Wireless Accelerometer and Surface Temperature Sensor

R718E

User Manual

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1. Introduction

The R718E is identified as a LoRaWAN Class A 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.

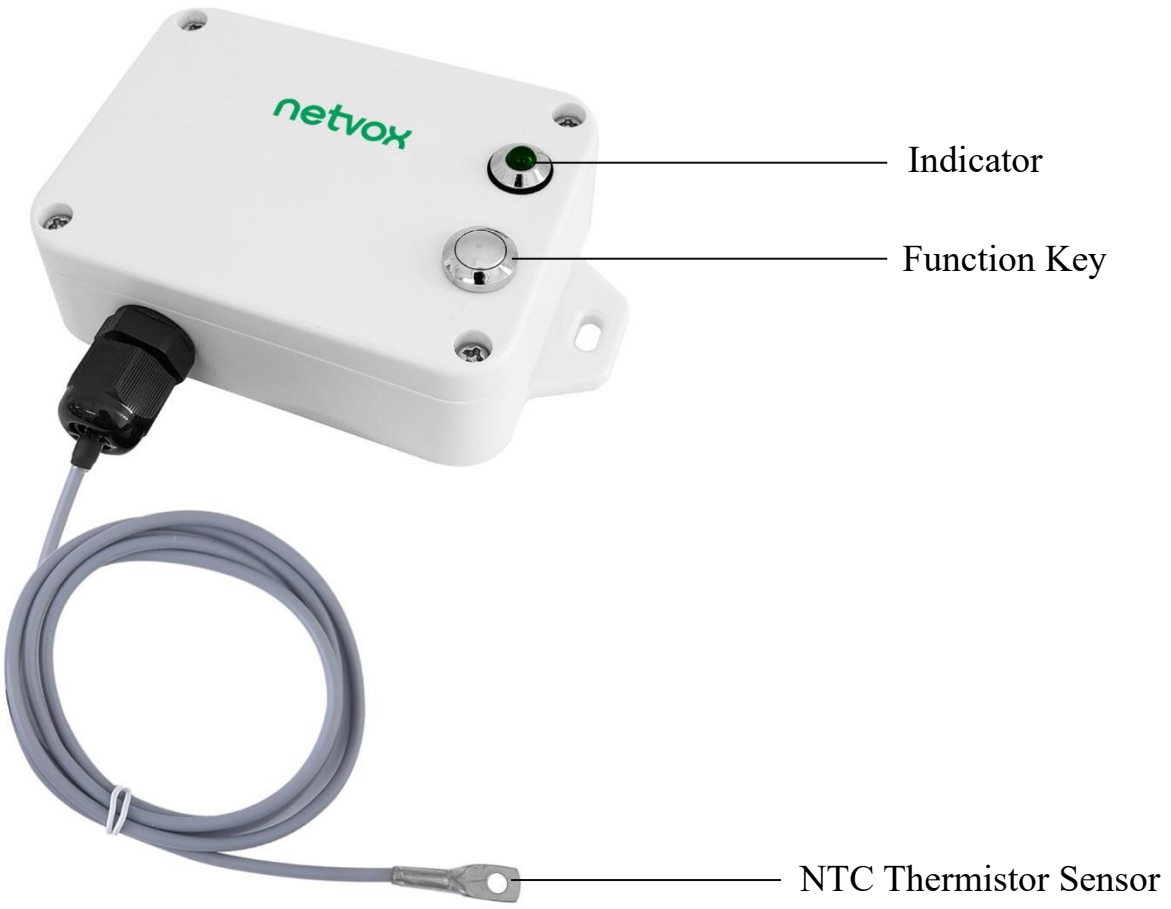
LoRa Wireless Technology

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



3. Features

- SX1276 wireless communication module
- 2 sections ER14505 3.6V Lithium AA size 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 ferromagnetic material object
- Protection level IP65/IP67 (optional)
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum technology
- Available third-party platform: Actility / ThingPark, TTN, MyDevices/Cayenne
- Low power consumption and long battery life

Note: Please refer to web: http://www.netvox.com.tw/electric/electric_calc.html for detailed information about battery life.

