Wireless Soil Moisture / Temperature / Electrical Conductivity Sensor

with 1 x Digital Output

R900PB02AO1 User Manual

Contents

1. Introduction

R900PB02AO1 is a wireless soil moisture, temperature, and electrical conductivity sensor with a digital output. It transmits digital signals to a third-party device when a value exceeds the threshold. With up to 7 flexible installation options, R900PB02AO1 integrates easily into various environments. In addition, with support for Netvox NFC app, users can easily configure settings, update firmware, and access data simply by tapping their smartphone to the device.

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 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

R900

Soil Sensor

Digital Output

Red (+): 3.3V   White (-)

NFC

Magnetic switch
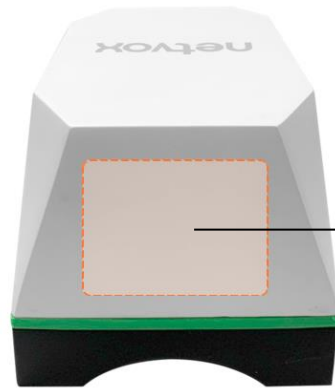
Top

Bottom

Left Side

Back

Battery

★ also support ER14505 battery with battery converter case

Indicator

Function key

3. Features

- Powered by 2* 3.6V ER18505 batteries (also support ER14505 batteries with battery converter case)

- Main unit: IP65

- Detect soil moisture, temperature, and conductivity

- Output digital signals when value exceeds the threshold

- Built-in vibration sensor for tamper alarm

- Up to 7 installation methods for different kinds of scenarios

- Support NFC. Configure and upgrade firmware on Netvox NFC app

- Store up to 10000 data

- LoRaWAN™ Class A compatible

- Frequency hopping spread spectrum

- 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)

- Applicable to the third-party platforms: Actility/ThingPark, TTN, MyDevices/Cayenne

- Low power consumption and longer battery life

Note: Battery life is determined by the sensor reporting frequency and other variables, please visit
http://www.netvox.com.tw/electric/electric_calc.html for battery life and calculation.

4. Setup Instructions

On / Off

Power on	Insert 2* ER18505 batteries or 2* ER14505 batteries with battery converter case.
Power off	Remove the batteries.

Function key

Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off	Step 1. Press and hold the function key for 5 seconds until the green indicator flashes once. Step 2. Release the function key and short press it in 5 seconds. Step 3. The green indicator flashes 5 times. R900 turns off.
Factory reset	Step 1. Press and hold the function key for 10 seconds. The green indicator flashes once every 5 seconds. Step 2. Release the function key and short press it in 5 seconds. Step 3. The green indicator flashes 20 times. R900 is factory reset and off.

Magnetic switch

Turn on	Hold a magnet near R900 for 3 seconds until the green indicator flashes once.
Turn off	Step 1. Hold a magnet close to R900 for 5 seconds. The green indicator flashes once. Step 2. Remove the magnet and get close to R900 in 5 seconds. Step 3. The green indicator flashes 5 times. R900 turns off.
Factory reset	Step 1. Hold a magnet close to R900 for 10 seconds. The green indicator flashes once every 5 seconds. Step 2. Remove the magnet and get close to R900 in 5 seconds. Step 3. The green indicator flashes 20 times. R900 is factory reset and off.

Note:
a. Remove and insert the battery; the device is off by default.
b. 5 seconds after powering on, the device will be in engineering test mode.
c. The on/off interval should be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components.
d. After the batteries are removed, the device can still operate for a while until the power supported by the supercapacitor runs out.

Join a Network

First time joining 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 before (Device is not factory reset.)	Turn on the device to search the network. The green indicator stays on for 5 seconds: Success The green indicator remains off: Fail
Fail to join the network	(1) Please turn off the device and remove the batteries to save power. (2) Please check the device verification information on the gateway or consult your platform server provider.

Function key

Short press	Device is in the network The green indicator flashes once. 6 seconds after sampling is completed, the device reports a data packet. Device is not in the network The green indicator remains off.

Note: The function key does not work during sampling.

Magnetic switch

Move magnet close to the switch and remove it	Device is in the network The green indicator flashes once. 6 seconds after sampling is completed, the device reports a data packet. Device is not in the network The green indicator remains off.

Sleep 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 based on the Min Interval.

Low Voltage Alarm

Low voltage	3.2V

Note: To ensure the accuracy of data, please replace the battery when it drops to low voltage.

5. Data Report

35 seconds after the device is powered on, it will send a version packet and data including soil moisture, temperature, electrical conductivity, and voltage.

Default setting:

    Min Interval = 0x0708 (1800s)

    Max Interval = 0x0708 (1800s) // should not be less than 30 seconds

    Soil_VWC Change = 0x012C (3%)

    Soil_TemperatureChange = 0x012C (3°C)

    Soil_ECChange = 0x01F4 (0.5 dS/m)

Note: a. If no configuration is done, the device sends data based on the default settings.

       b. Please refer to Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver

       http://www.netvox.com.cn:8888/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 30 to 65535	Any number between Min time to 65535	Cannot be 0	Report per Min Interval	Report per Max Interval

5.1 Example of ReportDataCmd

FPort: 0x16

Bytes	1	2	1	Var (length according to the payload)
	Version	DeviceType	ReportType	NetvoxPayLoadData

Version – 1 bytes – 0x03——the Version of NetvoxLoRaWAN Application Command Version

DeviceType – 2 bytes – Device Type of Device

        The devicetype is listed in Netvox LoRaWAN Application Devicetype V3.0.doc

ReportType – 1 byte – the presention of the NetvoxPayLoadData, according to the devicetype

NetvoxPayLoadData – Var bytes (length according to the payload)

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 03010F000A0120250325, the firmware version is 2025.03.25.

3. Data Packet

    When Report Type=0x01 is the data packet.

4. Signed Value

    When the temperature is negative, 2's complement should be calculated.

Device	Device Type	Report Type	NetvoxPayLoadData					
R900PB 02AO1	0x010F	0x01	Battery (1 Byte) unit: 0.1v	Soil_VWC (2 Bytes) unit: 0.01%	Soil_Temperature (Signed 2 Bytes) unit: 0.01°C	Soil_EC (2 Bytes) unit: 0.001dS/m	ThresholdAlarm (1 Bytes) Bit0_Low Soil_VWC Alarm, Bit1_High Soil_VWC Alarm, Bit2_Low Soil_Temperature Alarm, Bit3_High Soil_Temperature Alarm, Bit4_Low Soil_EC Alarm, Bit5_High Soil_EC Alarm, Bit6-7: Reserved	ShockTamperAlarm (1 Byte) 0x00_NoAlarm, 0x01_Alarm

Example of Uplink: **03010F012401C607D500000001**

1st Byte (03): Version

2nd 3rd Byte (010F): DeviceType— R900PB02AO1

4th (01): ReportType

5th Byte (24): Battery – 3.6V   24 (Hex) = 36 (Dec), 36* 0.1v = 3.6V

6th – 7th Byte (01C6): Soil_VWC – 4.54%   01C6 (Hex) = 454 (Dec), 454* 0.01% = 4.54%

8th – 9th Byte (07D5): Soil_Temperature – 20.05°C   07D5 (Hex) = 2005 (Dec), 2005* 0.01°C = 20.05°C

10th – 11th Byte (0000): Soil_EC – 0 dS/m

12th Byte (00): ThresholdAlarm –no alarm

13th Byte (01): ShockTamperAlarm – alarm

5.2 Example of ConfigureCmd

FPort: 0x17

Bytes	1	2	Var (length according to the payload)
	CmdID	DeviceType	NetvoxPayLoadData

CmdID – 1 byte

DeviceType – 2 bytes – Device Type of Device

The devicetype is listed in Netvox LoRaWAN Application Devicetype3.0.doc

NetvoxPayLoadData– var bytes Var bytes (length according to the payload)

