Wireless Infrared Proximity Sensor

R311LA
User Manual

Table of Content

1. Introduction

R311LA is a Wireless Infrared Proximity Sensor for Netvox ClassA type devices based on the LoRaWAN open protocol.

It has an infrared proximity sensor that can detect if there is object (toilet paper) existing within its detection range and transmits the detected data to gateway for display via a wireless network.

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. Main Feature

- Compatible with LoRaWAN™ Class A
- Adopt SX1276 wireless communication module
- 2 sections 3V CR2450 button batteries power supply
- Infrared Proximity Sensor
- Simple operation and setting
- Frequency hopping spread spectrum technology
- Configuration parameters can be configured via a third-party software platform, data can be read and alerts 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

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 various models at different configurations.

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

4.Set up Instruction

On/Off

Power on	Insert batteries (users may need a flat screwdriver or other tools to open the battery cover) Insert two sections 3V CR2450 button batteries and close the battery cover. Note: Require 2 button batteries to supply power at the same time.
Turn on	Press any function key until the red and green indicator lights flash at the same time: success
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, and the device memorizes previous on/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. If press any function key and insert batteries at the same time, it will enter engineer testing 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 (not restore to factory setting)	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	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 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 setting value or the state changes, a data report is sent according to Min Interval.

Low Voltage Warning

Low Voltage	2.4V

5. Data Report

After the device is powered, it will immediately send a version package and an attribute report data that reports the current status of the object and the raw data of infrared range.

The device sends data according to the default configuration before any other configuring.

Default Setting

Maximum time: 3600s

Minimum time: 3600s (By default, the current is detected every MinTime.)

Battery: 0x01 (0.1V)

OnDistanceThreshold :0xC409 little-endian (2500)

* Distance Threshold value is used little-endian;

When you need configure distance threshold default setting, please change to little-endian,

for example 2500(Hex) =9C4(Dec) is big-endian and 0xC409 is little-endian

Determining the status of the object

(1) The raw data of detection of infrared ranging is greater than the OnDistanceThreshold parameter setting value, the status would be 1, indicating the presence of the object.

(2) The raw data of detection of infrared ranging is smaller than the OnDistanceThreshold parameter setting value, the status would be 0, indicating the absence of the object

Threshold setting instructions

A. First of all, fix the location of the device.

B. When first detection appears no object, the device detects RawSenseData (infrared ranging data), assuming A (2400)

C. Then detect again appears there is object, the device detects RawSenseData (infrared ranging data), assuming B (4000)

D. The range of Threshold(X) is set: A（2400）< X < B（4000）, it would recommend to take a value in the middle of range.

E. The RawSenseData value has no unit and is a signal value of a distance.

The closer the device is to the detected object, the larger the value; the farther the device is to the detected object, the smaller the value.

Note:

1. The cycle of the device sending the data report is according to the default.
2. The interval between two reports must be the MinTime.
3. If there are special customized shipments, the settings will be changed according to customer's requirement.

The device reported data parsing please refer to

Netvox LoraWAN Application Command document and *Netvox Lora Command Resolver*

http://www.netvox.com.cn:8888/cmddoc

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

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 =8bytes)

Device	**Device Type**	**Report Type**	**NetvoxPayLoadData**			
R311LA	0xAA	0x01	Battery (1Byte, unit:0.1V)	Status(1Byte) 0x01_On 0x00_Off	RawSenseData (2Bytes)	Reserved (4Bytes,fixed 0x00)

Uplink:01AA011E01080400000000

Byte	Value	Attribute	Result	Resolution
1st	01	Version	1	-
2nd	AA	DeviceType	AA	-
3rd	01	ReportType	1	-
4th	1E	Battery	3.0v	1E(HEX)=30(DEC),30*0.1v=3.0v
5th	01	Status	ON	-
6th~7th	0804	RawSenseData	2052	-
8th~11th	00000000	Reserved	-	-

