Wireless Top Mounted Ultrasonic Liquid Level Sensor
R718PE

User Manual

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1. Introduction

R718PE is a ClassA device based on LoRaWAN open protocol of Netvox. R718PE is a wireless communication device that can detect water level and parking space. The device is connected to an ultrasonic sensor to detect its current water level or the status of parking space, and the detected data will be transmitted to other devices through the wireless network for display. It adopts SX1276 wireless communication module and is compatible with LoRaWAN protocol.

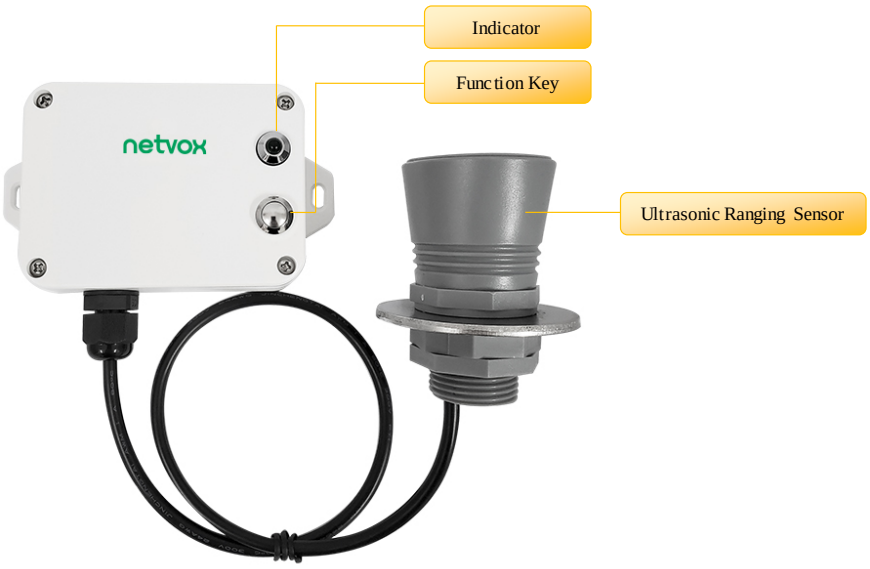
LoRa Wireless Technology:

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 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 Feature

- Apply SX1276 wireless communication module
- 2 sections ER14505 3.6V Lithium AA SIZE batteries
- Liquid level detection
- Host Body Protection Level: IP65 / IP67 (optional), Ultrasonic Probe Protection Level: IP67
- Compatible with LoRaWAN™ Class A
- Frequency hopping spread spectrum 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 platform: 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 life time for varied models at 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 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 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 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
Fail to Join The Network	Suggest to check the device verification information on the gateway or consult your platform server provider.

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

After power on, the device will immediately send a version packet report and an attribute packet report. The device sends data according to the default configuration before any other configuring.

Default Setting

Maximum time: Max Interval = 15 min

Minimum time: Min Interval = 15 min

BatteryVoltageChange - 0x01 (0.1V)

DistanceChange - 0x012C(300mm)

Note:

1. The cycle of the device sending the data report is according to the default.
2. The interval between two reports must be the MinTime
3. R718PE defaults Max Interval = 15 min, Min Interval = 15 min.
   (If there are special customized shipments, the setting will be changed according to customer's requirements.)

Please refer Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver http://www.netvox.com.cn:8888/page/index to resolve uplink data.

Example of ConfigureCmd

FPort：0x07

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

CmdID– 1 bytes

DeviceType– 1 byte – Device Type of Device

NetvoxPayLoadData– var bytes (Max=9bytes)

