Wireless Temperature Sensor - Digital Sensor

with 1 x Digital Output

R900A02O1 User Manual

Contents

1. Introduction

R900A02O1 is a wireless temperature sensor with a digital output. It transmits digital signals to a third-party device when temperature exceeds the threshold. With up to 7 flexible installation options, R900A02O1 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.

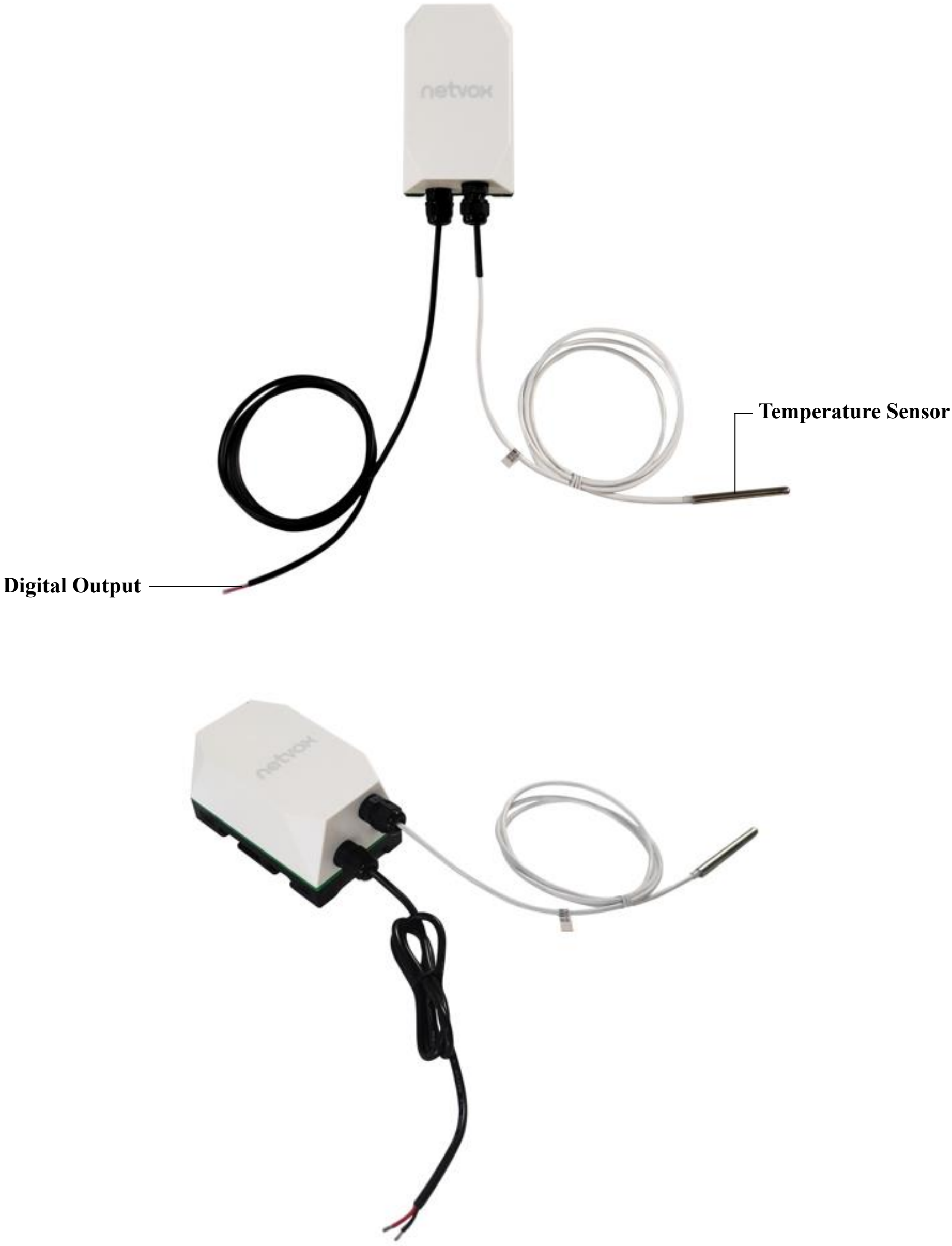
LoRa Wireless Technology

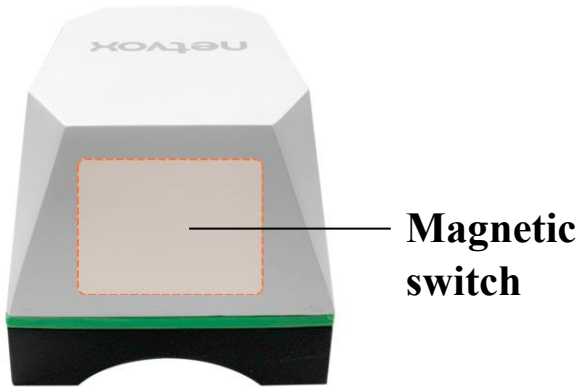
LoRa is a wireless communication technology famous for its long-distance transmission and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation technique greatly extends the communication distance. It can be widely used in any case that requires long-distance 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



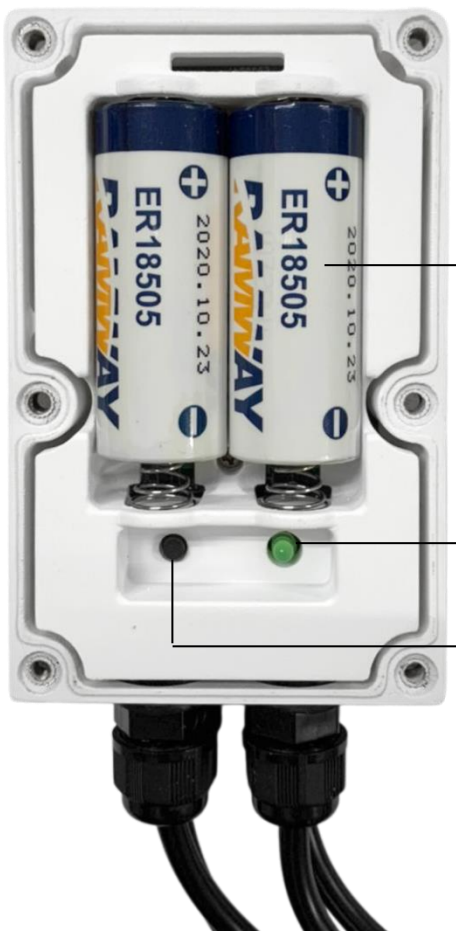


Top

Bottom

Left Side

Back



Battery

★ also support ER14505 battery with battery converter case

3. Features

- Output digital signal based on the threshold of temperature
- Powered by 2* 3.6V ER18505 batteries (also support ER14505 batteries with battery converter case)
- Support magnetic switch to turn on/off and factory reset device
- Up to 7 installation methods for different kinds of scenarios
- Report when device disconnects from the network
- 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. 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. 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

5. Data Report

35 seconds after the device is powered on, it will send a version packet and data including battery power and temperature.

Default setting:

Min Interval = 0x0384 (900s)

Max Interval = 0x0384 (900s) // should not be less than 30 seconds

TemperatureChange = 0x0064 (1°C)

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 based on 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 based on 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 030112000A0120250424, the firmware version is 2025.04.24.

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	DeviceType	ReportType	NetvoxPayLoadData			
R900A02O1	0x0112	0x01	Battery (1 Byte, unit: 0.1V)	Temperature (Signed 2 Bytes, unit: 0.01°C)	ThresholdAlarm (1 Byte) Bit0_LowTemperatureAlarm, Bit1_HighTemperatureAlarm, Bit2-7: Reserved	ShockTamperAlarm (1 Byte) 0x00_NoAlarm, 0x01_Alarm

Example of Uplink: **03011201240DAC0001**

1st Byte (03): Version

2nd 3rd Byte (0112): DeviceType－ R900A02O1

4th (01): ReportType

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

6th – 7th Byte (0DAC): Temperature－35˚C　0DAC (Hex) = 3500 (Dec), 3500* 0.01˚C = 35˚C

8th Byte (00): ThresholdAlarm － no alarm

9th Byte (01): ShockTamperAlarm － alarm

5.2 Example of ConfigureCmd

FPort: 0x17

Bytes	1	2	Var (length based on 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 (length based on the payload)

Description	Device	Cmd ID	Device Type	NetvoxPayLoadData			
ConfigReport Req	R900A 02O1	0x01	0x0112	MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	TemperatureChange (2 Bytes, unit: 0.01°C)	
ConfigReport Rsp		0x81		Status (0x00_success)			
ReadConfigReportReq		0x02					
ReadConfigReportRsp		0x82		MinTime (2 Bytes, unit: s)	MaxTime (2 Bytes, unit: s)	TemperatureChange (2 Bytes, unit: 0.01°C)	
SetShockSensorSensitivityReq		0x03		ShockSensorSensitivity (1 Byte)			
SetShockSensorSensitivityRsp		0x83		Status (0x00_success)			
GetShockSensorSensitivityReq		0x04					
GetShockSensorSensitivityRsp		0x84		ShockSensorSensitivity (1 Byte)			
ConfigDigitalOutPutReq		0x05		DigitalOutPutType (1 Byte) 0x00_NormallyLowLevel 0x01_NormallyHighLevel	OutPulseTime (1 Byte, unit: s)	BindAlarmSource (1 Byte) Bit0_LowTemperatureAlarm Bit1_HighTemperatureAlarm Bit2-7: Reserved	Channel (1 Byte) 0x00_Channel1 0x01_Channle2
ConfigDigitalOutPutRsp		0x85		Status (0x00_success)			

