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netvox R718EB Wireless Tilt Angle Sensor User Manual

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Introduction

R718EB is the Class A device based on the LoRaWANTM protocol of Netvox. The device detects the tilt angle of three axes. When the device moves or vibrates beyond the set threshold value, and after the device is stationary, if the angle variation of any one of the three axes is greater or equal to than the Angle Change, it will immediately report the current tilt angle of the X, Y, and Z axes and the battery voltage. The device is compatible with LoRaWAN protocol. 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.

Appearance

Main Features

Apply SX1276 wireless communication module 2 sections ER14505 3.6V Lithium AA size battery in parallel Built-in tilt measurement chip The base is attached with a magnet that can be attached to a ferromagnetic material object Protection level IP65/IP67 (optional) 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: Activity / Thing Park, TTN, My Devices/Cayenne Low power consumption and long battery life

Battery Life: Please refer to web: **http://www.netvox.com.tw/electric**/electric_calc.html At this website, users can find battery life time 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.

Application

Pillars, telegraph poles and other applications such as tilt sensing, angle detection, direction identification, etc. Industrial equipment Other

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 second, 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: 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
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 report change exceeds setting value or the state changes: send a data report according to Min Interval.

Low Voltage Warning
Low Voltage 3.2V

Data Report

The device will send a version package report immediately after power-on. After it is powered on, and the auto-calibration is executed for one minute (Do not move the device), the device will report the attribute data.

Note:

1. The device must be placed horizontally during automatic calibration.
2. After calibration, the x, y, z three-axis angles are about 0°, 0°, -90° when the device is placed horizontally.

3. There will be no operation when pressing the button before the automatic calibration is completed.

The device sends data in the default configuration before any configuration is done.

Default setting:
Max Time: Max Interval = 60 min = 3600s Min Time: Max Interval = 60 min = 3600s (It is recommended that Min Time is not less than 1min.) (By default, the current voltage and three-axis tilt value are detected once every Min Interval.) Battery Change = 0x01 (0.1v) Angle Change = 0xC8 (20°) , Unit:0.1°; The accuracy is 3° in horizontal position.

Angle of Three-axis:
If the three-axis acceleration of the device exceeds Active Threshold, and the tilt angle variation of one of the three axes
is greater than or equal to the set Angle Change after the device is stationary, a report will be sent. After the three-axis tilt angle and battery voltage are reported, the three-axis acceleration of the device needs to be lower than In Active Threshold, 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.

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 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 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

Active Threshold and In Active Threshold

Formula	**Active Threshold = Critical value ÷ 9.8 ÷ 0.0625** • The gravitational acceleration at standard atmospheric pressure is 9.8 m/s^2 • The scale factor of the threshold is 62.5 mg
Active Threshold	• Active Threshold can be changed by Configure Cmd • Active Threshold range is **0x0003-0x00FF** (default is 0x0003);
In Active Time	In Active Time can be changed by Configured In Active Time means that the acceleration variation during the stationary time is less than the set In Active Threshold to declare stationary.
Example	Assuming that the critical value is set to 10m/s^2, the Active Threshold (or In Active Threshold) to be set is 10/9.8/0.0625=16.32 Active Threshold (or In Active Threshold) to be set integer as 16.

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 R718EB, users need to let the device rest for 1 minute, and then power on. Then, turn on the device and wait for the device taking 1 minute to join the network. After that, the device will automatically executes the calibration.

Example of data configuration

FPort 0x07

Bytes	1	1	Var(Fix =9 Bytes)
	CmdID	Device Type	Netvox Pay Load Data

CmdID – 1 byte
Device Type – 1 byte – Device Type of Device
Netvox Pay Load Data – var bytes (Max=9bytes)

Description	Device	Cmd ID	Device Type	Netvox Pay Load Data

Config Report Req		0x01		Min Time (2bytes, Unit: s)	Max Time (2bytes, Unit: s)	Battery Change (1byte, Unit: 0.1 v)	Angle Change (2byte, Unit: 0.1°)	Reserved (2Bytes, Fixed 0x00)
Config Report Rsp		0x81		Status(0x00_success)			Reserved (8Bytes, Fixed 0x00)	
Read Config Report Req		0x02		Reserved (9Bytes,Fixed 0x00)				
Read Config Report Rsp		0x82		Min Time (2bytes, Unit: s)	Max Time (2bytes, Unit: s)	Battery Change (1byte, Unit: 0.1 v)	Angle Change (2byte, Unit: 0.1°)	Reserved (2Bytes, Fixed 0x00)
Set Active Threshold Req		0x03		Threshold (2Bytes)	In Active time (1Bytes, Unit: 1s)		Reserved (5Bytes, Fixed 0x00)	
Set Active Threshold Rsp	R718 E B	0x83	0xC8	Status (0x00_success)			Reserved (8Bytes, Fixed 0x00)	