Description	**Device**	**Cmd ID**	**Device Type**	**NetvoxPayLoadData**				
ConfigReport Req	R718 PE	0x01	0x B1	MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	BatteryChange (1byte Unit:0.1v)	DistanceChange (2byte Unit:1mm)	Reserved (2byte)
ConfigReport Rsp		0x81		Status (0x00_success)		Reserved (8Bytes, Fixed 0x00)		
ReadConfig ReportReq		0x02		Reserved (9Bytes, Fixed 0x00)				
ReadConfig ReportRsp		0x82		MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	BatteryChange (1byte Unit: 0.1v)	DistanceChange (2byte Unit: 1mm)	Reserved (2byte)
SetOnDistance ThresholdRreq		0x03		OnDistanceThreshold (2byte Unit: 1mm)		Reserved (7Bytes, Fixed 0x00)		
SetOnDistance ThresholdRrsp		0x83		Status (0x00_success)		Reserved (8Bytes, Fixed 0x00)		
GetOnDistanc e ThresholdRreq		0x04		Reserved (9Bytes, Fixed 0x00)				
GetOnDistanc e ThresholdRrsp		0x84		OnDistanceThreshold (2byte Unit: 1mm)		Reserved (7Bytes, Fixed 0x00)		
SetFillMax DistanceReq		0x05		FillMaxDistance (2byte Unit: 1mm)		Reserved (7Bytes, Fixed 0x00)		
SetFillMax DistanceRsp		0x85		Status (0x00_success)		Reserved (8Bytes, Fixed 0x00)		
GetFillMax DistanceReq		0x06		Reserved (9Bytes, Fixed 0x00)				
GetFillMax DistanceRsp		0x86		FillMaxDistance (2byte Unit: 1mm)		Reserved (7Bytes, Fixed 0x00)		

(1) Configure the device parameter MinTime = 1min, MaxTime = 1min, BatteryChange = 0.1v, DistanceChange = 500mm

Downlink: 01B1003C003C0101F40000

Device Return:

81B1000000000000000000 (configuration success)

81B1010000000000000000 (configuration failure)

(2) Read the device parameter

Downlink: 02B1000000000000000000

Device Return:

82B1003C003C0101F40000 (device current parameter)

(3) Configure the device parameter FillMaxDistance = 5000mm

Downlink: 05B1138800000000000000

Device Return:

85B1000000000000000000 (configuration success)

85B1010000000000000000 (configuration failure)

(4) Read device parameter FillMaxDistance

Downlink: 06B1000000000000000000

Device returns:

86B1138800000000000000 (device current parameter)

Level Sensor Calibrate configuration example:

FPort:0x0E

Description	Cmd ID	Sensor Type	PayLoad(Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	0x36	Channel (1Byte) 0_Channel1, 1_Channel2,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_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)			

(1) Set the calibration (GlobalCalibrate configuration):

If the distance between the device and the water R718PE detects is 490mm and the actual distance is 500mm, it means the calibration should be +10mm.

Channel 1= 00, Multiplier = 000A, Divisor = 0000, DeltValue=0001

Downlink：013600000A000000010000

Response: 8136000000000000000000 (Configuration success)

8136010000000000000000 (Configuration failure)

(2) Check whether the setting in (1) calibration

Downlink：0236000000000000000000

Response：823600000A000000010000 (Current configuration)

(3) Clear the setting

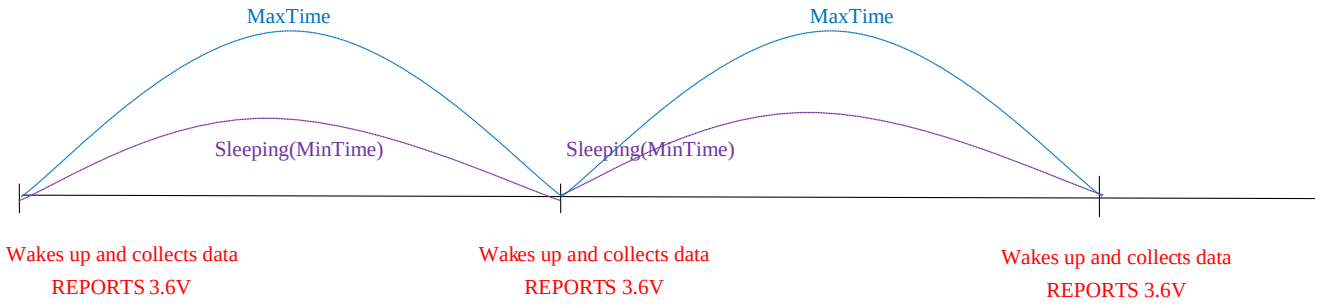
Downlink：0300000000000000000000

Response：8300000000000000000000 (Configuration success)

