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netvox R718UBB Series Wireless Multifunctional CO2 Sensor User Manual

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Introduction

R718UBB all-in-one series is a ClassA type testing device based on the LoRaWAN open protocol of Netvox, which can support multiple combinations of temperature and humidity, CO2, vibration, atmospheric pressure, and illumination sensors, and is compatible with LoRaWAN 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 devices, 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.

The specific model of R718UBB all-in-one is shown in the following table: UBB represents the basic function of battery power CO2

1. represents temperature and humidity,
2. represents vibration
3. represents air pressure
4. represents light

Device Model	Product functions
R718UBB	CO2
R718UBB1	CO2, temperature, and humidity
R718UBB12	CO2, temperature and humidity, vibration
R718UBB123	CO2, temperature and humidity, vibration, air pressure
R718UBB23	CO2, vibration, air pressure
R718UBB25	CO2, vibration, light
R718UBB125	CO2, temperature and humidity, vibration, light
R718UBB235	CO2, vibration, air pressure, light
R718UBB1235	CO2, temperature and humidity, vibration, air pressure, light

Appearance

Main Feature

- Apply SX1276 wireless communication module
- 2 sections ER14505 3.6V Lithium AA size batteries
- Detectable CO2 concentration
- The base is attached with a magnet, which can be adsorbed on iron objects
- Host Body Protection Level: IP65
- Compatible with LoRaWANTM Class A
- Frequency Hopping Spread Spectrum (FHSS) 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 long battery life.

Note

Battery life is determined by the sensor reporting frequency and other variables, please refer to **http://www.netvox.com.tw/electric/electric_calc.html**. On this website, users can find battery lifetime for varied models at different configurations.

Set up Instruction

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 (Restore to factory setting)	Press and hold the function key for 5 seconds till the green indicator flashes 20 times.
Power off	Remove Batteries.
Note:	1. Remove and insert the battery; the device is at off state by default. Turn on the device to use it again. 2. On/off interval is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. In the first 5 seconds after power on, the device will be in engineering test mode.
Network Joining	
Never joined the network	Turn on the device to search the network to join. The green indicator stays on for 5 seconds: success The green indicator remains off: fail
Had joined the network (not at the factory setting)	Turn on the device to search for the previous network to join. The green indicator stays on for 5 seconds: success The green indicator remains off: fail
Fail to Join The Network	Suggest checking the device verification information on the gateway or consulting your platform server provider.
Function Key	

Press and hold for 5 seconds	Restore to factory setting / Turn off
	The green indicator rapidly flashes 20 times: success The green indicator remains off: fail
Press once	The device is in the network: green indicator flashes once and sends a report
	The device is not in the network: the green indicator remains off
Sleeping Mode	
The device is on and in the network	Sleeping period: Max Interval.
	When the report change exceeds the setting value or the state changes: send a data report according to Max Interval.
Low Voltage Warning	
Low Voltage	3.2V(after reporting low voltage, the device may still work, but the CO2 data will be inaccurate.
	Please replace the battery in time)

Data Report

- When the device is powered on, it will immediately send a version package report and then report the device data.

Default setting

- Min interval = 10s (subject to factory setting)
- Max interval = 15min (subject to factory setting)
- R718UBB,R718UBB1,R718UBB12 reportcount=1
- R718UBB123,R718UBB23,R718UBB25,R718UBB125,R718UBB235,R718UBB1235 reportcount=2

Data detection

When the device is in a network state, the light flashes once after pressing the key and then reads the data. When the time to return the corresponding data or configure is up, it will also detect and return the corresponding data information. (Note: The interval between multiple data packets is meantime)

Note

1. Before any configuration, the device sends data according to the default configuration.
2. Do not send any configuration before turning on the device.

3. CO2 data will be unstable due to transportation relations, long storage time, and other factors.

- If the CO2 value which customers test is inconsistent, or there is a large discrepancy of the primary standard, it can be recalibrated. For specific calibration methods, please refer to command 0x03 CalibrateType.
- Refer to Netvox LoRaWan Application Command documents and for data analysis reported by the device **http://www.netvox.com.cn:8888/page/index** Instruction parsing

The report configuration and sending time are as follows

Min Interval (Unit: s)	Max Interval (Unit: s)
Not 0	Meantime * report count ~ 65535

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 device type is listed in the Netvox LoRaWAN Application Devicetype doc
- ReportType – 1 byte –the presentation of the NetvoxPayLoadData according to the device type
- NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

			Battery (1Byte, unit:0.1 V)	Temperature (Signed2Bytes,unit:0.01°C)	Humidity (2Bytes,unit:0.01 %)	CO2 (2Byte ,1ppm)	ShockEvent (1Byte) 0x00_NoShock 0x01_ Shock
R718UBB	0xBB	0x01					
		0x02	Battery (1Byte, unit:0.1V)	AirPressure (4Bytes,unit:0.01hPa)		Illuminance (3Bytes,unit:1Lux)	

