

Wireless Toilet Occupancy Sensor

R718PQA User Manual

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1. Introduction

R718PQA is a long-range wireless occupancy and door sensor for Netvox Class A type devices based on LoRaWAN open protocol.

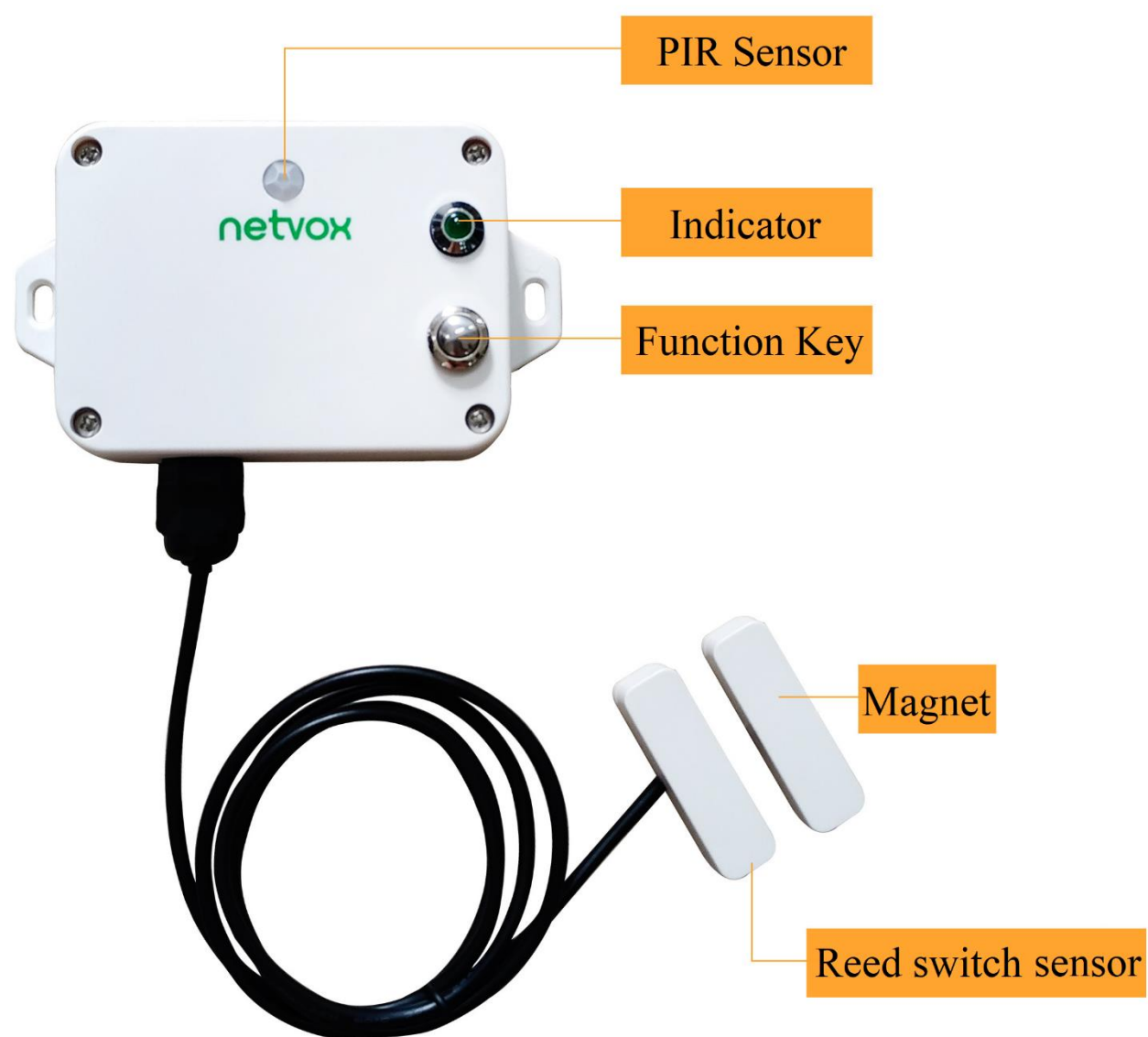
LoRa Wireless Technology

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, and industrial monitoring. The 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