8301000000000000000000 (Configuration failure)

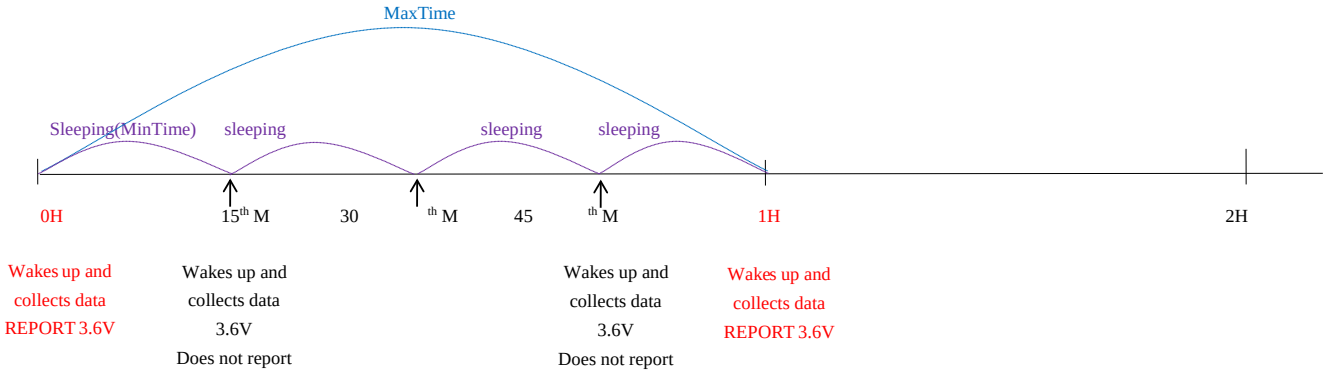
Example for MinTime/MaxTime logic:

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

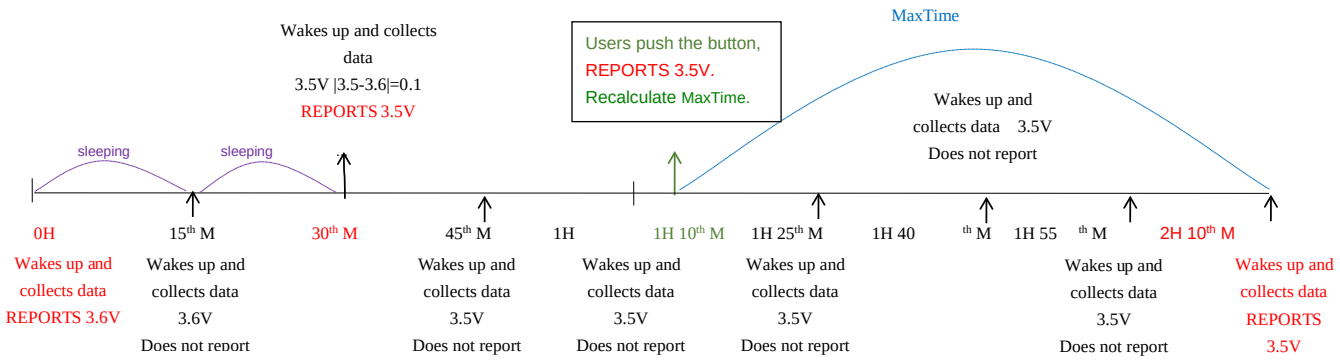


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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 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.
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. Application

In the case of detecting the water level of a water tower/tank, install the device on the top of the water tower/tank and power on the device after the fixation is completed. The device collects the distance between the water level and the sensor and the percentage of the water level in the water tower/tank once in a while.

H: the height of the water tank

(this value can be set with the payload command; the “fillmaxdistance” in payload means H)

D: the distance between the device and the water (this value is “distance” in uplinks)

L: the water level

(this value can be calculated by the “distance” in uplink and “fillmaxdistance” in payload)

Calculation: L = fillmaxdistacnce - distance

FillLevel: the percentage of the water level in the water tank.

