Wireless Soil Moisture / Temperature/ Electrical Conductivity Sensor

R718PB15
User Manual

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1. Introduction

R718PB15 is a Class A type device based on the LoRaWAN protocol.

R718PB15 is connected with soil sensor (RS485 type) as detectors for soil moisture, temperature, electrical conductivity, the values collected by the sensor are reported to the corresponding gateway.

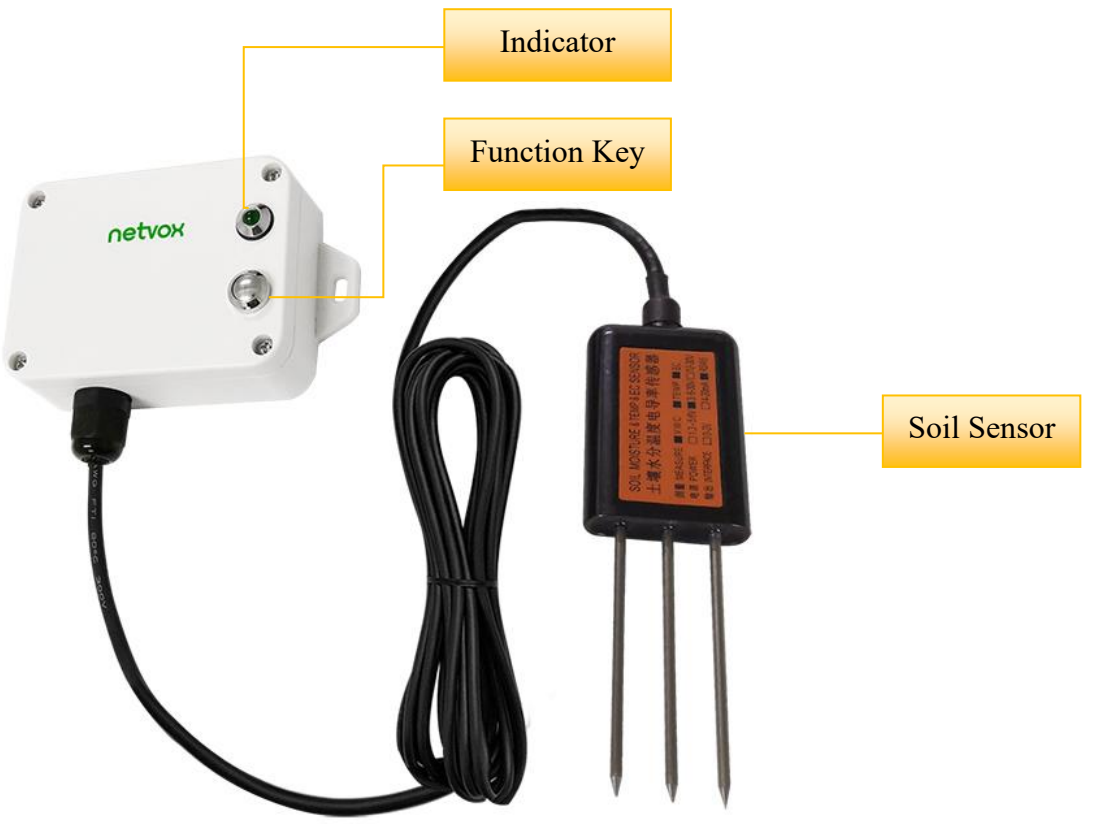
LoRa Wireless Technology:

LoRa is a wireless communication technology dedicated to long distance and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation method greatly increases to expand the communication distance. Widely used in long-distance, low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, industrial monitoring. Main features include small size, low power consumption, transmission distance, anti-interference ability and so on.

LoRaWAN:

LoRaWAN uses LoRa technology to define end-to-end standard specifications to ensure interoperability between devices and gateways from different manufacturers.