Description	Device	Cmd ID	Device Type	NetvoxPayLoadData				
ConfigReportReq	R900PB 02AO1	0x01	0x010F	MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	Soil_VWC Change (2 Byte, unit: 0.01%)	Soil_Temperature Change (2 Bytes, unit: 0.01°C)	Soil_ECChange (2Bytes, unit: 0.001 dS/m)
ConfigReportRsp		0x81		Status (0x00_success)				
ReadConfig ReportReq		0x02						
ReadConfig ReportRsp		0x82		MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	Soil_VWC Change (2 Byte, unit: 0.01%)	Soil_Temperature Change (2 Bytes, unit: 0.01°C)	Soil_ECChange (2Bytes, unit: 0.001 dS/m)
SetShockSen sorSensitivit yReq		0x03		ShockSensorSensitivity (1 Byte)				
SetShockSen sorSensitivit yRsp		0x83		Status (0x00_success)				
GetShockSe nsorSensitivi tyReq		0x04						
GetShockSe nsorSensitivi tyRsp		0x84		ShockSensorSensitivity (1 Byte)				
SetSoilType Req (REMAIN Lastconfig when resetfac)		0x05		SoilType (1 Byte) 0x00_Mineral Soil; 0x01_SandySoil; 0x02_Clay; 0x03_Organic soil)				

SetSoilType Rsp (REMAIN Lastconfig when resetfac)		0x85		Status (0x00_success)		
GetSoilType Req		0x06				
GetSoilType Rsp		0x86		SoilType (1 Byte) 0x00_Mineral Soil; 0x01_SandySoil; 0x02_Clay; 0x03_Organic soil)		

			DigitalOutPutType (1 Byte) 0x00_NormallyLow Level 0x01_NormallyHigh Level	OutPulse Time (1 Byte) unit: s	BindAlarmSource (1 Byte) Bit0_Low Soil_VWC Alarm Bit1_High Soil_VWC Alarm Bit2_Low Soil_Temperature Alarm Bit3_High Soil_Temperature Alarm Bit4_Low Soil_EC Alarm Bit5_High Soil_EC Alarm Bit6-7: Reserved	Channel (1 Byte) 0x00_Channel1 0x01_Channle2
ConfigDigitalOutPutReq		0x07	DigitalOutPutType (1 Byte) 0x00_NormallyLow Level 0x01_NormallyHigh Level	OutPulse Time (1 Byte) unit: s	BindAlarmSource (1 Byte) Bit0_Low Soil_VWC Alarm Bit1_High Soil_VWC Alarm Bit2_Low Soil_Temperature Alarm Bit3_High Soil_Temperature Alarm Bit4_Low Soil_EC Alarm Bit5_High Soil_EC Alarm Bit6-7: Reserved	Channel (1 Byte) 0x00_Channel1 0x01_Channle2
ConfigDigitalOutPutRsp		0x87	Status (0x00_success)			
Read ConfigDigitalOutPutReq		0x08	Channel (1Byte) 0x00_Channel1 0x01_Channle2			
Read ConfigDigitalOutPutRsp		0x88	DigitalOutPutType (1 Byte) 0x00_NormallyLow Level 0x01_NormallyHigh Level	OutPulse Time (1 Byte, unit: s)	BindAlarmSource (1 Byte) Bit0_Low Soil_VWC Alarm Bit1_High Soil_VWC Alarm Bit2_Low Soil_Temperature Alarm Bit3_High Soil_Temperature Alarm Bit4_Low Soil_EC Alarm Bit5_High Soil_EC Alarm Bit6-7: Reserved	Channel (1Byte) 0x00_Channel1 0x01_Channle2
TriggerDigitalOutPutReq		0x09	OutPulseTime (1 Byte, unit: s)		Channel (1 Byte) 0x00_Channel1 0x01_Channle2	
TriggerDigitalOutPutRsp		0x89	Status (0x00_success)			

(1) Configure device parameters

MinTime = 0x003C (60s), MaxTime = 0x003C (60s),

Soil_VWC Change = 0x0064 (1%), Soil_TemperatureChange = 0x012C (3°C), Soil_ECChange = 0x0064 (0.1 dS/m)

Downlink: 01010F003C003C0064012C0064

Response: 81010F00 (configuration success)

81010F01 (configuration fail)

Read device parameters

Downlink: 02010F

Response: 82010F003C003C0064012C0064

(2) Configure ShockSensorSensitivity = 0x14 (20)

Downlink: 03010F14

Response: 83010F00 (configuration success)

83010F01 (configuration fail)

Note: ShockSensorSensitivity range = 0x01 to 0x14

0xFF (disables vibration sensor)

Read ShockSensorSensitivity

Downlink: 04010F

Response: 84010F14 (device's current parameters)

(3) Configure SoilType = 0x03 (Organic soil)

Downlink: 05010F03

Response: 85010F00 (configuration success)

85010F01 (configuration fail)

Read SoilType

Downlink: 06010F

Response: 86010F03

(4) Configure DigitalOutPutType = 0x00 (NormallyLowLevel),

OutPulseTime = 0xFF (disable pulse duration),

BindAlarmSource = 0x08 = 0000 1000 (BIN)   Bit3_High Soil_Temperature Alarm =1

(when High Soil_Temperature Alarm is triggered, DO outputs signals)

Channel = 0x00_Channel1

Downlink: 07010F00FF0800

Response: 87010F00 (configuration success)

87010F01 (configuration fail)

Read DO parameters

Downlink: 08010F00

Response: 88010F00FF0800

Configure OutPulseTime = 0x0A (10 seconds)

Downlink: 09010F0A00

Response: 89010F00 (configuration success)

89010F01 (configuration fail)

5.3 Example of SetSensorAlarmThresholdCmd

CmdDescriptor	CmdID (1 Byte)	Payload (10 Bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1 Byte) 0x00_Channel1, 0x01_Channel2, 0x02_Channel3, etc.	SensorType (1 Byte) 0x00_Disable ALL 0x01_Temperature 0x1D_Soil_VWC 0x1E_Soil_EC	SensorHighThreshold (4 Bytes) unit: Temperature – 0.01℃ VWC – 0.01% EC – 0.001 dS/m	SensorLowThreshold (4 Bytes) unit: Temperature – 0.01℃ VWC – 0.01% EC – 0.001 dS/m
SetSensorAlarm ThresholdRsp	0x81	Status (0x00_success)	Reserved (9 Bytes, Fixed 0x00)		
GetSensorAlarm ThresholdReq	0x02	Channel (1 Byte) 0x00_Channel1, 0x01_Channel2, 0x02_Channel3, etc.	SensorType (1 Byte) 0x00_Disable ALL 0x01_Temperature 0x1D_Soil_VWC 0x1E_Soil_EC	Reserved (8 Bytes, Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1 Byte) 0x00_Channel1, 0x01_Channel2, 0x02_Channel3, etc.	SensorType (1 Byte) 0x00_Disable ALL 0x01_Temperature 0x1D_Soil_VWC 0x1E_Soil_EC	SensorHighThreshold (4 Bytes) unit: Temperature – 0.01℃ VWC – 0.01% EC – 0.001 dS/m	SensorLowThreshold (4 Bytes) unit: Temperature – 0.01℃ VWC – 0.01% EC – 0.001 dS/m

Note: a. Set SensorHigh/LowThreshold as 0xFFFFFFFF to disable threshold.

     b. The last configuration will be saved when the device is reset to factory settings.

Channel: 0x00_Channel1

(1) Configure parameters

    Channel = 0x00, SensorType = 0x1D (Soil_VWC),

    SensorHighThreshold = 0x00001388 (50%), SensorLowThreshold = 0x000003E8 (10%)

    Downlink: 01001D00001388000003E8

    Response: 810000000000000000000000

(2) GetSensorAlarmThresholdReq

    Downlink: 02001D0000000000000000

    Response: 82001D00001388000003E8

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

    Downlink: 010000000000000000000000

    Response: 810000000000000000000000

5.4 Example of GlobalCalibrateCmd

Description	Cmd ID	SensorType	PayLoad (Fix = 9 Bytes)				
SetGlobalCalibrateReq	0x01		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	0x17_EC Sensor 0x20_Temperature_Soil_Sensor 0x21_Humid_Soil_Sensor	Channel (1 Byte) 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)
ClearGlobalCalibrateReq	0x03	Reserved (10Bytes, Fixed 0x00)					
ClearGlobalCalibrateRsp	0x83	Status (1Byte, 0x00_success)	Reserved (9 Bytes, Fixed 0x00)				

Electric conductivity: SensorType – 0x17; Channel – 0x02

Soil Temperature: SensorType – 0x20; Channel – 0x01

Soil Humidity: SensorType – 0x21; Channel – 0x00

(1) SetGlobalCalibrateReq

　　Calibrate temperature sensor by increasing 10°C

　　Channel: 0x01 (channel1); Multiplier: 0x0001 (1); Divisor: 0x0001 (1); DeltValue: 0x03E8 (1000)

　　Downlink: 0120010001000103E80000

　　Response: 8120010000000000000000 (configuration success)

　　　　　　81200101000000000000000(configuration fail)

(2) Read parameters

　　Downlink: 0220010000000000000000

　　Response: 8220010001000103E80000 (configuration success)

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(3) ClearGlobalCalibrateReq

    Downlink: 0300000000000000000000

    Response: 8300000000000000000000

5.5 Example of NetvoxLoRaWANRejoin

Fport:0x20

Check if the device is connected to the network during RejoinCheckPeriod. If the device does not respond within the RejoinThreshold, it will be rejoied back to the network automatically.

