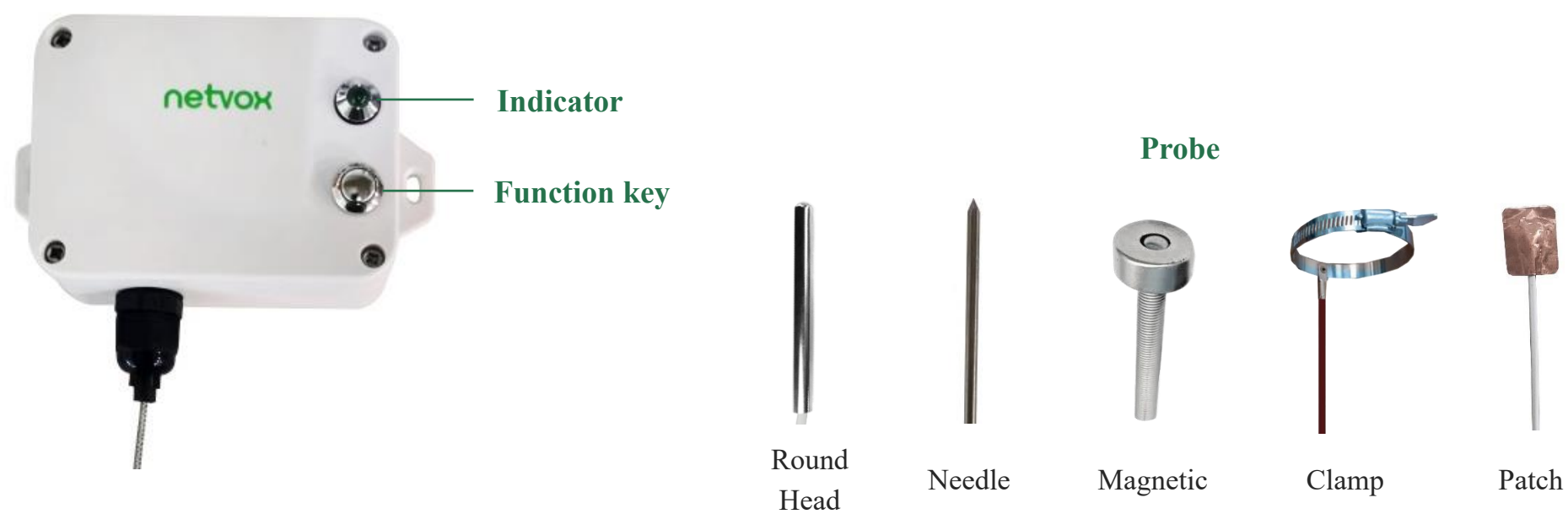
LoRa Wireless Technology

LoRa is a wireless communication technology dedicated to long-distance and low power consumption. Compared with other communication methods, the 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, and 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



R718B series



R718B120 - Round head probe
-70° to 200°C



R718B121 - Needle probe
-70° to 200°C



R718B140 - Round head probe
-40° to 375°C



R718B141 - Needle probe
-40° to 375°C



R718B150 -Round head probe
-40° to 500°C



R718B151 - Needle probe
-40° to 500°C



R718B122 - Magnetic probe
-50° to 180°C



R718BC - Clamp probe
-50° to 150°C



R718BP - Patch probe
-50° to 150°C

3. Features

- SX1276 wireless communication module
- 2* ER14505 lithium batteries in parallel
- IP65 / 67 (main body)
- Magnetic base
- Compatible with LoRaWANTM Class A
- Frequency spread spectrum technology
- 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 of battery lifespan.

4. Set up 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 resetting)	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. The on/off interval should be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. 5 seconds after powering on, the device will be in engineering test mode.

Network Joining

Never joined the network	<u>Turn on to search the network to join.</u> The green indicator stays on for 5 seconds: success The green indicator remains off: fail
Had joined the network (without factory resetting)	<u>Turn on to search the previous network to join.</u> The green indicator stays on for 5 seconds: success The green indicator remains off: fail
Fail to join the network	1. Please remove batteries if the device is not in use. 2. Please check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold for 5 seconds	<u>Factory resetting / Turn off</u> The green indicator flashes for 20 times: success The green indicator remains off: fail
Press once	The device is <u>in the network</u> : green indicator flashes once and sends a report. The device is <u>not in the network</u> : the green indicator remains off

Sleeping 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.
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Low Voltage Warning

Low Voltage	3.2V
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5. Data Report

The device will immediately send a version packet report with an uplink packet including temperature and battery voltage. It sends data in the default configuration before any configuration is done.