5.2 Example of ConfigureCmd

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			
ConfigReportReq	R311LA	0x01	0xAA	MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	BatteryChange (1byte Unit: 0.1v)	Reserved (4Bytes, Fixed 0x00)
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)	Reserved (4Bytes, Fixed 0x00)
SetOnDistance ThresholdRreq		0x03		OnDistanceThreshold (2byte)		Reserved (7Bytes, Fixed 0x00)	
SetOnDistance ThresholdRrsp		0x83		Status (0x00_success)		Reserved (8Bytes, Fixed 0x00)	
GetOnDistance ThresholdRreq		0x04		Reserved (9Bytes, Fixed 0x00)			
GetOnDistance ThresholdRrsp		0x84		OnDistanceThreshold (2byte)		Reserved (7Bytes, Fixed 0x00)	

(1) **Command Configuration:**

MinTime = 1min、MaxTime = 1min、BatteryChange = 0.1v

Downlink：01AA003C003C0100000000

Response：

81AA000000000000000000（Configuration success）

81AA010000000000000000（Configuration failure）

(2) **Read Configuration:**

Downlink：02AA000000000000000000

Response：

82AA003C003C0100000000（Current configuration）

(3) **OnDistanceThreshold Configuration=3000**

Downlink：03AAB80B00000000000000　　// little-endian (0xB80B) ; 0BB8 H_{ex}=3000D_{ec}

Response：

83AA000000000000000000（Configuration success）

83AA010000000000000000（Configuration failure）

(4) **Read OnDistanceThreshold**

Downlink：04AA000000000000000000

Response：

84AAB80B00000000000000 （Current configuration）

5.3 GlobalCalibrateCmd

Fport : 0x0E

Description	Cmd ID	Sensor Type	PayLoad(Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	0x36	Channel (1Byte) 0_Channel 1, 1_Channel 2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
SetGlobal CalibrateRsp	0x81		Channel (1Byte) 0_Channel1, 1_Channel2,etc	Status (1Byte,0x00_success)		Reserved (7Bytes,Fixed 0x00)	
GetGlobal CalibrateReq	0x02		Channel(1Byte) 0_Channel1, 1_Channel2,etc	Reserved (8Bytes,Fixed 0x00)			

GetGlobal CalibrateRsp	0x82		Channel(1Byte) 0_Channel1, 1_Channel2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)

(1)Setting GlobalCalibrate Configuration:

Assuming that the current measured distance of R311LA is 3001, it should be corrected to 3000, and the difference is 3000-3001=-1;

Channel 1= 00,Multiplier = 0001,Divisor = 0000,DeltValue= -1 (0xFFFF)

Downlink：01360000010000FFFF0000

Response：

81360000000000000000（Configuration success）

81360100000000000000（Configuration failure）

(2) Getting GlobalCalibrate Configuration:

Downlink：02360000000000000000

Response：

82360000000000000000（Configuration success）

82360000010000FFFF0000（Configuration failure）

Note:

1.When Multiplier does not = 0, Calibration value = DeltValue*Multiplier.

