netvox R718E Wireless Accelerometer and Surface Temperature Sensor User Manual

Wireless Accelerometer and Surface Temperature Sensor
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Surface Temperature Sensor

Model: R718E
User Manual

Contents

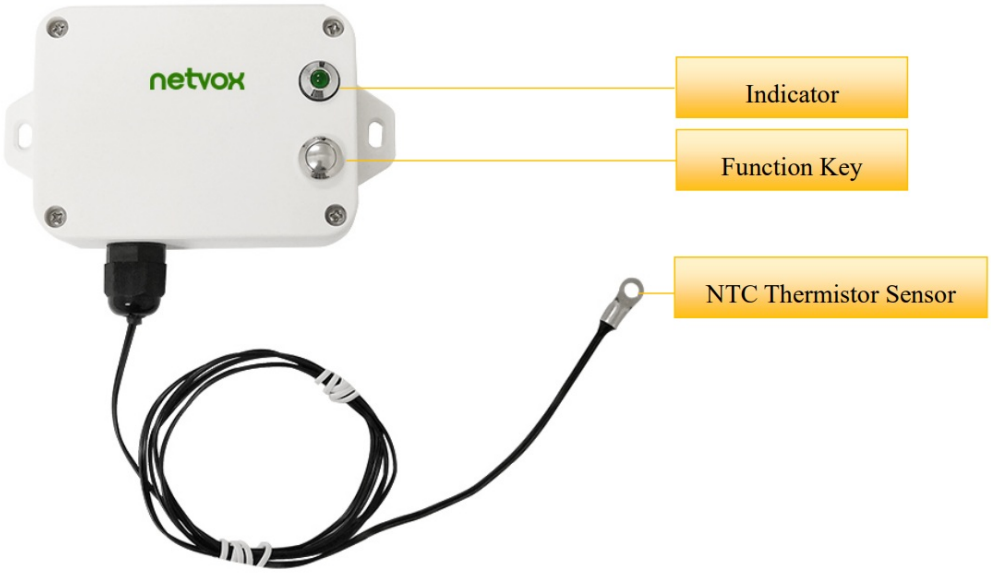
Introduction

The R718E is identified as a LoRaWAN ClassA device with three-axis acceleration, temperature, and compatibility with the LoRaWAN protocol.
When the device moves or vibrates over the threshold value, it immediately reports the temperature, acceleration, and velocity of the X, Y, and Z axes.

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, 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.

Appearance



Main Features

- Apply SX1276 wireless communication module
- 2 sections ER14505 3.6V Lithium AA size battery
- Detect the acceleration and velocity of the X, Y, a n d Z axes
- The base is attached with a magnet that can be attached to a ferromagnetic material object
- Protection level IP65/IP67 (optional)
- Compatible with LoRaWANTMClass A
- Frequency-hopping spread spectrum technology
- Configuration parameters can be configured through third-party software platforms, data can be read and alarms can be set via SMS text and email (optional)
- Available third-party platform: Actility / ThingPark, TTN, MyDevices/Cayenne
- Low power consumption and long battery life:
  - Please refer to web: **http://www.netvox.com.tw/electric/electric_calc.html**
  - On this website, users can find battery lifetime for various models at different configurations.

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

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, and the green indicator flashes 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. The first 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. The green indicator stays on for 5 seconds: succes The green indicator remains off: fail
Had joined the network	Turn on the device to search the previous network. The green indicator stays on for 5 seconds: succes The green indicator remains off: fail

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: the green indicator remains off

Sleeping Mode

The device is on and in the network	Sleeping period: Mir When the report cha ccording to Min Inter

Low Voltage Warning

Low Voltage	3.2V

Data Report

The device will immediately send a version packet report along with two uplink packets including temperature,

battery voltage, acceleration and velocity of the X, Y, and Z axes.
The interval between these two packets will be 10 seconds.
The device sends data in the default configuration before any configuration is done.