4. Setup Instructions

On/Off

Power on	Insert batteries. (Users may need a screwdriver to open)
Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off (Reset to factory setting)	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. On and off interval should be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. 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 to join. 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 to join. The green indicator stays on for 5 seconds: Success The green indicator remains off: Fail
Fail to join the network	Please check the device registration 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: the 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: Min Interval. When the reportchange exceeds the 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 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: 0x0E10 (3600s); MinTime: 0x0E10 (3600s)

BatteryChange: 0x01 (0.1v)

Acceleratedspeedchange: 0x0003 ($3m/s^2$)

AngleChange: 0x0FA0 (20°)

ActiveThreshold: 0x0003

InActiveThreshold: 0x0002

RestoreReportSet: 0x00

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 velocity are reported, the three-axis acceleration needs to be lower than InActiveThreshold for more than 5 seconds (cannot be modified) and the next detection will start. If the vibration continues during this process after the report is sent, the duration will restart.

The device sends 3 packets of data: (1) acceleration of three axes, (2) velocity of three axes and temperature, and (3) angles and angle alarms of 3 axes. The interval between each packet is 10 seconds.

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

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 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/s^2.

When the acceleration is within 1m/s^2 and the speed is within 160mm/s, it can be judged that the device is stationary.

5.2 The X, Y, Z axis direction of R718E

During auto-calibration, R718E needs to be placed horizontally with the function key and indicator facing upward.

After the calibration is done, the angle X = 0°, angle Y = 0°, and angle Z = -90°.

5.3 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 to 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 011C000A02202306200000, the firmware version is 2023.06.20.

3. **Data Packet:**

   a. When Report Type=0x01 is data packet. If the device data exceeds 11 bytes or there are shared data packets, the Report Type will have different values.

   b. R718E value uses big-endian computing.

   c. Because of the length limitation of R718E instruction. Therefore, R718E sends out 2 bytes and adds 0 to the data to form 4 bytes of float32.

Device	Device Type	Report Type	NetvoxPayLoadData				
R718E	0x1C	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)	AccelerationX (Float16_ 2 Bytes, m/s^2)	AccelerationY (Float16_ 2 Bytes, m/s^2)	AccelerationZ (Float16_ 2 Bytes, m/s^2)	Status (1Byte, 0x01_Active 0x00_Inactive)
		0x02	VelocityX (Float16_2 Bytes, mm/s)	VelocityY (Float16_2 Bytes, mm/s)	VelocityZ (Float16_2 Bytes, mm/s)		Temperature (Signed 2 Bytes, unit: 0.1°C)
		0x03	Battery (1 Byte, unit: 0.1V)	AngleX (2 Bytes, Signed Value, Unit: 0.005°)	AngleY (2 Bytes, Signed Value, Unit:0.005°)	AngleZ (2 Bytes, Signed Value, Unit:0.005°)	ThresholdAlarm (1Byte, Bit0_LowAngleXAlarm, Bit1_HighAngleXAlarm, Bit2_LowAngleYAlarm, Bit3_HighAngleYAlarm, Bit4_LowAngleZAlarm, Bit5_HighAngleAlarm, Bit6-7: Reserved)
		0x04	Battery (1 Byte, unit: 0.1V)	ThresholdAlarmAcceleration (1 Byte, Bit0_LowAccelerationXAlarm, Bit1_HighAccelerationXAlarm, Bit2_LowAccelerationYAlarm, Bit3_HighAccelerationYAlarm, Bit4_LowAccelerationZAlarm, Bit5_HighAccelerationZAlarm, Bit6-7: Reserved)	ThresholdAlarmVelocity (1 Byte, Bit0_LowVelocityXAlarm, Bit1_HighVelocityXAlarm, Bit2_LowVelocityYAlarm, Bit3_HighVelocityYAlarm, Bit4_LowVelocityZAlarm, Bit5_HighVelocityZAlarm, Bit6-7: Reserved)	ThresholdAlarm Temperature (1 Byte, Bit0_LowTemperatureAlarm, Bit1_HighTemperatureAlar, Bit2-7: Reserved)	Reserved (4 Bytes, fixed 0x00)

