

Wireless Capacitive Proximity Sensor

R718VA

User Manual

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1. Introduction

R718VA is a device to detect the level of toilet water and liquid hand soap. This device is connected with a non-contact capacitive sensor can be mounted to the exterior of the container. Without direct contact, the sensor can detect presence and absence of water or liquid hand soap within the measurement range. The collected data could be transmitted to and displayed by other devices through the wireless network.

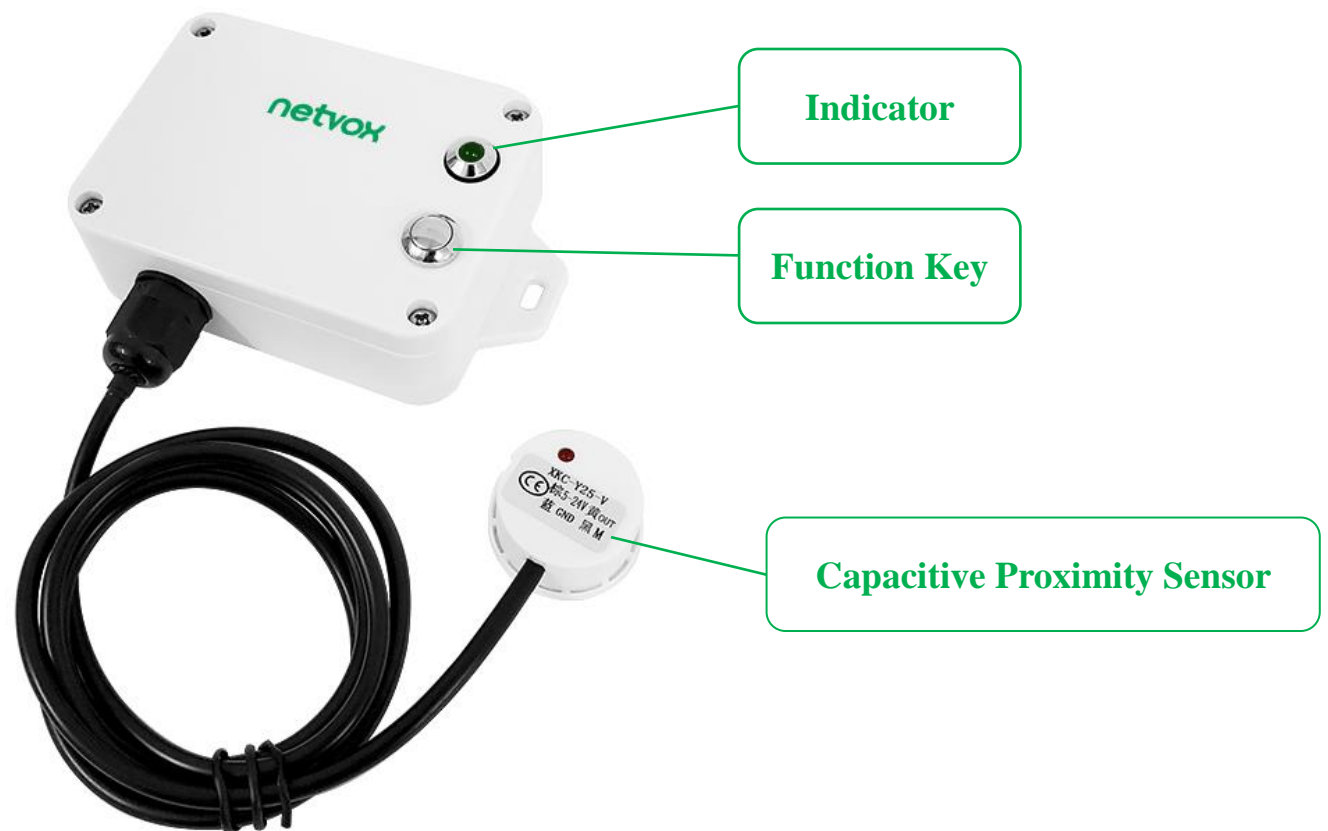
LoRa Wireless Technology:

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. Features

- Non-contact capacitive sensor
- 2 ER14505 battery AA size (3.6V / section) in parallel
- Main body: IP65/IP67 (optional); sensor probe: IP67
- SX1276 wireless communication module
- Magnetic base
- LoRaWAN™ Class A compatible
- Frequency hopping spread spectrum technology
- Configure parameters and read data via third-party software platforms; set alarms via SMS and email (optional)
- Applicable to 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 various types of battery lifetime in different configurations.