- Compatible with LoRaWAN protocol
- 2 sections ER14505 3.6V AA size Lithium battery
- Detect occupancy status
- Simple operation and setting
- Protection level IP65 / IP67 (optional)
- Compatible with LoRaWAN™ 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 platforms: Actility / ThingPark, TTN, MyDevices/Cayenne
- Low power consumption and longer 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 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 (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	<ol style="list-style-type: none"> 1. Remove and insert the battery; the device is off 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. 5 seconds after power on, the device will be in engineering test mode.

Network Joining

Never joined the network	<p><u>Turn on the device to search the network to join.</u></p> <p>The green indicator stays on for 5 seconds: Success</p> <p>The green indicator remains off: Fail</p>
Had joined the network (without factory resetting)	<p><u>Turn on the device to search the previous network to join.</u></p> <p>The green indicator stays on for 5 seconds: Success</p> <p>The green indicator remains off: Fail</p>
Fail to join the network (when the device is on)	Please check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold for 5 seconds	<p><u>Restore to factory setting / Turn off</u></p> <p>The green indicator flashes for 20 times: Success</p> <p>The green indicator remains off: Fail</p>
Press once	<p>The device is <u>in the network</u>: the green indicator flashes once and sends a report</p> <p>The device is <u>not in the network</u>: the green indicator remains off</p>

Sleeping Mode

The device is on and in the network	<p>Sleeping period: Min Interval.</p> <p>When the reportchange exceeds the setting value or the state changes: send a data report according to Min Interval.</p>
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Low Voltage Warning

Low Voltage	3.2V
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5. Data Report

The device will immediately send a version packet report along with an uplink packet including occupied status.

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

Default setting:

Maximum time: 0x0E10 (3600s)

Minimum time: 0x0E10 (3600s) (Voltage and occupancy status are detected every Min Interval.)

Battery change: 0x01 (0.1V)

Disable time: 0x001E (30s)

Detection time: 0x12C (300s)

* If there is special custom shipment, the setting is changed according to customer's requirements.

* IRDisableTime must ≥ 5 s and IRDectionTime \geq IRDisableTime

Occupancy alarm:

(1) R718PQA reports **status =1** when both of the conditions are satisfied: (a) the PIR is triggered, and (b) the reed switch is closed in the following 10 seconds.

(2) If no motion is detected during the last 30% of IRDisableTime, PIR reports **status = 0** when IRDetectionTime ends.

Note: a. The interval between two reports must be the Mintime.

b. 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 \geq 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 the devicetype

NetvoxPayloadData– Fixed bytes (Fixed =8bytes)

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 0197000A04202104120000, the firmware version is 2021.04.12.

3. Data Packet:

When Report Type=0x01 is a data packet.

Device	Device Type	Report Type	NetvoxPayLoadData			
R718PQA	0x97	0x00	SoftwareVersion (1 Byte) Eg.0x0A—V1.0	HardwareVersion (1 Byte)	DateCode (4 Bytes, e.g. 0x20170503)	Reserved (2 Bytes, fixed 0x00)
		0x01	Battery (1 Byte, unit: 0.1V)	Status (1 Byte) 0: off; 1: on	Reserved (6 Bytes, fixed 0x00)	