Read ConfigDigital OutPutReq		0x06		Channel (1Byte) 0x00_Channel1 0x01_Channle2			
Read ConfigDigital OutPutRsp		0x86		DigitalOutPutType (1 Byte) 0x00_NormallyLow Level 0x01_NormallyHigh Level	OutPulseTime (1 Byte, unit: s)	BindAlarmSource (1 Byte) Bit0_LowTemperature Alarm Bit1_HighTemperatureAlarm Bit2-7: Reserved	Channel (1Byte) 0x00_Channel1 0x01_Channle2
TriggerDigital OutPutReq		0x07		OutPulseTime (1 Byte, unit: s)		Channel (1 Byte) 0x00_Channel1 0x01_Channle2	
TriggerDigital OutPutRsp		0x87		Status (0x00_success)			

(1) Configure device parameters

MinTime = 0x003C (60s), MaxTime = 0x003C (60s), TemperatureChange = 0x012C (3°C)

Downlink: 010112003C003C012C

Response: 81011200 (configuration success)

81011201 (configuration fail)

Read device parameters

Downlink: 020112

Response: 820112003C003C012C

(2) Configure ShockSensorSensitivity = 0x14 (20)

Downlink: 03011214

Response: 83011200 (configuration success)

83011201 (configuration fail)

Note: ShockSensorSensitivity range = 0x01 to 0x14

0xFF (disables vibration sensor)

Read ShockSensorSensitivity

Downlink: 040112

Response: 84011214 (device's current parameters)

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

OutPulseTime = 0xFF (disable pulse duration),

BindAlarmSource = 0x01 = 0000 0001 (BIN) Bit0_LowTemperatureAlarm = 1

(when LowTemperatureAlarm is triggered, DO outputs signals)

Channel = 0x00_Channel1

Downlink: 05011200FF0100

Response: 85011200 (configuration success)

85011201 (configuration fail)

Read DO parameters

Downlink: 06011200

Response: 86011200FF0100

Configure OutPulseTime = 0x03 (3 seconds)

Downlink: 0701120300

Response: 87011200 (configuration success)

87011201 (configuration fail)

5.3 Example of SetSensorAlarmThresholdCmd

FPort: 0x10

CmdDescriptor	CmdID (1 Byte)	Payload (10 Bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1 Byte) 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.	SensorType (1 Byte) 0x00_Disable ALL 0x01_Temperature	SensorHighThreshold (4 Bytes) unit: Temperature – 0.01˚C	SensorLowThreshold (4 Bytes) unit: Temperature – 0.01˚C
SetSensorAlarm ThresholdRsp	0x81	Status (0x00_success)	Reserved (9 Bytes, Fixed 0x00)		
GetSensorAlarm ThresholdReq	0x02	Channel (1 Byte) 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.	SensorType (1 Byte) 0x00_Disable ALL 0x01_Temperature	Reserved (8 Bytes, Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1Byte) 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.	SensorType (1 Byte) 0x00_Disable ALL 0x01_Temperature	SensorHighThreshold (4 Bytes) unit: Temperature – 0.01˚C	SensorLowThreshold (4 Bytes) unit: Temperature – 0.01˚C

Note:

a. Temperature sensor – Channel: 0x00; SensorType: 0x01

b. Set SensorHigh/LowThreshold as 0xFFFFFFFF to disable threshold.

c. The last configuration will be saved when the device is reset to factory setting.

(1) Configure parameters

Channel = 0x00, SensorType = 0x01 (Temperature),

SensorHighThreshold = 0x00001388 (50˚C), SensorLowThreshold = 0x000003E8 (10˚C)

Downlink: 0100010000138800003E8

Response: 810000000000000000000 (configuration success)

810100000000000000000 (configuration fail)

(2) Read parameters

Downlink: 020001000000000000000

Response: 820001000013880000003E8 (device's current parameters)

5.4 Example of GlobalCalibrateCmd

Fport: 0x0E

<table>
<tr><th>Description</th><th>Cmd ID</th><th>SensorType</th><th colspan="5">PayLoad (Fix =9 Bytes)</th></tr>
<tr><td>SetGlobalCalibrate Req</td><td>0x01</td><td rowspan="4">0x01_Temperature Sensor</td><td>Channel
(1 Byte)
0_Channel1
1_Channel2, etc.</td><td>Multiplier
(2 Bytes, Unsigned)</td><td>Divisor
(2 Bytes, Unsigned)</td><td>DeltValue
(2 Bytes, Signed)</td><td>Reserved
(2 Bytes, Fixed 0x00)</td></tr>
<tr><td>SetGlobalCalibrate Rsp</td><td>0x81</td><td>Channel
(1 Byte)
0_Channel1
1_Channel2, etc.</td><td>Status
(1 Byte)
0x00_success)</td><td colspan="3">Reserved
(7 Bytes, Fixed 0x00)</td></tr>
<tr><td>GetGlobalCalibrate Req</td><td>0x02</td><td>Channel
(1 Byte)
0_Channel1
1_Channel2, etc.</td><td colspan="4">Reserved
(8 Bytes, Fixed 0x00)</td></tr>
<tr><td>GetGlobalCalibrate Rsp</td><td>0x82</td><td>Channel
(1 Byte)
0_Channel1
1_Channel2, etc.</td><td>Multiplier
(2 Bytes, Unsigned)</td><td>Divisor
(2 Bytes, Unsigned)</td><td>DeltValue
(2 Bytes, Signed)</td><td>Reserved
(2 Bytes, Fixed 0x00)</td></tr>
<tr><td>ClearGlobalCalibrate Req</td><td>0x03</td><td colspan="6">Reserved (10 Bytes, Fixed 0x00)</td></tr>
<tr><td>ClearGlobalCalibrate Rsp</td><td>0x83</td><td>Status (1 Byte, 0x00_success)</td><td colspan="5">Reserved (9 Bytes, Fixed 0x00)</td></tr>
</table>

SensorType: 0x01_Temperature Sensor; Channel: 0x00_Channel1

(1) SetGlobalCalibrateReq

Calibrate temperature sensor by increasing 10°C

Channel: 0x00 (channel1); Multiplier: 0x0001 (1); Divisor: 0x0001 (1); DeltValue: 0x03E8 (1000)

Downlink: 01010000010000103E80000

Response: 810100000000000000000 (configuration success)

810100010000000000000 (configuration fail)

(2) Read parameters

Downlink: 020100000000000000000

Response: 8201000001000103E80000 (configuration success)

(3) Clear all calibration

Downlink: 030000000000000000000

Response: 830000000000000000000

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: 0300010002000300040005000600 07

Response: 830000000000000000000000000000 (Configuration success)

830100000000000000000000000000 (Configuration failure)

