Wireless Proximity Sensor

R315LA User Manual

Table of Contents

1. Introduction

R315LA is a proximity sensor that detects an object’s presence by measuring the distance between the sensor and the item. With a 62cm measurement range, it is suitable for short-range measurements, such as toilet paper detection. In addition, R315LA is small and light in weight. Without time-consuming and complicated installation methods, users can easily fix R315LA on a surface and get accurate measurement results.

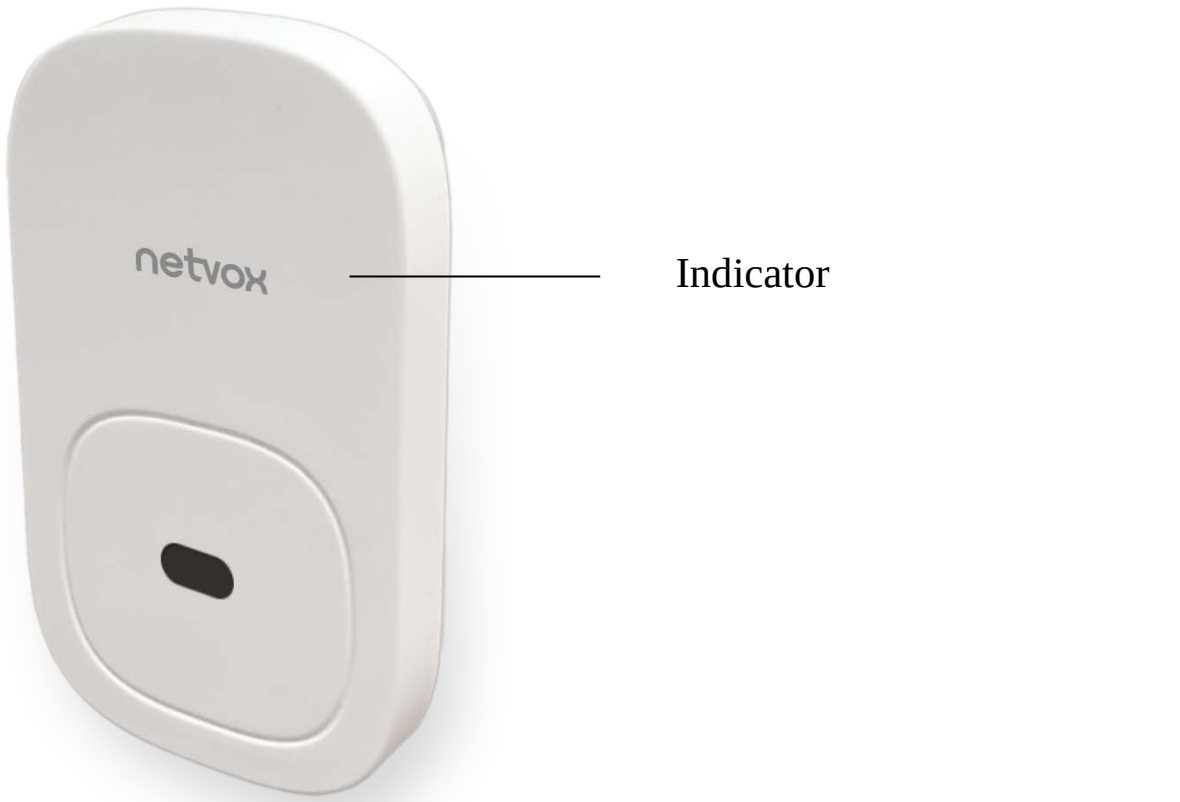
LoRa Wireless Technology

LoRa is a wireless communication technology famous for its long-distance transmission and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation technique greatly extends the communication distance. It can be widely used in any use case that requires long-distance and low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, and industrial monitoring. It has features like small size, low power consumption, long transmission distance, strong 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

- Time of Flight (ToF) sensor
- SX1262 wireless communication module
- 2* 3V CR2450 coin cell batteries
- Compatible with LoRAWAN Class A
- Frequency hopping spread spectrum technology
- Configure parameters through third-party software platforms, read data, and set alarms via SMS text and email (optional)
- Applicable to third-party platforms: Actility / ThingPark, TTN, MyDevices / Cayenne
- Low power consumption and long battery life

Note: Please visit http://www.netvox.com.tw/electric/electric_calc.html for more information about battery life.