2. Appearance



3. Main Characteristics

- Using SX1276 wireless communication module
- 2 ER14505 batteries AA size (3.6V / cell) power supply in parallel
- IP Rating: Main body IP65 / IP67 (Optional), Sensor IP67
- Soil moisture detection
- Soil temperature detection
- Soil electrical conductivity detection
- Compatible with LoRaWAN™ Class A
- Using frequency hopping spread spectrum technology
- Configurable parameters via third-party software platform, reading data and setting alarms via SMS text and email (optional)
- Applicable to third-party platforms: Actility / ThingPark, TTN, MyDevices / Cayenne
- The product has low power consumption and supports longer battery life.

Note *:

The battery life is determined by the frequency and other variables reported by the sensor.

Please refer to http://www.netvox.com.tw/electric/electric_calc.html

On the website, users can find various models of battery life in different configurations

4. 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 green indicator flashes for 20 times.
Power off	Remove Batteries.
Note	1. Remove and insert the battery; the device is at off state by default. 2. On/off interval is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. At 1st -5th second 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 factory setting)	Turn on the device to search the previous network to join. The green indicator stays on for 5 seconds: success The green indicator remains off: fail

Function Key

Press and hold for 5 seconds	Restore to factory setting / Turn off The green indicator flashes for 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: green indicator remains off

Sleeping Mode

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

Low Voltage Warning

Low Voltage	3.2V

5. Data Report

The device will immediately send a version packet report along with an uplink packet including soil moisture, soil temperature and soil electrical conductivity values.

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

Default setting:

MaxTime: Max Interval = 60 min

MinTime: MinTime configuration is invalid

*But the software has restriction, MinTime must be configured a number greater than 0.

Soil electrical conductivity unit switching:

0x01 use 0.1 ds/m as unit (default)

0x02 use 0.001 ds/m as unit

Soil type:

0x00 Mineral soil (default)

0x01 Sandy soil

0x02 Clay

0x03 Organic soil

* The function of soil electrical conductivity unit/soil type is supported by the firmware version after 2022.04.20

* After the setting is successful (soil electrical conductivity unit/soil type), the device needs to be powered off and then powered on again before it can be used normally.

Note:

(1) The device report interval will be programmed based on the default firmware which may vary.

(2) Mintime and ReportChange are not supported by R718PB15 (Invalid configuration).

(3) Report cycle will be based on Report Max Time period when sending data packet.

(4) Data packet: soil moisture, soil temperature and soil electrical conductivity

(5) It would take about 20 seconds for the soil sensor to sample and process the collected value if you were to manually trigger the device by pressing the button, please be patient.

(6) Please refer Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver http://cmddoc.netvoxcloud.com/cmddoc to resolve uplink data.

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)

1. When soil EC unit is set to 0x01, EC unit is 0.1 ds/m (Report type = 0x0A).

The reported data are as follows: 01580A2420C30837FFFF24

Device	Device Type	Report Type	NetvoxPayLoadData				
R718PB15	0x58	0x0A	Battery (1Byte, unit:0.1V)	Soil_VWC (2Bytes,unit:0.01%)	Soil_Temperature (Signed 2Bytes,unit:0.01°C)	WaterLevel (2Bytes,unit:1cm)	Soil_EC (1Byte, unit:0.1dS/m)

1st byte (01): Version

*VWC: Volumetric Water Content

2nd byte (58): DeviceType 0x58 — R718PB15

3rd byte (0A): ReportType

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

5th 6th byte (20C3): Soil VWC, 20C3(HEX)=8387(DEC),8387*0.01%=83.87%

7th 8th byte (0837): Soil Temperature, 0837(HEX)=2103(DEC),2103*0.01℃=21.03℃

9th 10th byte (FFFF): Water Level

11th byte (24): Soil EC, 24(HEX)=36(DEC),36*0.1dS/m=3.6 dS/m

2. When soil EC unit is set to 0x02, EC unit is 0.001 ds/m (Report type = 0x10)

The reported data are as follows: 0158102420C308370E5F00

Device	Device Type	Report Type	NetvoxPayLoadData				
R718PB15	0x58	0x10	Battery (1Byte) unit:0.1V)	Soil_VWC (2Bytes) unit:0.01%	Soil_Temperature (Signed 2Bytes,unit:0.01°C)	Soil_EC (2Bytes) unit:0.001ds/m	Reserved (1Byte) fixed 0x00)