Example of Uplink :0197012401000000000000

1st Byte (01): Version

2nd Byte (97): DeviceType — R718PQA

3rd Byte (01): ReportType

4th Byte (24): Battery — 3.6v 24 (HEX) = 36 (DEC), 36* 0.1v = 3.6v

5th Byte (01): Status — on

6th–11th Byte (000000000000): 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	CmdID	Device Type	NetvoxPayloadData			
ConfigReport Req	R718PQA	0x01	0x97	MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes unit: s)	BatteryChange (1 Byte unit: 0.1v)	Reserved (4 Bytes, Fixed 0x00)
ConfigReport Rsp		0x81		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)		
ReadConfigReportReq		0x02		Reserved (9 Bytes, Fixed 0x00)			
ReadConfigReportRsp		0x82		MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	BatteryChange (1 Byte, unit: 0.1v)	Reserved (4 Bytes, Fixed 0x00)
SetIRDisableTimeReq		0x03		IRDisableTime (2 Bytes, unit: s)	IRDectionTime (2 Bytes, unit: s)		Reserved (5 Bytes, Fixed 0x00)
SetIRDisableTimeRsp		0x83		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)		
GetIRDisableTimeReq		0x04		Reserved (9 Bytes, Fixed 0x00)			
GetIRDisableTimeRsp		0x84		IRDisableTime (2 Bytes, unit: s)	IRDectionTime (2 Bytes, unit: s)		Reserved (5 Bytes, Fixed 0x00)

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

Downlink: 0197003C003C0100000000

Respond: 81970000000000000000 (configuration succeeded)

81970100000000000000 (configuration failed)

(2) Read device parameters

Downlink: 02970000000000000000

Respond: 8297003C003C0100000000 (current configuration parameter)

(3) Configure IRDisableTime and IRDectionTime

IRDisableTime= 0x001E (30s), IRDectionTime= 0x001E (30s) // IRDectionTime \geq IRDisableTime

Downlink: 0397001E001E0000000000

Respond: 84970000000000000000 (configuration is successful)

84970100000000000000 configuration is failed)

(4) Read IRDisableTime and IRDectionTime

Downlink: 04970000000000000000

Respond: 8497001E001E0000000000 (current device configuration parameters)

5.3 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

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

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

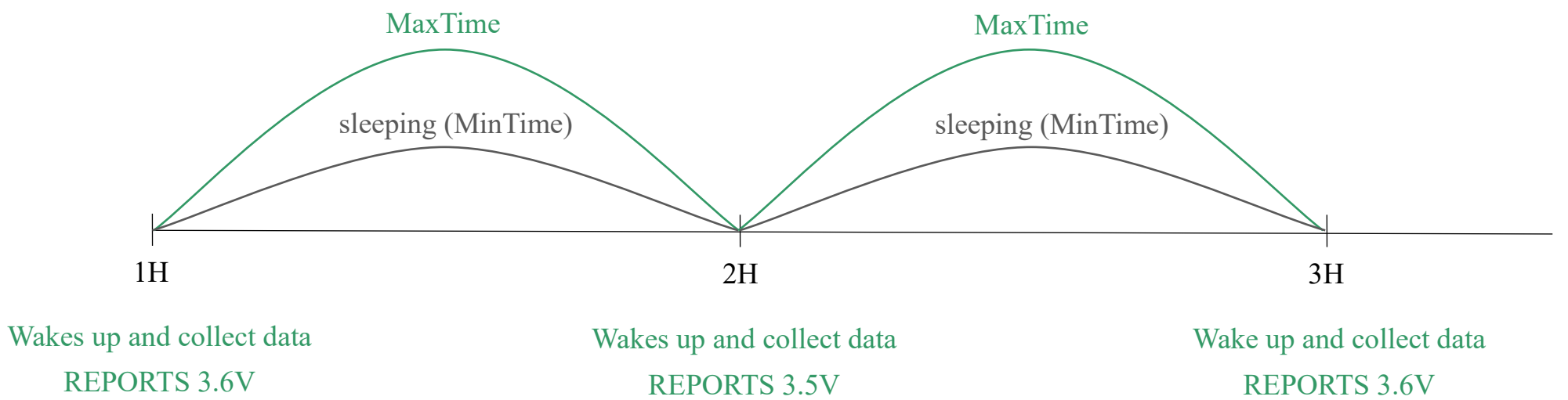
Note: a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