4. Set up Instruction

On/Off

Power on	Insert batteries. (User may need a screwdriver to open battery cover.)
Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off (factory resetting)	Press and hold the function key for 5 seconds until the green indicator flashes for 20 times.
Power off	Remove Batteries
Note	<ol style="list-style-type: none"> 1. Remove and insert the batteries; the device is at off state by default. Please 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. At 1st to 5th second after power on, the device will be in engineering test mode.

Network Joining

Never joined the network	<p>Turn on the device to search the network to join.</p> <p>The green indicator stays on for 5 seconds: Success</p> <p>The green indicator remains off: Fail</p>
Had joined the network (Not yet restore to factory setting)	<p>Turn on the device to search the previous network to join.</p> <p>The green indicator stays on for 5 seconds: Success</p> <p>The green indicator remains off: Fail</p>
Fail to join the network (when the device is on)	Suggest to check the device verification information on the gateway or consult your platform server provider

Function Key

Press and hold for 5 seconds	<p>Restore to factory setting / Turn off</p> <p>The green indicator flashes for 20 times: Success</p> <p>The green indicator remains off: Fail</p>
Press once	<p>The device is in the network: the green indicator flashes once and sends a report</p> <p>The device is not in the network: the green indicator remains off</p>

Sleeping Mode

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

Low Voltage	3.2V
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6. Data Report

The device will immediately send a version packet report along with an uplink packet including liquid level status, battery voltage.

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

Default Setting:

Maximum time: 0x384 (15min)

Minimum time: 0x384 (15min) (detect voltage and liquid level every Min Interval)

BatteryVoltageChange: 0x01 (0.1V)

R718VA detection status:

As the device detects liquid, the device would send a report of current status and battery voltage.

The threshold could be modified through sensitivity adjustment as the distance between liquid and sensor reaches the threshold.

When the device detects liquid level, status = 1; when the device does not detect liquid level, status = 0

Under two conditions, the device will report the status of the detected liquid and the battery voltage at MinTime interval:

- When the liquid level changes from where the device can detect to where the device cannot detect. (1→0)
- When the liquid level changes from where the device cannot detect to where the device can detect. (0→1)

If none of the above conditions is met, the device will report at the MaxTime interval.

Please refer Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver

<http://cmddoc.netvoxcloud.com/cmddoc> to resolve uplink data.

Note: The device sends data cycle depends on real programming configuration according to the customer's inquiry.

The interval between two reports must be the minimum time.

6.1 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– Var (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=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 019F000A02202108130000, the firmware version is 2021.08.13.

2. Data Packet:

When Report Type=0x01 is data packet.

Device	DeviceType	ReportType	NetvoxPayLoadData			
R718VA	0x9F	0x00	SoftwareVersion (1 Byte) Eg.0x0A-V1.0	HardwareVersion (1 Byte)	DateCode (4 Byte) eg 0x20170503	Reserved (2 Byte)
		0x01	Battery (1Byte, unit:0.1V)	Status (1Byte 0:off 1:on)	Reserved (6Bytes, fixed 0x00)	

Example of Uplink: 019F01240000000000000000

1st byte (01): Version

2nd byte (9F): DeviceType 0x9F – R718VA

3rd byte (01): ReportType

4th byte (24): Battery – 3.6v 24 Hex=36 Dec 36*0.1v=3.6v

5th byte (00): Status

6th-11th byte (000000000000): Reserved

6.2 Example for Report Configuration

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	Device Type	NetvoxPayloadData			
ConfigReportReq	R718VA	0x01	0x9F	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 (2bytes Unit:s)	MaxTime (2bytes Unit:s)	BatteryChange (1byte Unit:0.1v)	Reserved (4Bytes, Fixed 0x00)

(1) Configure the device report parameters MinTime = 1min (003C), MaxTime = 1min (003C), BatteryChange = 0.1v (0x01)

Downlink: 019F003C003C0100000000

The device returns:

819F00000000000000000000 (configuration succeeded)

819F01000000000000000000 (configuration failed)

(2) Read the device configuration parameters

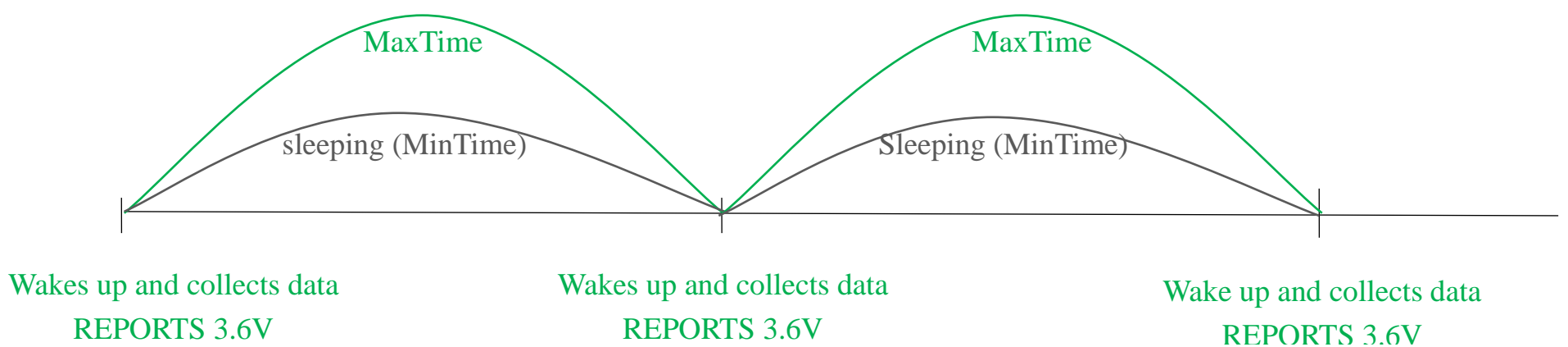
Downlink: 029F00000000000000000000

The device returns:

829F003C003C0100000000 (current configuration parameters)