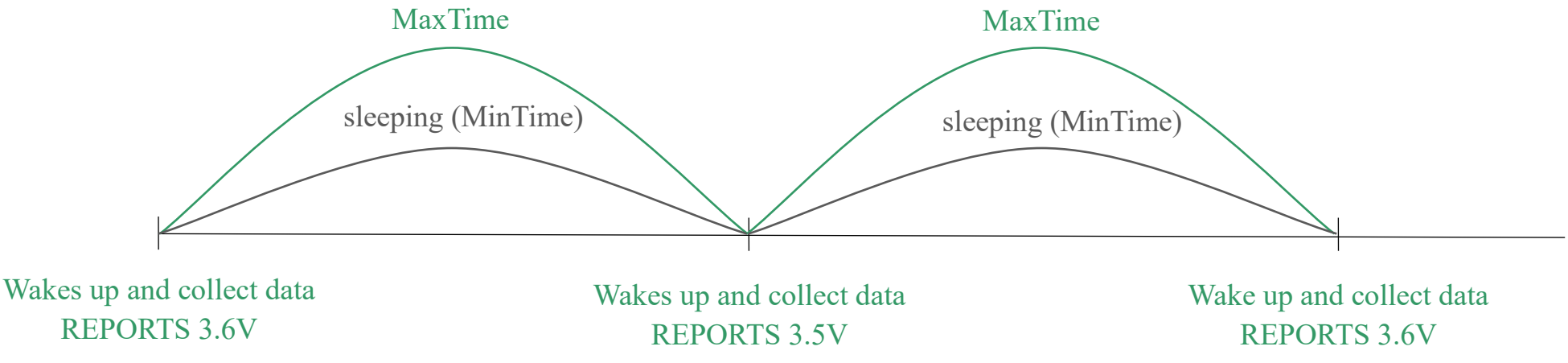
(4) Read Rejoin Time parameter

Downlink: 040000000000000000000000000000

Response: 840001000200030004000500060007

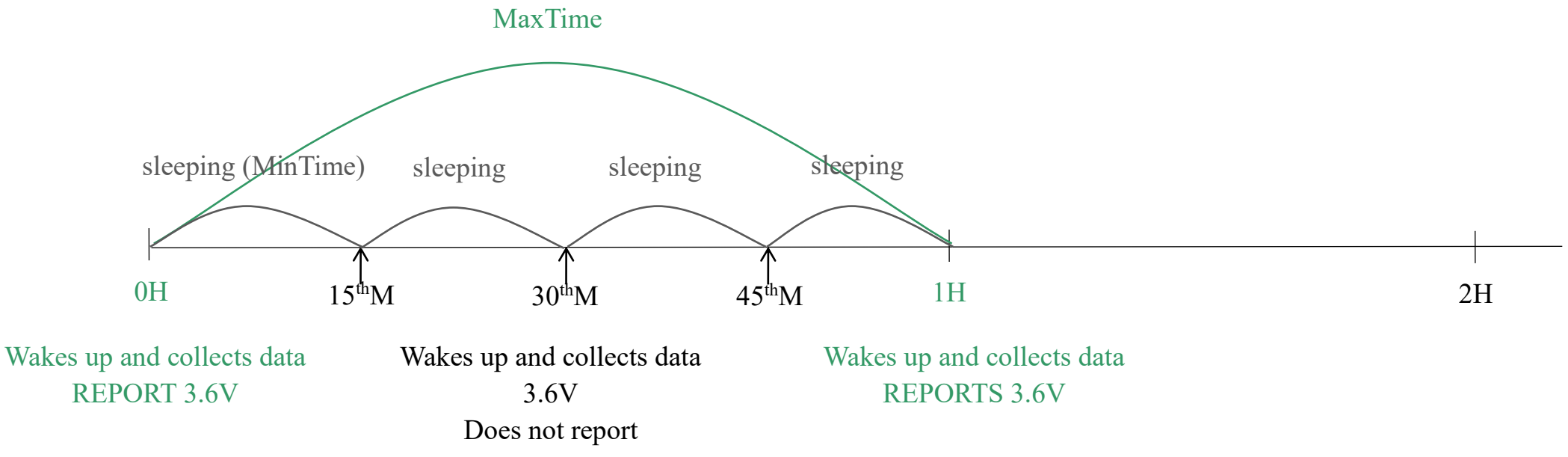
5.6 Example for MinTime/MaxTime logic

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

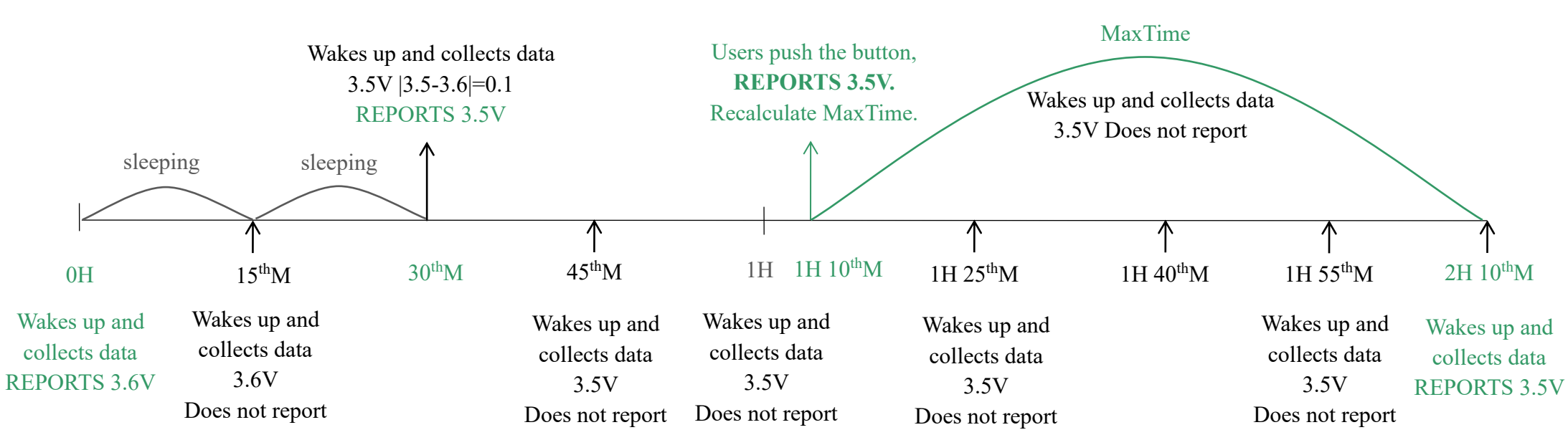


Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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:

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 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.

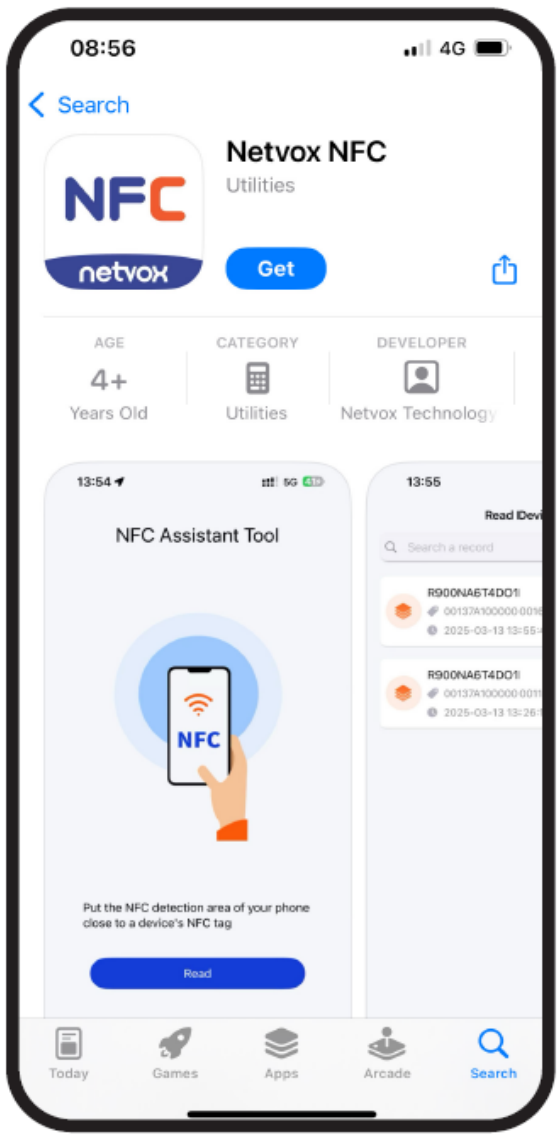
c. We do not recommend setting the MinTime Interval value too low. If the MinTime Interval is too low, the device wakes up frequently and the battery will be drained soon.

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

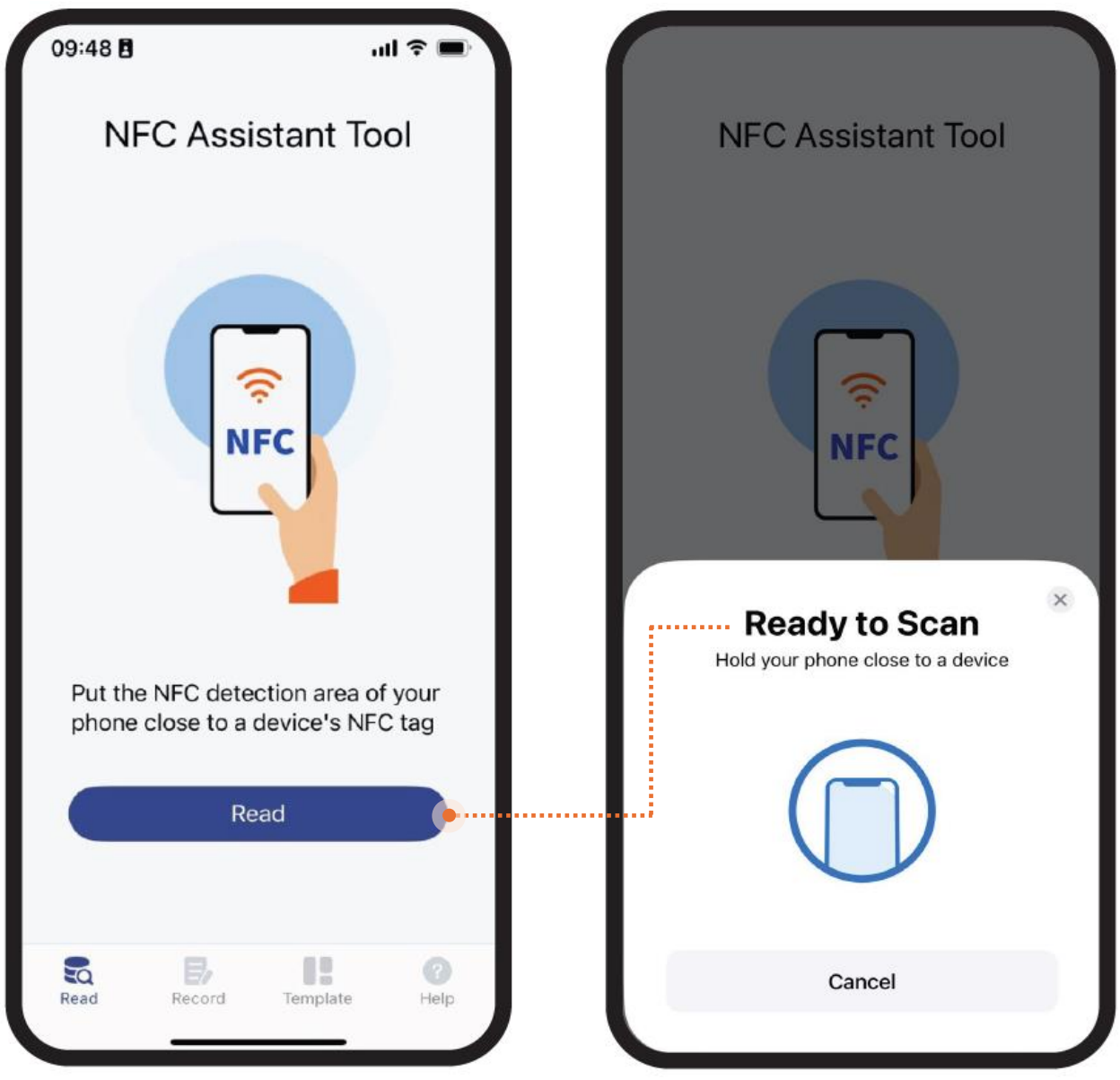
(1) Download Netvox NFC app.