4. Setup Instructions

On/Off

Power on	Insert two 3V CR2450 batteries.
Turn on	Press the function key and the green indicator flashes once.
Turn off (Factory resetting)	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 on/off according to the last status before powering off. 2. The on/off interval should be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. Press and hold the function key until the batteries are inserted, 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 (without factory resetting)	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	1. Please remove batteries when the device is not in use. 2. Please check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold for 5 seconds	Factory resetting / 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 the setting value or the state changes: send a data report according to Min Interval.
The device is on but not in the network	1. Please remove batteries when the device is not in use. 2. Please check the device verification information on the gateway or consult your platform server provider.

Low Voltage Warning

Low Voltage	2.6V

5. Data Report

The device will immediately send a version packet report and an attribute report, including status and distance.

It sends data in the default configuration before any configuration is done.

Default setting:

Max Interval: 0x0E10 (3600s)

Min Interval: 0x0E10 (3600s)

BatteryChange: 0x01 (0.1V)

DistanceChange: 0x0014 (20mm)

OnDistanceThreshold = 0x0064 (100mm)

Threshold Alarm:

Low Distance Alarm: 0x01 (bit0=1)

High Distance Alarm: 0x02 (bit1=1)

Note:

a. When the Distance ≤ OnDistanceThreshold, the Status = 0x01 (object detected).

When the Distance > OnDistanceThreshold, the Status = 0x00 (no object detected).

b. The device report interval will be programmed based on the default firmware which may vary.

c. The interval between two reports must be the minimum time.

d. Please refer Netvox *LoRaWAN Application Command document* and *Netvox Lora Command Resolver* http://cmddoc.netvoxcloud.com/cmddoc to resolve uplink data.

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 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 to bit 6, bit 7=0 is normal voltage, and bit 7=1 is low voltage.

   Battery=0xA0, binary= 1001 1010, if bit 7= 1, it means low voltage.

   The actual voltage is 0001 1010 = 0x1A = 26, 26*0.1V = 2.6V

2. **Version Packet:**

   When Report Type=0x00 is the version packet, such as 01DD000A01202404010000, the firmware version is 2024.04.01.

3. **Data Packet:**

   When Report Type=0x01 is the data packet.

Device	**Device Type**	**Report Type**	**NetvoxPayLoadData**					
R315LA	0xDD	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)	VModbusID (1 Byte, Virtual Modbus ID)	Status (1 Byte 0x01_On 0x00_Off)	Distance (2 Bytes, unit:1mm)	Threshold Alarm (1 Byte) Bit0_Low Distance Alarm, Bit1_High Distance Alarm, Bit2-7: Reserved	Reserved (2 Bytes, fixed 0x00)

Example 1 of Uplink: 01DD011D00010085000000

1st byte (01): Version

2nd byte (DD): DeviceType 0xDD－R315LA

3rd byte (01): ReportType

4th byte (1D): Battery－2.9V, 1D (H_{ex}) = 29 (D_{ec}), 29*0.1V=2.9V

5th byte (00): VmodbusID

6th byte (01): Status －On

7th8th byte (0085): Distance－133mm, 0085 (H_{ex}) = 133 (D_{ec}), 133* 1mm = 133mm

9th byte (00): ThresholdAlarm－No Alarm

10th11th byte (0000): Reserved

* Low Distance Alarm = 0x01 (bit0=1)

* High Distance Alarm = 0x02 (bit1=1)