R718UBB1235 report example

Report data 1: 01BB0124097A151F020C01

- 1st byte (01): Version

- 2nd byte (BB): DeviceType 0xBB   R718UBB Series
- 3rd byte (01): ReportType
- 4th byte (24): Battery 3.6v , 24(HEX)=36(DEC),36*0.1v=3.6v
- 5th 6th byte (097A): Temperature 24.6°C ,097A(HEX)=2426(DEC),2426*0.01°C =24.26°C
- 7th 8th byte (151F): Humidity 54.07% , 151F(HEX)=5407(DEC),5407*0.01%=54.07%
- 9th 10th byte (020C): CO2 524ppm , 020C(HEX)=524(DEC),524*1ppm=524ppm
- 11th byte (01): ShockEvent 1, Shock

Report data 2: 01BB02240001870F000032

- 1st byte (01): Version
- 2nd byte (BB): DeviceType 0xBB   R718UBB Series
- 3rd byte (02): ReportType
- 4th byte (24): Battery 3.6v , 24(HEX)=36(DEC),36*0.1v=3.6v
- 5th ~ 8th byte (0001870F): AirPressure 1001.11hPa,
  0001870F(HEX)=100111(DEC),100111*0.01hPa=1001.11hPa
- 9th ~11th byte (000032): Illuminance 50 Lux , 000032(HEX)=50(DEC),50*1Lux=50Lux

Note

Unsupported sensor detection item data is 0xFF/0xFFFF/0xFFFFFF/0xFFFFFFFF

Example of ConfigureCmd

- FPort 0x07

Bytes	1	1	Var (Fix =9 Bytes)
	Cmd ID	Device Type	Netvox Pay Load Data

- CmdID– 1 byte
- DeviceType– 1 byte – Device Type of Device
- NetvoxPayLoadData– var bytes (Max=9bytes)

Config Report Req	0x01	Min Time (2bytes Units:s)	Maxime (2bytes Units:s)	Reserved (2Bytes,Fixed 0x00)
Config Report Rsp	0x81	Status (0x00_suBBess)		Reserved (8Bytes,Fixed 0x00)
Read Config Report Req	0x02	Reserved (9Bytes,Fixed 0x00)		
Read Config Report Rsp	0x82	Min Time (2bytes Units:s)	Maxime (2bytes Units:s)	Reserved (2Bytes,Fixed0x00)

CalibrateCO2Req	R718UBB	0x03	0xBB	Calibrate Type (1Byte, 0x01_TargetCalibrate, 0x02_ZeroCalibrate, 0x03_BackgroudCalibrate, 0x04_ABCCalibrate)	Calibrate Point (2Bytes, Unit:1ppm) Only valid in target Calibrate Type	Reserved (6Bytes, Fixed 0x00)
Calibrate CO2 Rsp		0x83		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)	
Set Shock Sensor Sensitivity Req		0x04		Shock Sensor Sensitivity (1Byte)	Reserved (8Bytes,Fixed 0x00)	

			Status	Reserved
Set Shock Sensor Sensitivity Rsp		0x84	Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)
Get Shock Sensor Sensitivity Req		0x05	Reserved (9Bytes,Fixed 0x00)	
Get Shock Sensor Sensitivity Rsp		0x85	Shock Sensor Sensitivity (1Byte)	Reserved (8Bytes,Fixed 0x00)

1. Configure the device parameter MinTime = 300s, MaxTime = 900s
   - Downlink: 01BB012C03840000000000
   - Device return:
   - 81BB000000000000000000 (configuration successful)
   - 81BB010000000000000000 (configuration failed)
2. Read the device parameter
   - Downlink: 02BB000000000000000000
   - Device Return:
   - 82BB012C03840000000000 (device current parameter)
3. Set CO2 calibration

   Downlink:
   - 03BB0103E8000000000000 // Select Target-calibrations
   - (calibrate when the known CO2 concentration is 1000ppm (concentration optional))
   - 03BB020000000000000000 // Select Zero-calibrations
   - (Calibration in an environment with a CO2 concentration of 0 ppm)
   - 03BB030000000000000000 // Select Background calibrations
   - (calibration shall be carried out in a stable environment in the fresh air, i.e. 400 ppm concentration)
   - 03BB040000000000000000 // Select ABC calibrations
   - (self-calibration is the default when power on, and 8 days is a cycle of self-calibration. The sensor must be exposed to
   - fresh air at least once (well-ventilated) for calibration)

     Device return:
   - 83BB000000000000000000 (configuration successful)
   - // Successfully configured, (Target/Zero/Background/ABC-alignments)
   - 83BB010000000000000000 (configuration failed)
   - //After calibration, the returned CO2 value is not within the error range
4. SetShockSensorSensitivityReq:
   - The effective range of the configuration is 0x01~0x14, and the vibration function is turned off when it is set to 0xFF