Example of Uplink 1: 011C019F303F1C3F654001

1st byte (01): Version

2nd byte (1C): DeviceType — R718E

3rd byte (01): ReportType

4th byte (9F): Battery—3.1v (low voltage) , 9F Hex = 31 Dec 31*0.1v=3.1v

5th 6th byte (303F): Acceleration X, float32(3F300000) = 0.68750000 m/s^2

7th 8th byte (1C3F): Acceleration Y, float32(3F1C0000) = 0.60937500 m/s^2

9th 10th byte (6540): Acceleration Z, float32(40650000) = 3.57812500 m/s^2

11th byte (01): ActiveStatus — Active

Example of Uplink 2: 011C02B03EC73EBB3F014E

1st byte (01): Version

2nd byte (1C): DeviceType — R718E

3rd byte (02): ReportType

4th 5th byte (B03E): Velocity X, float32(3EB00000) = 0.34375000 mm/s

6th 7th byte (C73E): Velocity Y, float32(3EC70000) = 0.38867188mm/s

8th 9th byte (BB3F): Velocity Z, float32(3FBB0000) = 1.46093750mm/s

10th 11th byte (014E): Temperature — 33.4°C, 014E(HEX)=334(DEC), 334*0.1°C =33.4°C

Example of Uplink 3: 011C039F0000FE8CBB1B01

1st byte (01): Version

2nd byte (1C): DeviceType — R718E

3rd byte (03): ReportType

4th byte (9F): Battery — 3.1 (low voltage), 9F (Hex) = 31 (Dec) 31*0.1v=3.1v

5th 6th byte (0000): Angle X— 0°

7th 8th byte (FF8C): Angle Y— -1.860° FE8C (HEX) = -372 (DEC), -372* 0.005° = -1.860°

9th 10th byte (BB1B): Angle Z— -88.185° BB1B (HEX) = -17637 (DEC), -17637* 0.005° = -88.185°

11th byte (01): ThresholdAlarm — 0x01 = 0000 0001 (BIN) // Bit0_LowAngleXAlarm = 1 — alarm

Example of Uplink 4: 011C049F01000000000000

1st byte (01): Version

2nd byte (1C): DeviceType — R718E

3rd byte (04): ReportType

4th byte (9F): Battery — 3.1 (low voltage), 9F (Hex) = 31 (Dec) 31*0.1v=3.1v

5th byte (01): ThresholdAlarmAcceleration — 0x01 = 0000 0001 (BIN) // Bit0_LowAccelerationXAlarm = 1 — alarm

6th byte (00): ThresholdAlarmVelocity — noalarm

7th byte (00): ThresholdAlarmTemperature— noalarm

8th –11th byte (00000000): Reserved

5.4 Example of ConfigureCmd

FPort: 0x07

Bytes	1	1	Var (Fix = 8 Bytes)
	CmdID	DeviceType	NetvoxPayLoadData

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

NetvoxPayLoadData– var bytes (Max=9bytes)

Description	Device	CmdID	Device Type	NetvoxPayLoadData				
ConfigReportReq	R718E	0x01	0x1C	MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	BatteryChange (1 Byte, unit:0.1v)	Acceleratedspeed change (2 Bytes, unit: m/s^2)	AngleChange (2 Bytes, unit: 0.005°)
ConfigReportRsp		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)	Acceleration Change (2 Bytes, unit: m/s2)	Reserved (2 Bytes, Fixed 0x00)
SetActive ThresholdReq		0x03		ActiveThreshold (2 Bytes)	InActiveThreshold (2 Bytes)	Reserved (5 Bytes, Fixed 0x00)		
SetActive ThresholdRsp		0x83		Status (0x00_success)		Reserved (8 Bytes, Fixed 0x00)		
GetActive ThresholdReq		0x04		Reserved (9 Bytes, Fixed 0x00)				
GetActive ThresholdRsp		0x84		ActiveThreshold (2 Bytes)	InActiveThreshold (2 Bytes)	Reserved (5 Bytes, Fixed 0x00)		