5.2 Example of Report Configuration

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 = 9 Bytes)

Description	**Device**	**Cmd ID**	**Device Type**	**NetvoxPayLoadData**				
Config ReportReq	R315LA	0x01	0xDD	MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	BatteryChange (1 Byte, unit: 0.1v)	DistanceChange (2 Bytes, unit: 1mm)	Reserved (2 Bytes, fixed 0x00)
Config ReportRsp		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)	DistanceChange (2 Bytes, unit: 1mm)	Reserved (2 Bytes, fixed 0x00)
SetOnDistance ThresholdRreq		0x03		OnDistanceThreshold (2 Bytes, unit: 1mm)		Reserved (7 Bytes, fixed 0x00)		
SetOnDistance ThresholdRrsp		0x83		Status (0x00_success)		Reserved (8 Bytes, fixed 0x00)		
GetOnDistance ThresholdRreq		0x04		Reserved (9 Bytes, fixed 0x00)				
GetOnDistance ThresholdRrsp		0x84		OnDistanceThreshold (2 Bytes, unit: 1mm)		Reserved (7 Bytes, fixed 0x00)		

(1) Configure device parameters

MinTime = 0x003C (60s), MaxTime = 0x003C (60s), BatteryChange = 0x01 (0.1V), Distancechange = 0x0032 (50mm)

Downlink: 01DD003C003C0100320000

Response: 81DD00000000000000000 (configuration successful)

81DD01000000000000000 (configuration failed)

(2) Read parameters

Downlink: 02DD000000000000000000

Response: 82DD003C003C0100320000 (current parameters)

(3) Configure parameters

OnDistanceThreshold = 0x001E (30mm)

Downlink: 03DD001E00000000000000

Response: 83DD000000000000000000 (configuration successful)

83DD010000000000000000 (configuration failed)

(4) Read parameters

Downlink: 04DD000000000000000000

Response: 84DD001E00000000000000 (current parameters)

Note: Distance > OnDistanceThreshold, the Status = 0x00. (no object detected)

Distance ≤ OnDistanceThreshold, the Status = 0x01. (object detected)

5.3 Example of GlobalCalibrateCmd

FPort: 0x0E (port 14, Dec)

Description	CmdID	SensorType	PayLoad (Fix = 9 Bytes)				
SetGlobalCalibrateReq	0x01	0x36	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)
SetGlobalCalibrateRsp	0x81		Channel (1Byte, 0_Channel1, 1_Channel2, etc.)	Status (1 Byte, 0x00_success)		Reserved (7 Bytes, fixed 0x00)	
GetGlobalCalibrateReq	0x02		Channel (1 Byte, 0_Channel1, 1_Channel2, etc.)	Reserved (8 Bytes, fixed 0x00)			
GetGlobalCalibrateRsp	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)

(1) Configure device parameters

Channel = 0x00, Multiplier = 0x0001, Divisor = 0x0001, DeltValue = 0xFFFF (2’s complement binary representation of -1)

Downlink: 013600000010001FFFF0000

Response: 8136000000000000000000 (configuration successful)

8136000100000000000000 (configuration failed)

(2) Read parameters

Downlink: 0236000000000000000000

Response: 823600000010001FFFF0000 (current parameters)

Note:

a. When Multiplier ≠ 0, calibration = DeltValue*Multiplier

b. When Divisor ≠ 1, calibration = DeltValue/Divisor

c. Positive and negative numbers are supported.

d. The last configuration will be kept when the device is factory reset.

5.4 Example of NetvoxLoRaWANRejoin

(NetvoxLoRaWANRejoin command is to check if the device is still in the network. If the device is disconnected, it will automatically rejoin back to the network.)