CmdDescriptor	CmdID (1 Byte)	Payload (Var Bytes)						
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 Bytes, unit: 1s) 0x FFFFFFFF_DisableNetvoxRejoinFunction					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) 0x FFFFFFFF_DisableNetvoxRejoinFunction					RejoinThreshold (1 Byte)	
SetNetvoxLoRaWANRejoinTimeReq	0x03	1st Rejoin Time (2 Bytes, unit:1 min)	2nd Rejoin Time (2 Bytes, unit: 1 min)	3rd Rejoin Time (2 Bytes, unit: 1 min)	4th Rejoin Time (2 Bytes, unit: 1 min)	5th Rejoin Time (2 Bytes, unit: 1 min)	6th Rejoin Time (2 Bytes, unit: 1 min)	7th Rejoin Time (2 Bytes, unit: 1 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:1 min)	2nd Rejoin Time (2 Bytes, unit: 1 min)	3rd Rejoin Time (2 Bytes, unit: 1 min)	4th Rejoin Time (2 Bytes, unit: 1 min)	5th Rejoin Time (2 Bytes, unit: 1 min)	6th Rejoin Time (2 Bytes, unit: 1 min)	7th Rejoin Time (2 Bytes, unit: 1 min)

Note:

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

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

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)

d. If device loses connection from network before data are reported, the data will be saved and reported every 30 seconds after the device is reconnected. Data will be reported based on the format of Payload + Unix timestamp. After all data are reported, the report time will be back to the normal setting.

(1) Command Configuration

Set RejoinCheckPeriod = 0x00000E10 (3600s), RejoinThreshold = 0x03 (3 times)

Downlink: 0100000E1003

Response: 810000000000 (Configuration success)

810100000000 (Configuration failure)

(2) Read 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: 03000100020003000400050006 0007

Response: 830000000000000000000000000000 (Configuration success)
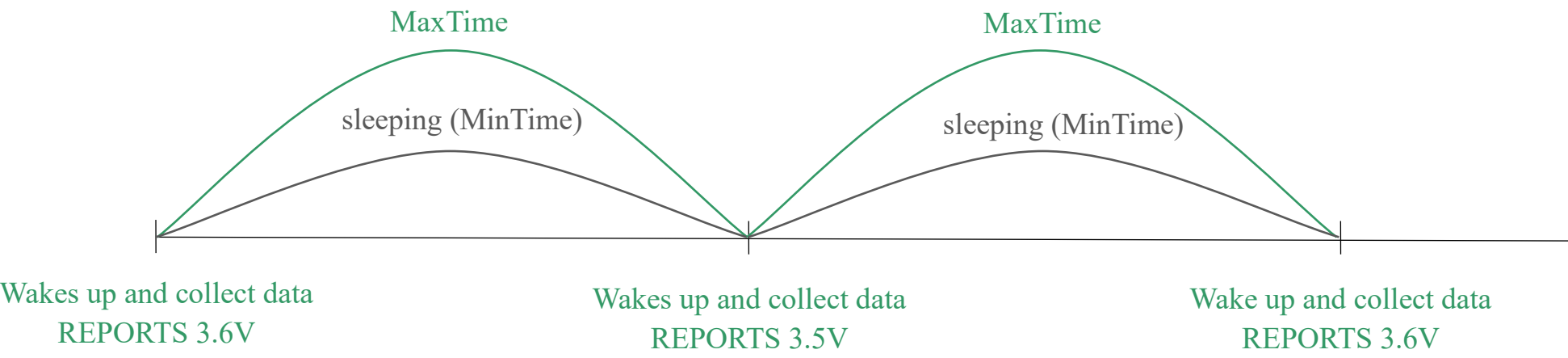
830100000000000000000000000000 (Configuration failure)

(4) Read Rejoin Time parameter

Downlink: 040000000000000000000000000000
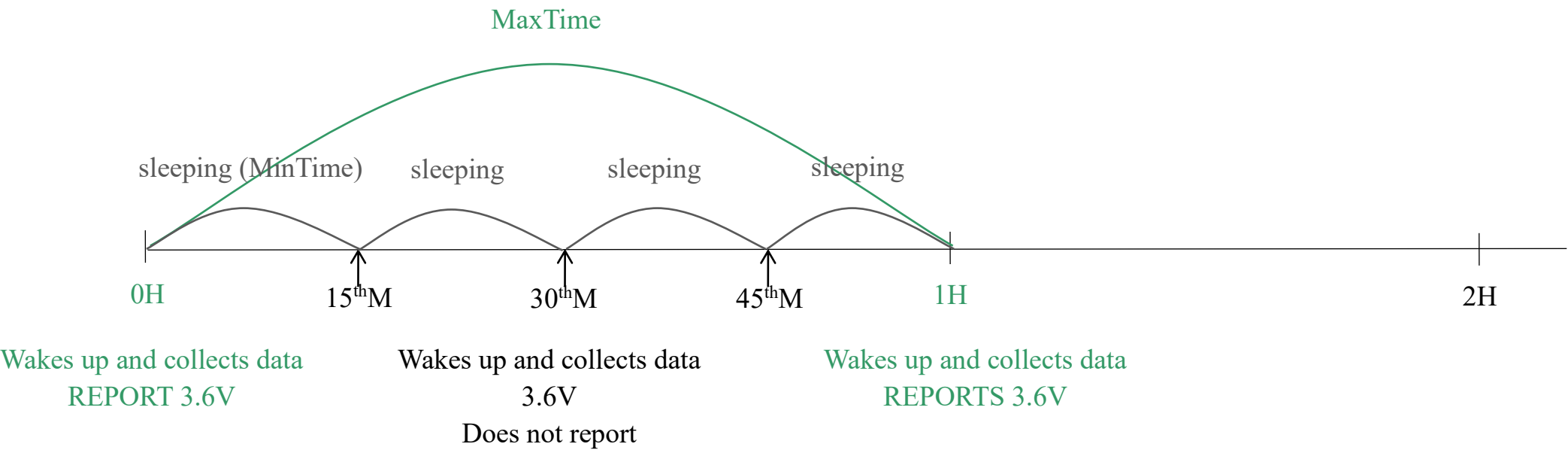
Response: 84000100020003000400050006 0007

5.6 Example for MinTime/MaxTime logic

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

MaxTime   MaxTime

sleeping (MinTime)   sleeping (MinTime)

Wakes up and collect data   Wakes up and collect data   Wake up and collect data
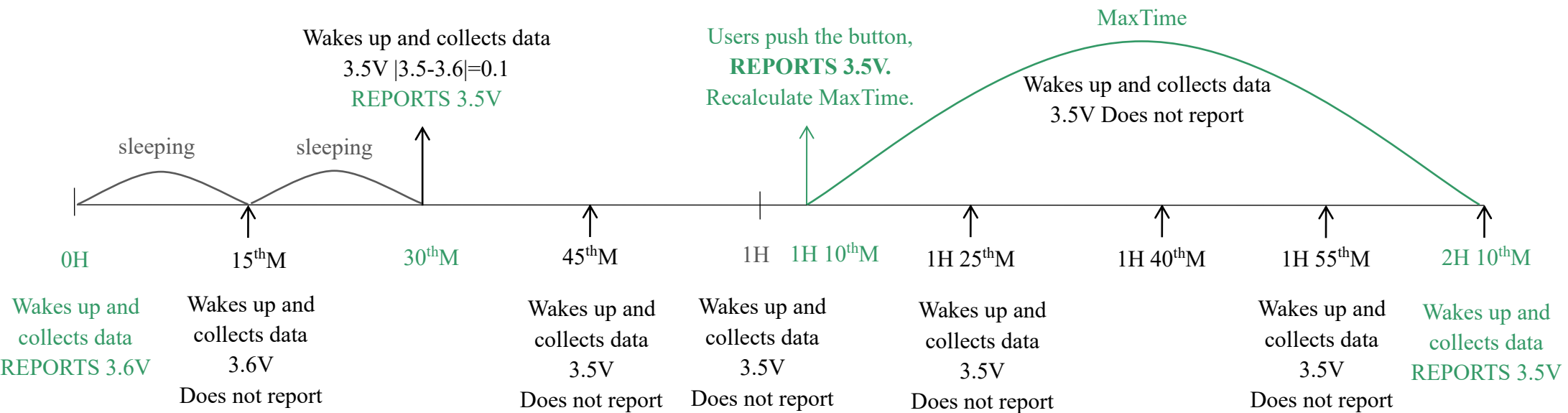REPORTS 3.6V   REPORTS 3.5V   REPORTS 3.6V

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.

