

# **Three-Axis Digital Accelerometer & NTC Thermistor**

## **R718E User Manual**

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## 1. Introduction

The R718E is identified as a LoRaWAN ClassA device with three-axis acceleration , temperature and compatible with LoRaWAN protocol. When the device moves or vibrates over 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, 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



Fig.1 R718E Appearance

### 3. Main Features

- Compatible with LoRaWAN protocol
- 2 sections ER14505 3.6V Lithium AA battery
- Detect the acceleration and velocity of the X, Y, and Z axes
- The base is attached with a magnet that can be attached to a ferrous object
- Protection level IP65
- Compatible with LoRaWANTM Class 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

Note:

Battery life is determined by the sensor reporting frequency and other variables, please refer to [http://www.netvox.com.tw/electric/electric\\_calc.html](http://www.netvox.com.tw/electric/electric_calc.html)

On this website, users can find battery life time for varied models at different configurations.

### 4. Set up Instruction

#### On/Off

Power on	Insert batteries. (users may need a flat blade 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:	<ol style="list-style-type: none"> <li>1. Remove and insert the battery; the device is at off state by default.</li> <li>2. On/off interval is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components.</li> <li>3. Five seconds after power on, the device will be in engineering test mode.</li> </ol>

#### Network Joining

Never joined the network	Turn on the device to search the network. The green indicator stays on for 5 seconds: success 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: success The green indicator remains off: fail
Fail to join the network (when the device is on)	First two mins: wake up every 15 seconds to send request. After two mins: enter sleeping mode and wake up every 15 minutes to send request. Note: Suggest to remove batteries if the device is not used to save power. 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.
The device is on but not in the network	First two mins: wake up every 15 seconds to send request. After two mins: enter sleeping mode and wake up every 15 minutes to send request. Note: Suggest to remove batteries if the device is not used. Suggest to check device verification on gateway.

## Low Voltage Warning

Low Voltage	3.2V
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## 5. Data Report

When the device is turned on, it will immediately send a version package and a cluster report data.

Data will be reported once per hour by default setting.

Maximum time: 3600s

Minimum time: 3600s (Detect the current voltage value every 3600s by default setting)

Default reportchange:

Batteryvoltagechange ---- 0x01(0.1V)

Acceleratedvelocitychange ---- 0x03(m/s<sup>2</sup>)

Remarks:

1. The device data sending cycle depends on the burning configuration before shipment.
2. The interval between two reports must be the minimum time.

### 5.1 R718E to report three-axis acceleration and velocity

R718E will report immediately when it detects vibration that exceeds the Active Threshold.

The next detection/report will not be ready until the the vibration has been stopped for at least 5 seconds. If vibration happens during this 5-second period, the period will restart.

\* The 5-second period cannot be modified.

R718 sends two packets. One is the three-axis acceleration value, and the other is the three-axis velocity and temperature. The interval between these two packets will be 10 seconds.

Note: MinInterval is the sampling period for the Sensor. Sampling period >= MinInterval.

The reported data is decoded by the Netvox LoRaWAN Application Command document and <http://www.netvox.com.cn:8888/page/index>

**Data report configuration and sending period are as following:**

Description	Device	CmdID	DeviceType	NetvoxPayLoadData					
ConfigReportReq	R718E	0x01	0x1C	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	BatteryChange (1byte Unit:0.1v)	Acceleratedvelocitychange (2byte Unit:m/s2)	Reserved (2bytes)	
ConfigReportRsp		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)	Acceleratedvelocitychange (2byte Unit:m/s2)	Reserved (2bytes)	

Configure device parameters MinTime = 1min, MaxTime = 1min, BatteryChange = 0.1v, Acceleratedvelocitychange = 1m/s<sup>2</sup>

Downlink: 011C003C003C0100010000

Device returns:

811C00000000000000000000 (configuration is successful)

811C01000000000000000000 (configuration failed)

Read device parameters

Downlink: 021C00000000000000000000

Device returns:

821C003C003C0100010000 (current device parameters)

**Example of threshold configuration:**

Description	Device	CmdID	DeviceType	NetvoxPayLoadData		
SetActiveThresholdReq	R718E	0x03	0x1C	ActiveThreshold (2Bytes)	InActiveThreshold (2Bytes)	Reserved (5Bytes,Fixed 0x00)
SetActiveThresholdRsp		0x83		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)	
GetActiveThresholdReq		0x04		Reserved (9Bytes,Fixed 0x00)		
GetActiveThresholdRsp		0x84		ActiveThreshold (2Bytes)	InActiveThreshold (2Bytes)	Reserved (5Bytes,Fixed 0x00)

Assuming that the Active Threshold is set to 10m/s<sup>2</sup>, 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/s<sup>2</sup>, 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: 031C0010000D000000000000

Device returns:

831C00000000000000000000 (configuration is successful)

831C01000000000000000000 (configuration failed)