Fport: 0x20 (port 32, Dec)

CmdDescriptor	CmdID (1 Byte)	Payload (5 Bytes)	
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 Bytes, unit: 1s 0XFFFFFFFF Disable NetvoxLoRaWANRejoinFunction)	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)

(1) Configure parameters

RejoinCheckPeriod = 0x00000E10 (60min); RejoinThreshold = 0x03 (3 times)

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

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

b. The last configuration would be kept as the device is factory reset.

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

5.5 Example of VModbusID

Fport: 0x22 (port 34, Dec)

CmdDescriptor	CmdID (1 Byte)	Payload (5 Bytes)
SetVModbusIDReq	0x01	VModbusID (1 Byte)
SetVModbusIDRsp	0x81	Status (1 Byte, 0x00_success)
GetVModbusIDReq	0x02	Reserved (1 Byte, fixed 0x00)
GetVModbusIDRsp	0x82	VModbusID (1 Byte)

(1) Configure device parameters

VModbusID = 0x01 (1)

Downlink: 0101

Response: 8100 (configuration successful)

8101 (configuration failed)

(2) Read parameters

Downlink: 0200

Response: 8201 (current parameters)

5.6 Example of AlarmThresholdCmd

FPort: 0x10 (port = 16, Dec)

CmdDescriptor	CmdID (1Byte)	Payload(10Bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1Byte) 0x00_Channel 1	SensorType(1Byte) 0x00_ Disable ALL SensorthresholdSet 0x2F_Distance	SensorHighThreshold (4Bytes,Unit:1mm)	SensorLowThreshold (4Bytes,Unit:1mm)
SetSensorAlarm ThresholdRsp	0x81	Status (0x00_success)		Reserved (9Bytes,Fixed 0x00)	
GetSensorAlarm ThresholdReq	0x02	Channel(1Byte) 0x00_Channel1	SensorType(1Byte) 0x00_ Disable ALL SensorthresholdSet 0x2F_ Distance	Reserved (8Bytes,Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1Byte) 0x00_Channel 1	SensorType(1Byte) 0x00_ Disable ALL SensorthresholdSet 0x2F_Distance	SensorHighThreshold (4Bytes,Unit:1mm)	SensorLowThreshold (4Bytes,Unit:1mm)
Note: (1) Distance sensor type = 0x2F, Channel = 0x00. (2) Set SensorHighThreshold or SensorLowThreshold as 0xFFFFFFFF to disable the threshold. (3) The last configuration will be kept after the device is factory reset.					

(1) Configure distance high alarm = 200mm, low alarm =100mm

Downlink: 01002F000000C800000064 // C8(Hex) = 200(DEC)
// 64(Hex) = 100(DEC)

Response: 810000000000000000000 (Configuration success)

(2) GetSensorAlarmThresholdReq

Downlink: 02002F0000000000000000

Response: 82002F000000C800000064 (Configuration success)

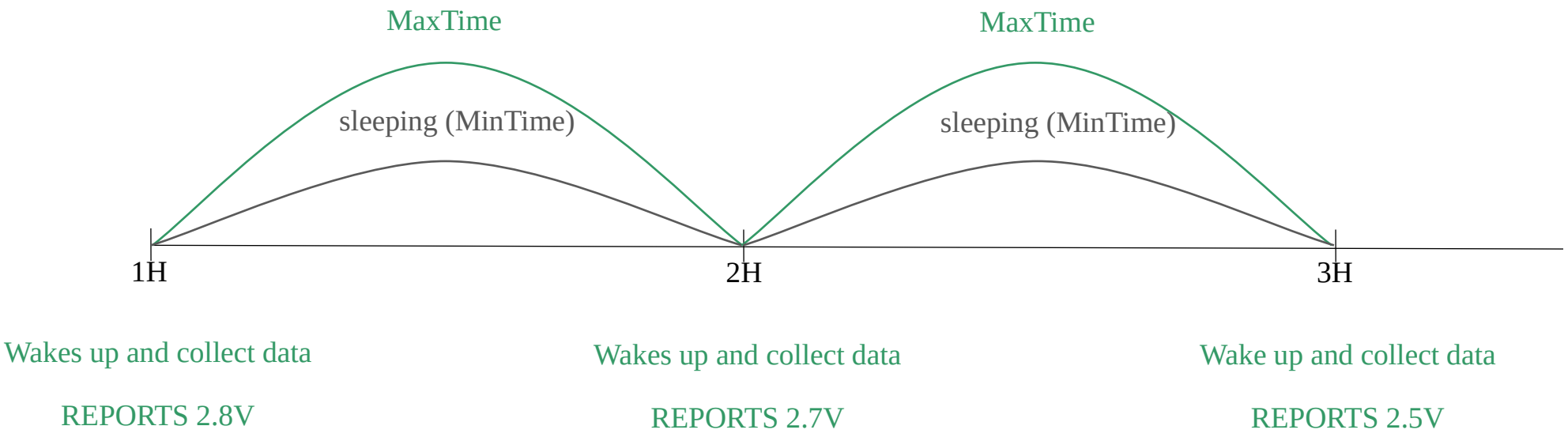
(3) Clear all SensorThreshold (Sensor type=0x00)