MaxTime

sleeping (MinTime)   sleeping   sleeping   sleeping

0H   15thM   30thM   45thM   1H   2H

Wakes up and collects data   Wakes up and collects data   Wakes up and collects data
REPORT 3.6V   3.6V   REPORTS 3.6V
                    Does not report

Example#3 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.

MaxTime

Wakes up and collects data
3.5V |3.5-3.6|=0.1
REPORTS 3.5V

Users push the button,
REPORTS 3.5V.
Recalculate MaxTime.

Wakes up and collects data
3.5V Does not report

sleeping   sleeping

0H   15thM   30thM   45thM   1H   1H 10thM   1H 25thM   1H 40thM   1H 55thM   2H 10thM

Wakes up and | Wakes up and | | Wakes up and | Wakes up and | | Wakes up and | | Wakes up and | Wakes up and
collects data | collects data | | collects data | collects data | | collects data | | collects data | collects data
REPORTS 3.6V | 3.6V | | 3.5V | 3.5V | | 3.5V | | 3.5V | REPORTS 3.5V
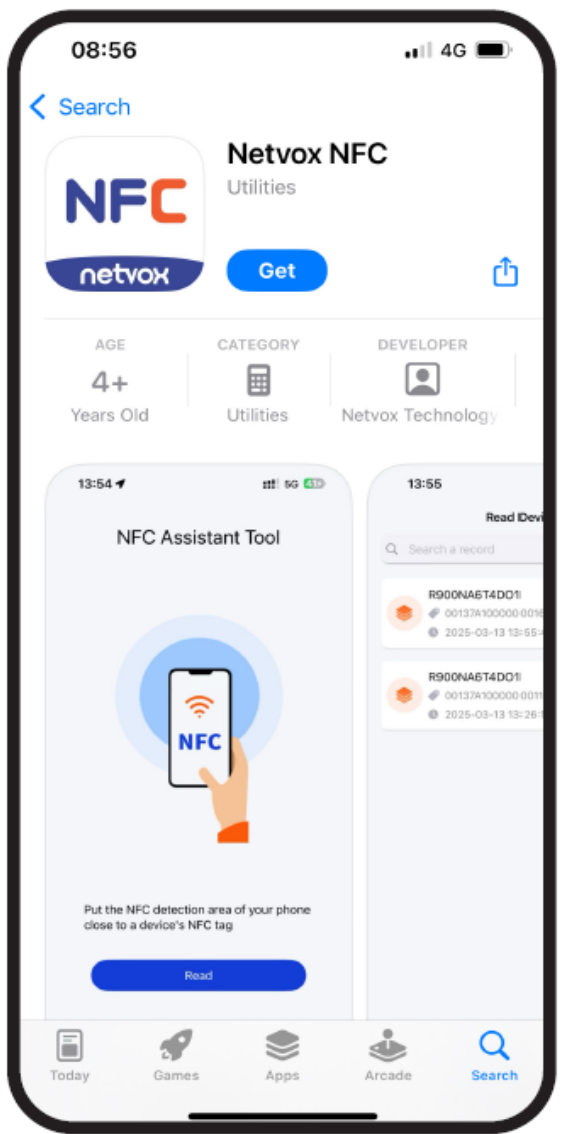 | Does not report | | Does not report | Does not report | | Does not report | | Does not report

Notes:

a. The device only wakes up and performs data sampling according to MinTime Interval. When it is sleeping, it does not collect data.

b. The data collected is compared with the last data <u>reported</u>. 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.

c. We do not recommend setting 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.

d. 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. Read R900 Data on NFC App

(1) Download Netvox NFC app.

    Please make sure your phone supports NFC.

(2) Enable NFC in Settings and find your phone's NFC area.

    Open the app and click Read.

(3) Hold your phone near R900's NFC tag.

NFC area

(4) After R900 is successfully read, the latest 10 data will be displayed.

Select a data and go to the Data processing.

Screen 1 (R900PB02O1 — Data tab):

Records (1)

03010F012400000A3100000001
2025-04-25 13:46:23

Screen 2 (Data Resolve): 03010F012400000A3100000001

Byte	Value	Attribute	Result
1st	03	Version	03
2nd~3rd	010F	DeviceType	010F
4th	01	ReportType	01
5th	24	Battery	3.6v
6th~7th	0000	SoilVWC	0.00%
8th~9th	0A31	SoilTemperature	26.09℃
10th~11th	0000	Soil EC	0.000dS/m
12th-0Bit	0	LowSoil_VWCAlarm	false
12th-1Bit	0	HighSoil_VWCAlarm	false
12th-2Bit	0	LowSoil_TemperatureAlarm	false
12th-3Bit	0	HighSoil_TemperatureAlarm	false

Screen 3 (Data Resolve): 03010F012400000A3100000001

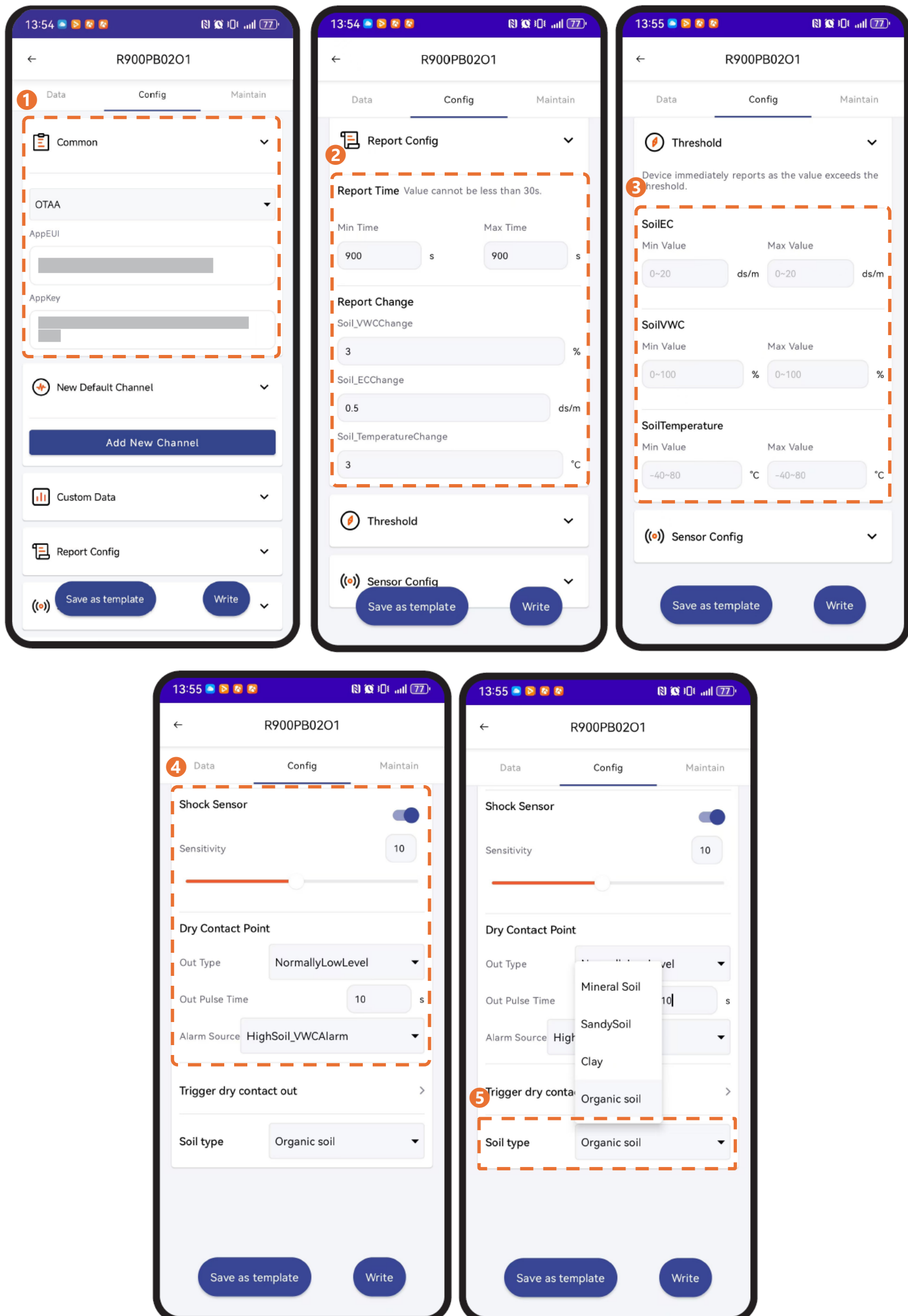| Byte	Value	Attribute	Result
6th~7th	0000	SoilVWC	0.00%
8th~9th	0A31	SoilTemperature	26.09℃
10th~11th	0000	Soil EC	0.000dS/m
12th-0Bit	0	LowSoil_VWCAlarm	false
12th-1Bit	0	HighSoil_VWCAlarm	false
12th-2Bit	0	LowSoil_TemperatureAlarm	false
12th-3Bit	0	HighSoil_TemperatureAlarm	false
12th-4Bit	0	LowSoil_ECAlarm	false
12th-5Bit	0	HighSoil_ECAlarm	false
12th-6-7Bit	-	Reserved	-
13th	01	ShockTamperAlarm	true