Get Active Threshold Req	0x04	Reserved(9Bytes, Fixed 0x00)		
Get Active Threshold Rsp	0x84	Threshold (2Bytes)	In Active time (1Bytes, Unit: 1s)	Reserved (5Bytes, Fixed 0x00)

1. Configure device parameters Min Time = 1min, Max Time = 1min, Battery Change = 0.1v, Angle Change = 5°

   Downlink: 01C8003C003C0100320000 003C(Hex) = 60(Dec) ; 0032(Hex) = 50(Dec)

   Device returns:

   81C8000000000000000000 (configuration is successful)

   81C8010000000000000000 (configuration failed)

2. **Read device parameters**

   Downlink: 02C8000000000000000000

   Device returns:

   82C8003C003C0100320000 (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.

   Configure device parameters Active Threshold=16, In Active Time=5

   Downlink: 03C8001005000000000000 0010(Hex) = 16(Dec)

   Device returns:

   83C8000000000000000000 (configuration is successful)

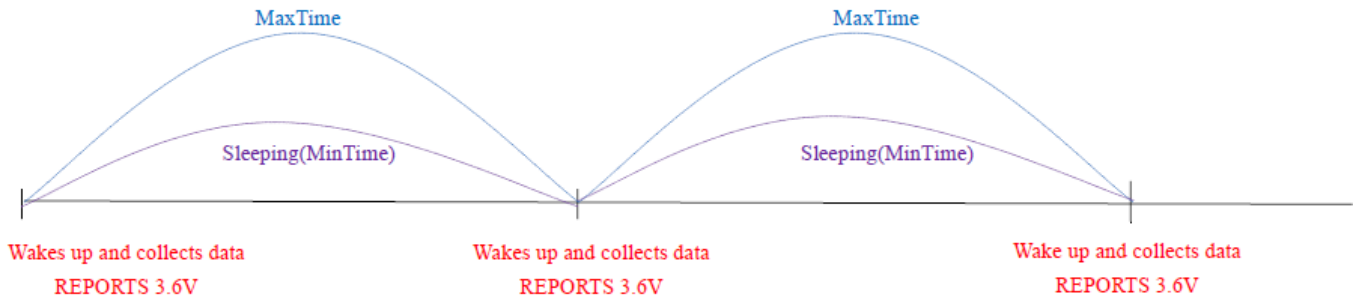   83C8010000000000000000 (configuration failed)

   Read device parameters

   Downlink: 04C8000000000000000000

   Device returns:

   84C8001005000000000000 (device current parameter)0

Example for Min Time/Max Time logic

Wakes up and collects data | Wakes up and collects data | Wake up and collects data
REPORTS 3.6V | REPORTS 3.6V | REPORTS 3.6V

Note: Max Time=Min Time. Data will only be report according to Max Time (Min Time) duration regardless Battery Voltage Change value.