**Read device parameters**

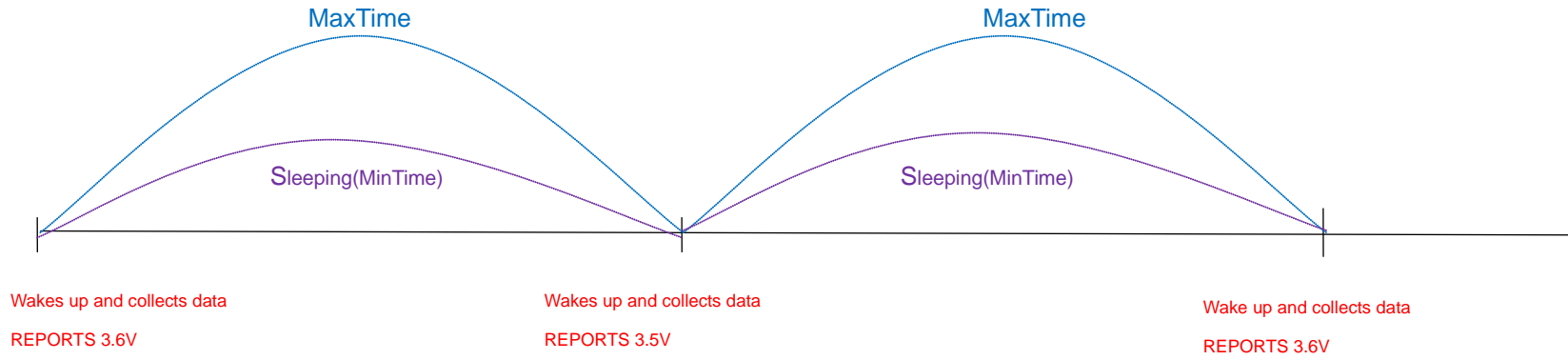
Downlink: 041C00000000000000000000

Device returns:

841C0010000D000000000000 (device current parameter)

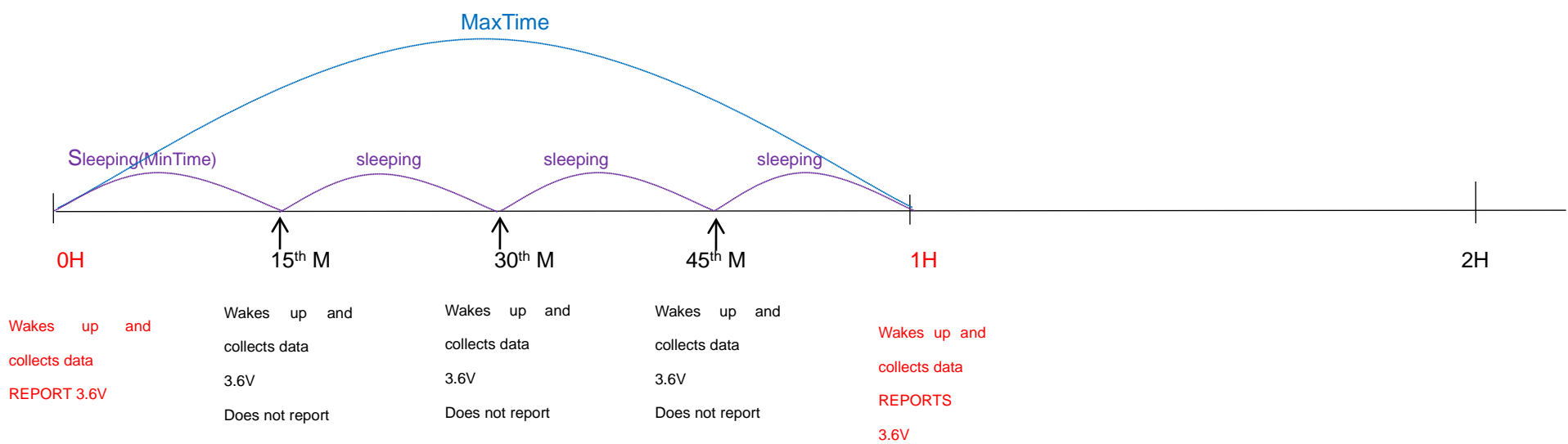
Min Interval (Unit:second)	Max Interval (Unit:second)	Reportable Change	Current Change ≥ Reportable Change	Current Change < Reportable Change
Any number between 1~65535	Any number between 1~65535	Can not be 0.	Report per Min Interval	Report per Max Interval