Default setting:
MaxTime: Max Interval = 60 min = 3600s
MinTime: Max Interval = 60 min = 3600s
BatteryChange = 0x01 (0.1v)
AccelerationChange = 0x0003
ActiveThreshold = 0x0003
InActiveThreshold = 0x0002
RestoreReportSet = 0x00 (DO NOT report when sensor restore)

Three-axis acceleration and velocity:
If the three-axis acceleration of the device exceeds ActiveThreshold, a report will be sent immediately. After the three-axis acceleration and speed are reported, the three-axis acceleration of the device needs to be lower than InActiveThreshold, the duration is greater than 5s (cannot be modified), and the vibration stops completely, the next detection will start. If the vibration continues during this process after the report is sent, the timing will restart. The device sends two packets of data. One is the acceleration of the three axes, and the other is the speed of the three axes and temperature. The interval between the two packets is 10s.

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.
Please refer to Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver **http://loraresolver.netvoxcloud.com:8888/page/index** to resolve uplink data.

Data report configuration and sending period are as follows:

Min Interval (Unit: second)	Max Interval (Unit: second)	Reportable Change	Current Chanue> Reportable Change	Current Change < Reportable Change
Any number between 1-65535	Any number between 1-65535	Can not be 0.	Report Eger Min Interval	Report per Max Interval

ActiveThreshold and InActiveThreshold

Formula	Active Threshold (or I nActiveThreshold) = Critical value — 9.8 — 0.0625 * The gravitational acceleration at standard atmospheric pressure is 9.8 m/s2 * The scale factor of the threshold is 62.5 mg
Active Threshold	Active Threshold can be changed by ConfigureCmd Active Threshold range is 0x0003-0x0OFF (default is 0x0003);
InActive Threshold	InActive Threshold can be changed by ConfigureCmd InActive Threshold range is 0x0002-0x0OFF (default is 0x0002)
Example	Assuming that the critical value is set to 10m/s2, the Active Threshold (or InActive Threshold) to be set is 10/9.8/0.0625=16.32 Active Threshold (or InActiveThreshold) to be set integer as 16. Note: When configuration, ensure that the Active Threshold must be greater than the InActive Threshold.

Calibration

The accelerometer is a mechanical structure that contains components that can move freely.
These moving parts are very sensitive to mechanical stress, far beyond solid-state electronics.
The 0g offset is an important accelerometer indicator because it defines the baseline used to measure acceleration.
After installing R718E, users need to let the device rest for 1 minute, and then power on. Then, turn on the device and wait for the device to take 1 minute to join the network. After that, the device will automatically execute the calibration.
After calibration, the reported three-axis acceleration value will be within 1m/s2
When the acceleration is within 1m/s2 and the speed is within 160mm/s, it can be judged that the device is stationary.

The X, Y, Z-axis direction of R718E

Example of data configuration

FPort 0x07

Bytes	1	1
	CmdID	DeviceType

CmdID– 1 bytes
DeviceType– 1 byte – Device Type of Device
NetvoxPayLoadData– var bytes (Max=9bytes)

<table>
<tr><td>Description</td><td>Devic e</td><td>und ID</td><td>Devic e Type</td><td colspan="5">NetvoxPayLoadData</td></tr>
<tr><td>ConfigRep ort Req</td><td rowspan="10">R7ls1 1</td><td>Os 0I</td><td rowspan="10">Ox IC</td><td>Minime (2b ytes Unit:s)</td><td>Maxime (2bytes U nits)</td><td>BatteryChang e (I byte Unit 0.1v)</td><td>Acceleration C hange (2byte Unit:m/ s2)</td><td>Reserved (2Byt es, Fixed Ox00)</td></tr>
<tr><td>ConfigRep ort Rp</td><td>Ox8 I</td><td colspan="2">Status(0x00_success)</td><td colspan="3">Reserved (8Bytes, Fixed Ox00)</td></tr>
<tr><td rowspan="2">ReadConfi g RcportReq</td><td>0x0 2</td><td colspan="5">Reserved (9Bytes, Fixed Ox00)</td></tr>
<tr><td>ox,</td><td>Minime (2b ytes Units)</td><td>Maxime (2b ytes limit:s)</td><td>BatteryChange (I byte Unit:0. 1v)</td><td>Acceleration C hange (2byte Unit:m/ s2)</td><td>Reserved (2Bytes, Fix ed Ox00)</td></tr>
<tr><td>ReadConfi g reporters</td><td>0x0 3</td><td colspan="2">ActiveThreshold (2Bytes)</td><td colspan="2">InActiveThreshold (2Bytes)</td><td>Reserved 5Bytes, Fixed Ox00)</td></tr>
<tr><td>SetActive Threshold Req</td><td>0x8 3</td><td colspan="3">Status (0x00success)</td><td colspan="2">Reserved (SBytes, Fixed Ox00)</td></tr>
<tr><td>SetActive Threshold Rsp</td><td>0x0 4</td><td colspan="5">Reserved (9Bytes, Fixed Ox00)</td></tr>
<tr><td rowspan="2">GetActive Threshold Req</td><td rowspan="2">no.;</td><td rowspan="2">ActiveThreshold (2B ytes)</td><td colspan="2" rowspan="2">InActiveThreshold (2Bytes)</td><td rowspan="2">Reserved (bytes, Fi xed Ox00)</td></tr>
<tr><td>GetActive Threshold Rsp</td></tr>
</table>