1st byte (01): Version

2nd byte (58): DeviceType 0x58 — R718PB15

3rd byte (10): ReportType

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

5th 6th byte (20C3): Soil VWC, 20C3(HEX)=8387(DEC),8387*0.01%=83.87%

7th 8th byte (0837): Soil Temperature, 0837(HEX)=2103(DEC),2103*0.01℃=21.03℃

9th 10th byte (0E5F): Soil EC, 0E5F(HEX)=3679(DEC),3679*0.001dS/m=3.679 dS/m

11th byte (00): Reserved

5.2 Example of ConfigureCmd

FPort：0x07

Bytes	1	1	Var (Fix =9 Bytes)
	CmdID	DeviceType	NetvoxPayLoadData

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

NetvoxPayLoadData– var bytes (Max=9bytes)

Description	Device	CmdID	DeviceType	NetvoxPayLoadData		
Config ReportReq	R718PB15	0x01	0x58	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	Reserved (5Bytes,Fixed 0x00)
Config ReportRsp		0x81		Status (1byte, 0x00_success)	Reserved (8Bytes,Fixed 0x00)	
ReadConfig ReportReq		0x02		Reserved (9Bytes,Fixed 0x00)		
ReadConfig ReportRsp		0x82		MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	Reserved (5Bytes,Fixed 0x00)

(1) Configure device parameters MaxTime = 1min

Downlink: 01580001003C0000000000

The device returns:

8158000000000000000000 (Configuration succeeded)

8158010000000000000000 (Configuration failed)

(2) Read device configuration parameters

Downlink: 0258000000000000000000

The device returns:

82580000003C0000000000 (device current configuration parameters)

Description	Device	Cmd ID	Device Type	NetvoxPayLoadData	
SetSoilTypeReq ForR718PB15	R718PB15	0x0D	0x58	SoilType(1byte) 0x00_Mineral Soil 0x01_SandySoil 0x02_Clay 0x03_Organic soil	Reserved (8Bytes,Fixed 0x00)
SetSoilTypeRsp ForR718PB15		0x8D		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)
GetSoilTypeReq ForR718PB15		0x0E		Reserved (9Bytes,Fixed 0x00)	
GetSoilTypeRsp For R718PB15		0x8E		SoilType(1byte) 0x00_Mineral Soil 0x01_SandySoil 0x02_Clay 0x03_Organic soil	Reserved (8Bytes,Fixed 0x00)

(3) SetSoilTypeReq: soil type = 0x02 (clay)

Downlink: 0D580200000000000000

The device return:

8D5800000000000000000 (Configuration succeeded)

8D5801000000000000000 (Configuration failed)

(4) GetSoilTypeReq:

Downlink: 0E5800000000000000000

The device returns:

8E5802000000000000000 (device current configuration parameters)

Note: After the setting is successful, the device needs to be powered off and then powered on again before it can be used normally.

Description	Device	Cmd ID	Device Type	NetvoxPayLoadData	
SetSoilECUnitReq ForR718PB15	R718PB15	0x0F	0x58	SoilECUnit(1byte) 0x01_Use 0.1ds/m as Unit 0x02_ Use 0.001ds/m as Unit	Reserved (8Bytes,Fixed 0x00)
SetSoilECUnitRsp ForR718PB15		0x8F		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)
GetSoilECUnitReq ForR718PB15		0x10		Reserved (9Bytes,Fixed 0x00)	
GetSoilECUnitRsp For R718PB15		0x90		SoilECUnit(1byte) 0x01_Use 0.1ds/m as Unit 0x02_ Use 0.001ds/m as Unit	Reserved (8Bytes,Fixed 0x00)

(5) SetSoilECUnitReq：UnitType = 0x02(0.001ds/m)

Downlink: 0F580200000000000000

The device returns:

8F5800000000000000000 (Configuration succeeded)

8F5801000000000000000 (Configuration failed)

(6) GetSoilECUnitReq:

Downlink: 1058000000000000000

The device returns:

905802000000000000000 (device current configuration parameters)

Note: The EC unit is restored after modification, and the last set value is maintained after leaving the factory.