(5) Click Config to edit R900's settings, including network connection, report configuration, threshold, sensor parameters, and soil type.
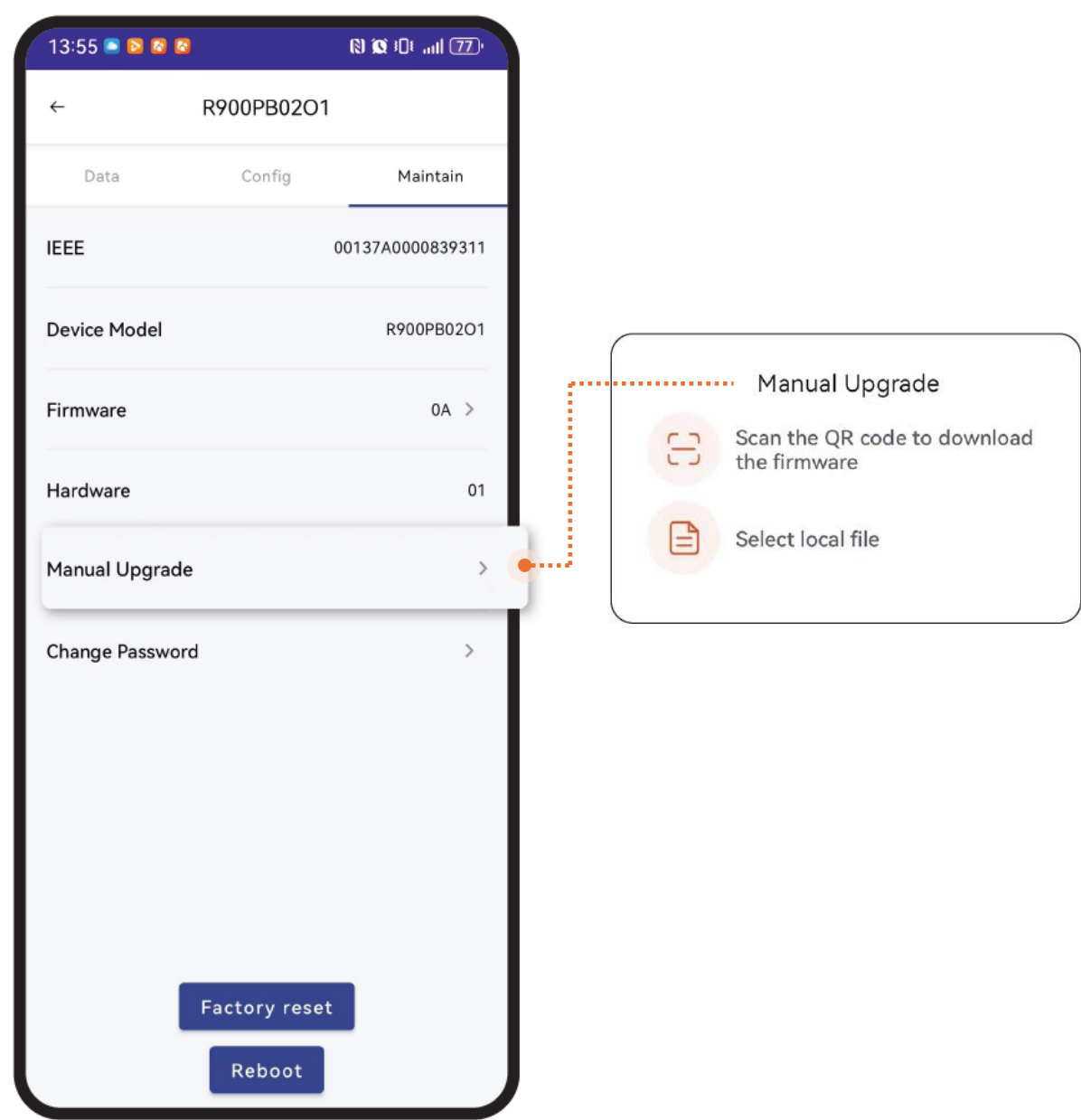
Note: a. To configure device parameters, users need to enter password: **12345678** (default).
b. Password can be changed on the app and reset to default when R900 is factory reset.
c. Please reboot the device if the parameters of network connection are configured.