(1) Configure device parameters

MinTime = 0x003C (1 min), MaxTime = 0x003C (1 min), BatteryChange = 0x01 (0.1v),

Acceleratedvelocitychange = 0x0001 (1 m/s^2), AngleChange = 0x0FA0 (20°)

Downlink: 011C003C003C0100010FA0

Response: 811C000000000000000000 (configuration success)

811C010000000000000000 (configuration fail)

(2) Read device parameters

Downlink: 021C000000000000000000

Response: 821C003C003C0100010FA0(current device parameters)

(3) Configure device parameters ActiveThreshold= 0x0010 (16); InActiveThreshold= 0x000D (13)

Downlink: 031C0010000D0000000000

Response: 831C000000000000000000 (configuration success)

831C010000000000000000 (configuration fail)

Note:

a. If the critical value is 10m/s^2, the ActiveThreshold will be 10/9.8/0.0625 = 16.32.

Round 16.32 to the nearest whole number. The final result of ActiveThreshold = 16.

b. If the critical value is 8m/s^2, the InActiveThreshold will be 8/9.8/0.0625 = 13.06.

Round 13.06 to the nearest whole number. The final result of InActiveThreshold = 13.

Formula	**Active Threshold (or InActiveThreshold) = 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
ActiveThreshold	Active Threshold can be changed by ConfigureCmd Active Threshold range is **0x0003-0x00FF** (default is 0x0003)
InActiveThreshold	InActiveThreshold can be changed by ConfigureCmd InActiveThreshold range is **0x0002-0x00FF** (default is 0x0002)
Example	If the critical value is set to 10m/s^2, the ActiveThreshold (or InActiveThreshold) 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.

(4) Read device parameters

Downlink: 041C000000000000000000

Response: 841C0010000D0000000000 (device current parameter)

5.5 Example of Restore Report

Fport: 0x07

Description	Device	Cmd ID	Device Type	NetvoxPayLoadData	
SetRestoreReport Req	R718E	0x07	0x1C	RestoreReportSet (1 Byte) 0x00_DO NOT report when sensor restore, 0x01_DO report when sensor restore	Reserved (8 Bytes, Fixed 0x00)
SetRestoreReport Rsp		0x87		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)
GetRestoreReport Req		0x08		Reserved (9 Bytes, Fixed 0x00)	
GetRestoreReport Rsp		0x88		RestoreReportSet (1 Byte) 0x00_DO NOT report when sensor restore, 0x01_DO report when sensor restore	Reserved (8 Bytes, Fixed 0x00)

0x00: Only report when the device detects vibration. (Default)

0x01: A report is sent when the device detects vibration, and when the vibration stops.

(The function of *Restore* is supported by the firmware version after 20200518 version)

(1) Configure DO report when sensor restore (When the vibration stops, R718E will report an uplink package)

Downlink: 071C010000000000000000

Response: 871C000000000000000000 (configuration success)

871C010000000000000000 (configuration failure)

(2) Read device parameters

Downlink: 081C000000000000000000

Response: 881C010000000000000000 (device current parameter)

5.6 Set/GetSensorAlarmThresholdCmd

Fport: 0x10

CmdDescriptor	CmdID (1 Byte)	Payload (10 Bytes)			
SetSensorAlarmThresholdReq	0x01	Channel (1 Byte) 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3	SensorType (1 Byte) 0x00_Disable ALL SensorthresholdSet 0x0C_Acceleration, 0x0D_Velocity, 0x0E_Angle	SensorHighThreshold (4 Bytes) unit: Acceleration_m/s^2, Velocity_mm/s, Angle_0.005°	SensorLowThreshold (4 Bytes) unit: Acceleration_m/s^2, Velocity_mm/s, Angle_0.005°
SetSensorAlarmThresholdRsp	0x81	Status (0x00_success)	Reserved (9 Bytes, Fixed 0x00)		
GetSensorAlarmThresholdReq	0x02	Channel (1 Byte) 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3	SensorType (1 Byte) 0x00_Disable ALL SensorthresholdSet 0x0C_Acceleration, 0x0D_Velocity, 0x0E_Angle	Reserved (8 Bytes, Fixed 0x00)	
GetSensorAlarmThresholdRsp	0x82	Channel (1 Byte) 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3	SensorType (1 Byte) 0x00_Disable ALL SensorthresholdSet 0x0C_Acceleration, 0x0D_Velocity, 0x0E_Angle	SensorHighThreshold (4 Bytes) unit: Acceleration_m/s^2, Velocity_mm/s, Angle_0.005°	SensorLowThreshold (4 Bytes) unit: Acceleration_m/s^2, Velocity_mm/s, Angle_0.005°