5.3 Example of GlobalCalibrateCmd

FPort: 0x0E

Description	Cmd ID	Sensor Type	PayLoad(Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	See below	Channel(1Byte) 0_Channel 1, 1_Channel 2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	DeltValue (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_Channel 1, 1_Channel 2,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)				

Sensor Type:

0x17 EC sensor (Electric Conductivity)

0x20 Temperature_Soil_Sensor

0x21 Humid_Soil_Sensor (Soil_VWC)

(7) Calibrate The Sensor：EC 21.5 dS/m → 22 dS/m // + 0.5 dS/m

Downlink: 0117000001000100050000

Cmd ID (01) –SetGlobal CalibrateReq

Sensor type (17) – EC sensor

Channel (00) – Channel 1

Multiplier (0001) – not used in this case, fill in '0001'

Divisor (0001) – not used in this case, fill in '0001'

Delt Value (0005) – 5 *0.1 dS/m = 0.5 dS/m

(8) Calibrate The Sensor：Soil temperature 27.15°C → 26.87°C // -0.28°C

Downlink: 01200100010001FFE40000

Cmd ID (01) –SetGlobal CalibrateReq

Sensor type (20) – Temperature_Soil_Sensor

Channel (01) – Channel 2

Multiplier (0001) – not used in this case, fill in ‘0001’

Divisor (0001) – not used in this case, fill in ‘0001’

Delt Value (FFE4) – -28*0.01 °C= -0.28 °C　　// 0x10000-FFE4

(9) Calibrate The Sensor：Soil humidity sensor 49.98% → 48.39%　　// -1.59%

Downlink: 01210200010001FF610000

Cmd ID (01) –SetGlobal CalibrateReq

Sensor type (21) – Temperature_Soil_Sensor

Channel (02) – Channel 3

Multiplier (0001) – not used in this case, fill in ‘0001’

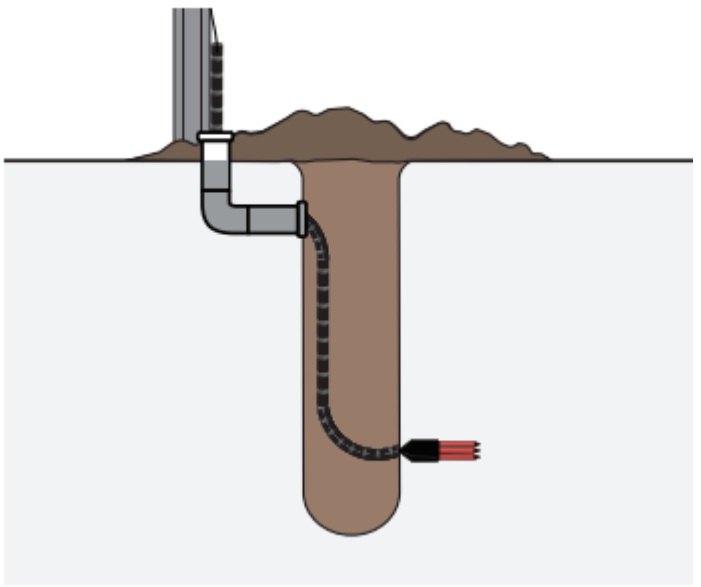
Divisor (0001) – not used in this case, fill in ‘0001’

Delt Value (FF61) – -159*0.01 %= -1.59 %　　// 0x10000-FF61

Note:

1. When Multiplier is not 1, Calibration value = DeltValue*Multiplier.
2. When Divisor is not 1, Calibration value = DeltValue/Divisor.
3. With different sensor type, it is forbidden to use that same Channel number.
4. This universal calibration supports calibration of positive and negative numbers.

