Wireless CO Detector

RA02C
User Manual

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1. Introduction

RA02C is a CO/temperature detector for Netvox Class-A devices based on the LoRaWAN open protocol and is compatible with the LoRaWAN protocol.

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 extend 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, 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

- 2 x 1.5V AAA size alkaline batteries
- CO and temperature detection
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum
- Configuration parameters can be configured via a third-party software platform, data can be read and alerts can be set via SMS text and email (optional)
- Applicable to the 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 lifespan.

4. Set up Instructions

On/Off

Power on	Insert batteries. (Users may need a screwdriver to open the cover.)
Turn on	Press any function key to turn on the device. After releasing the key, the red and green indicators flash once.
Turn off (Restore to factory setting)	Press and hold both keys for 5 seconds until the green indicator flashes and then release; LED flashes 20 times.
Power off	Remove Batteries.
Note:	1. After removing and inserting the battery, the device memorizes the previous on/off state by default. 2. On/off interval is suggested to be about 10 seconds to avoid the interference of the capacitor inductance and other energy storage components. 3. Do not power on the device while any function key is pressed, otherwise the device will enter the 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	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	Please check the device verification information on the gateway or consult your platform server provider.

Function Key and Test Key

Press and hold both keys for 5 seconds	<u>Restore to factory setting / Turn off</u> The green indicator flashes 20 times: success The green indicator remains off: fail
Press function key once	<u>The device is in the network:</u> The green indicator flashes once and sends a report. <u>The device is not in the network:</u> The green indicator remains off.
Press test key once	<u>The device is in the network:</u> The red indicator flashes; the buzzer sounds. The device sends a data packet of alarm = 0x01. 7 seconds later, the device sends alarm = 0x00. The indicator and buzzer stop working. <u>The device is not in the network:</u> The red indicator flashes and the buzzer sounds.

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, a data report will be sent according to Min Interval.

Low Voltage Warning

Low Voltage Threshold	2.4V

5. Data Report

The device will immediately send a version packet report and a data report.

Data will be reported by default setting before any configuration.

Default setting:

Max Interval = 0x0E10 (3600s)

Min Interval = 0x0E10 (3600s) (The voltage is detected every Min Interval by default.)

Battery Voltage Change: 0x01 (0.1V)

Alarmthreshold = 0x6E (110ppm) (The last data would be kept as the device is reset back to factory setting.)

RejoinCheckPeriod = 0x00001C20 (2 hr)

RejoinThreshold = 0x03 (3 times)

CO Trigger:

The CO concentration is sampled 30 seconds after the device is powered on. When the concentration is higher than 110 ppm, the red indicator flashes and the buzzer sounds. The device immediately sends a report (CO alarm bit is 1).

If the alarm continues, the report will be sent every 30 seconds. When the concentration drops below 110ppm, the indicator and buzzer stop working. The device sends a report.

High Temperature Alarm:

After the device is successfully connected to the network, the temperature will be sampled once every 1 minute.

When the temperature is higher than 60°C, the buzzer will sound, the red indicator will flash, and a report will be sent immediately. (The fire alarm bit is 1.)

If the alarm continues, the report will be sent every 1 minute. When the temperature below 60°C, the flashing end alarm will stop and an alarm will be sent to restore the report. (The fire alarm bit is 0.)

Note: (1) The device report interval will be programmed based on the default firmware.

(2) The interval between two reports must be the minimum time.

(3) The reported data is decoded by the Netvox LoRaWAN Application Command document and http://cmddoc.netvoxcloud.com/cmddoc

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=0x90, binary=1001 0000, if bit 7= 1, it means low voltage.

The actual voltage is 0001 1000 = 0x18 = 24, 24*0.1v =2.4v.

2. Version Packet

When Report Type=0x00 is the version packet, such as 0111000A15202305150000, the firmware version is 2023.05.15.