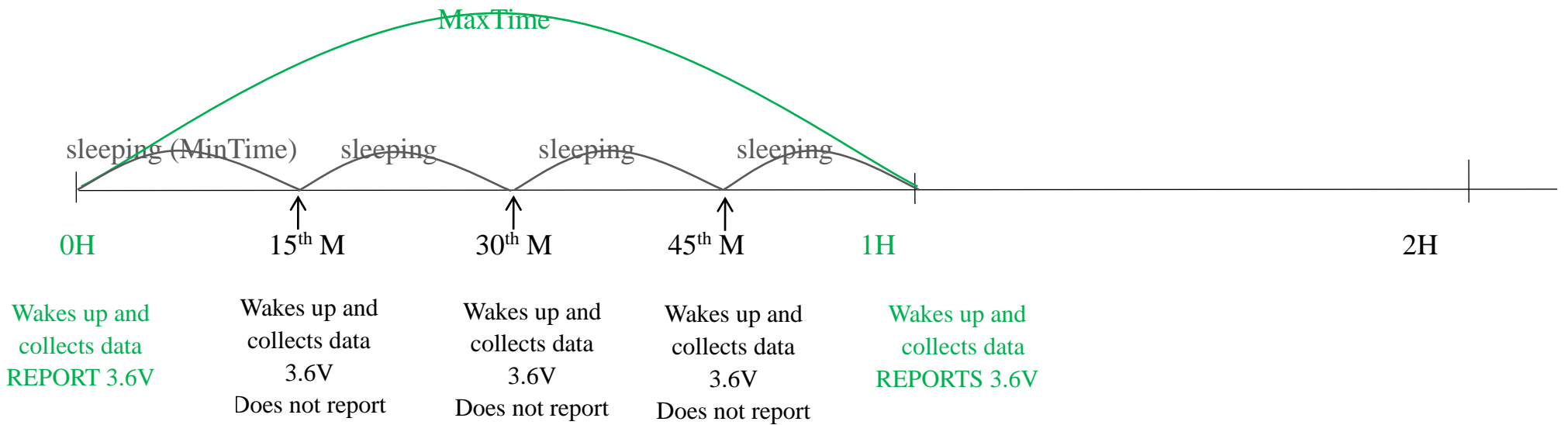
6.3 Example for MinTime/MaxTime logic

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

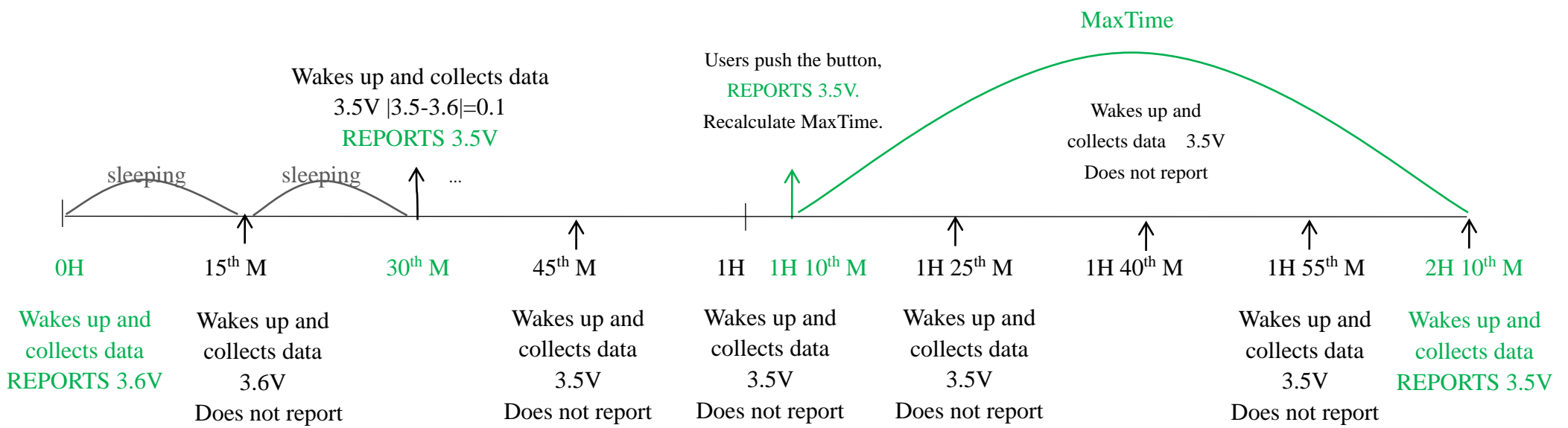


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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.



Note:

- 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.

7. Application

When the device is used to detect the water level of the toilet tank, please install the device at a desired level of the toilet tank.

Turn on the device after it is fixed to the toilet tank and powered. The device will detect the status regularly at the MinTime interval.

There are two conditions in which the device will report the status of the detected liquid and the battery voltage at MinTime interval:

- a. When the liquid level changes from where the device can detect to where the device cannot detect
- b. When the liquid level changes from where the device cannot detect to where the device can detect