Default setting:

Max Interval: 0x0384 (900s)

BatteryChange: 0x01 (0.1V)

Min Interval: 0x0384 (900s)

TemperatureChange: 0x0064 (10°C)

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 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 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 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 0195000A03202312180000, the firmware version is 2023.12.18.

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			
R718B series	0x95	0x00	SoftwareVersion (1 byte) e.g.0x0A—V1.0	HardwareVersion (1 byte)	DateCode (4 bytes, e.g. 0x20170503)	Reserved (2 bytes, fixed 0x00)
		0x01	Battery (1 byte, unit:0.1V)	Temperature1 (Signed 2 bytes, unit: 0.1℃)	ThresholdAlarm (1 byte) Bit0_LowTemperatureAlarm, Bit1_HighTemperatureAlarm, Bit2-7: Reserved)	Reserved (4 bytes, fixed 0x00)

Example 1 of Uplink: 0195019FFE050000000000

- 1st byte (01): Version
- 2nd byte (95): DeviceType 0x95—R718B series
- 3rd byte (01): ReportType
- 4th byte (9F): Battery—3.1V (low voltage), 9F (H_{ex}) = 31 (D_{ec}), 31* 0.1V = 3.1V
- 5th6th byte (FE05): Temperature—-50.7℃ , FE05 (H_{ex}) = -507 (D_{ec}), -507* 0.1℃ = -50.7℃
- 7th byte (00): ThresholdAlarm—No alarm
- 8th-11th byte (00000000): 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				
Config ReportReq	R718B series	0x01	0x95	MinTime (2 bytes, Unit: s)	MaxTime (2 bytes, Unit: s)	BatteryChange (1 byte, Unit: 0.1v)	Temperaturechange (2 bytes, Unit: 0.1°C)	Reserved (2 bytes, Fixed 0x00)
Config ReportRsp		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: 0.1°C)	Reserved (2 bytes, Fixed 0x00)

(1) Configure device parameters

MinTime = 0x003C (1 min), MaxTime = 0x003C (1 min), BatteryChange = 0x01 (0.1V), Temperaturechange = 0x0001 (0.1°C)

Downlink: 0195003C003C0100010000

Response: 819500000000000000000000 (configuration succeed)

819501000000000000000000 (configuration fail)

(2) Read device parameters

Downlink: 029500000000000000000000

Response: 8295003C003C0100010000 (current parameters)

5.3 Set/GetSensorAlarmThresholdCmd

FPort: 0x10

CmdDescriptor	CmdID (1 byte)	Payload (10 bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1 byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	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_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 byte, 0x00_Disable ALL SensorthresholdSet 0x01_Temperature)	Reserved (8 bytes, Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1 byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	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_Temperature1, Channel = 0x01_Temperature2

(1) SetSensorAlarmThresholdReq

Configure Channel = 0x00 (Temperature1), HighThreshold = 0x0000012C (30°C), and LowThreshold = 0x00000064 (10°C)

Downlink: 0100010000012C00000064

Response: 8100000000000000000000

(2) GetSensorAlarmThresholdReq

Downlink: 0200010000000000000000

Response: 8200010000012C00000064

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

Downlink: 0100000000000000000000

Response: 8100000000000000000000

5.4 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 (60min); RejoinThreshold = 0x03 (3 times)

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

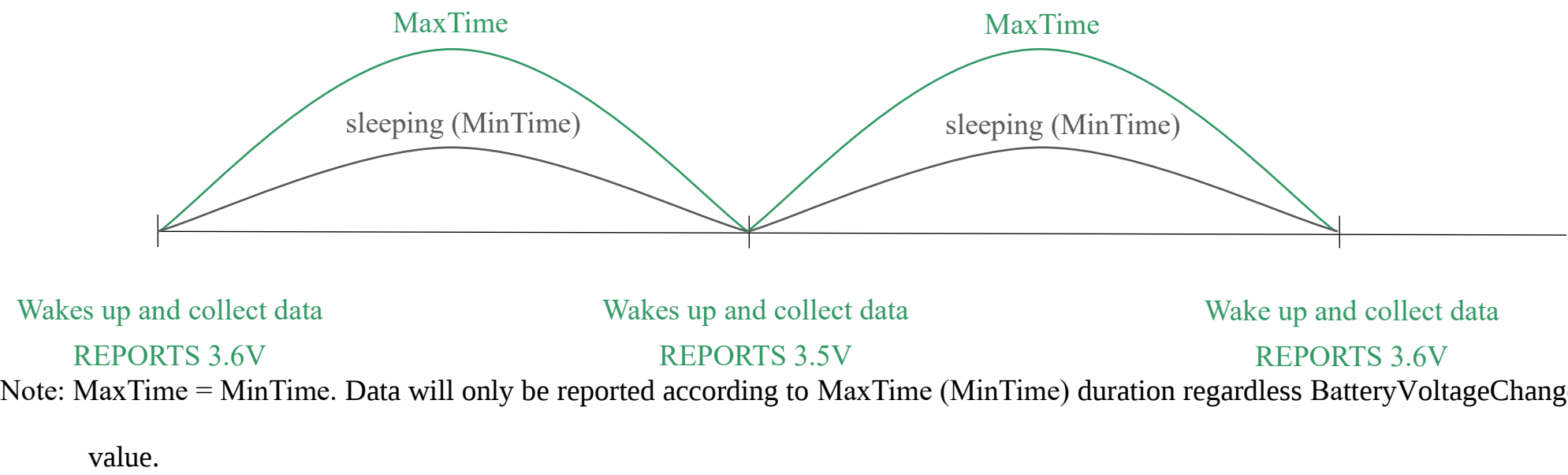
Note: a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