1. Configure device parameters MinTime = 1min, MaxTime = 1min, BatteryChange = 0.1v, Acceleratedvelocitychange = 1m/s2
   Downlink: 011C003C003C0100010000 003C(Hex) = 60(Dec)
   Device returns: 811C000000000000000000 (configuration is successful)
   811C010000000000000000 (configuration failed)
2. Read device parameters
   Downlink: 021C000000000000000000
   Device returns: 821C003C003C0100010000 (current device parameters)
3. Assuming that the Active Threshold is set to 10m/s2, the value to be set is 10/9.8/0.0625=16.32, and the last value obtained is an integer and is configured as 16.
   Assuming that the InActive Threshold is set to 8m/s2, the value to be set is 8/9.8/0.0625=13.06, and the last value obtained is an integer and is configured as 13.
   Configure device parameters ActiveThreshold=16, InActiveThreshold=13
   Downlink: 031C0010000D0000000000
   Device returns: 831C000000000000000000 (configuration is successful)

831C010000000000000000 (configuration failed)

Read device parameters

Downlink: 041C000000000000000000

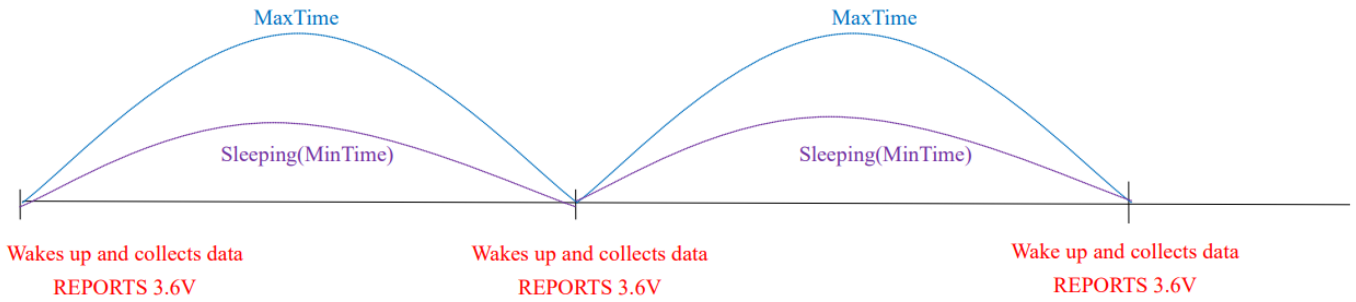
Device returns: 841C0010000D0000000000 (device current parameter)

SetRestore ReportReq	R718E	0x07	0x1C	RestoreReportSet(1byte) 0x00_DO NOT report when sensor restore, 0x01_DO report when sensor restore	Reserved (8Bytes,Fixed 0x00)
SetRestore ReportRsp		0x87		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)
GetRestor Report Req		0x08		Reserved (9Bytes,Fixed 0x00)	
GetRestore ReportRsp		0x88		RestoreReportSet(1byte) 0x00_DO NOT report whensensor restore, 0x01_DO report when sensor restore	Reserved (8Bytes, Fixed 0x00)