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

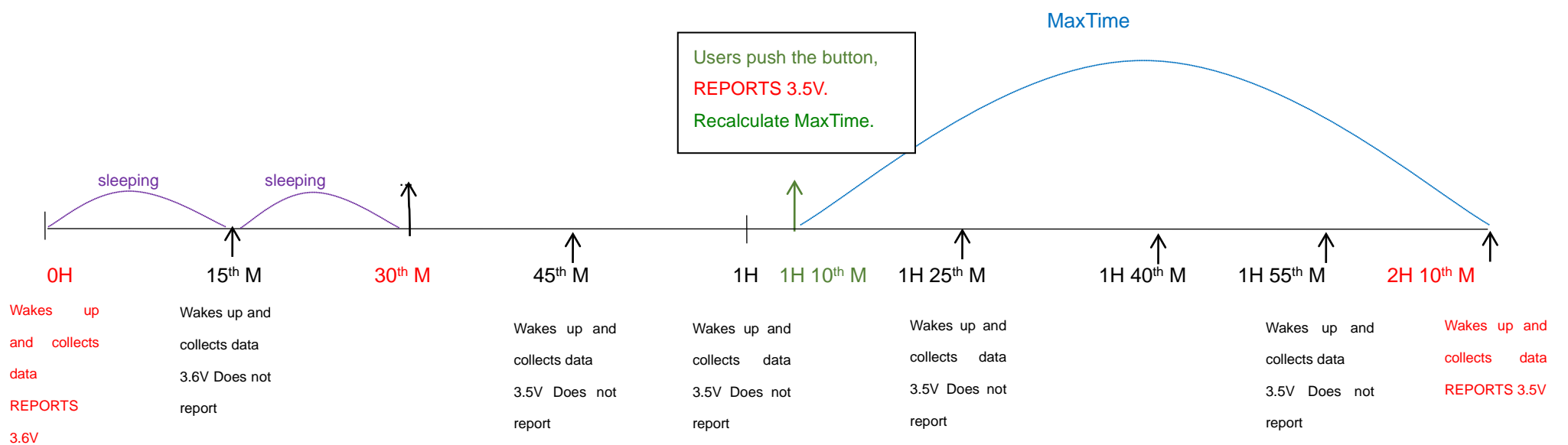


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BtteryVoltageChange value.

**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.

## 5.2 ActiveThreshold and InActiveThreshold

Active Threshold	Active Threshold can be changed by ConfigureCmd Active Threshold range is <b>0x0003-0x00FF</b> (default is 0x0003); The scale factor of the threshold is 62.5 mg, and g is the gravitational acceleration at standard atmospheric pressure.
InActive Threshold	InActive Threshold can be changed by ConfigureCmd InActive Threshold range is <b>0x0002-0xFF</b> (default is 0x0002) The scale factor of the threshold is 62.5 mg, and g is the gravitational acceleration at standard atmospheric pressure.
Example	if you need to set the active threshold to $10\text{m/s}^2$ , you need to set the value to $10/9.8/0.0625=16.32$ . The last value obtained is an integer and is configured as 16.

## 5.3 Offset 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 or offset is an important accelerometer indicator because it defines the baseline used to measure acceleration.

After installing R718E, turn on the device and wait for the device join the network 1 minute, the device will automatically offset the calibration.

If the device installation position moves, you need to power off the device 1 minute and restart turn on.

## 6. Example Application

In the case of detecting whether the motor is working normally, it is necessary to install the device in the state where the device is powered off and the motor is stationary. It is recommended to install it horizontally. After the fixing is completed, power on the device. The device performs offset calibration of the device after one minute of network-joining. (The device offset cannot be moved after calibration. If it needs to be moved, it needs to be powered off for 1 minute and then re-offset calibration). The equipment needs to collect the triaxial acceleration and temperature of the target motor for a period of time, and it is used as a reference for the setting of the static threshold, the motion threshold and whether the motor is abnormal. Assume that the acquired Z-axis acceleration is stable at  $100\text{m/s}^2$  with an error of  $\pm 2\text{m/s}^2$ , and the active threshold can be set to  $110\text{m/s}^2$ , and the static threshold is  $104\text{m/s}^2$ . The specific configuration needs to be based on actual conditions.

The configuration of the Active Threshold and the InActive Threshold can be found in the Netvox LoRaWAN Application Command document.

## 7. Installation

This product comes with waterproof function. When using it, the back of it can be adsorbed on the iron surface, or the two ends can be fixed to the wall with screws.

Note: To install the battery, use a screwdriver or similar tool to assist in opening the battery cover.

## 8. Important Maintenance Instruction

Your device is a product of superior design and craftsmanship and should be used with care. The following suggestions will help you use the warranty service effectively.

- Keep the equipment dry. Rain, moisture, and various liquids or moisture may contain minerals that can corrode electronic circuits. In case the device is wet, please dry it completely.
- Do not use or store in dusty or dirty areas. This can damage its detachable parts and electronic components.
- Do not store in excessive heat. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store in a cold place. 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 wash with strong chemicals, detergents or strong detergents.
- Do not apply with paint. Smudges can block debris in detachable parts and affect normal operation.
- Do not throw the battery into a fire to prevent the battery from exploding. Damaged batteries may also explode.

All of the above suggestions apply equally to your device, battery and accessories. If any device is not working properly. Please take it to the nearest authorized service facility for repair.