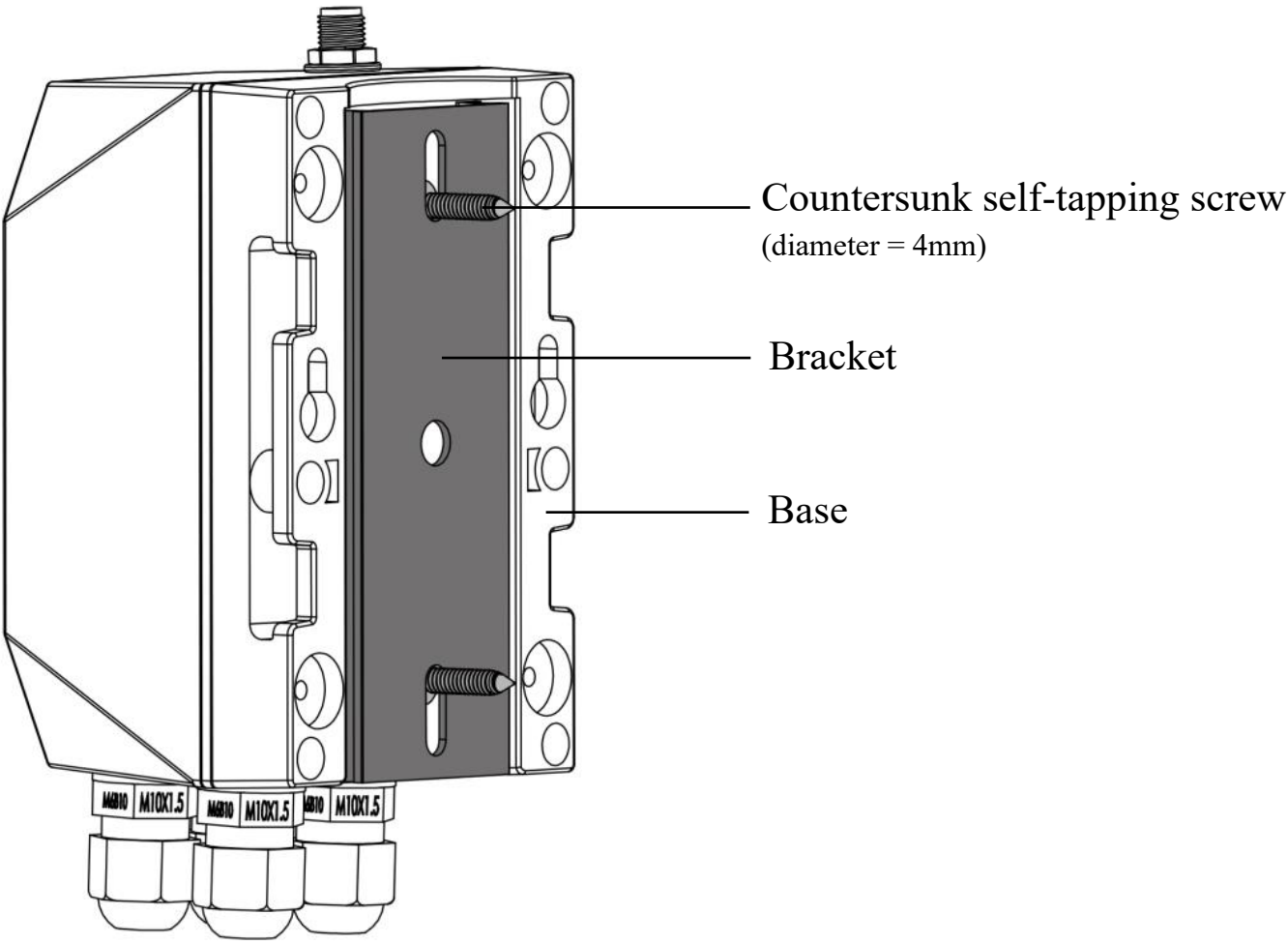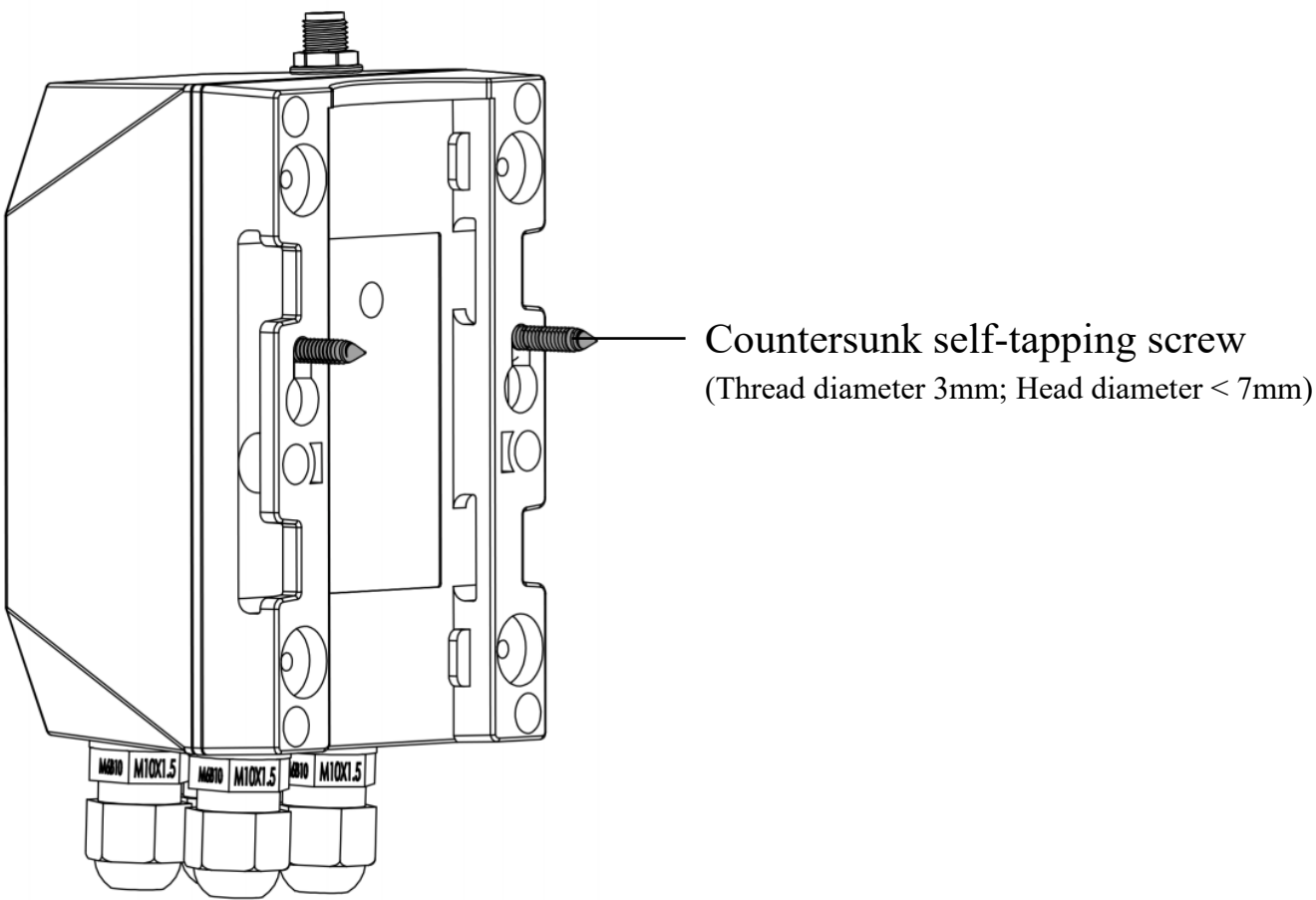(6) Click Maintain to check R900PB02AO1's info and available upgrade.

7. Installation

R900

- Standard

(1) Screws + Bracket

Countersunk self-tapping screw
(diameter = 4mm)

Bracket

Base

❶ Mount the bracket on a surface with 2 counter self-tapping screws.

❷ Hold R900 and slide down to connect the base and bracket.

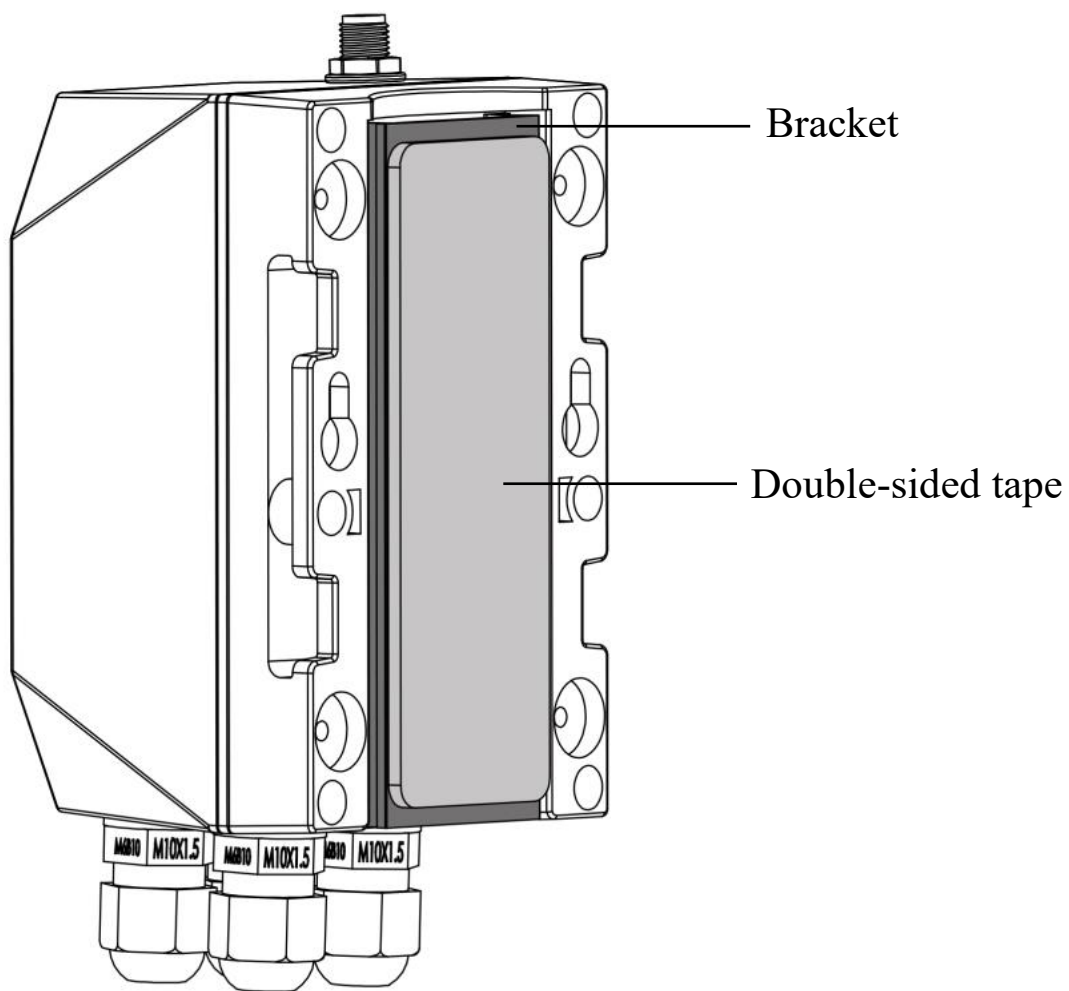(2) Screws

Countersunk self-tapping screw
(Thread diameter 3mm; Head diameter < 7mm)

❶ Mount 2 countersunk self-tapping screws or expansion bolts on the wall.