6. Installation



Method1. Horizontal Installation

1. Excavate a hole or trench a few centimeters deeper than the depth at which the sensor is to be installed.
2. At the installation depth, shave off some soil from the vertical soil face exposing undisturbed soil.
3. Insert the sensor into the undisturbed soil face until the entire sensor is inserted. The tip of each prong has been sharpened to make it easier to push the sensor into the soil.

   Be careful with the sharp tips!
4. Backfill the trench taking care to pack the soil back to natural bulk density around the sensor body of the soil sensor.

Method2. Vertical Installation

1. Auger a 3-in hole to the depth at which the sensor is to be installed.
2. Insert the sensor into the undisturbed soil at the bottom of the auger hole using a hand or any other implement that will guide the sensor into the soil at the bottom of the hole. Many people have used a simple piece of PVC pipe with a notch cut in the end for the sensor to sit in, with the sensor cable routed inside the pipe.
3. After inserting the sensor, remove the installation device and backfill the hole taking care to pack the soil back to natural bulk density while not damaging the black overmolding of the sensor and the sensor cable in the process.

Cleaning And Maintenance

The EC measurement is very sensitive to the presence of nonconducting contamination on the screws, especially at high EC. The most common source of contamination is skin oil from handling the screws with bare hands

Use the following steps to clean the sensor:

1. Clean the screws using a mild detergent such as liquid dish soap and a nonabrasive sponge or cloth.

   Note: Avoid detergents that contain lotions or moisturizers.
2. Rinse the sensor and screws thoroughly with tap or DI water.

   Do not touch the screws without gloved hands and never contact the sensors with any source of oil or other nonconducting residue.

7. 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 reaction between lithium and thionyl chloride, but battery passivation may also lead to voltage delay when the batteries are put into operation, and our devices may not work correctly in this situation.

As a result, please make sure to source batteries from reliable vendors, and it is suggested that if the storage period is more than one month from the date of battery production, all the batteries should be activated.

If encountering the situation of battery passivation, users can activate the battery to eliminate the battery hysteresis.

ER14505 Battery Passivation:

7.1 To determine whether a battery requires activation

Connect a new ER14505 battery to a resistor in parallel, and check the voltage of the circuit.

If the voltage is below 3.3V, it means the battery requires activation.

7.2 How to activate the battery

a. Connect a battery to a resistor in parallel

b. Keep the connection for 5~8 minutes

c. The voltage of the circuit should be ≧3.3, indicating successful activation.

Brand	Load Resistance	Activation Time	Activation Current
NHTONE	165 Ω	5 minutes	20mA
RAMWAY	67 Ω	8 minutes	50mA
EVE	67 Ω	8 minutes	50mA
SAFT	67 Ω	8 minutes	50mA

Note:

If you buy batteries from other than the above four manufacturers, then the battery activation time, activation current, and required load resistance shall be mainly subject to the announcement of each manufacturer.

8. Important Maintenance Instruction

Your device is a product of superior design and craftsmanship and should be used with care. The following suggestions will help you use the warranty service effectively.

- Keep the device dry. Rain, moisture, and various liquids or moisture 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 can damage its detachable parts and electronic components.
- Do not store in excessive heat. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store in a cold place. 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 wash with strong chemicals, detergents or strong detergents.
- Do not apply with paint. Smudges can block debris in detachable parts and affect normal operation.
- Do not throw the battery into a fire to prevent the battery from exploding. Damaged batteries may also explode.

All of the above suggestions apply equally to your device, battery and accessories.

If any device is not working properly, please take it to the nearest authorized service facility for repair.