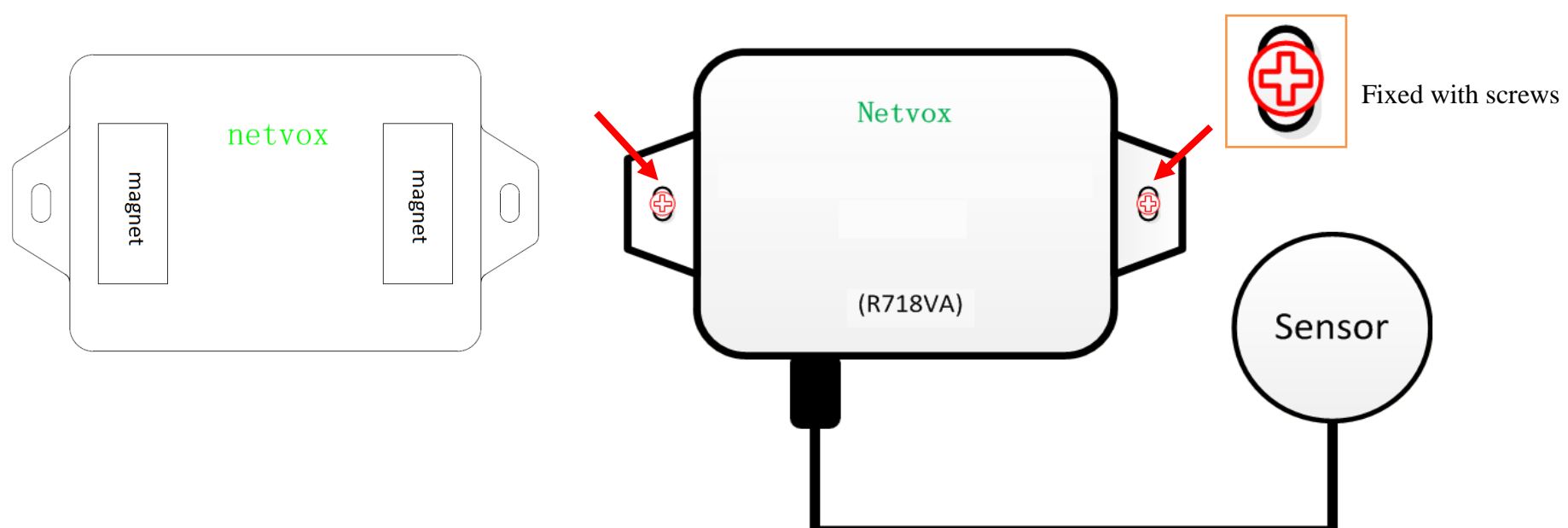
If none of the above conditions is met, the device will report at the MaxTime interval.

8. Installation

Wireless Capacitive Proximity Sensor (R718VA) has two magnets on the back. When using it, the back can attach to a ferromagnetic material, or the two ends can be fixed to the wall with screws (that purchased by users).

Note:

Do not install the device in a metal shielded box or around electrical equipment or it may affect the wireless transmission of the device.



8.1 Measurement and liquid viscosity

8.1.1 What is dynamic viscosity?

Dynamic viscosity is the tangential force per unit area required to move one horizontal plane with respect to another plane - at an unit velocity - when maintaining an unit distance apart in the fluid.

8.1.2 Dynamic viscosity

A. $< 10\text{mPa}\cdot\text{s}$ (the liquid can be measured)

B. $10\text{mPa}\cdot\text{s} < \text{Dynamic viscosity} < 30\text{mPa}\cdot\text{s}$ (the results may be affected)

C. $> 30\text{mPa}\cdot\text{s}$ (cannot be measured due to a large amount of liquid attached to the container wall)

Note: The viscosity decreases as the temperature rises.

Liquid with high viscosity is easily affected by temperature. To get accurate result, please mind the liquid temperature while measuring.

8.1.3 Common substances

Substance	Viscosity (mPa·s)	Temperature (°C)
Benzene	0.604	25
Water	1.0016	20
Mercury	1.526	25
Whole milk	2.12	20
Olive oil	56.2	26

Reference source: <https://en.wikipedia.org/wiki/Viscosity>

8.2 Containers and installation instruction

1. Fix the probe by glue and tapes or held by tiny shelf on the outside of the container.
2. Avoid metal materials around the probe to get accurate result.
3. The place where the probe is installed should avoid the liquid and the flow path of the liquid.
4. There should be no silt or other debris inside the container where the lower probe is directly facing, so as not to affect the detection.

8.2.1 Insulation Materials

Containers made of non-metallic materials with flat surface, uniform thickness, tight material and good insulation performance; such as glass, plastic, non-absorbent ceramic, acrylic, rubber and other materials or their composite materials.

Cautions:

1. If the wall of the container where the measuring probe is installed is a multi-layer material, the layers should be in close contact without bubbles or gas inter-layers. The inside and outside surfaces of the container should be flat.
2. The thickness of container: 0 to 20mm
3. Tank type: spherical tank, horizontal tank, vertical tank, etc.