Please make sure your phone supports NFC.

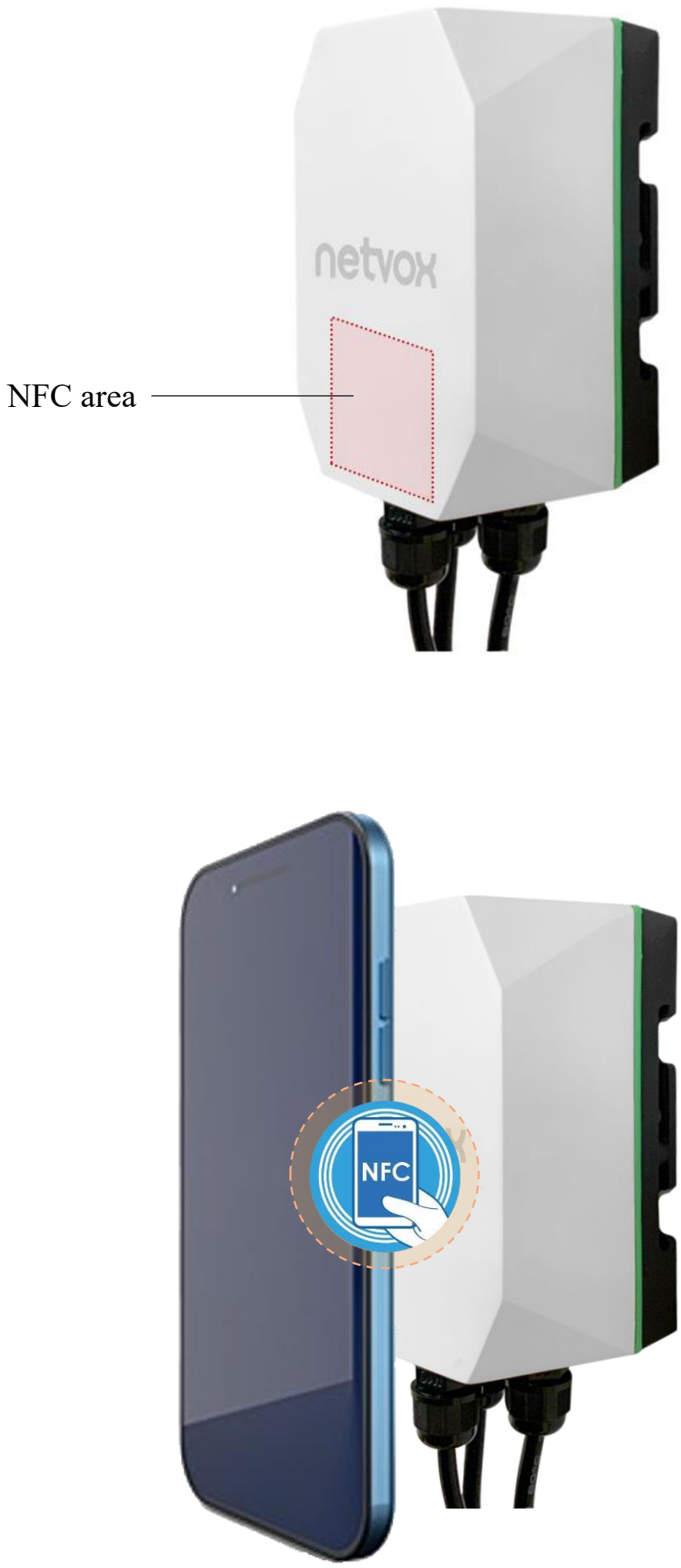


(2) Enable NFC in Settings and find your phone’s NFC area.

Open the app and click Read.

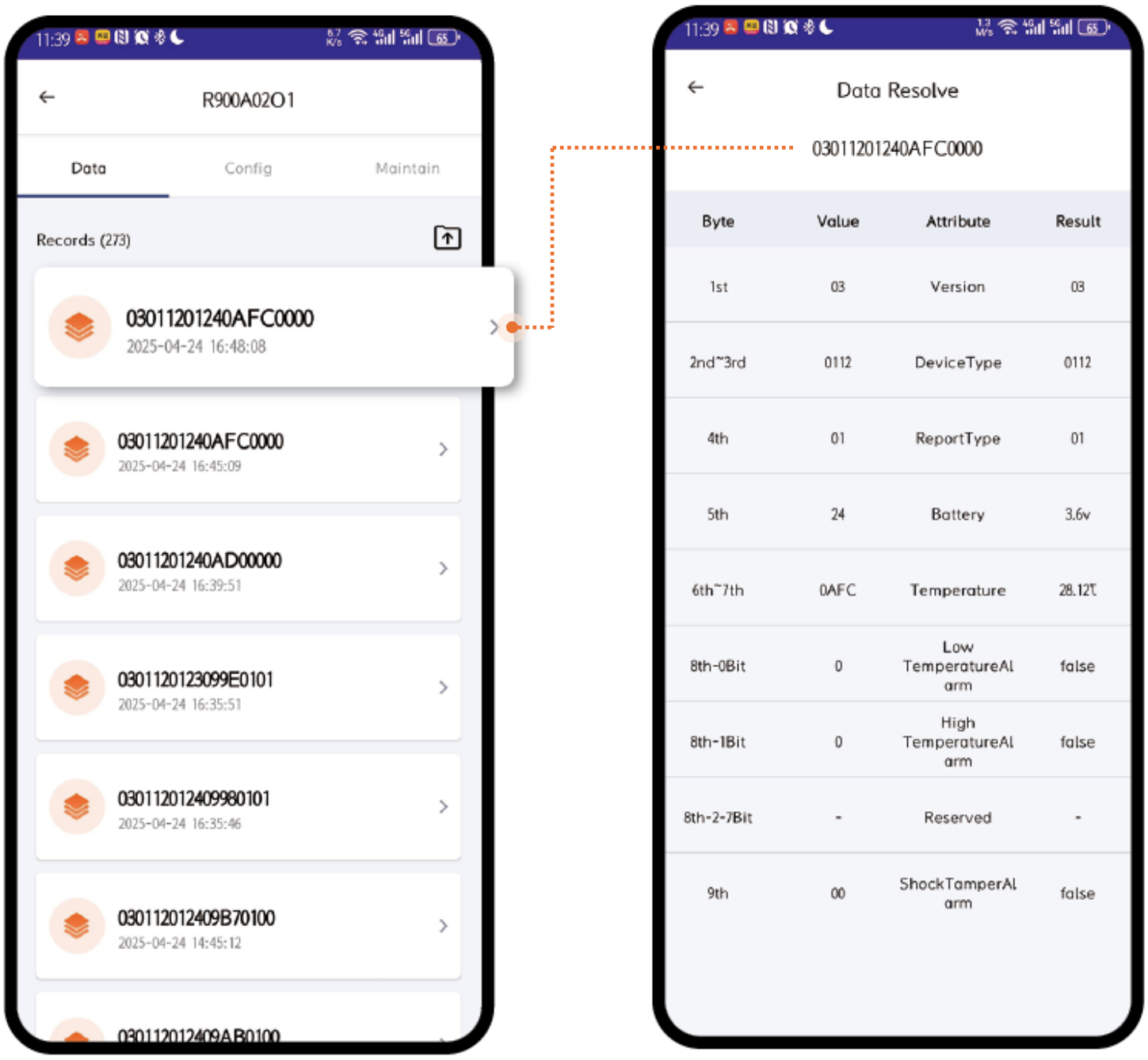


(3) Hold your phone near R900’s NFC tag.