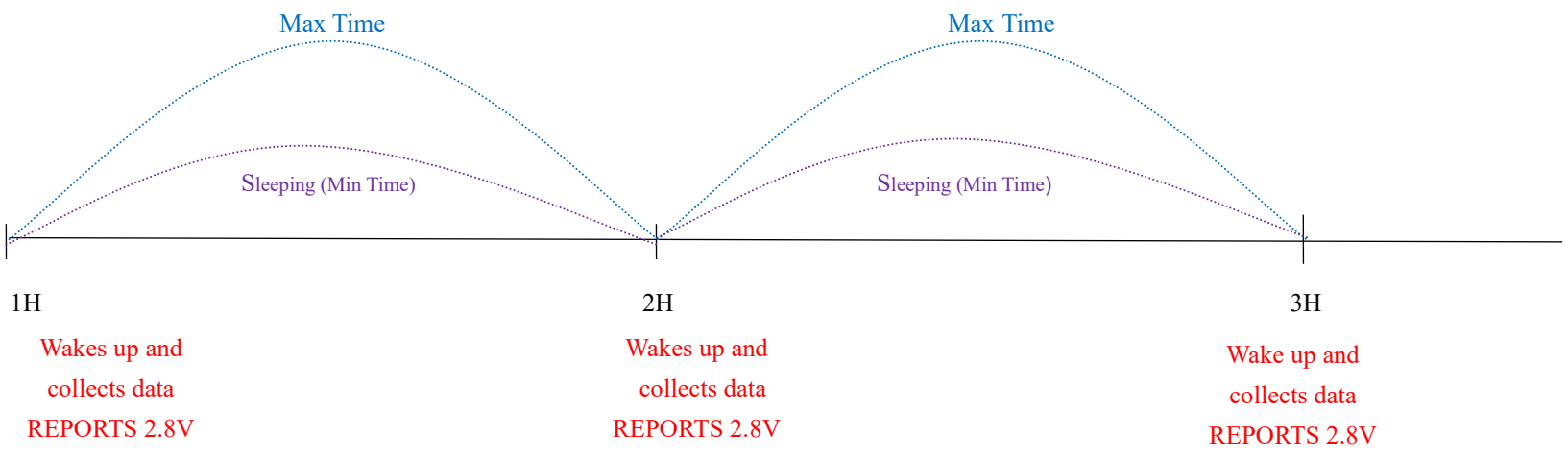
2.When Divisor does not = 0, Calibration value = DeltValue/Divisor.

3.The choices of the Channel would be 00-03. Channel

4.This universal calibration supports calibration of positive and negative numbers.

Example for MinTime/MaxTime logic:

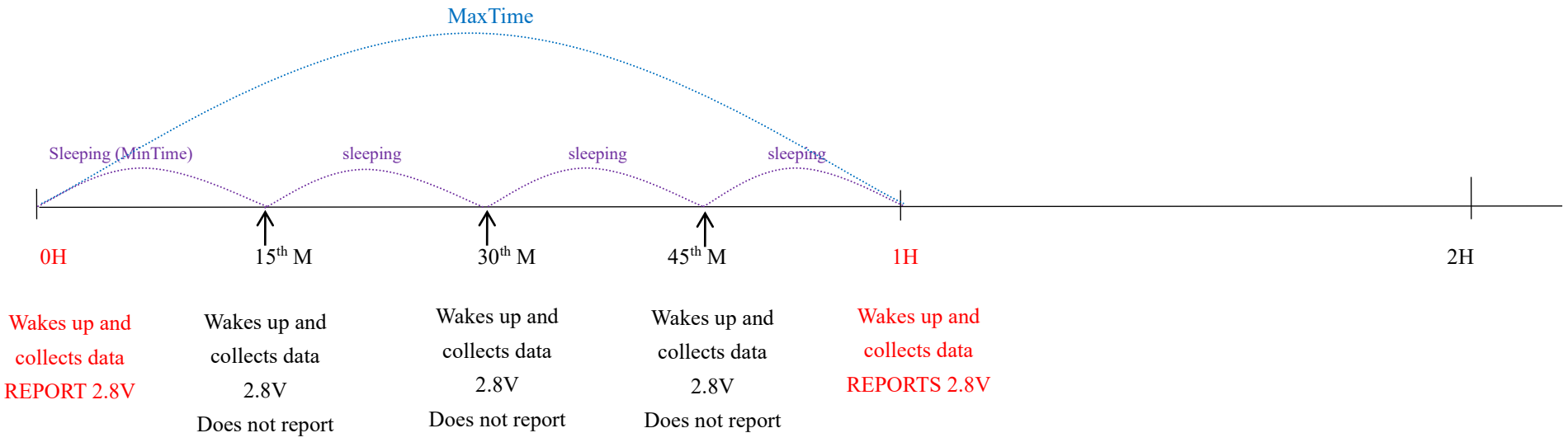
Example#1 based on MinTime = 1 Hour, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange=0.1V