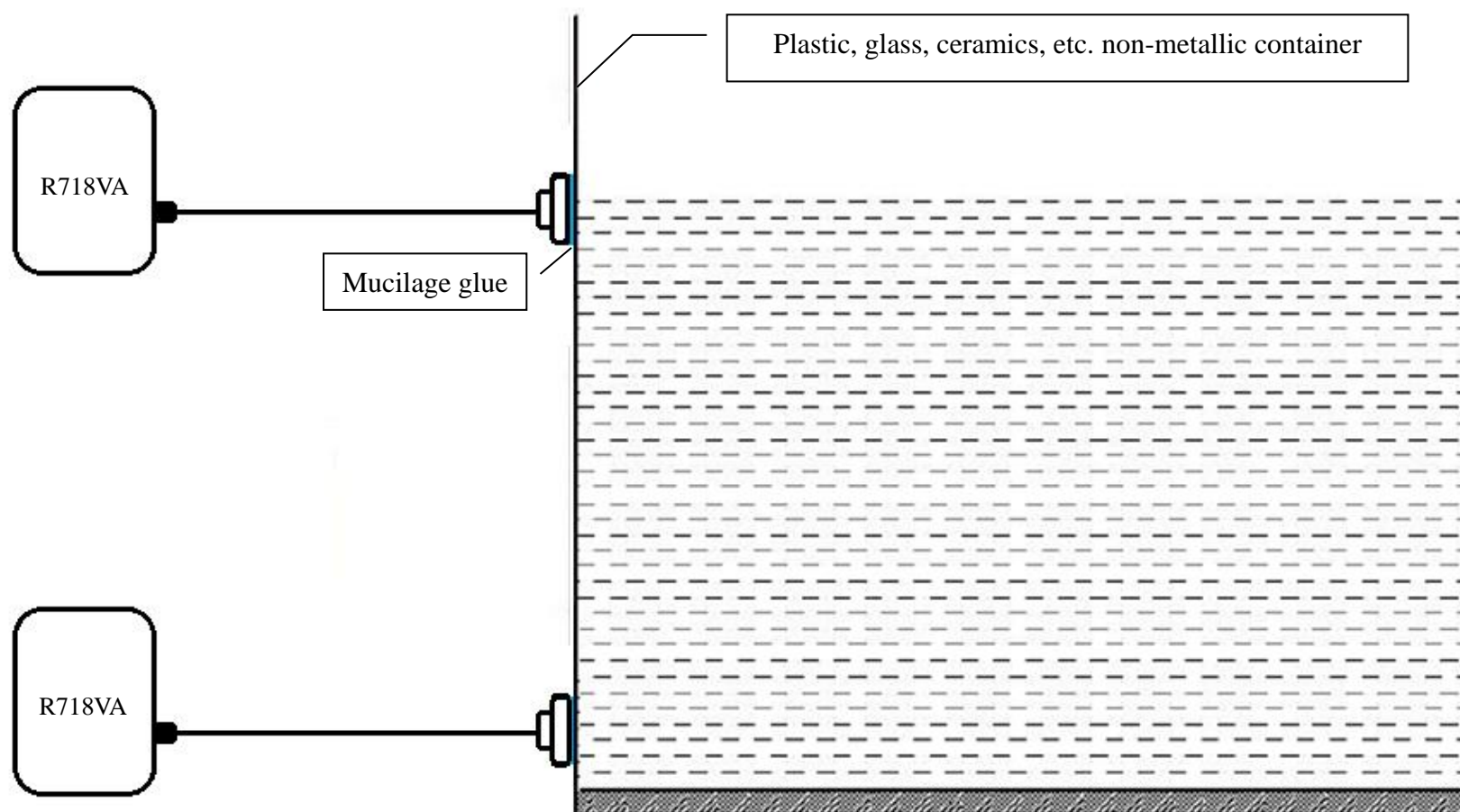


Figure 1. Sensor installation for non-metallic containers

8.2.2 Metallic container

Containers made of metal or other conductive materials; such as stainless steel iron, copper, aluminum alloy or materials with electroplated metal layer on the surface. Because the capacitive sensor is sensitive to all conductive objects, sensor cannot be glued on the outside of the container. Therefore, users should drill holes on the container so as to install the sensor.

Installation method:

1. Prepare 2 rubber plugs and tools for drilling.
2. Open one hole in the high position and one in low position, the hole diameter have to match the size of the rubber plug.
3. Put the rubber plug into the holes and check if there is water leakage. Add glue to seal the holes if necessary.
4. Glue the sensor on the rubber plug with glue and fix it with a tiny shelf. Make sure the glue has solidified before removing the shelf.