Downlink: 010000000000000000000

Response: 810000000000000000000

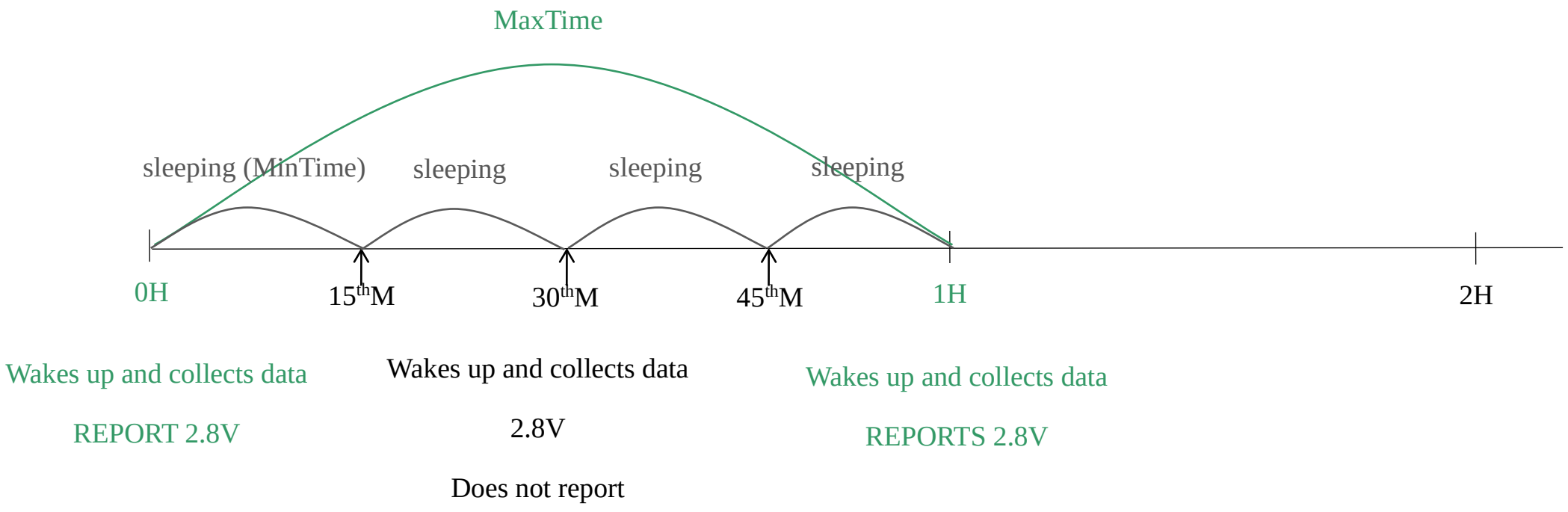
5.7 Example for MinTime/MaxTime logic

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

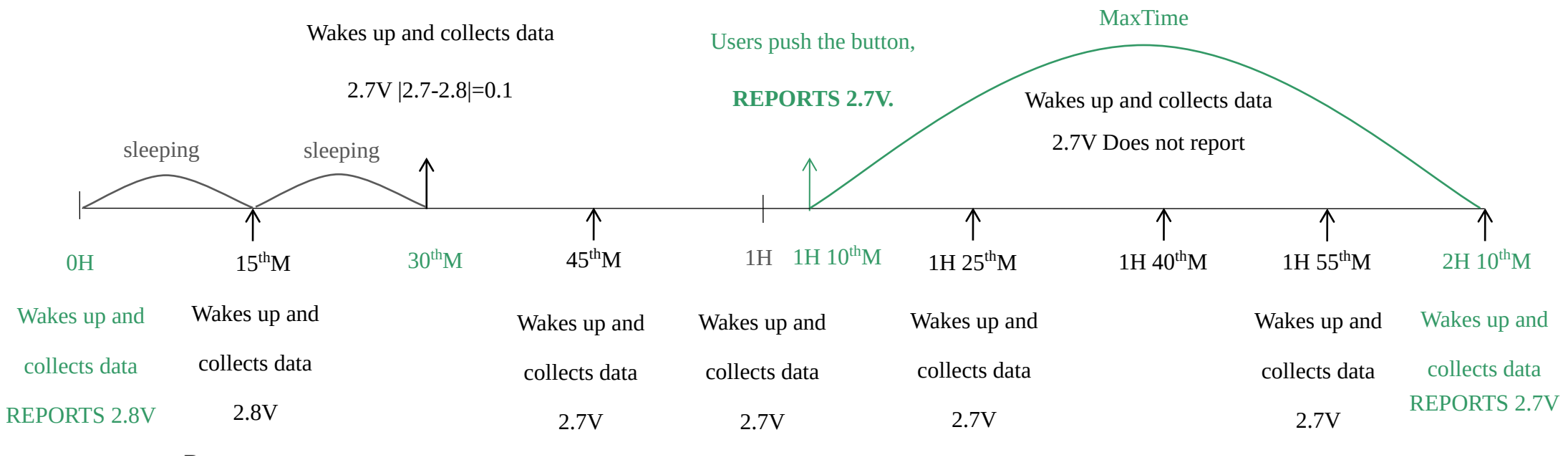


Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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 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