4. Configure DO report when sensor restores (When the vibration stops, R718E will report an uplink package)
   Downlink: 071C010000000000000000
   Device return: 871C000000000000000000 (configuration success)
   871C010000000000000000 (configuration failure)
5. Read device parameters
   Downlink: 081C000000000000000000
   Device return: 881C010000000000000000 (device current parameter)

Example for MinTime/MaxTime logic

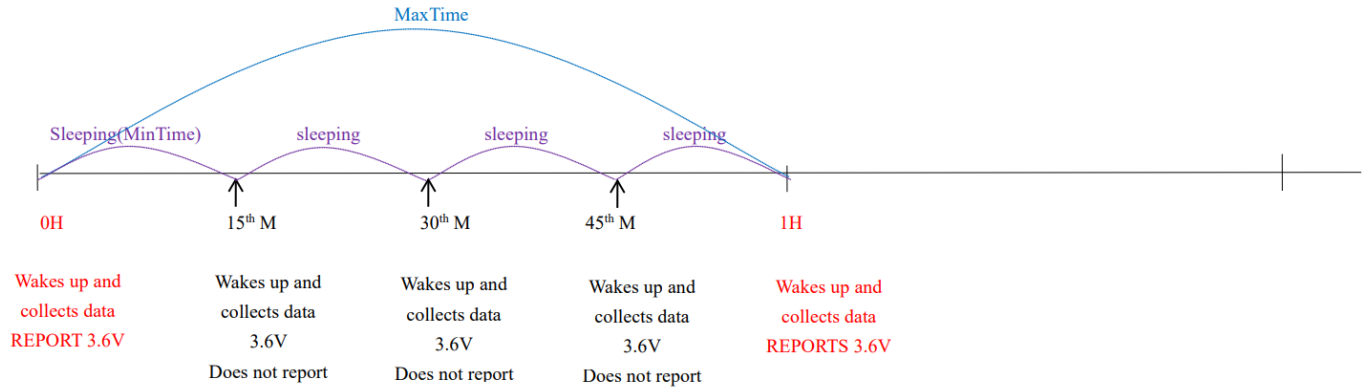
Example#1 based on MinTime = 1 Hour, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange=0.1V



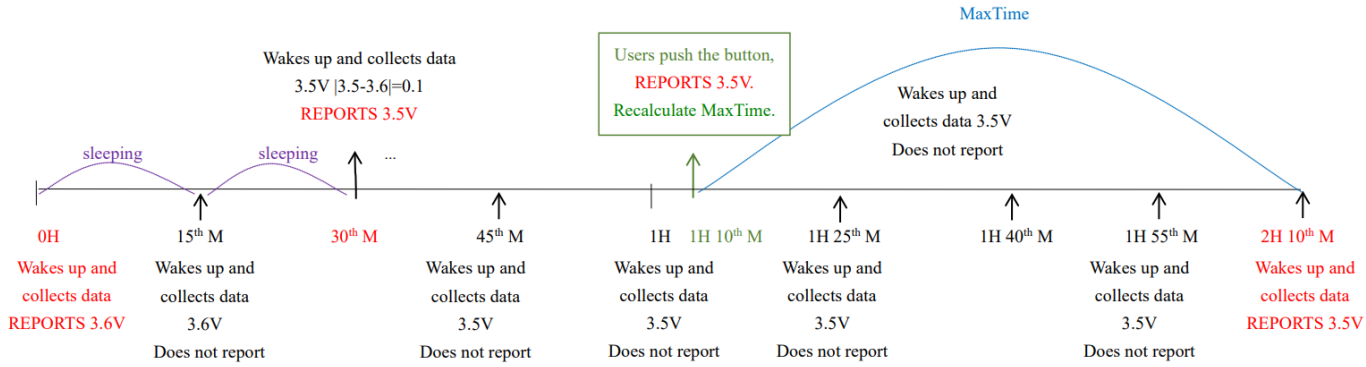
Note: MaxTime=MinTime. Data will only be reported according to Maxime (MinTime) duration regardless BatteryVoltageChange value.