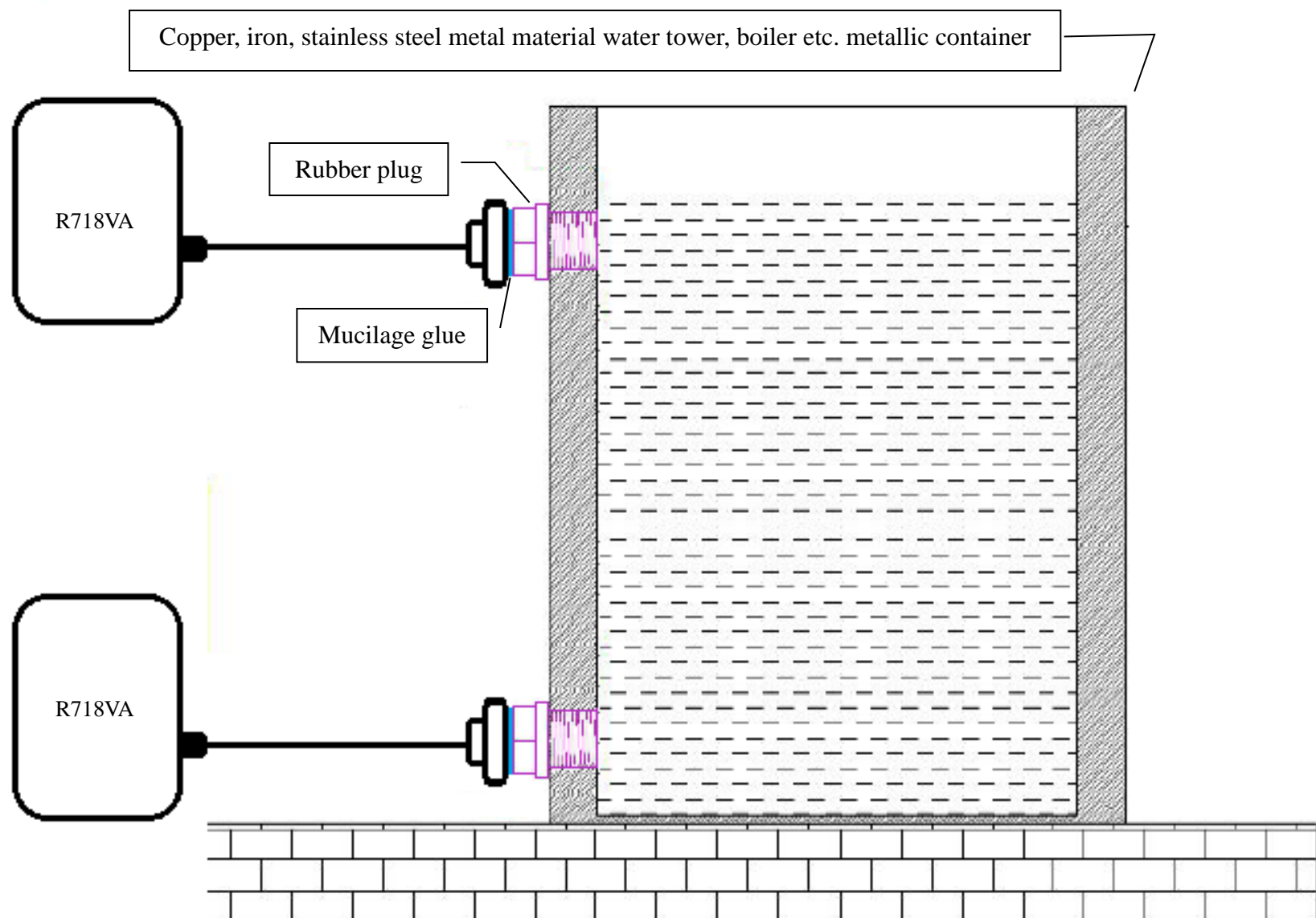


Figure 2. Sensor installation for metallic container

8.2.3. Water-absorbing container

Containers made of ceramics, tiles, bricks, tiles, cement, wooden boards and other materials are insulators or weakly conductive. Without water or under dry condition, the container may not be detected when the water level sensor is approached. However, when the water is filled in the container, the wall will absorb water thus causing the container wall to become a conductor. In this case, even if the water is out of the container, the sensor will still detect when the sensor approaches the wall of the container. If user would like to use water-absorbing containers, the installation method should follow as the same as the metallic containers' or install external pipes as below (figure 3 and 4).