The distance between the two screws should be 48.5mm. The gap between the bottom of the screw head and the wall should be 3mm.

❷ After the screws are mounted, align the holes of the base with the screws.

❸ Move R900 down to clamp it.

(3) Double-Sided Tape

Bracket

Double-sided tape
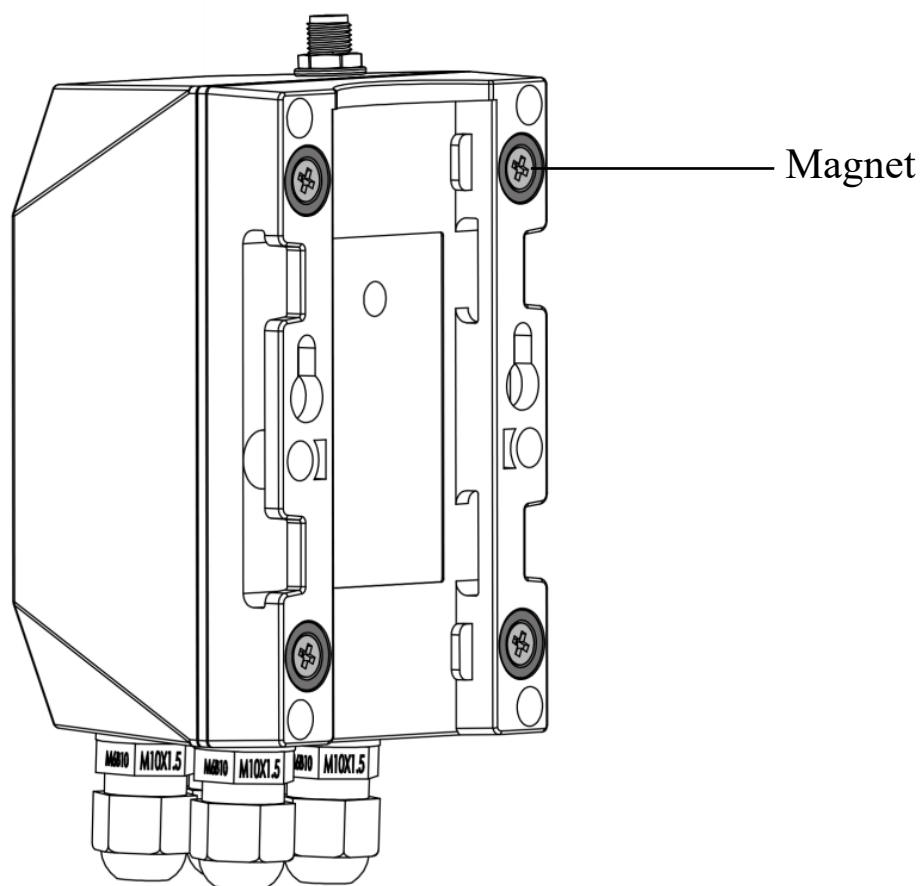
❶ Stick the double-sided tape on the bracket.

❷ Peel the liner and fix R900 on the surface.

❸ Press to ensure R900 is firmly installed.

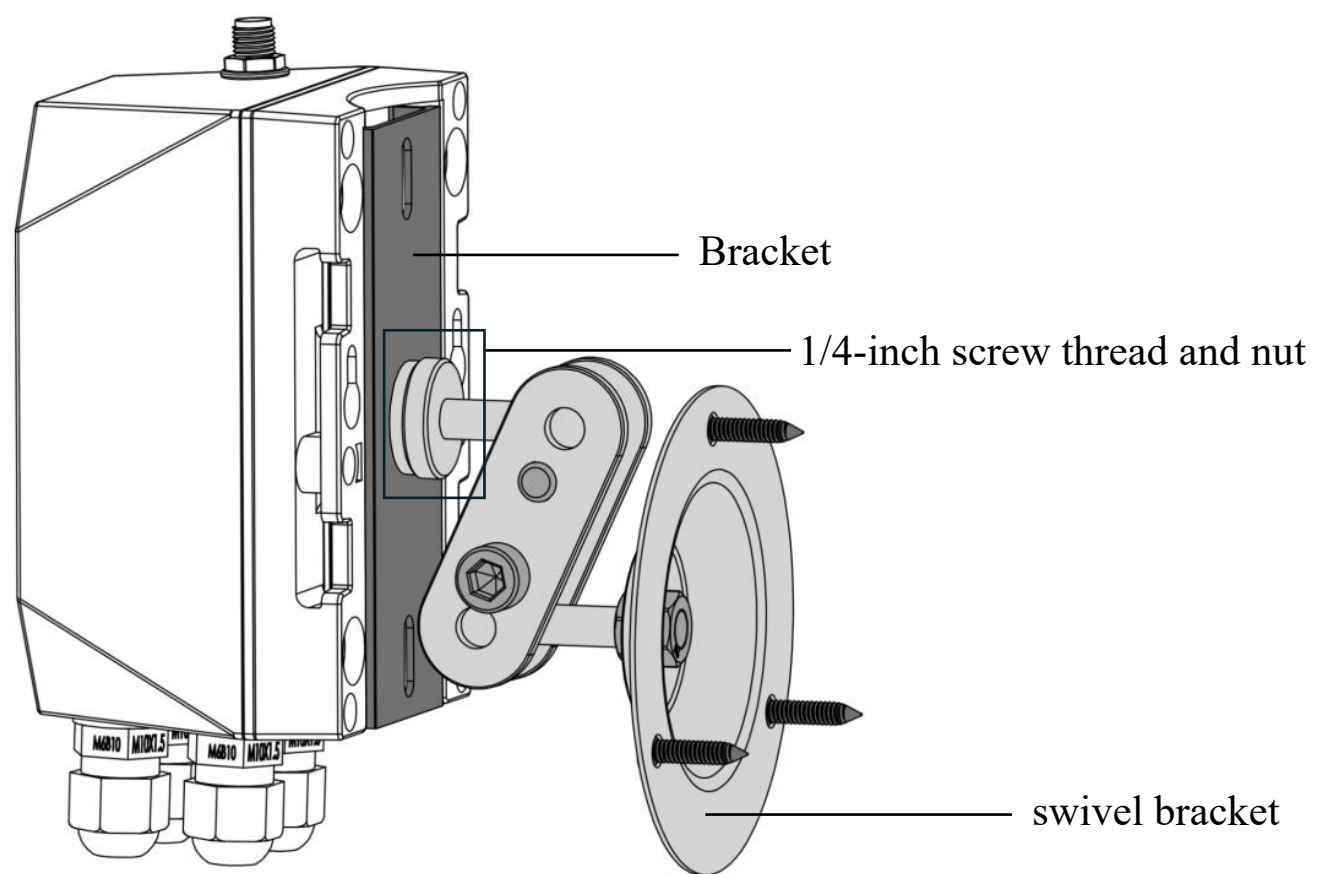Note: Please make sure the surface is clean and dry before applying double-sided tape.
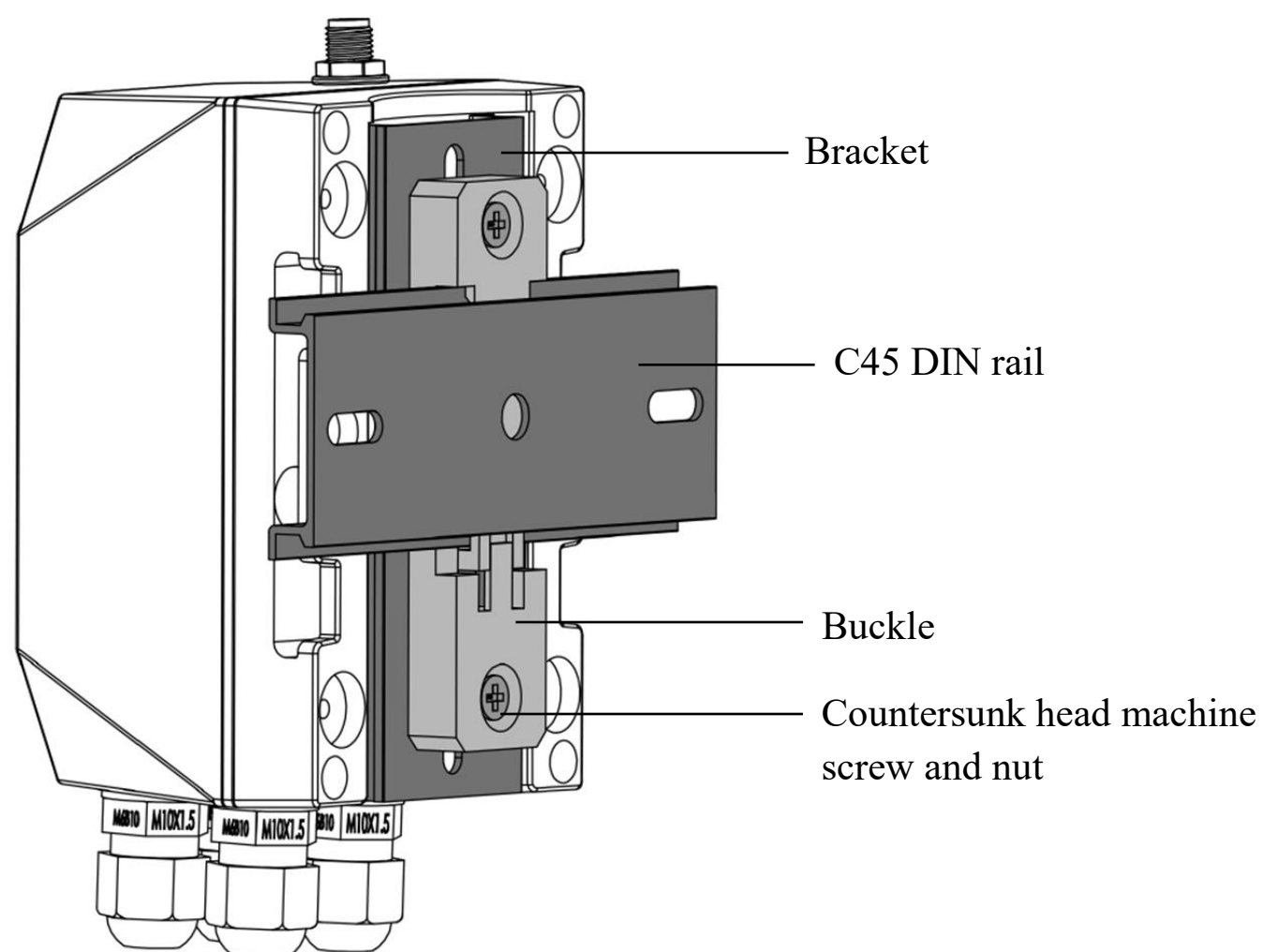
● Optional