Default: Channel1_X-axis; Channel2_Y-axis; Channel3_Z-axis

(1) Configure 0x00_Channel1 (X-axis); AngleHighThreshold = 0x00000000 (0°); AngleLowThreshold = 0x0000BB40 (-88°)

Downlink: 01000E000000000000BB40

Response: 81000E000000000000000000

(2) GetSensorAlarmThresholdReq：

Downlink: 02000E0000000000000000

Response: 82000E000000000000BB40

(3) Clear all SensorThreshold (SensorType = 0x00)

Downlink: 0100000000000000000000

Response: 8100000000000000000000

Note: a. Set SensorHighThreshold or SensorLowThreshold as 0xFFFFFFFF to disable the threshold.

b. The last configuration will be kept after the device is factory reset.

5.7 Example of GlobalCalibrateCmd

FPort: 0x0E

Description	CmdID	Sensor Type	PayLoad (Fix = 9 Bytes)				
SetGlobalCalibrate Req	0x01	0x37	Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Multiplier (2 bytes, Unsigned)	Divisor (2 bytes, Unsigned)	DeltValue (2 bytes, Signed)	Reserved (2 Bytes, Fixed 0x00)
SetGlobalCalibrate Rsp	0x81		Channel (1 Byte) 0_Channel1 1_Channel2, etc.		Status (1 Byte, 0x00_success)		Reserved (7 Bytes, Fixed 0x00)
GetGlobalCalibrate Req	0x02		Channel (1 Byte) 0_Channel1 1_Channel2, etc.				Reserved (8 Bytes, Fixed 0x00)
GetGlobalCalibrate Rsp	0x82		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Multiplier (2 bytes, Unsigned)	Divisor (2 bytes, Unsigned)	DeltValue (2 bytes, Signed)	Reserved (2 Bytes, Fixed 0x00)
ClearGlobalCalibra teReq	0x03	Reserved (10 Bytes, Fixed 0x00)					
ClearGlobalCalibra teRsp	0x83	Status (1 Byte, 0x00_success)	Reserved (9 Bytes, Fixed 0x00)				

SensorType: 0x37_Angle Sensor

Channel: 0x00_AngleX, 0x01_AngleY, 0x02_AngleZ

The original value of Angle_X = 0°. When the calibration increases by 1°, the device reports 1°.

(1) SetGlobalCalibrateReq

Multiplier = 0x0001, Divisor = 0x0001, DeltValue = 0x00CB

Downlink: 01370000010001000CB0000

Response: 81370000000000000000

GetGlobalCalibrateReq

Downlink: 02370000000000000000

Response: 82370000010001000CB0000

(2) The original value of Angle_X = 0°. When the calibration decreases by 1°, the device reports -1°.

SetGlobalCalibrateReq

Multiplier =0x0001, Divisor = 0x0001, DeltValue = 0xFF38

Downlink: 01370000010001FF380000

Response: 813700000000000000000

GetGlobalCalibrateReq

Downlink: 023700000000000000000

Response: 82370000010001FF380000

(3) Clear all calibration (AngleX = 0°)