b. The last configuration would be kept as the device is factory reset.

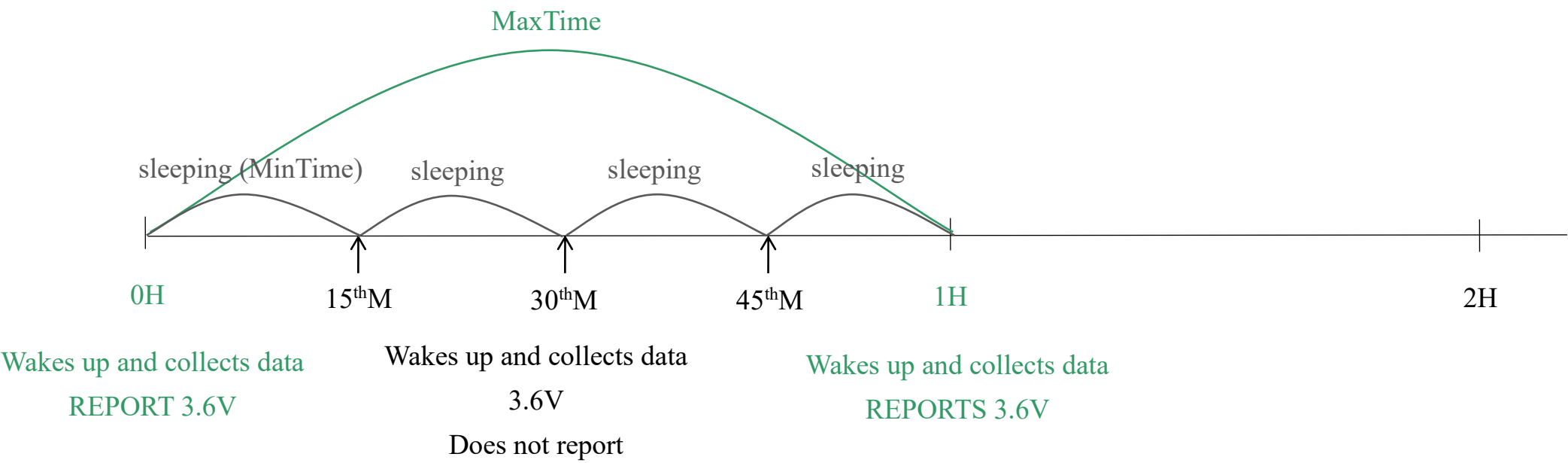
c. Default setting: RejoinCheckPeriod = 2 (hr) and RejoinThreshold = 3 (times)