FillLevel = ((H - D) / H) * 100%

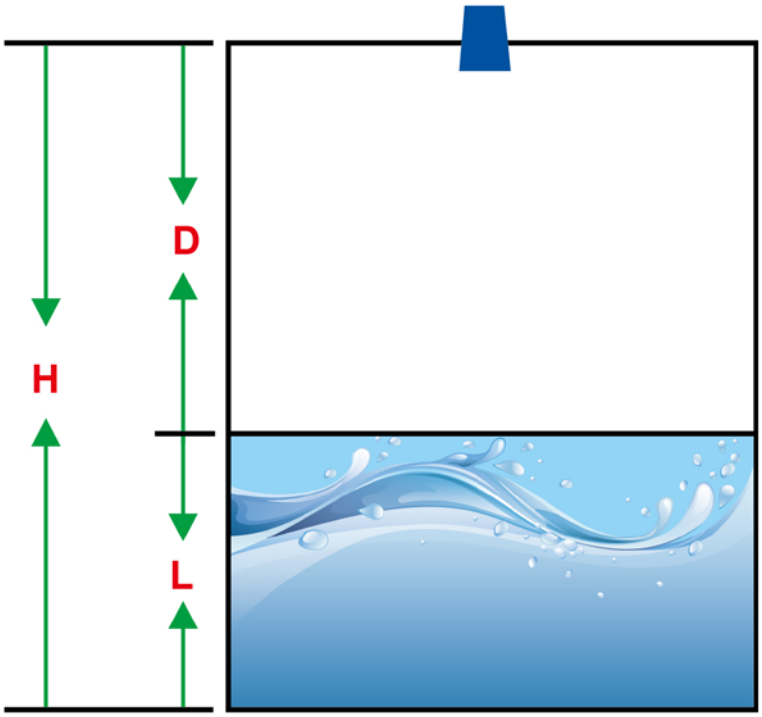
Note:

(1) The detecting range of the device is **250mm~8000mm**

(2) When the device is used as water level detection or trash can detection, the detected distance (Distance) and the percentage of water level or garbage (FillLevel) are reported. Otherwise, the parking status (Status) is not reported (in this case, Status is 0 by default).

(3) When the device is used as parking space detection, it will report the detected distance (Distance) and the parking status (Status) (with car report “on”, without car report “off”), but FillLevel is not reported. (At this time, FillLevel defaults 0.)

Illustration



7. Installation

Kindly note the illustration is only for reference.

1. The device can be installed in the middle or anywhere of the top of the container that is flat enough to ensure the ultrasonic detection direction will be vertical to the detected object, so the accuracy can be maintained.