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

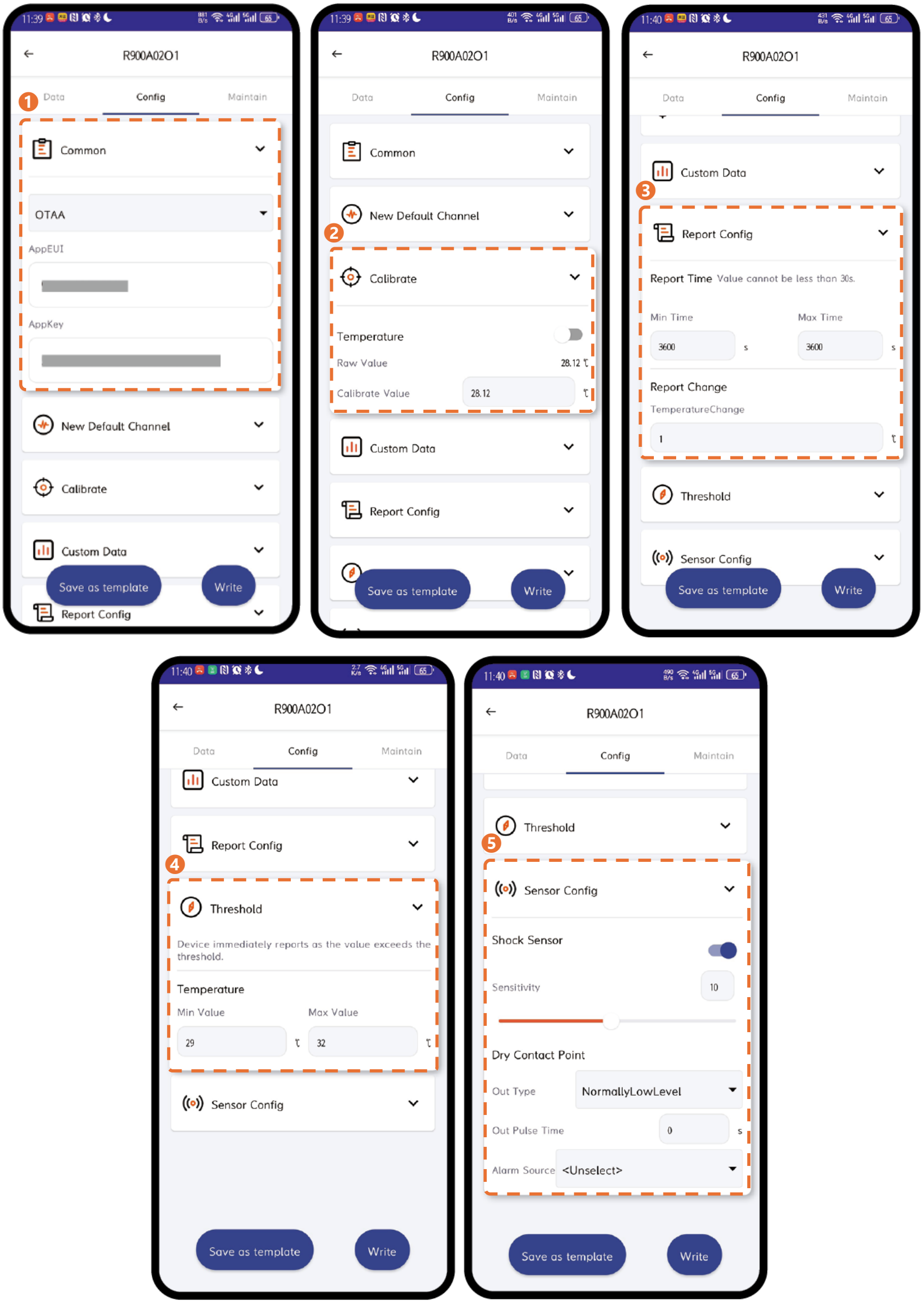
Select a data and go to the Data processing.



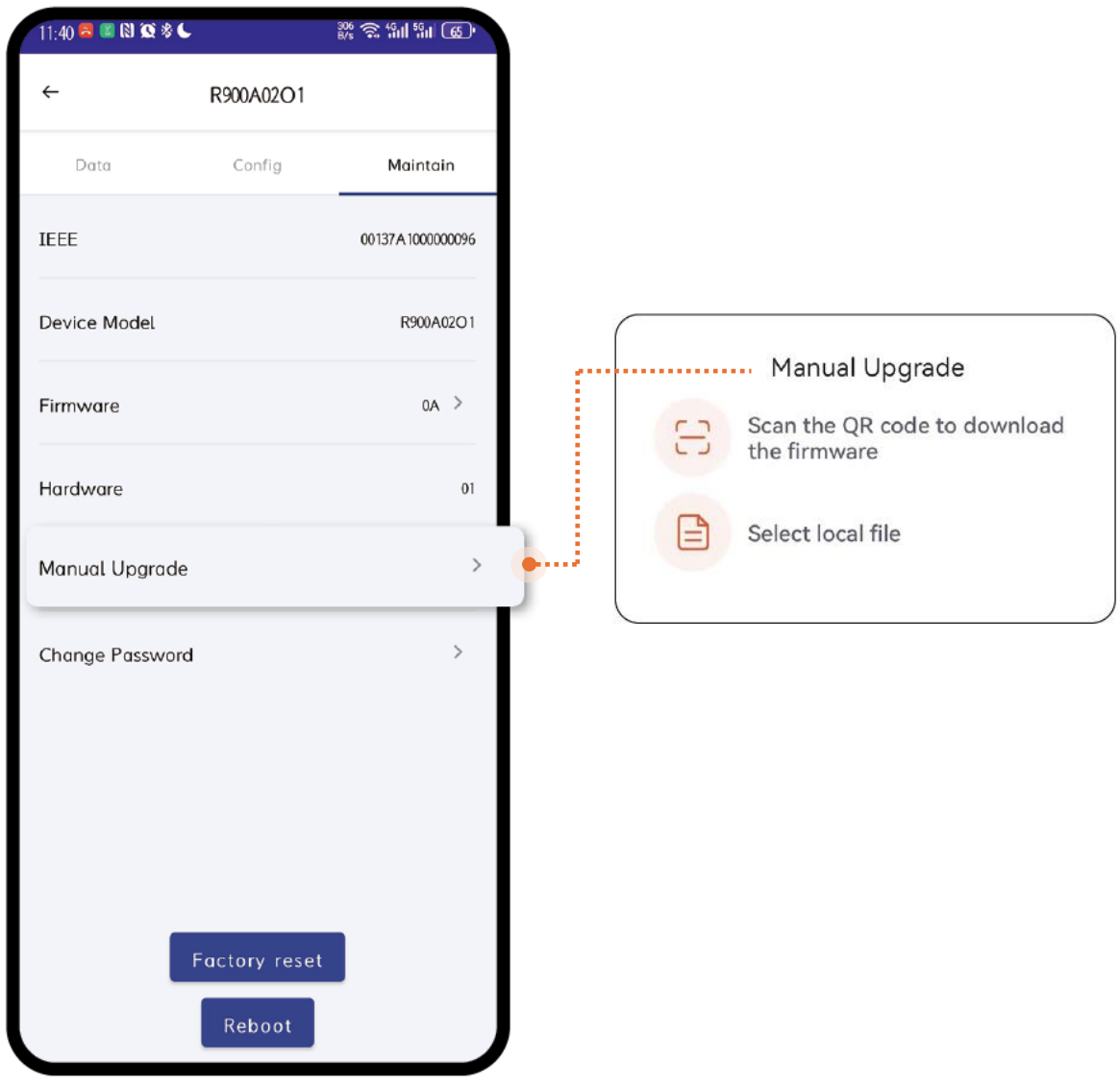
(5) Click Config to edit R900's settings, including network connection, calibration, report configuration, threshold, and sensor parameters.

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.



(6) Click Maintain to check R900A02O1’s info and available upgrade.