5.5 Example for MinTime/MaxTime logic

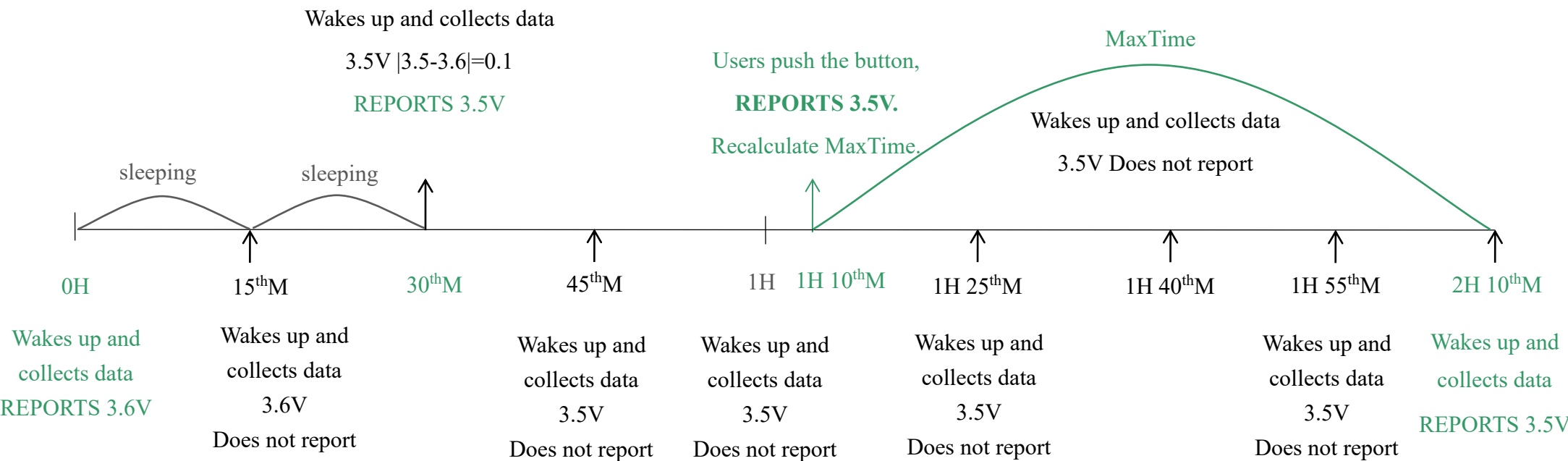
Example#1 based on MinTime = 1 Hour, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange=0.1V



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.



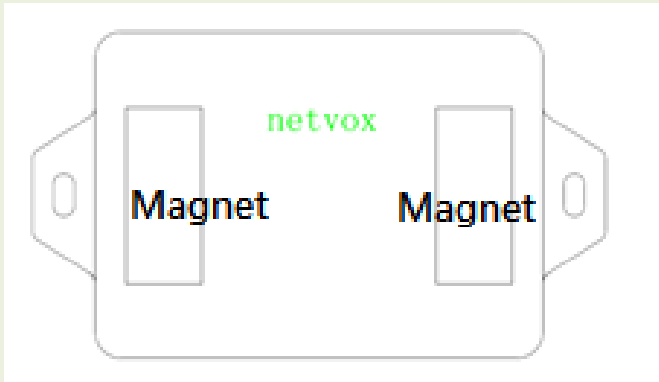
Notes:

- (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 Resistance Temperature Detector (R718B series) 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 fix the unit to a wall or other surface (see 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.



Screw hole diameter: Ø4mm

2. When R718B series is compared with the last reported values, the temperature change is exceeded 0.1°C (default), it will report values at the MinTime interval; If does not exceed 0.1°C (default), it will report values at the MaxTime interval.

R718B series is suitable for the below scenarios:

- Oven
- Industrial control equipment
- Semiconductor industry



3. Put only 30mm of the 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.

▼ R718BC

3.1 When installing R718BC, user needs to fix the clamp probe on the surface of a tube. The adjustable range of the clamp is 21 – 44mm (diameter).



▼ R718BP

3.2 When installing R718BP, user needs to ...

- Remove the liner of the doubled-sided tape on the back of the patch probe.
- Put the patch probe on the surface of an object.
- Fix the patch probe with PTFE tape.



Note:

- Please do not disassemble the device unless it is required to replace the batteries.
- Do not touch the waterproof gasket, LED indicator light, or function keys when replacing the batteries. 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 reactions 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. Relevant Products

Model		Temperature Range	Wire Material	Wire Length	Probe Type	Probe Material	Probe Dimension	Probe IP Rating		
R718B120	One-gang	-70° to 200°C	PTFE + silicone	2m	Round head	316 stainless steel	Ø5mm*30mm	IP67		
R718B220	Two-gang				Needle		Ø5mm*150mm			
R718B121	One-gang					NdFeB magnet + stainless steel spring	Ø15mm			
R718B221	Two-gang				Magnetic					
R718B122	One-gang	-50° to 180°C								
R718B222	Two-gang									
R718B140	One-gang	-40° to 375°C	Braided Fiberglass		Round head	316 stainless steel	Ø5mm*30mm	IP50		
R718B240	Two-gang				Needle		Ø5mm*150mm			
R718B141	One-gang						Round head		Ø5mm*30mm	
R718B241	Two-gang				Needle				Ø5mm*150mm	
R718B150	One-gang	-40° to 500°C							Clamp	Ø Range: 21 to 44mm
R718B250	Two-gang									
R718B151	One-gang									
R718B251	Two-gang									
R718BC	One-gang	-50° to 150°C	PTFE + silicone		Patch	Copper		15mm x 20mm		
R718BP	One-gang	-50° to 150°C	PTFE							

9. Important Maintenance Instructions

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, 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, moisture inside the device will damage the board when the temperature rises.
- 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.

10. 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.