Device	**Device Type**	**Report Type**	**NetvoxPayLoadData**			
RA02C	0x11	0x01	Battery (1 Byte, unit: 0.1V)	CO Alarm (1 Byte) 0: no alarm 1: alarm	HighTempAlarm (1 Byte) 0: noalarm 1: alarm	Reserved (5 Bytes, fixed 0x00)

Example of Uplink: 011101980100010E000000

1st byte (01): Version

2nd byte (11): DeviceType 0x11 — RA02C

3rd byte (01): ReportType

4th byte (98): Battery — 2.4v (low voltage) , 98 (HEX) = 24 (DEC), 24* 0.1v = 2.4v

5th byte (01): CO Alarm

6th byte (0): HighTemperatureAlarm — no alarm

7th – 8th byte (010E): Temperature — 27.0℃ 010E (HEX) = 270 (DEC), 270* 0.1℃ = 27.0℃

9th–11th byte (000000): 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 = 9 bytes)

Description	**Device**	**CmdID**	**Device Type**	**NetvoxPayLoadData**			
ConfigReportReq	RA02C	0x01	0x11	MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	BatteryChange (1byte, Unit: 0.1v)	Reserved (4Bytes, Fixed 0x00)
ConfigReportRsp		0x81		Status (0x00_success)		Reserved (8Bytes, Fixed 0x00)	
ReadConfigReportReq		0x02		Reserved (9Bytes, Fixed 0x00)			
ReadConfigReportRsp		0x82		MinTime (2 bytes, Unit: s)	MaxTime (2 bytes, Unit: s)	BatteryChange (1byte, Unit: 0.1v)	Reserved (4 Bytes, Fixed 0x00)
SetAlarmthresholdReq		0x03		Alarmthreshold (1 byte, Unit: 1ppm)		Reserved (8 Bytes, Fixed 0x00)	
SetAlarmthresholdRsp		0x83		Status (0x00_success)		Reserved (8 Bytes, Fixed 0x00)	
GetAlarmthresholdReq		0x04		Reserved (9 Bytes, Fixed 0x00)			
GetAlarmthresholdRsp		0x84		Alarmthreshold (1 byte, Unit: 1 ppm)		Reserved (8 Bytes, Fixed 0x00)	

(1) Command Configuration

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

Downlink: 0111003C003C0100000000 003C($H_{ex)}$ = 60($D_{ec)}$

Response: 8111<u>00</u>00000000000000000 (Configuration success)

8111<u>01</u>00000000000000000 (Configuration failure)

(2) Read Configuration

Downlink: 0211000000000000000000

Response: 8211003C003C0100000000 (Current configuration)

(3) Configure CO Alarmthreshold = 80ppm (0x50)

Downlink: 0311500000000000000000

Response: 8311000000000000000000

(4) Read CO Alarmthreshold

Downlink: 0411000000000000000000

Response: 8411500000000000000000

5.3 Example of NetvoxLoRaWANRejoin

Only Support firmware after 2024.01.09

(Note: 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)	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 (1Byte)

(1) Command Configuration

Set RejoinCheckPeriod = 60min (0x0E10), RejoinThreshold = 3 times (0x03)

Downlink: 0100000E1003

Response: 810000000000 (Configuration success)

810100000000 (Configuration failure)

(2) Read current configuration

RejoinCheckPeriod = 60min (0x0E10), RejoinThreshold = 3 (times)