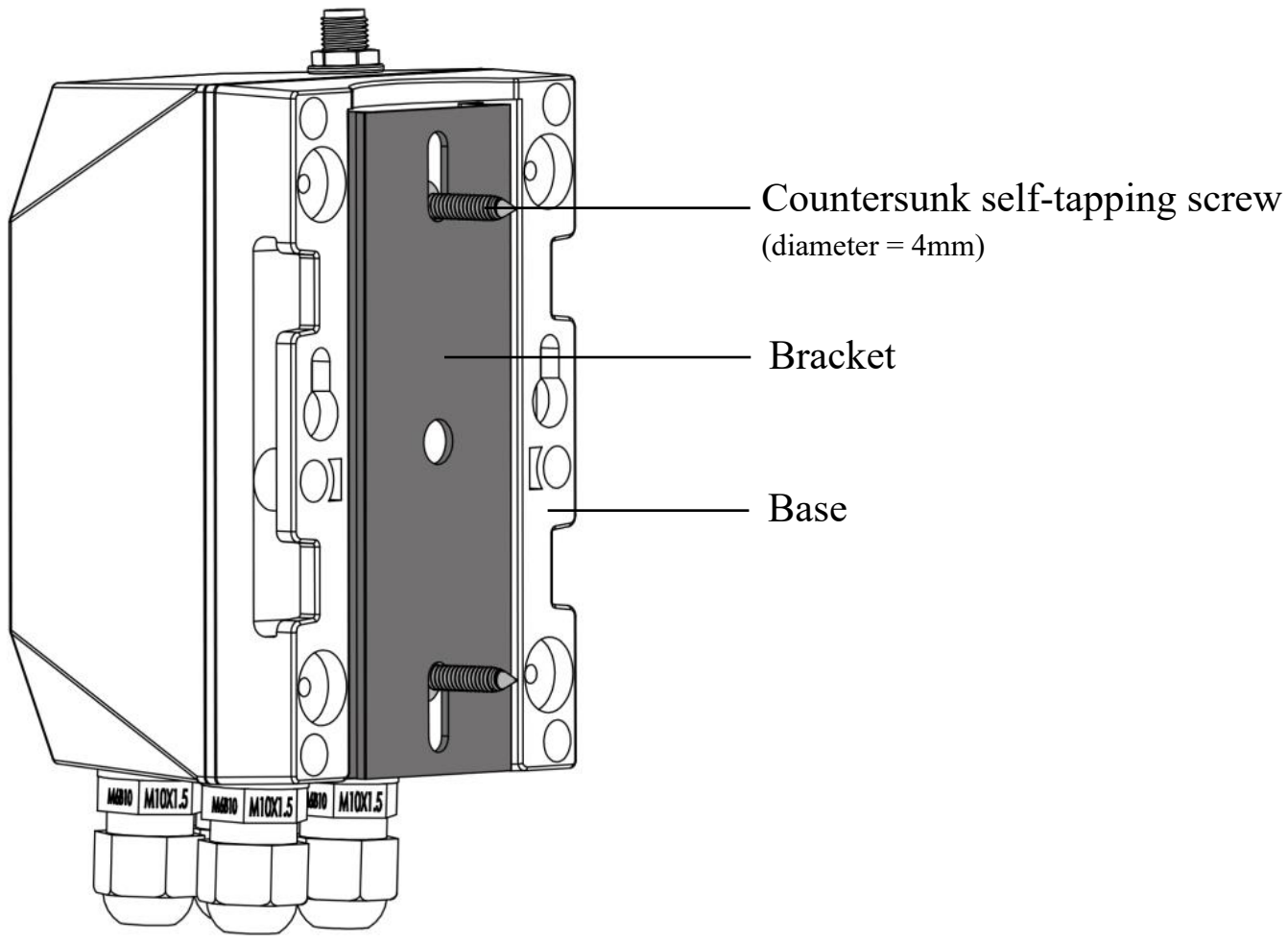


7. Installation

R900

- Standard

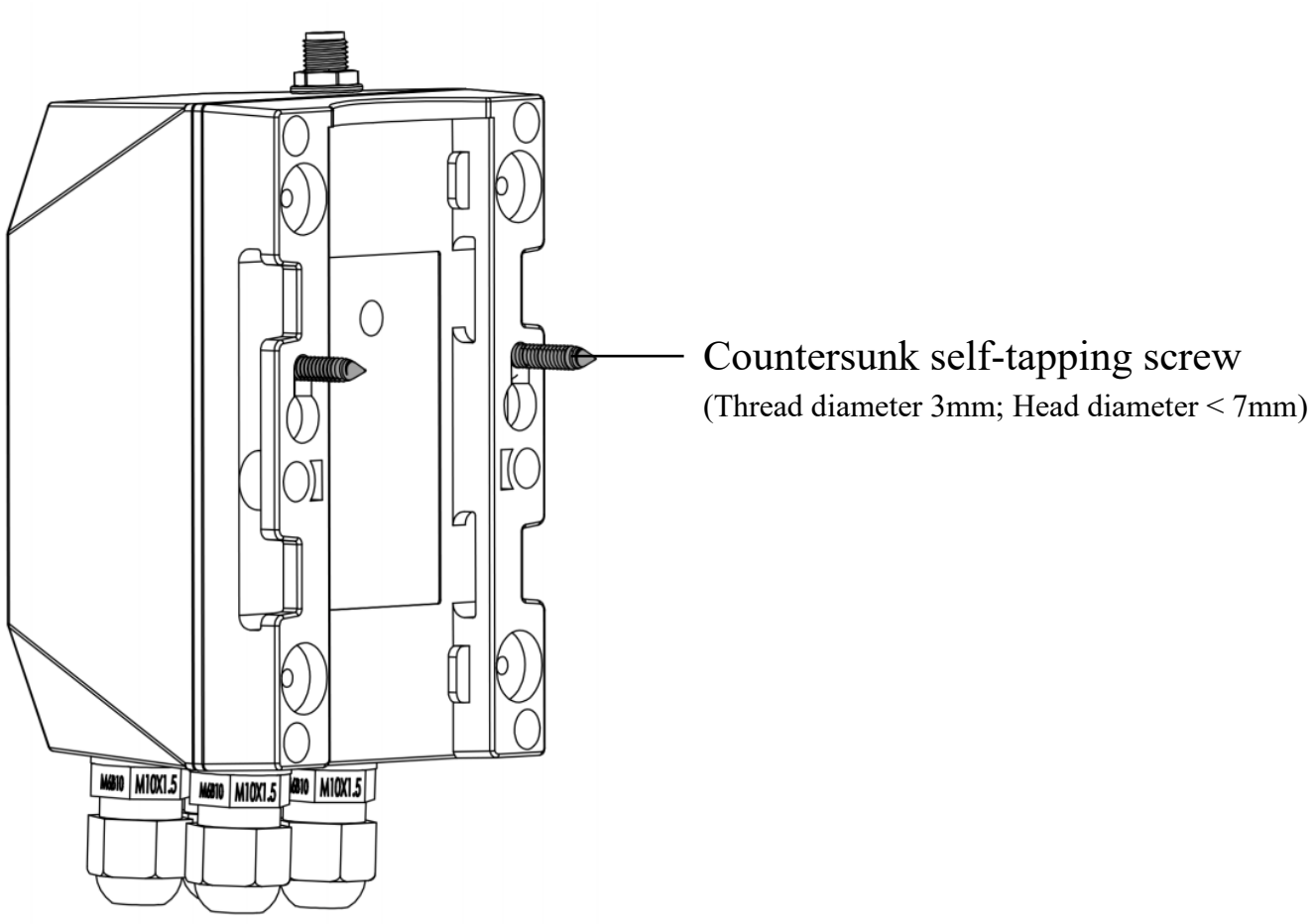
(1) Screws + Bracket



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



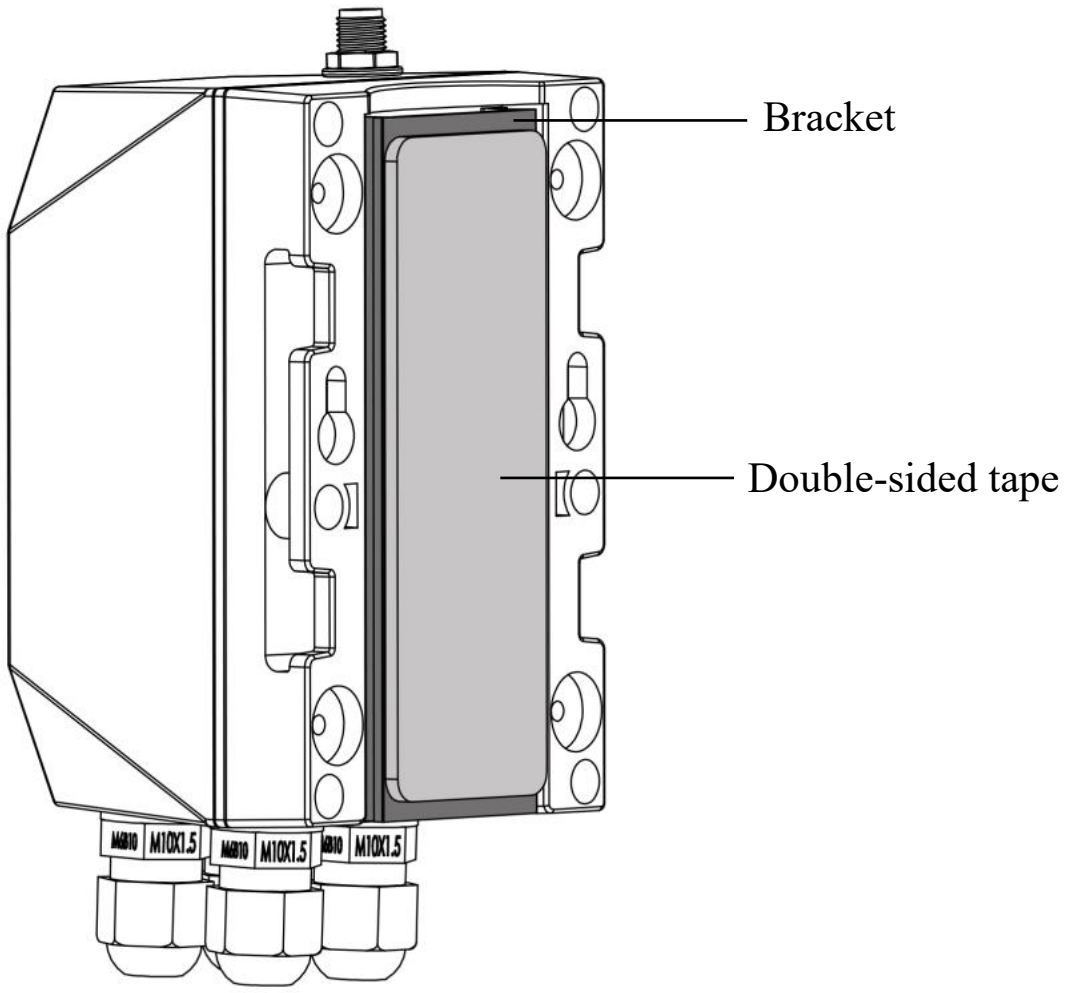
❶ Mount 2 countersunk self-tapping screws or expansion bolts on the wall.