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 Maxime interval.
3. We do not recommend setting 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 Maxime interval, another cycle of MinTime/Maxime calculation is started.

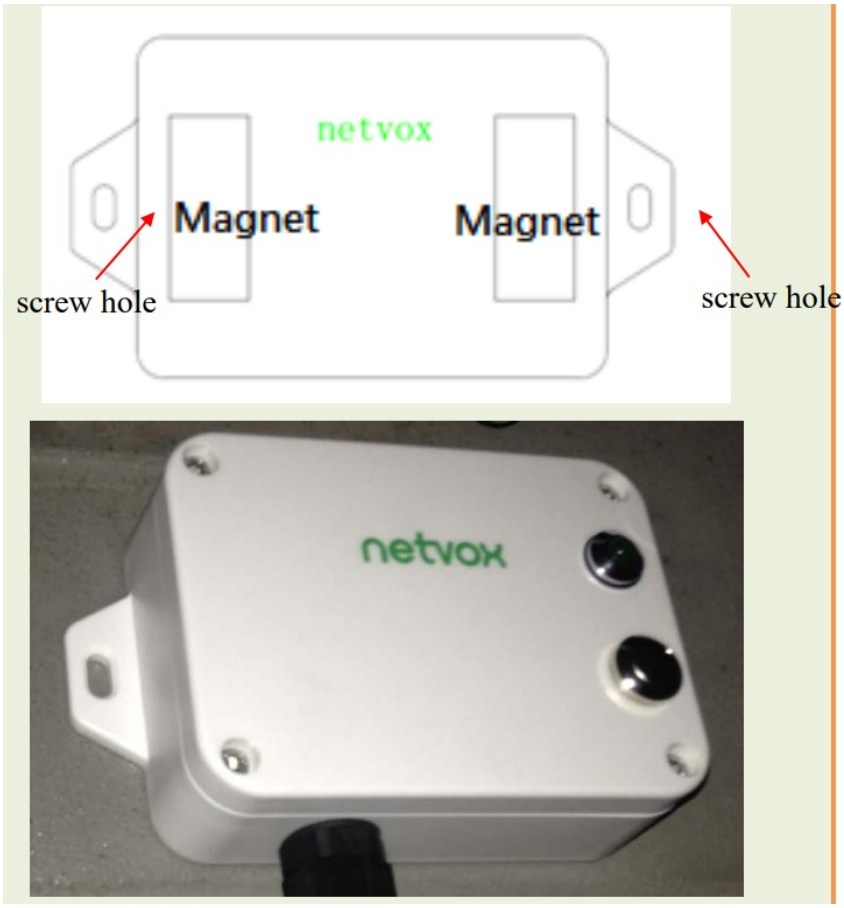
Example Application

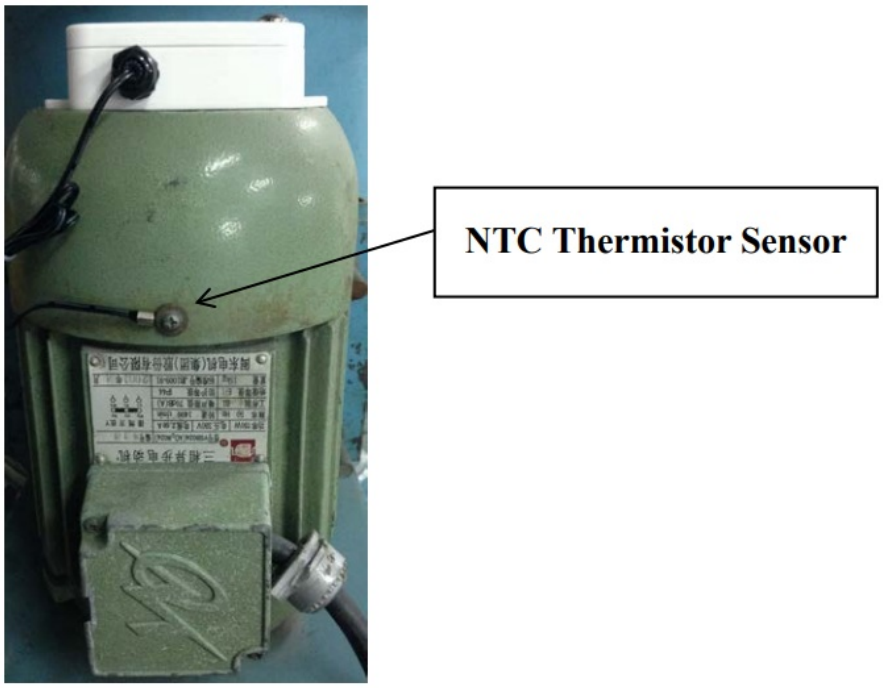
In the case of detecting if the generator is working normally, it is recommended to install R718E horizontal while the generator is power-off and in static status. After installing and fixing R718E, please turn on the device. After the device is joined, one minute later, R718E would perform the calibration of the device (the device cannot be moved after the calibration. If it needs to be moved, the device needs to be turned off/powered off for 1 minute, and then the calibration would be performed again). R718E would need some time to gather the data of the three-axis accelerometer & the temperature of the generator while it is working normally. The data is a reference for the settings of ActiveThreshold & InActiveThreshold, it is also for checking if the generator is working abnormally. Assuming that the collected Z-Axis Accelerometer data is stable at 100m/s², the error is ±2m/s², the ActiveThreshold can be set to 110m/s², and the InActiveThreshold is 104m/s².

Installation

1. The Wireless Accelerometer and Surface Temperature Sensor(R718E) 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 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. Installation Precautions

While installing, it is recommended to install R718E horizontal while the generator is power-off and in static status. After installing and fixing R718E, please turn on the device. After the device is joined, one minute later, R718E would perform the calibration of the device (the device cannot be moved after the calibration. If it needs to be moved, the device needs to be turned off/powered off for 1 minute, and then the calibration would be performed again). R718E would need some time to gather the data of the three-axis accelerometer & the temperature of the generator while it is working normally. The data is a reference for the settings of ActiveThreshold & InActiveThreshold, it is also for checking if the generator is working abnormally.