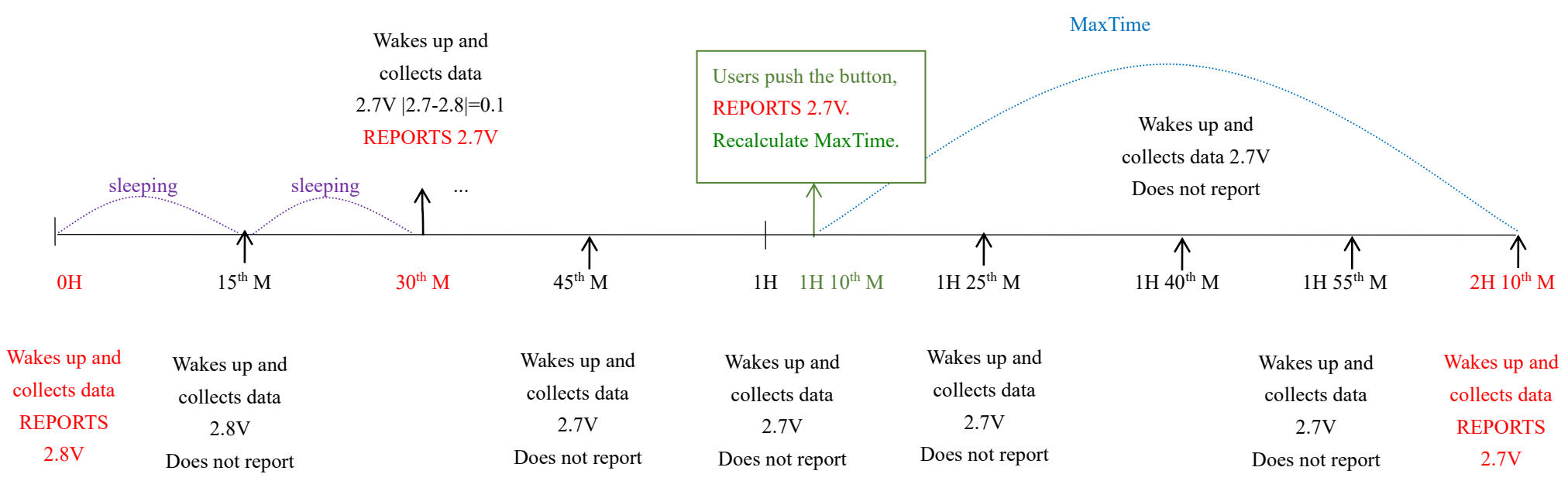
Note:

MaxTime=MinTime. Data will only be report 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 change value 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.

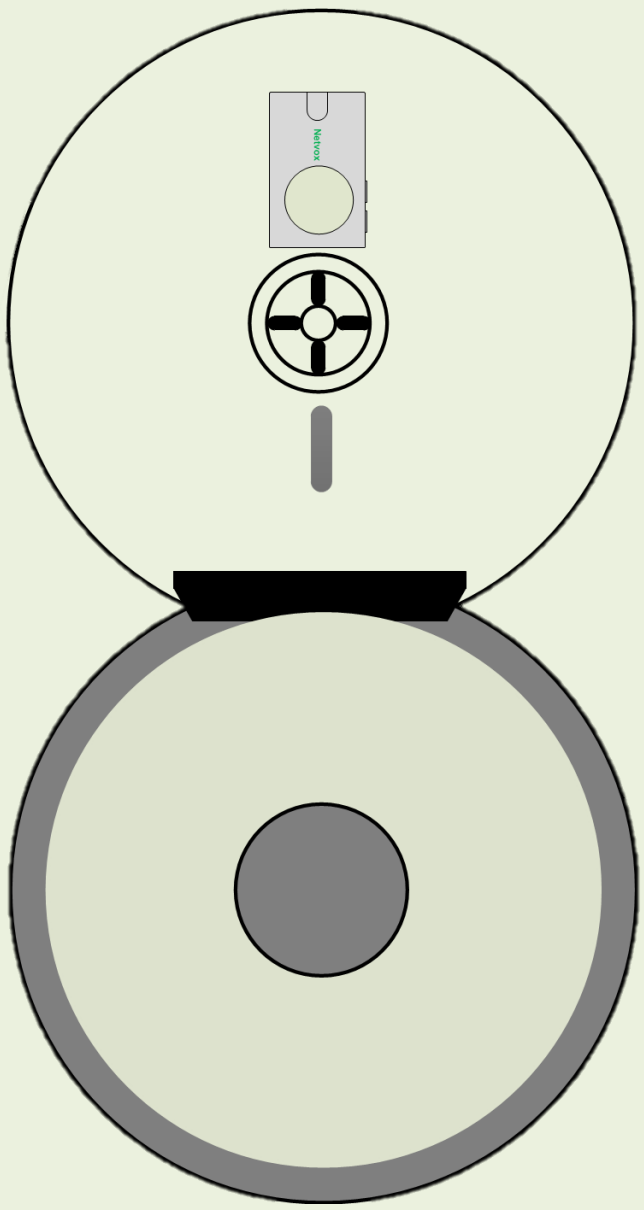
4) Whenever the device sends a report, no matter resulting from data variation, button pushed or MaxTime interval, another cycle of MinTime / MaxTime calculation is started.