- Downlink: 04BB0A0000000000000000 //Set ShockSensorSensitivity = 10 (Dec)
- Device return:
- 84BB000000000000000000 (device current parameter)

5. GetShockSensorSensitivityReq:
    - Downlink: 05BB000000000000000000
    - Device return:
    - 85BB0A0000000000000000 (device current parameter)

Example of calibration configuration

- FPort 0x0E

Description	CmdID	Sensor Type	Payload(Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	See below	Channel (1Byte) 0_Channel1 1_Channel2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	Delt Value (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
SetGlobal CalibrateRsp	0x81		Channel (1Byte) 0_Channel1 1_Channel2,etc	Status (1Byte,0x00_success)	Reserved (7Bytes,Fixed 0x00)		
GetGlobal CalibrateReq	0x02		Channel (1Byte) 0_Channel1 1_Channel2,etc	Reserved (8Bytes,Fixed 0x00)			
GetGlobal CalibrateRsp	0x82		Channel (1Byte) 0_Channel1 1_Channel2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
ClearGlobal CalibrateReq	0x03		Reserved (10Bytes,Fixed 0x00)				
ClearGlobal CalibrateRsp	0x83		Status (1Byte,0x00_success)	Reserved (9Bytes,Fixed 0x00)			

SensorType – byte

- The calibration sensor type corresponding to each sensor type:
- 0x01_Temperature Sensor, 0x02_Humidity Sensor, 0x03_Light Sensor, 0x06_CO2 Sensor, 0x35_Air PressSensor
- The calibration channel corresponding to each sensor type:
- CO2=0x00, temperature=0x01, humanity=0x02, light=0x03, air press=0x04

1. Assume that the reported original value of CO2 is 500ppm, the calibration increases by 100ppm, and the

reported value is 600ppm

- SetGlobalCalibrateReq: Calibration increased by 100ppm Multiplier =0x0001 Divisor = 0x0001 DeltValue = 0x0064
- Downlink: 0106000001000100640000
- Device return:810600000000000000000000 (configuration successful)
- 810600010000000000000000 (configuration failed)

2. GetGlobalCalibrateReq
   - Downlink:0206000000000000000000
   - Device return:820600000100010064000000

3. Assume that the reported original CO2 value is 500ppm, the calibration is reduced by 100ppm, and the reported value is 400ppm
   - SetGlobalCalibrateReq: Calibration reduction by 100ppm Multiplier =0x0001 Divisor = 0x0001 DeltValue = 0xFF9C
   - Downlink: 01060000010001FF9C0000
   - Device return:810600000000000000000000

4. GetGlobalCalibrateReq:
   - Downlink:0206000000000000000000
   - Device return:82060000010001FF9C0000

5. ClearGlobalCalibrateReq (Clear calibration value: reported value returns to 500ppm)
   - Downlink: 0300000000000000000000
   - Device return:8300000000000000000000

Information about Battery Passivation

- Many of 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 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 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.

ER14505 Battery Passivation

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.

How to activate the battery

- Connect a battery to a resistor in parallel
- Keep the connection for 5~8 minutes
- 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.

Precautions for Outdoor Installation

- According to Enclosure Protection Class
- This standard is equivalent to IEC 60529:2001 Degrees of Protection Provided by Enclosures
- The test method for IP65 waterproof grade is:

  spray the device in all directions under 12.5L/min water flow for 3min, and the internal electronic function is normal.
- The test method for IP67 waterproof grade is:

  the device is immersed in 1m deep water for 30min, and the internal electronic function is normal.
- IP65 is dust-proof and prevents damage caused by water from nozzles in all directions from invading electrical appliances. It can be used in general indoor environments and sheltered outdoor environments.
- It is not suitable for use in environments with high water pressure, high temperature, and high humidity, such as long-time direct sunlight outdoors and possible direct exposure to rainstorms. If it is really necessary to install in harsh environments, it is recommended to add sunscreen and rainproof shields when installing.

Case I (face down with LED and buttons)   Case II (installed under the rain shield)

Important Maintenance Instruction

Kindly pay attention to the following in order to achieve the best maintenance of the product:

- Keep the device dry. Rain, moisture, and various liquids or water may contain minerals that can corrode electronic circuits. In case the device is wet, please dry it completely.
- Do not use or store in dusty or dirty areas. This way can damage its detachable parts and electronic components.
- Do not store in an excessive heat place. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store in excessively cold places. 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. Treating devices roughly can destroy internal circuit boards and delicate structures.
- Do not wash with strong chemicals, detergents, or strong detergents.
- Do not paint the device. Smudges can make debris block detachable parts and affect normal operation.
- Do not throw the battery into the fire to prevent the battery from exploding. Damaged batteries may also explode.

All the above suggestions apply equally to your device, batteries, and accessories.
If any device is not operating properly, please take it to the nearest authorized service facility for repair.

Documents / Resources

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References

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