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



❶ Stick the double-sided tape on the bracket.

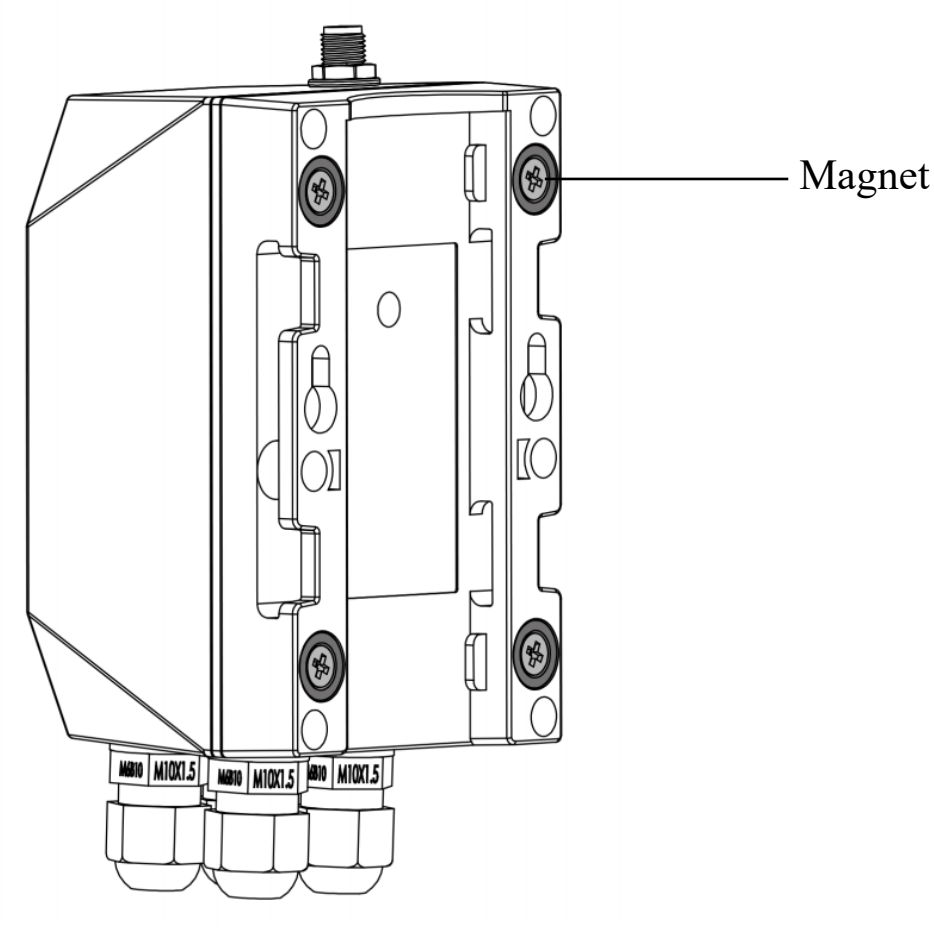
❷ Peel the liner and fix R900 on the surface.

❸ Press to ensure R900 is firmly installed.

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

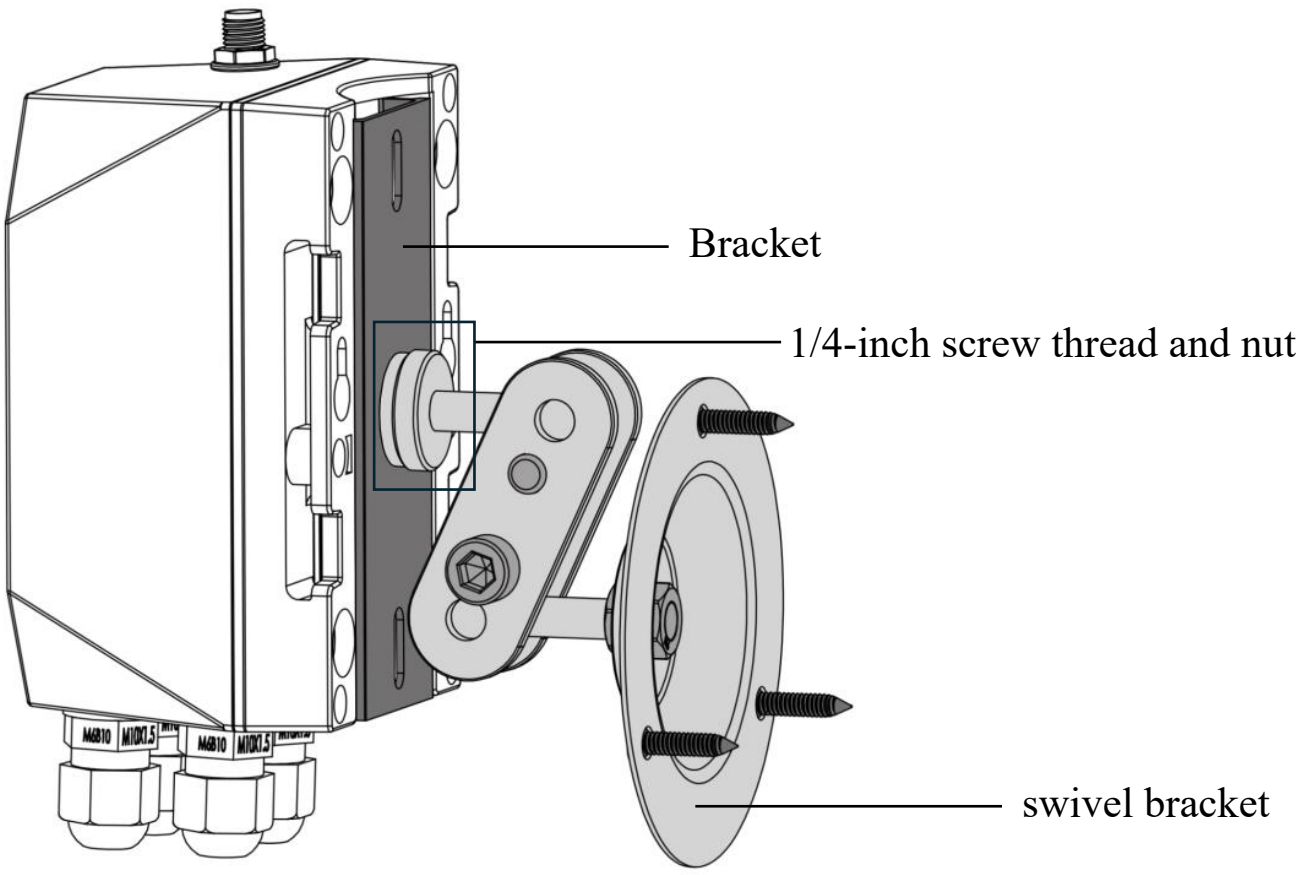
- Optional

(1) Magnet



❶ Fix the R900 on a metal surface.