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

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

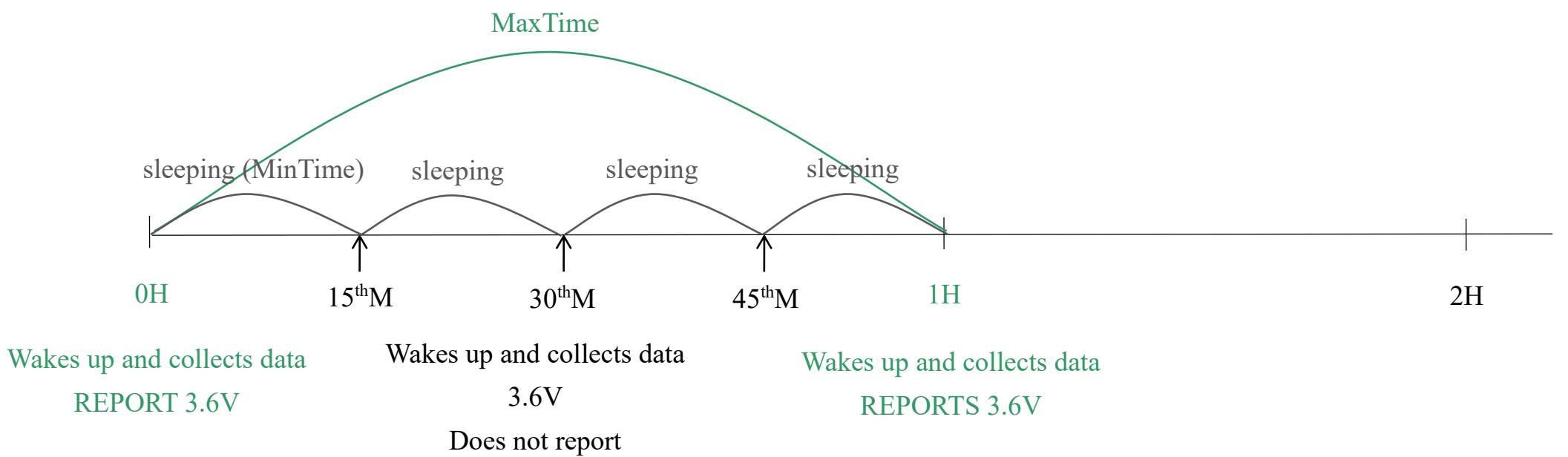
5.4 Example for MinTime/MaxTime logic

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

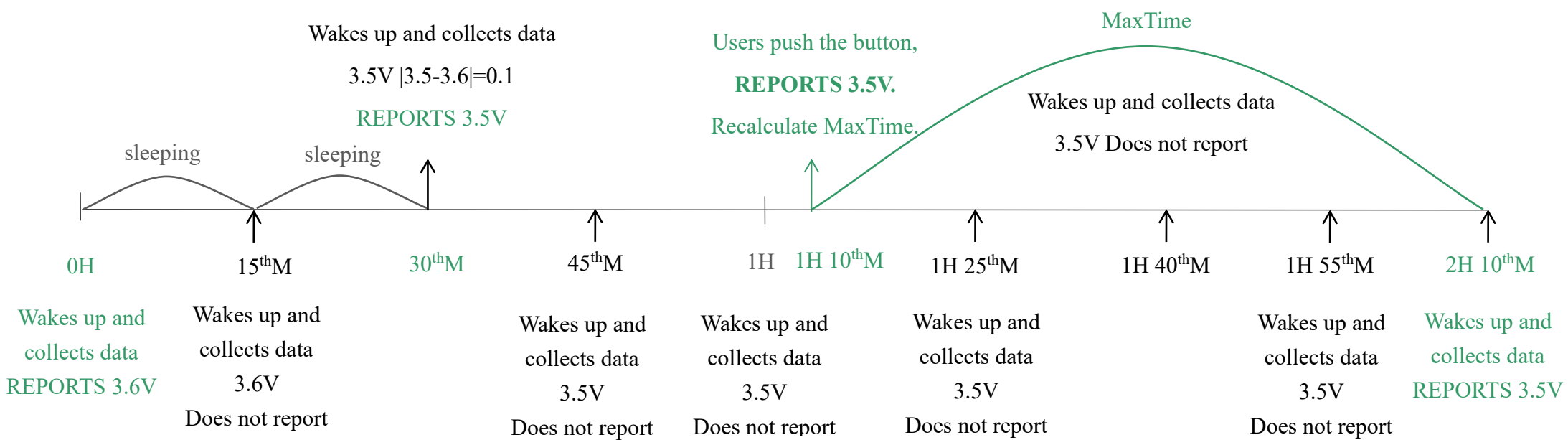


Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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. IR Disable Time and Detection Time

Default: IRDetectionTime: 5 minutes

IRDisableTime: 30 seconds

Note: IRDisableTime \geq 5s, IRDetectionTime \geq IRDisableTime

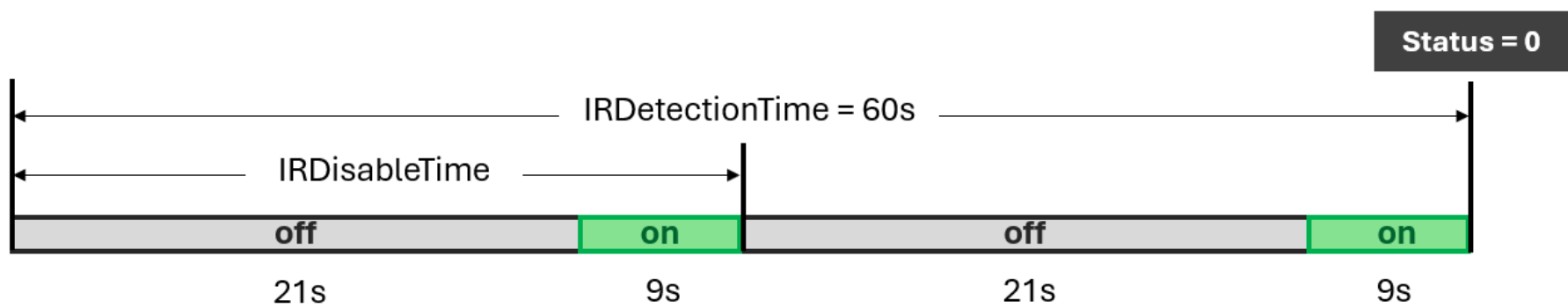
When PIR is triggered, it starts the IRDetectionTime, which includes multiple parts of IRDisableTime. To save energy, PIR remains off during the 70% of the IRDisableTime and starts detecting in the last 30% of it. If no motion is detected during the last 30% of IRDisableTime, PIR reports status = 0 when IRDetectionTime ends. However, if PIR is triggered during the last 30% of IRDisableTime, IRDetectionTime restarts and continues until no motion is detected.

R718PQA only reports status =1 when both of the conditions are satisfied: (a) the PIR is triggered, and (b) the reed switch is closed in the following 10 seconds.

Example 1.

IRDetectionTime = 60 seconds; IRDisableTime = 30 seconds

After the PIR is triggered, R718PQA starts IRDisableTime. PIR remains off during the 21 seconds and starts detection at the last 9 seconds. No motion is detected and status = 0 is reported when IRDetectTime ends.