Downlink: 020000000000

Response: 8200000E1003

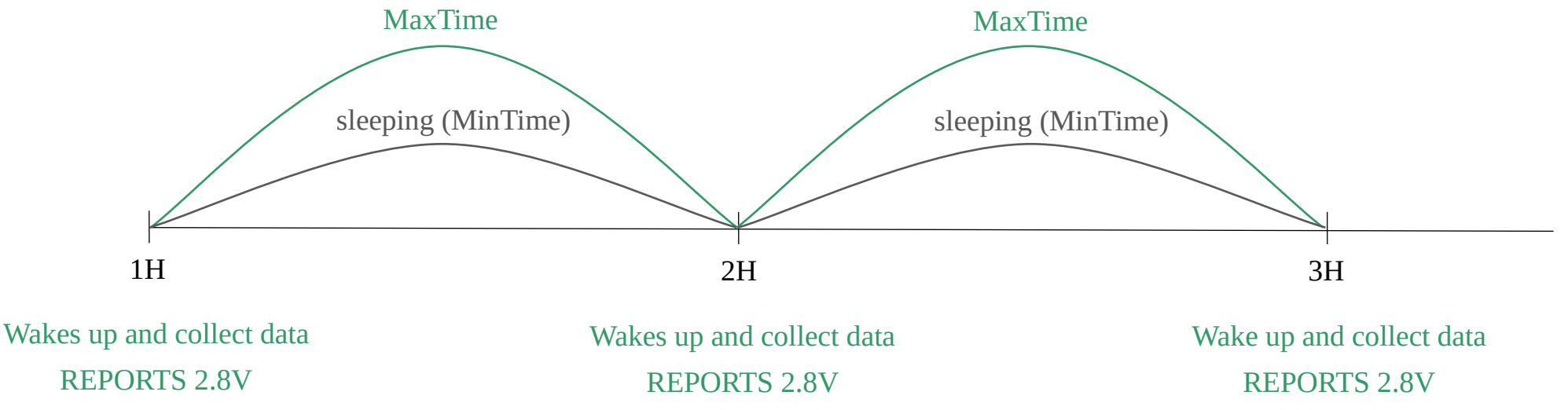
Note: a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

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)