Toilet Paper Detection

❶ Turn R315LA over and peel the backings off the double-sided tapes.

❷ Clean the surface and install R315LA on it.

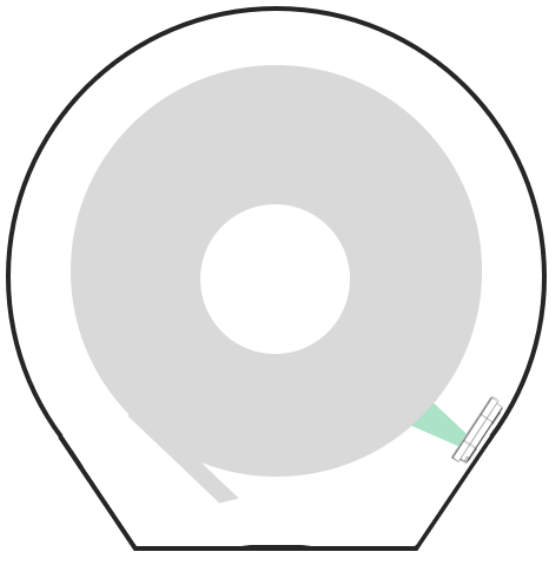
❸ Close the case and finish installation.

Note: a. Please install R315LA on a flat surface. Installing it on a rough surface could affect the adhesion of the double-sided tape.