(1) Magnet

Magnet

❶ Fix the R900 on a metal surface.

(2) Swivel Bracket

Bracket

1/4-inch screw thread and nut

swivel bracket

❶ Insert a 1/4-inch screw thread into the hole of the bracket.

❷ Tighten the thread with a nut.

❸ Mount the swivel bracket with self-tapping screws and expansion bolts.

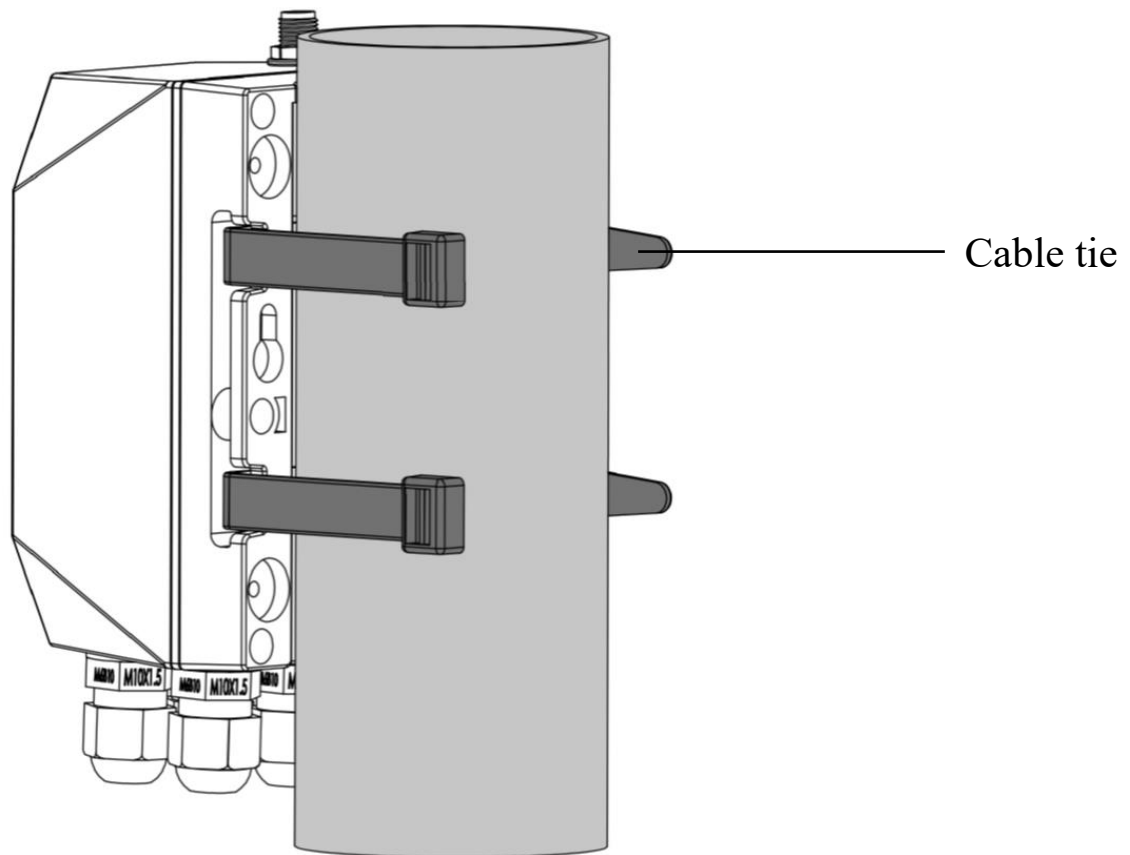❹ Hold R900 and slide down to connect the base and bracket.

(3) DIN Rail

Bracket

C45 DIN rail

Buckle

Countersunk head machine screw and nut

❶ Mount the rail buckle onto R900's bracket with countersunk head machine screws and nuts.

❷ Snap the buckle onto the DIN rail.

❸ Hold R900 and slide down to connect the base and bracket.

● Prepared by customers

(1) Cable Tie

Cable tie

❶ Insert cable ties through the holes of the base.

❷ Insert the pointed end through the slot.

❸ Tighten the cable ties and make sure R900 is fixed firmly around a column.

Soil Sensor

Option 1. Vertical Installation

❶ Choose a suitable location and avoid rocks or hard objects.

❷ Remove some surface soil.

❸ Insert the sensor vertically into the soil. Please do not shake or move the sensor during installation.

❹ To ensure the accuracy of measurement results, please test the sensor multiple times around the location and average the results.

Option 2. Horizontal Installation

❶ Dig a hole of at least 20cm in diameter.

❷ Insert the sensor horizontally into the soil.

❸ Pack the soil around the sensor firmly.

❹ For more reliable readings, please settle the soil sensor for a while after installation

Note:

a. Please make sure the probe is buried completely.

b. Direct sunlight exposure to the sensor can cause rising temperatures and affect reading.

c. Soil sensor can be damaged by lightning. Please make sure to take protection measures.

d. Please do not bend the steel needle, pull the sensor lead, and drop or violently hit the sensor.

e. With IP68 protection, the soil sensor can be submerged in water.

f. Please do not leave the sensor powered in the air for too long due to radio frequency electromagnetic radiation.

8. Battery Passivation

Many Netvox devices are powered by 3.6V ER14505 / ER18505 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 reactions 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 purchase 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, please **activate the battery with 67Ω load resistance for 8 minutes** to eliminate hysteresis in batteries.

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