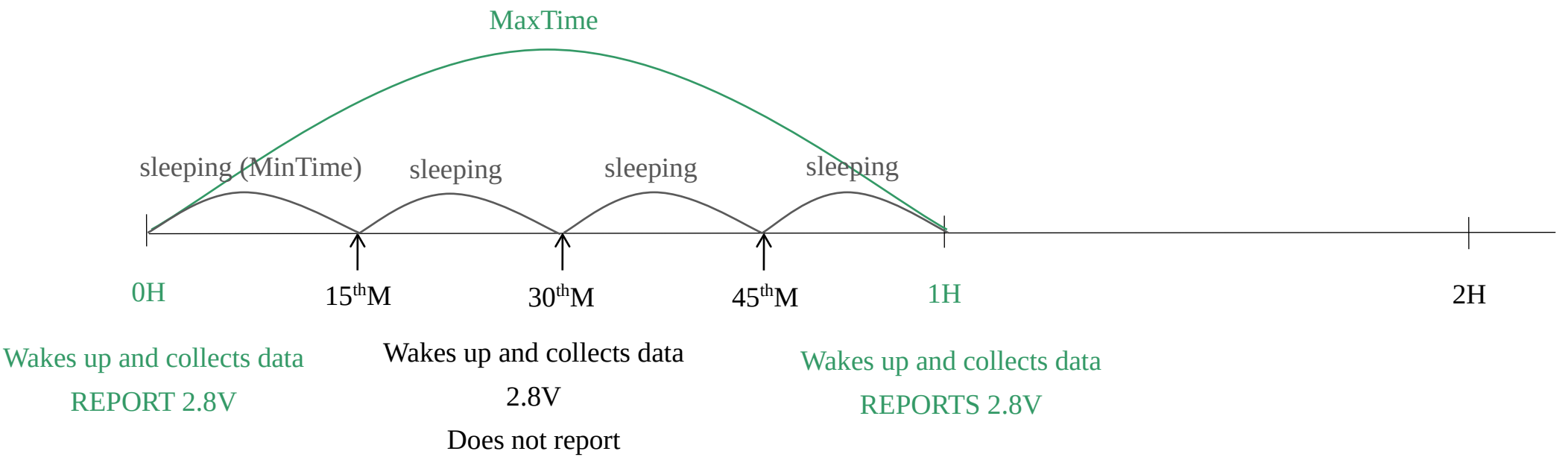
5.4 Example for MinTime/MaxTime logic

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

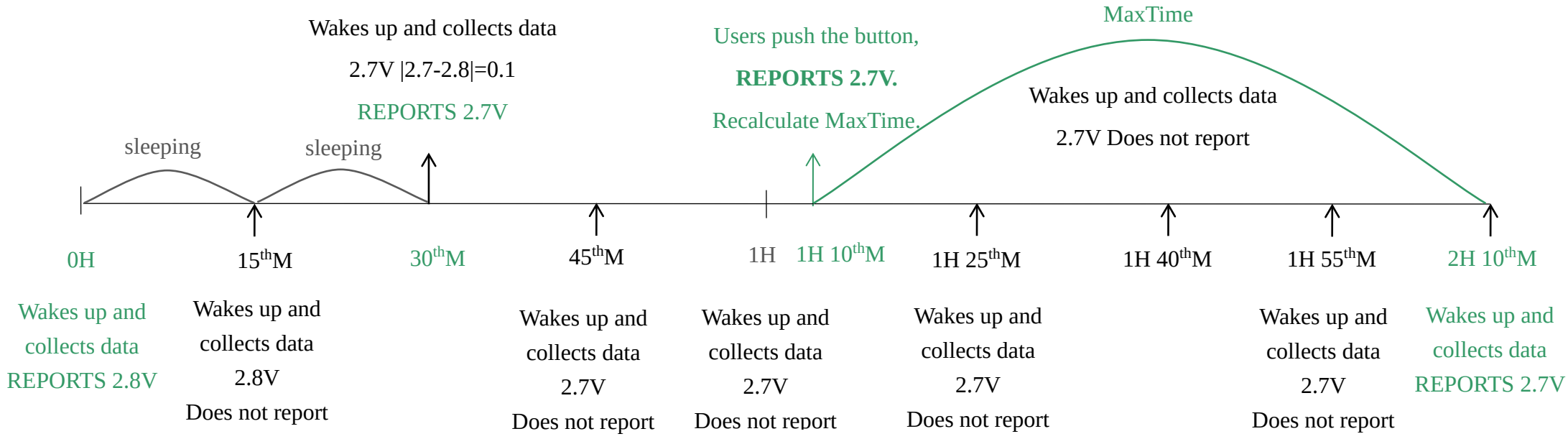


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

Example#2 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.



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



Notes:

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

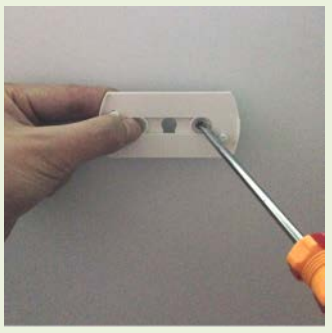
2) The data collected is compared with the last data reported. If the data change value is greater than the ReportableChange value, the device reports according to MinTime interval. If the data variation is not greater than the last data reported, the device reports according to MaxTime interval.

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

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

6. Installation

1. Tighten the screws and install the fixed chassis on the ceiling. The CO sensor should be 0.3 to 0.6m high from the floor.



Note: Please do not install the sensor around metallic enclosures and electric appliances or it may interfere sensor’s transmission signal.

2.1 Match the round hole of the sensor (fig 1.) with the fixed chassis (fig 2.).

2.2 Press and turn counterclockwise until the sensor is fixed.

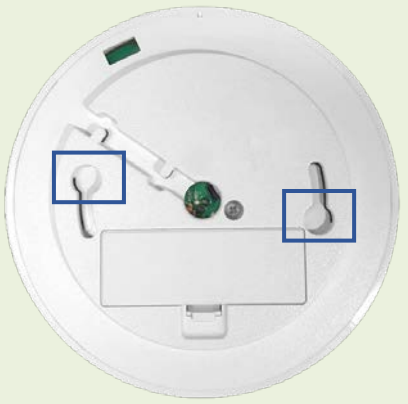


Fig 1. the back of RA02C

Fig 2. the fixed chassis

3. When the RA02C detects the CO concentration is over 1100ppm or the temperature is over 60℃, it reports alarm (bit =1).

When the CO concentration is lower than the threshold, it reports alarm (bit = 0) at MaxTime.

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 excessively 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 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 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.