ClearGlobalCalibrateReq

Downlink: 030000000000000000000

Response: 830000000000000000000

5.8 Example of NetvoxLoRaWANRejoin

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						
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 Bytes, Unit: 1s)				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)		
SetNetvoxLoRaWANRejoinTimeReq	0x03	1st Rejoin Time (2 Bytes, Unit: 1Min)	2nd Rejoin Time (2 Bytes, Unit: 1Min)	3rdRejoin Time (2 Bytes, Unit: Min)	4th Rejoin Time (2 Bytes, Unit: Min)	5th Rejoin Time (2 Bytes, Unit: Min)	6th Rejoin Time (2 Bytes, Unit: Min)	7th Rejoin Time (2 Bytes, Unit: Min)
SetNetvoxLoRaWANRejoinTimeRsp	0x83	Status (1 Byte, 0x00_success)				Reserved (13 Bytes, Fixed 0x00)		
GetNetvoxLoRaWANRejoinTimeReq	0x04	Reserved (15 Bytes, Fixed 0x00)						
GetNetvoxLoRaWANRejoinTimeRsp	0x84	1st Rejoin Time (2 Bytes, Unit: 1Min)	2nd Rejoin Time (2 Bytes, Unit: 1Min)	3rdRejoin Time (2 Bytes, Unit: Min)	4th Rejoin Time (2 Bytes, Unit: Min)	5th Rejoin Time (2 Bytes, Unit: Min)	6th Rejoin Time (2 Bytes, Unit: Min)	7th Rejoin Time (2 Bytes, Unit: Min)

Note:

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

b. The last configuration would be kept as user reset the device back to the factory setting.

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

1st Rejoin Time = 0x0001 (1 min), 2nd Rejoin Time = 0x0002 (2 mins), 3rd Rejoin Time = 0x0003 (3 mins), 4th Rejoin Time = 0x0004 (4 mins), 5th Rejoin Time = 0x003C (60 mins), 6th Rejoin Time = 0x0168 (360 mins), 7th Rejoin Time = 0x05A0 (1440 mins)

(1) Command Configuration

Set RejoinCheckPeriod = 3600s (0x00000E10), RejoinThreshold = 3 times

Downlink: 0100000E1003

Response: 8100000000000 (Configuration success)

8101000000000 (Configuration failure)

(2) Read current configuration (RejoinCheckPeriod and RejoinThreshold)

Downlink: 020000000000

Response: 8200000E1003

(3) Configure Rejoin Time

1st Rejoin Time = 0x0001 (1 min), 2nd Rejoin Time = 0x0002 (2 mins), 3rd Rejoin Time = 0x0003 (3 mins),

4th Rejoin Time = 0x0004 (4 mins), 5th Rejoin Time = 0x0005 (5 mins), 6th Rejoin Time = 0x0006 (6 mins),

7th Rejoin Time = 0x0007 (7 mins)

Downlink: 0300010002000300040005000600 07

Response: 830000000000000000000000000000 (Configuration success)

830100000000000000000000000000 (Configuration failure)