Example#2 based on Min Time = 15 Minutes, Max Time= 1 Hour, Reportable Change i.e. Battery Voltage Change= 0.1V.
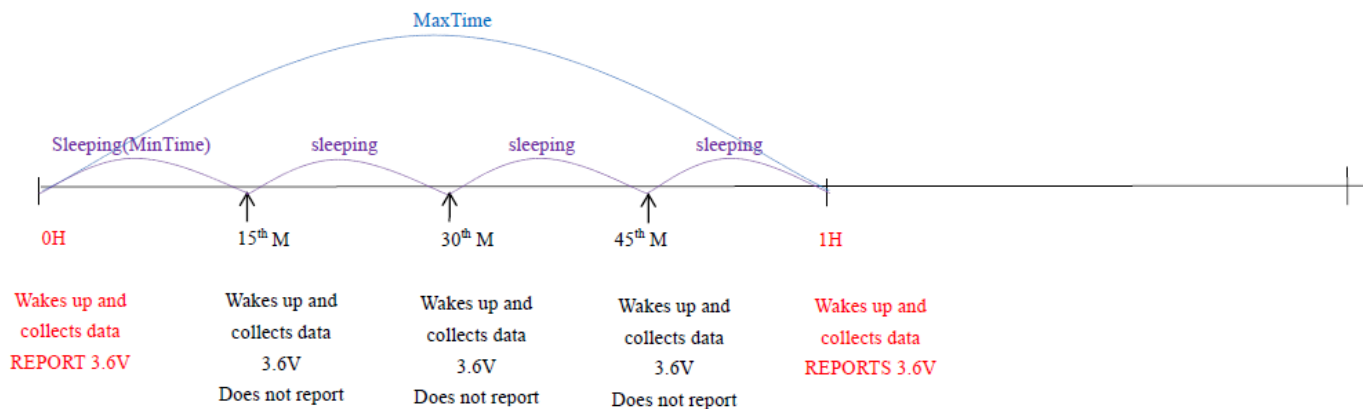
Example#3 based on Min Time = 15 Minutes, Max Time= 1 Hour, Reportable Change i.e. Battery Voltage Change= 0.1V.
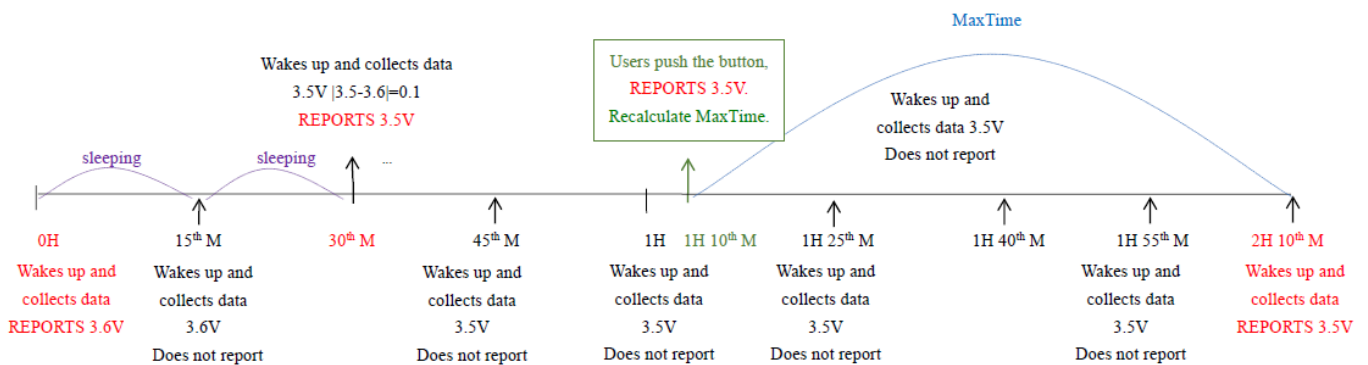
Notes :

1. The device only wakes up and performs data sampling according to Min Time 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 Reportable Change value, the device reports according to Min Time interval. If the data variation is not greater than the last data reported, the device reports according to Max Time interval.

3. We do not recommend to set the Min Time Interval value too low. If the Min Time 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 Max Time

interval, another cycle of Min Time/Max Time calculation is started.

Installation

The device needs to be installed when it is powered off and the detected building/pole is in static status. It is recommended to install the device horizontally. After the fixation is completed, please power on the device. The device performs offset calibration after it has joined the network for one minute. The device needs a period of time to collect the three-axis tilt angle and battery voltage of the detected building/telephone pole, and to make reference for the activity threshold, the inactive time, and whether the building/telephone pole is tilted. The specific configuration depends on the actual situation. Note: After the device is turned on, it must be placed horizontally for one minute before using. (The purpose is that the device will automatically perform the offset calibration to reduce the error of the detection result.)

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:

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.

How to activate the battery

- Connect a battery to a resistor in parallel
- Keep the connection for 5~8 minutes
- 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.

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.

Documents / Resources

	netvox R718EB Wireless Tilt Angle Sensor [pdf] User Manual R718EB, Wireless Tilt Angle Sensor, R718EB Wireless Tilt Angle Sensor, Tilt Angle Sensor, Angle Sensor, Sensor

References

- 🌐 **Netvox Command Resolver**
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