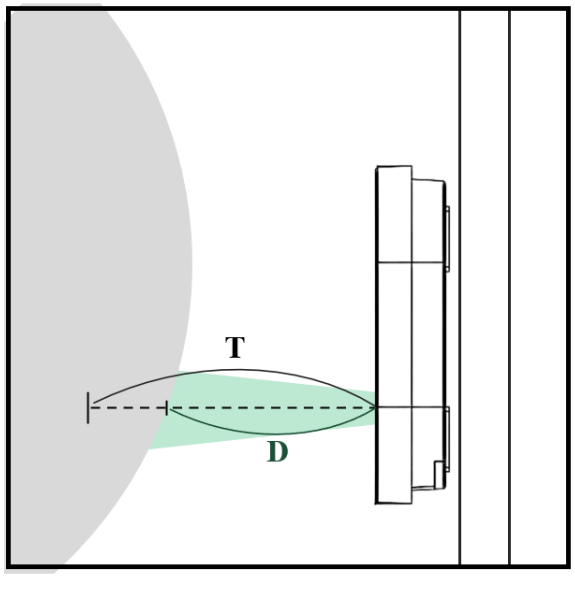
b. Installing R315LA near a metal shielding box or any electrical equipment could cause interruptions to transmission.

❹ R315LA reports data.

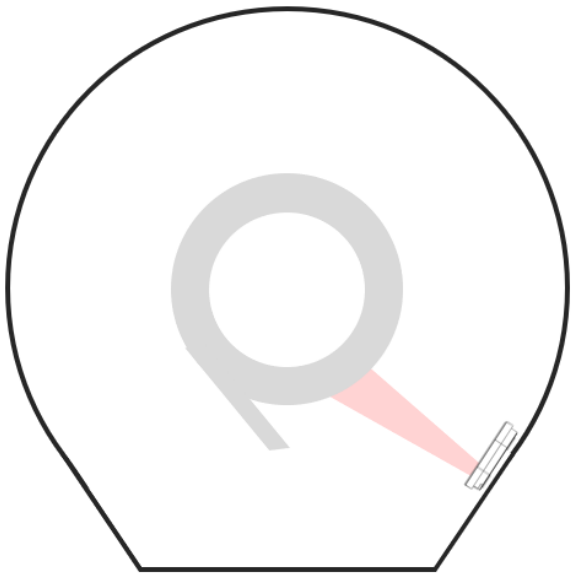
A. When the toilet paper is still **sufficient**, …



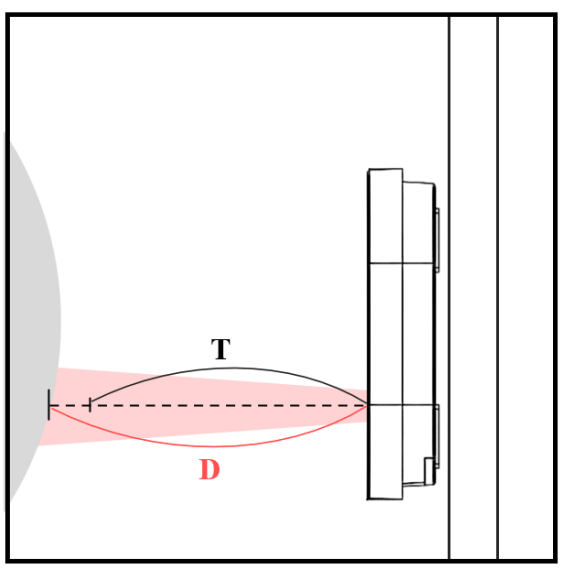
Distance ≤ OnDistanceThreshold, the **Status = 0x01**.



B. When the toilet paper is about to **run out**, …



Distance > OnDistanceThreshold, the **Status = 0x00.**



Note:

Default: DistanceChange = 0x0014 (20mm)

OnDistanceThreshold = 0x0064 (100mm)

7. 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.