(2) Swivel Bracket



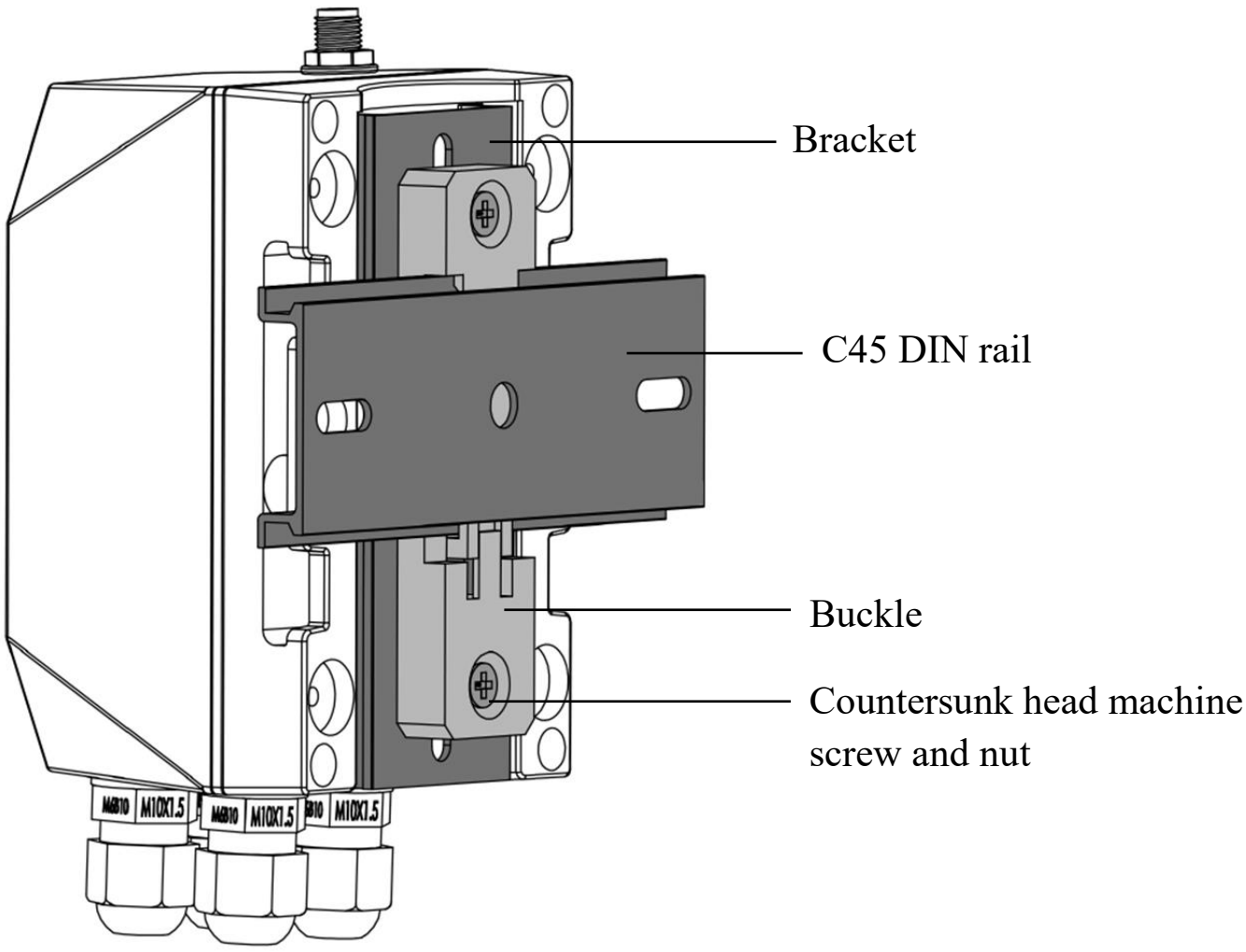
❶ Insert a 1/4-inch screw thread into the hole of the bracket.

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



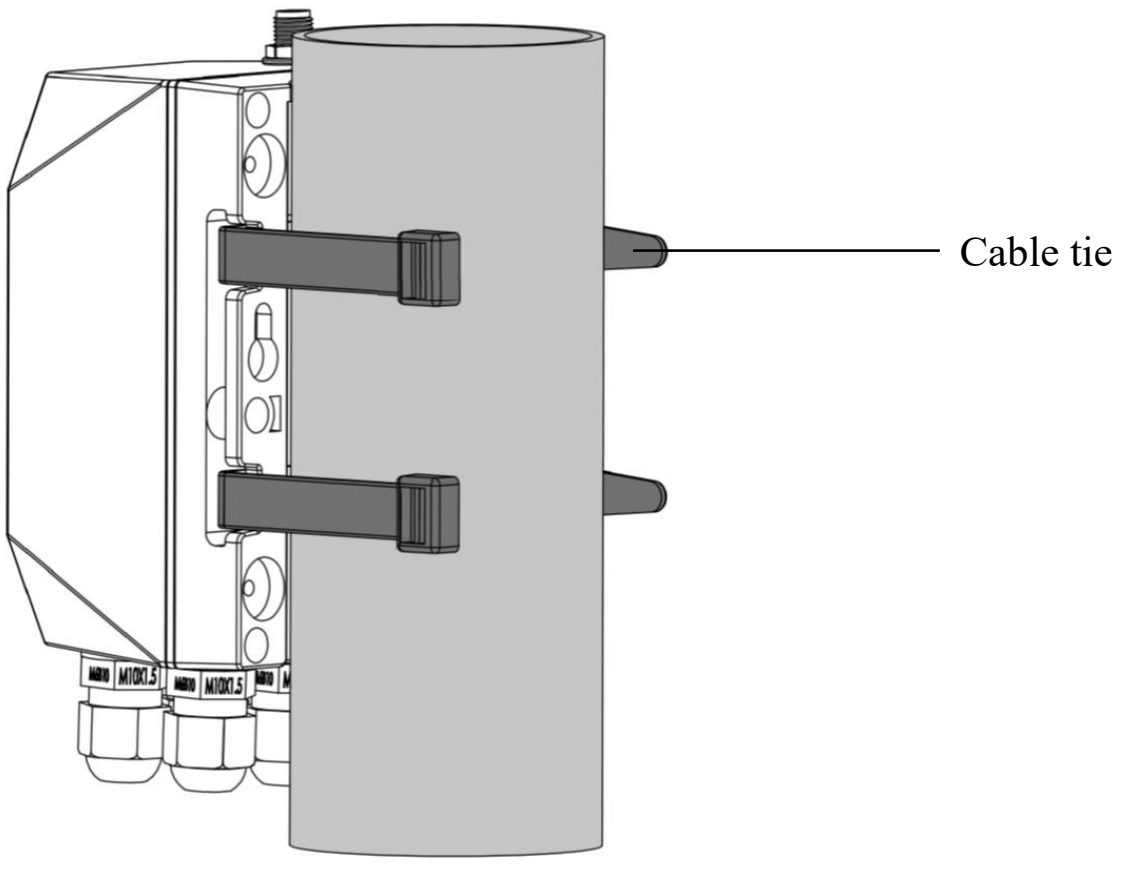
❶ Mount the rail buckle onto R900’s bracket with countersunk head machine screws and nuts.

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

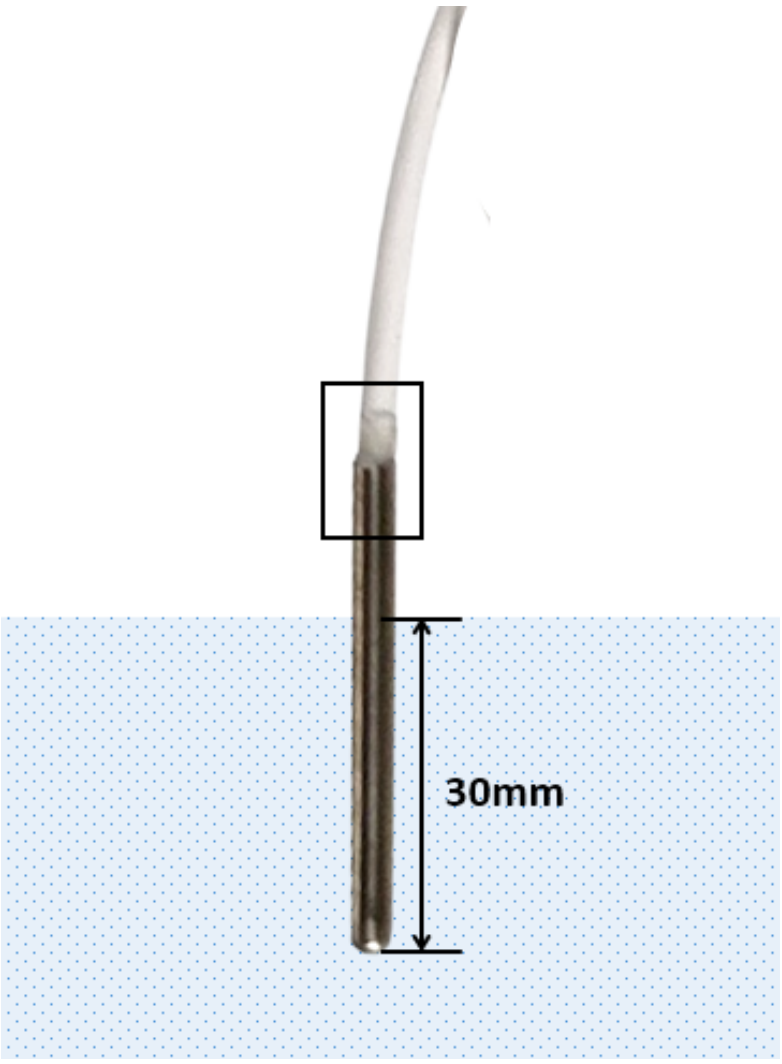


❶ Insert cable ties through the holes of the base.

❷ Insert the pointed end through the slot.

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

Temperature Sensor



❶ The length of the stainless probe is 50mm. Please immerse it to a depth of **30mm**.

❗ Please do not put the whole stainless probe into chemical solutions, such as alcohol, ketone, ester, acid, and alkali. It could damage the sealing compound and thus cause the liquid to get inside the PCB.

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 68Ω load resistance for 1 minute** 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