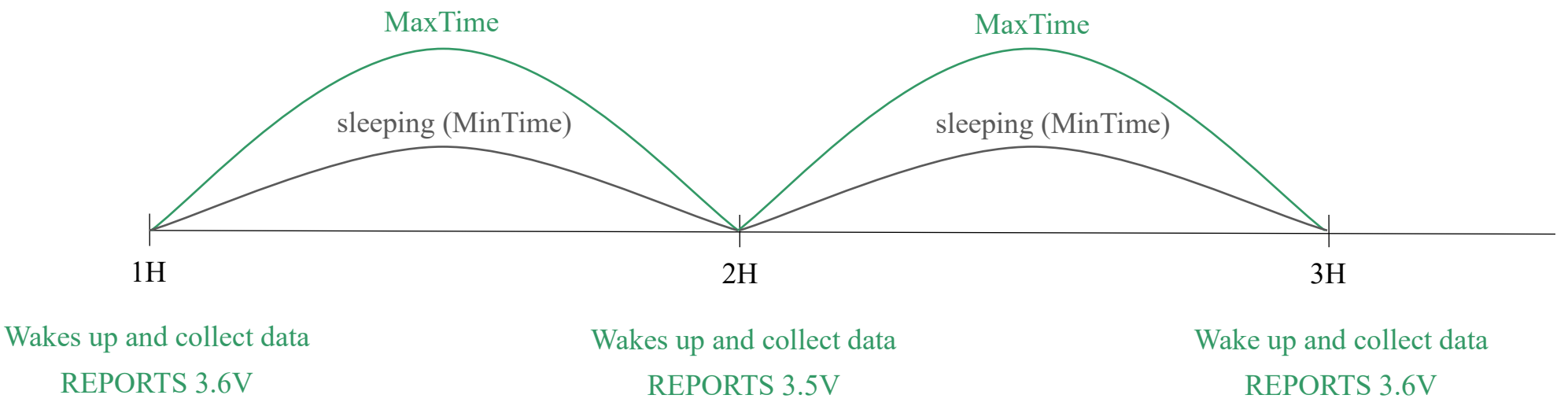
(4) Read RejoinTime parameter

Downlink: 040000000000000000000000000000

Response: 840001000200030004000500060007

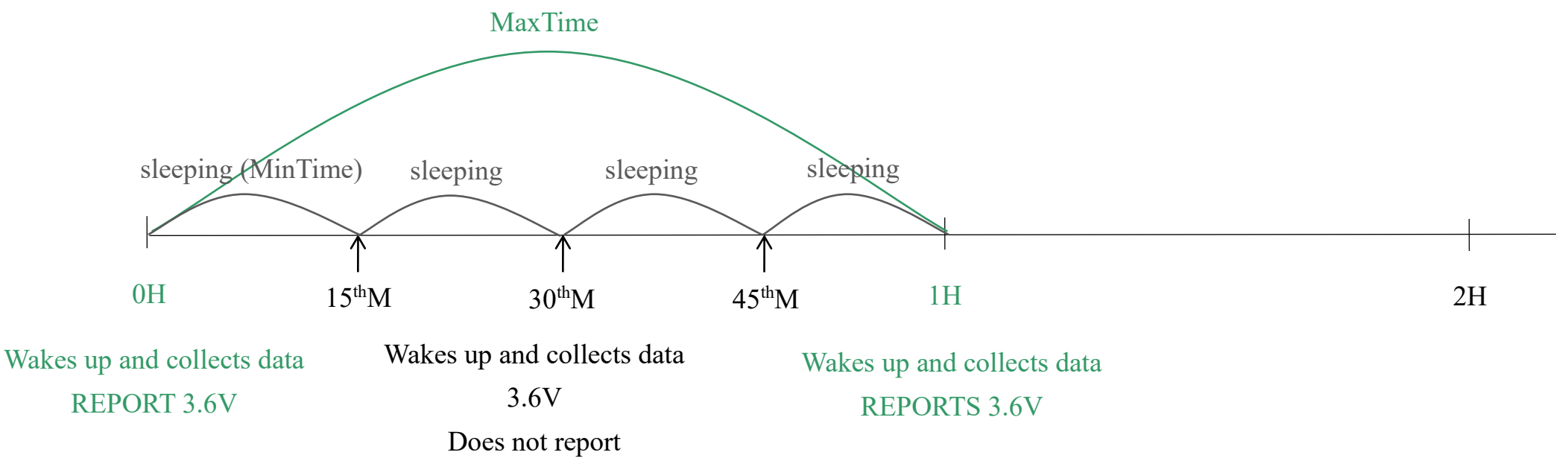
5.9 Example for MinTime/MaxTime logic

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

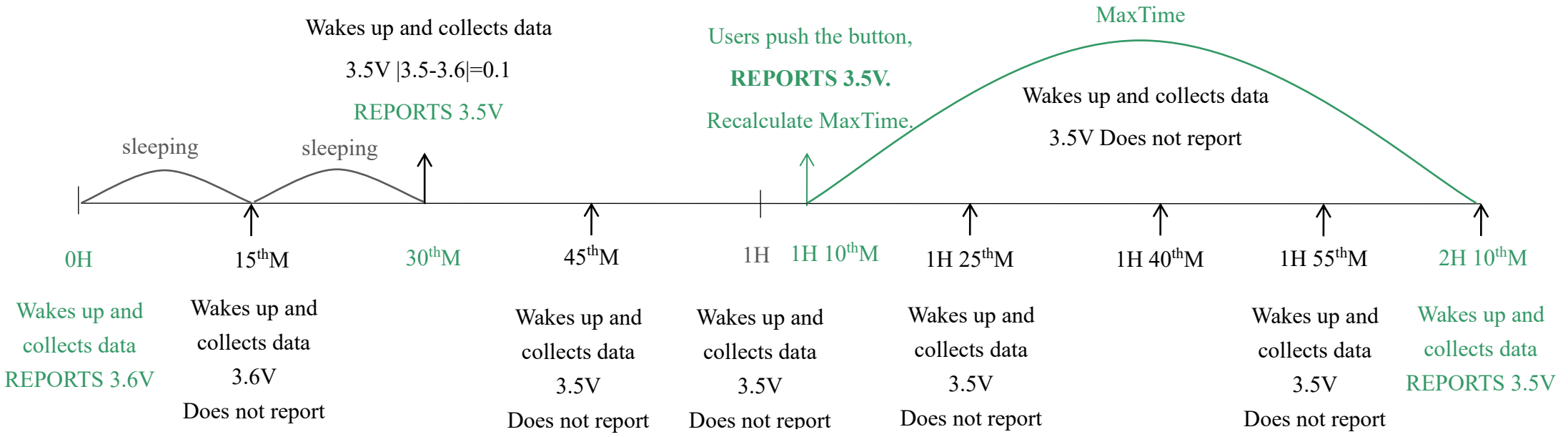


Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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. Example Application

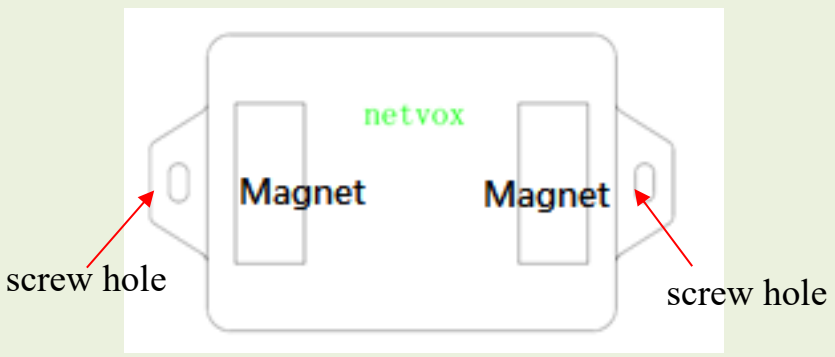
In the case of detecting if the generator is working normally, it is recommended to install R718E horizontal while the generator is power-off and in static status. After installing and fixing R718E, please turn on the device. After the device is joined, one minute later, R718E would perform the calibration 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 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.

7. 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. To make the installation more secure, please use screws (purchased) to fix 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.



The 3-axis acceleration band temperature sensor (R718E) is suitable for the following scenarios:

- Industrial equipment
- Equipment

2. Installation Precautions:

While installing, please install R718E horizontally while the generator is powered off and in static status. After installing and fixing R718E, please turn on the device. One minute after R718E joins the network, it starts calibration. (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).

It takes a while for R718E to sample the data of 3-axis accelerometer and the temperature of the generator when the generator operates normally. The sampling data are used to set ActiveThreshold and InActiveThreshold, and check if the generator operates abnormally.

3.When R718E detects the data of three-axis acceleration exceeds the ActiveThreshold, R718E would report the data immediately.

The data of the three-axis acceleration needs to be lower than InActiveThreshold for more than 5 seconds (cannot be modified) before the next detection starts.

Note: a. When the three-axis acceleration is lower than InActiveThreshold for less than 5 seconds and the vibration continues (the three-axis acceleration is higher than InActiveThreshold), a new round of duration starts and continues until the 3-axis acceleration is lower than the InActiveThreshold for more than 5 seconds.

b. R718E will send two data packets: (1) the 3-axis acceleration; (2) 3-axis velocity and temperature (sent 10 seconds after 3-axis acceleration)

Note: a. Please do not disassemble the device unless it is required to replace the batteries.

b. Do not touch the waterproof gasket, LED indicator light, and 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.

8. 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 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.

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

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.

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 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 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, when the temperature rises, moisture that forms inside the device will damage 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 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