2. When the use case is water tank, the diameter of the water tank is recommended to be larger than 60cm.

3. Customers can refer to the below formula to see if the container is suitable:

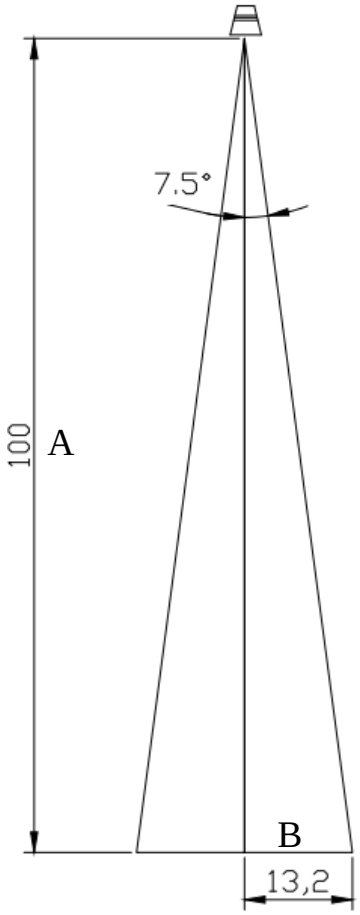
   tan7.5°=A / B

   A is the radius of the container (water tank),

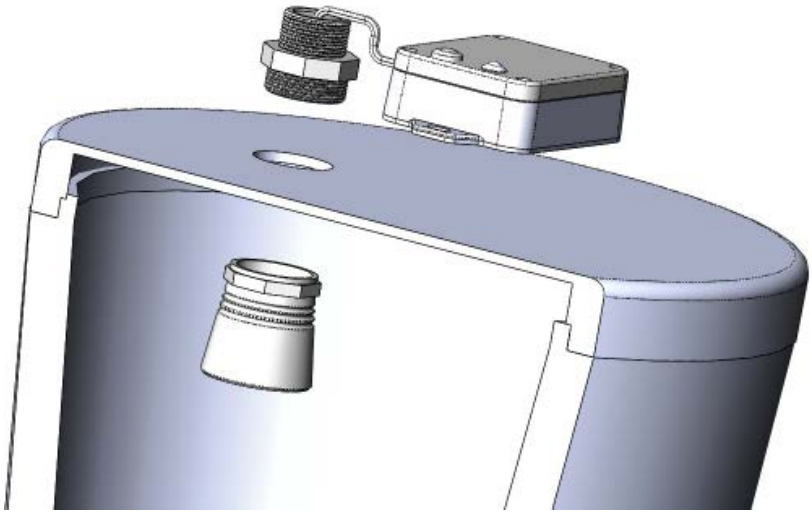
   B is the height of the container (water tank);

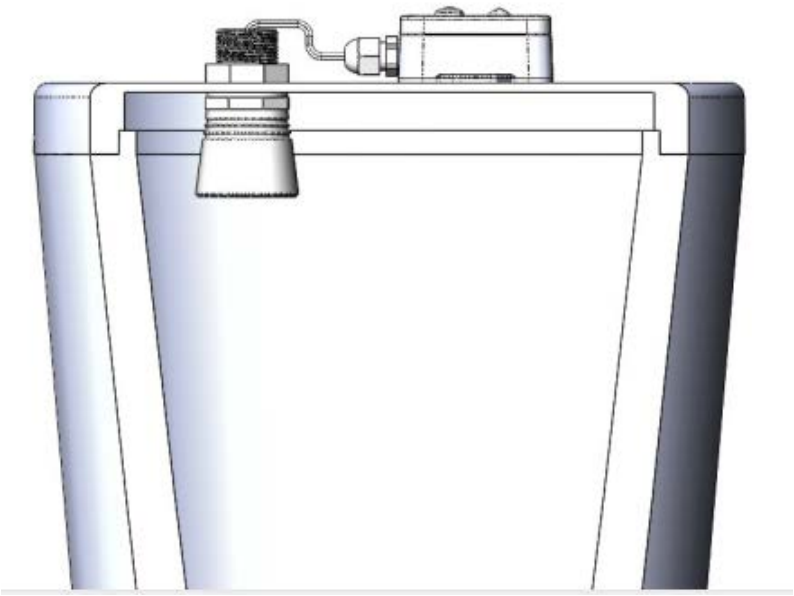
tan7.5°	A	B
0.1316	3.9	30
	6.6	50
	13.2	100
	19.7	150
	26.3	200
	32.9	250
	39.5	300
	46.1	350
	52.6	400
	59.2	450
	65.8	500
	72.4	550
	79.0	600
	85.5	650
	92.1	700
	98.7	750
	105.3	800