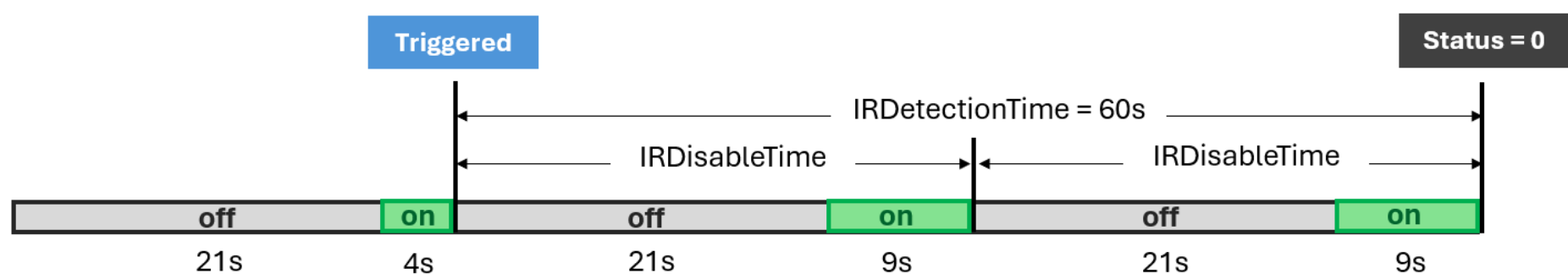


Example 2.

IRDetectionTime = 60 seconds; IRDisableTime = 30 seconds

PIR is triggered at 25th second and R718PQA restarts the IRDetectionTime.

No motion is detected, status = 0 is reported when IRDetectionTime ends.

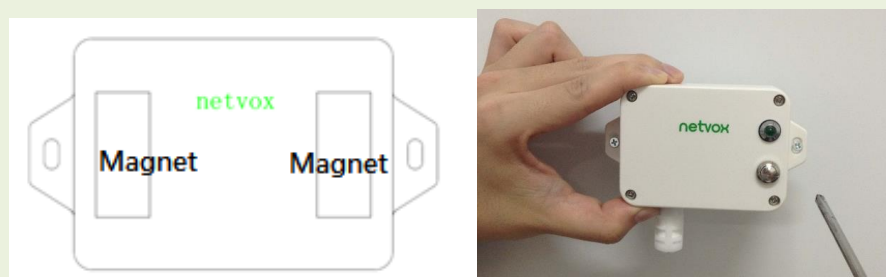


7. Installation

1. R718PQA has a built-in magnet (as the figure below).

When installed, it can be attached to the surface of an object with iron. To make the installation more secure, please use screws to fix the unit on a wall or a surface.

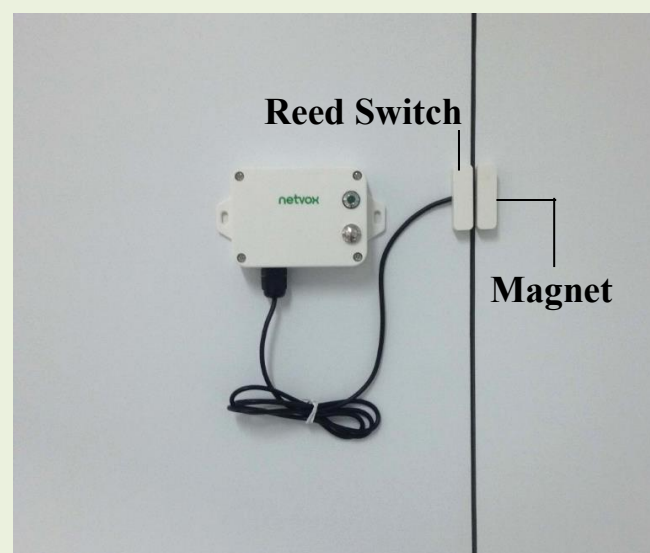
Note: Do not install the device in a metal shielded box or in an environment with other electrical equipment around it to avoid affecting the wireless transmission of the device.



2. Peel the backings off the double-sided tapes on reed switch and magnet. Fix the reed switch and magnet on the door.

Note: a. The reed switch and magnet must be parallel.