6. Installation

1. Remove the 3M release paper on the back of the device and attach the device to the smooth wall (please do not stick it to the rough wall to avoid falling off after a longtime usage).

Note

- Wipe the wall surface before installation to avoid dust on the wall surface that affect the effect of the paste.
- Do not install the device in a metal shielded box or other electrical equipment around it to avoid affecting the wireless transmission of the device.



2. According to the situation of different paper boxes, choose the appropriate installation position.

Take the large roll paper box as an example, as the right figure.

3. The status bits for judging whether there is toilet paper are as follows:

A. The raw data of infrared distance measurement (RawSenseData) is greater than the setting value of parameter -- OnDistanceThreshold.

The status bit is 1 indicating that there is toilet paper.

B. The raw data of infrared distance measurement (RawSenseData) detection is less than or equal to the setting value of parameter -- OnDistanceThreshold.

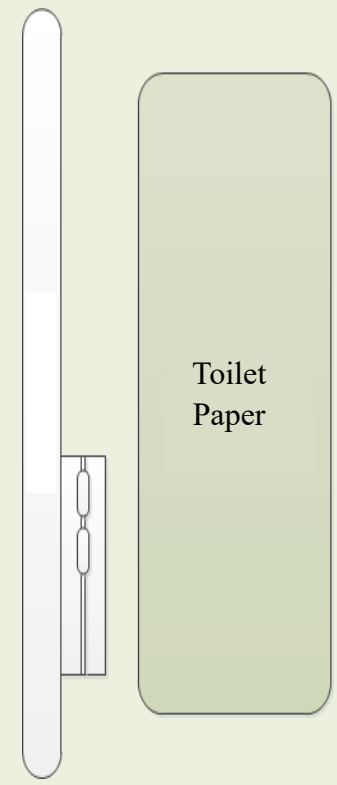
The status bit is 0 indicating that there is no toilet paper.

Note:

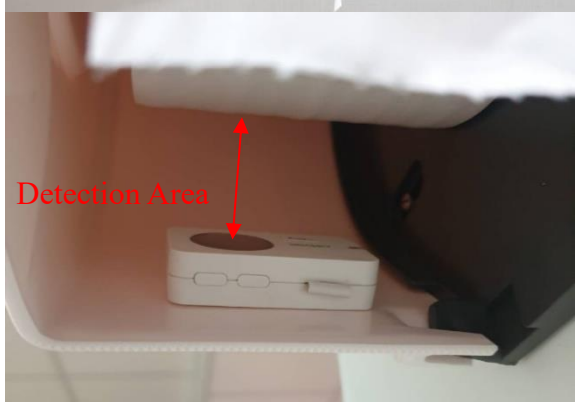
RawSenseData is the approach signal value.