Reference Form Unit: cm

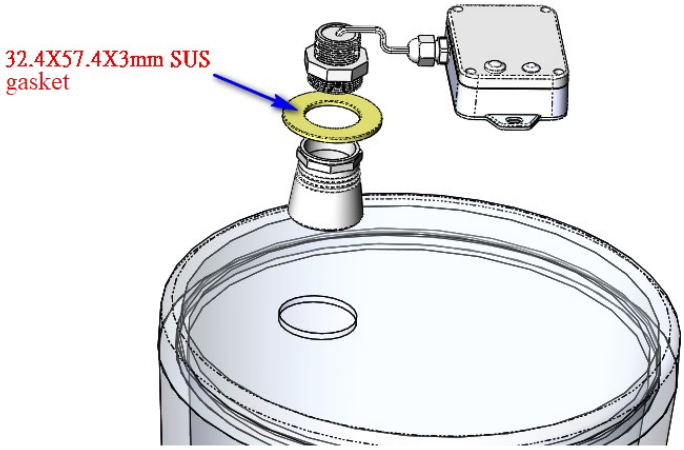


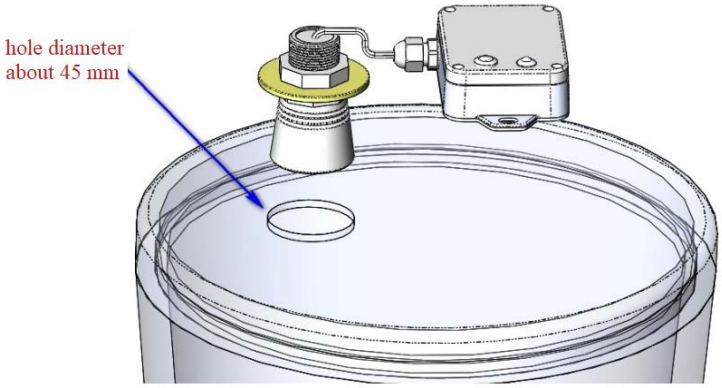
4. If the top of the water tank can be opened, it is recommended to make a hole of diameter 32mm on the top of the water tank.

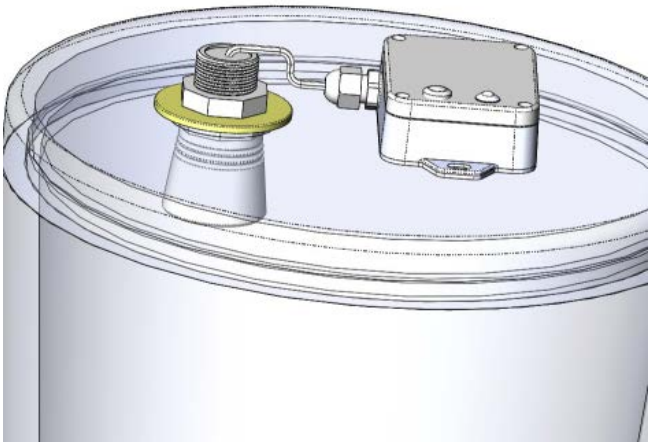




5. If the top of the water tank cannot be opened, the hole made on the top of the water tank is recommended to be 45mm diameter. It is recommended to add a gasket (size: 32.4*57.4*3mm) between the hole and the sensor.







6. The place directly below the ultrasonic probe should avoid to be put in some position to reduce the impact on measurement accuracy. For example, the position that the liquid level is violently fluctuating such as the water inlet and outlet, and the position that foam floats are easy to accumulate.
7. There should be no obstacles within the radiation range of the ultrasonic beam to avoid affecting the measurement. For example, when installing in a well, it should avoid escalators, water inlet and outlet pipes and other facilities in the well.
8. The installation site should be far away from the equipment that produces strong electromagnetic interference.
9. Please do not disassemble the device unless it is required to replace the batteries.

   Do not touch the waterproof gasket, LED indicator light, function keys when replacing the batteries.

   Please use suitable screwdriver to tighten the screws (if using an electric screwdriver, it is recommended to set the torque as 4kgf) to ensure the device is impermeable.

8. 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 the batteries should be produced within the last three months.

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

8.1 To determine whether a battery requires activation

Connect a new ER14505 battery to a 68ohm resistor in parallel, and check the voltage of the circuit. If the voltage is below 3.3V, it means the battery requires activation.

8.2 How to activate the battery

a. Connect a battery to a 68ohm resistor in parallel

b. Keep the connection for 6~8 minutes

c. The voltage of the circuit should be ≧3.3V

9. Important Maintenance Instruction

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

- Keep the equipment 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 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 excessive 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. Treating equipment 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 up 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 repairing.