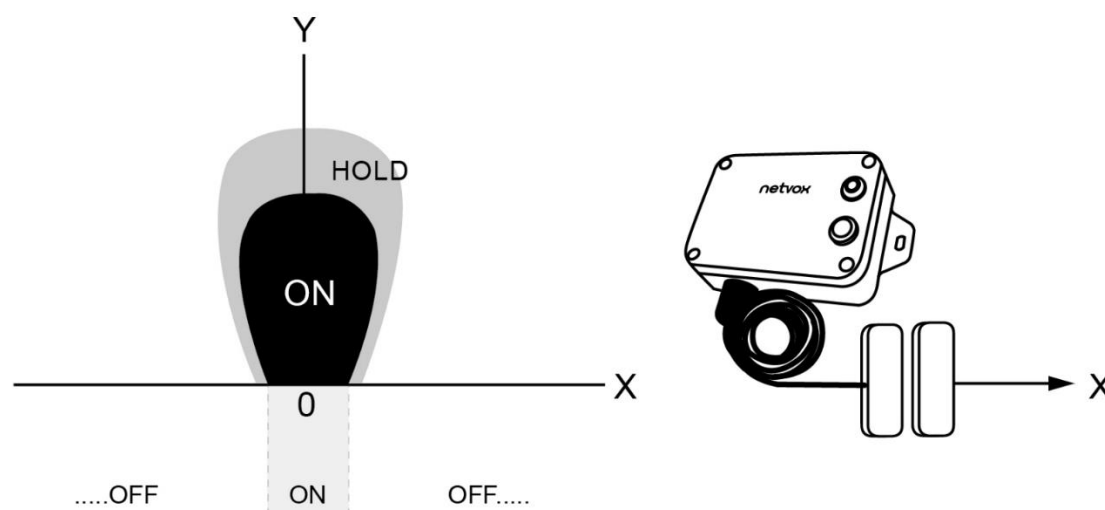
b. The distance between reed switch and magnet must be less than 2cm.



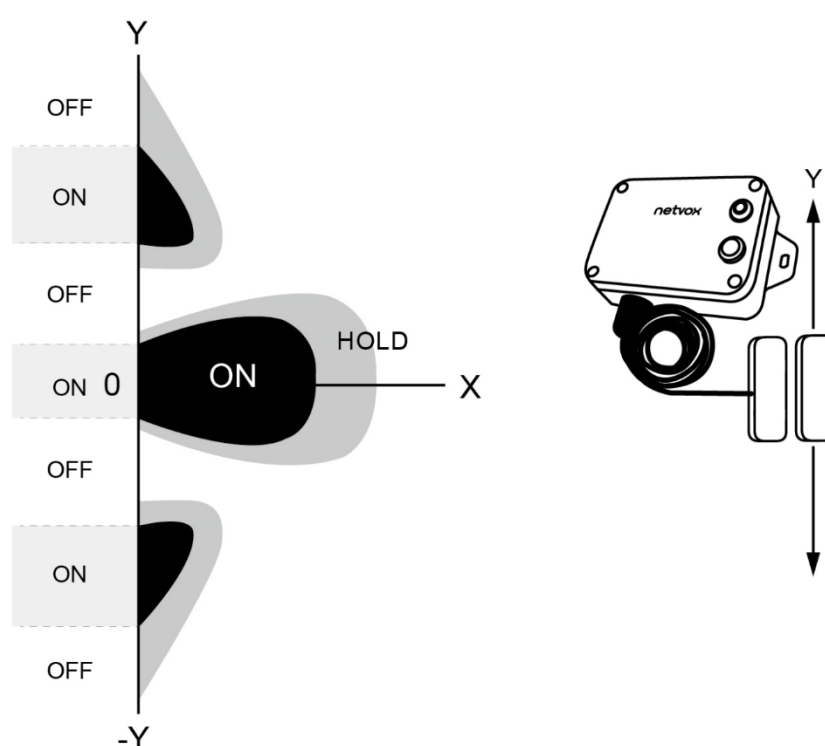
Caution:

- PIR sensor may fail to work through glass or Allyl.
- PIR sensor may not be triggered when an object remains still or moves fast.
- PIR could have false alarm when sunlight, car light, or incandescent light faces directly toward PIR or temperature fluctuate wildly.

When installing the device, the magnet **must move along the X axis** relative to the sensor.



If the magnet moves along the Y axis relative to the sensor, it will cause repeated reports due to the magnetic field.



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, 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.

8.1 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.

8.2 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 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.