3. When R718E detects the data of the three-axis accelerometer exceeding ActiveThreshold, R718E would report the data that was detected. After sending the data of the three-axis accelerometer, the data of the three-axis accelerometer of the device needs to be lower than InActiveThreshold and the duration has to be more than 5 seconds (cannot be modified) before the next detection.

Note

- While the data of the three-axis accelerometer of the device is lower than InActiveThreshold and the duration has to be lesser than 5 seconds, at this time, if the vibration continues (the data of the three-axis accelerometer is higher than InActiveThreshold), it will be delayed for 5 seconds. Until the data of the three-axis accelerometer is lower than InActiveThreshold, and the duration is more than 5 seconds.
- R718E would send two packets, one is the data of the three-axis accelerometer, and the other would be sent after 10 seconds with the data of the speed of the three-axis & the temperature.

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 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.

Information about Battery Passivation

Many 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 a 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 the batteries should be produced within the last three months.
If encountering the situation of battery passivation, users can activate the battery to eliminate the battery hysteresis.

To determine whether a battery requires activation

Connect a new ER14505 battery to a 68ohm resistor in parallel, and check the voltage of the circuit.
If the voltage is below 3.3V, it means the battery requires activation.

How to activate the battery

a. Connect a battery to a 68ohm resistor in parallel
b. Keep the connection for 6~8 minutes
c. The voltage of the circuit should be ≧3.3V

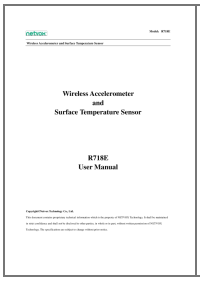
Important Maintenance Instruction

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 a dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under excessive heat conditions. 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
- 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 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.

Documents / Resources

	netvox R718E Wireless Accelerometer and Surface Temperature Sensor [pdf] User Manual R718E, Wireless Accelerometer and Surface Temperature Sensor, R718E Wireless Accelerometer and Surface Temperature Sensor