The closer the device is to the detected object, the larger the value; otherwise, the smaller the value.

R311LA can be used in the toilet to detect whether the toilet paper is used up.



Installation diagram



Battery Installation Steps:

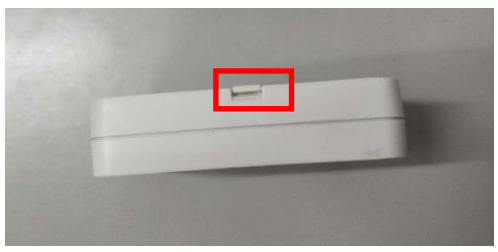
Warning: When replacing the battery, it must be done by professionals.

Please must use 2 CR2450 batteries for this device, and a single battery specification is 3V.

Please note that the positive and negative poles of the battery are not reversed.

Step 1: Use a flat screwdriver, along the opening of the back cover (the red frame in the Fig. 1.),

gently press it toward the center of the device, and then remove the battery back cover toward the back of the device (with sticker).



Step 2: Put 2 batteries into the battery slot, please note that the positive pole of the battery is facing up and the negative pole is facing down.

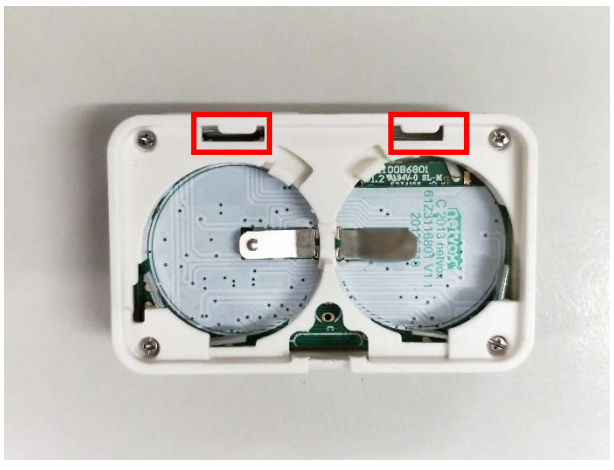


Fig. 2.

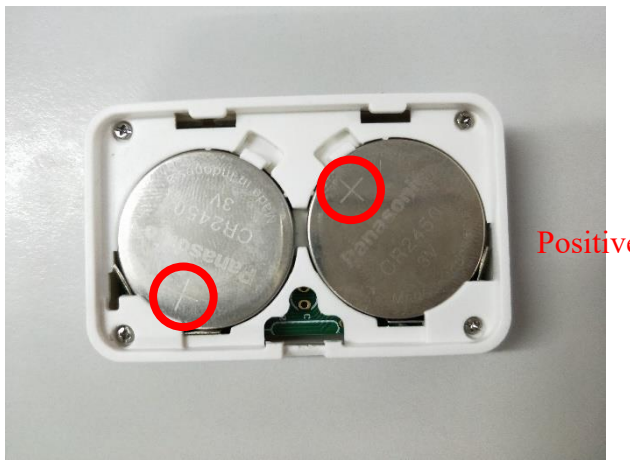


Fig. 3.

Step 3: First align the side groove of the battery back cover with the protruding points of the host body (the red frame in Fig. 2.), and then close the battery back cover.

7. Important Maintenance Instruction

Kindly pay attention to the following in order to achieve the best maintenance of the product:

- Keep the equipment dry. Rain, moisture and various liquids or water 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 way can damage its detachable parts and electronic components.
- Do not store in excessive heat place. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store in excessive 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. Treating equipment roughly can destroy internal circuit boards and delicate structures.
- Do not wash with strong chemicals, detergents or strong detergents.
- Do not paint the device. Smudges can make debris block detachable parts up and affect normal operation.
- Do not throw the battery into the fire to prevent the battery from exploding. Damaged batteries may also explode.

All the above suggestions apply equally to your device, batteries and accessories.

If any device is not operating properly. Please take it to the nearest authorized service facility for repairing.