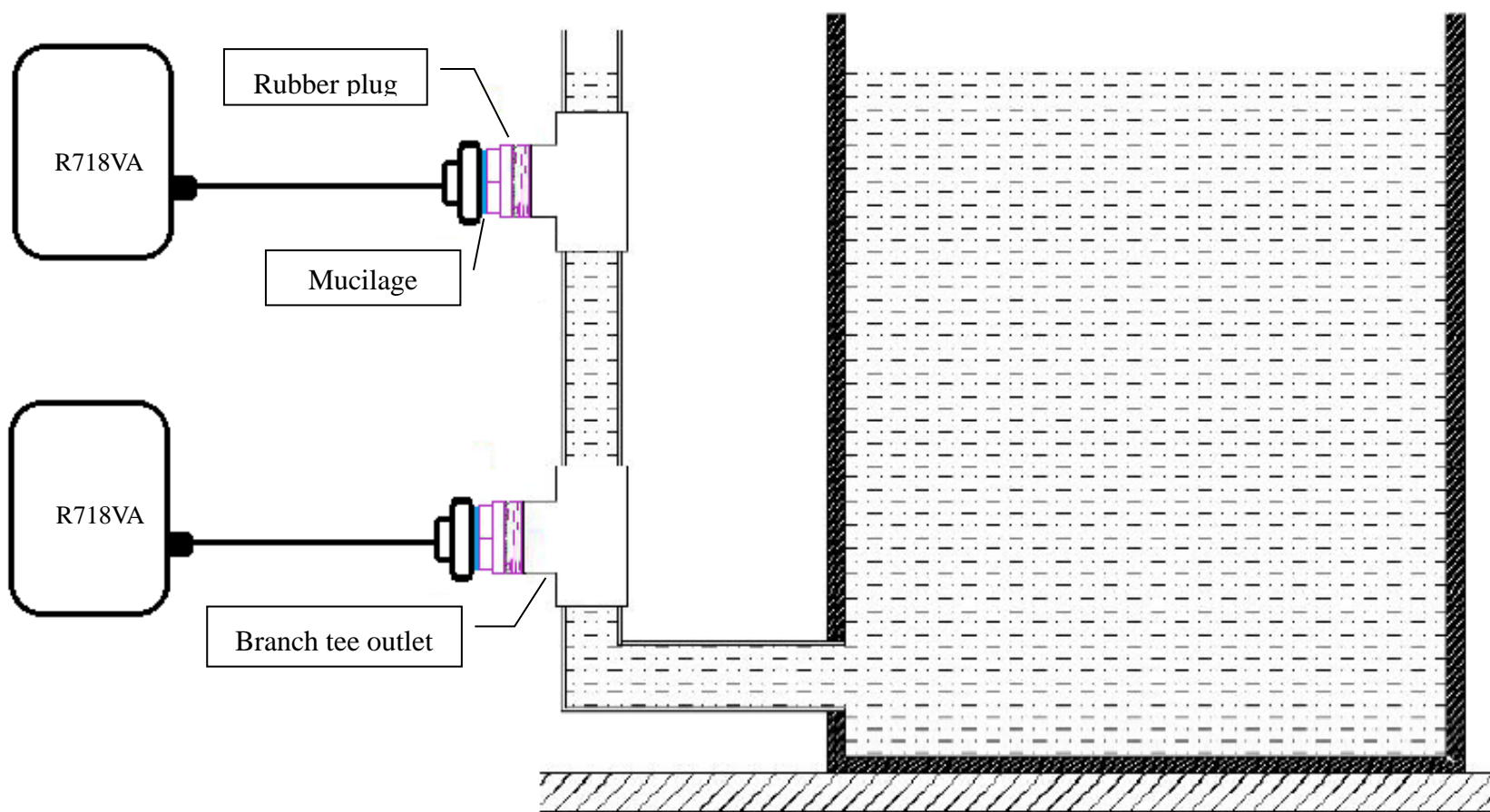


Figure 3. Sensor installation on the branch tee outlet

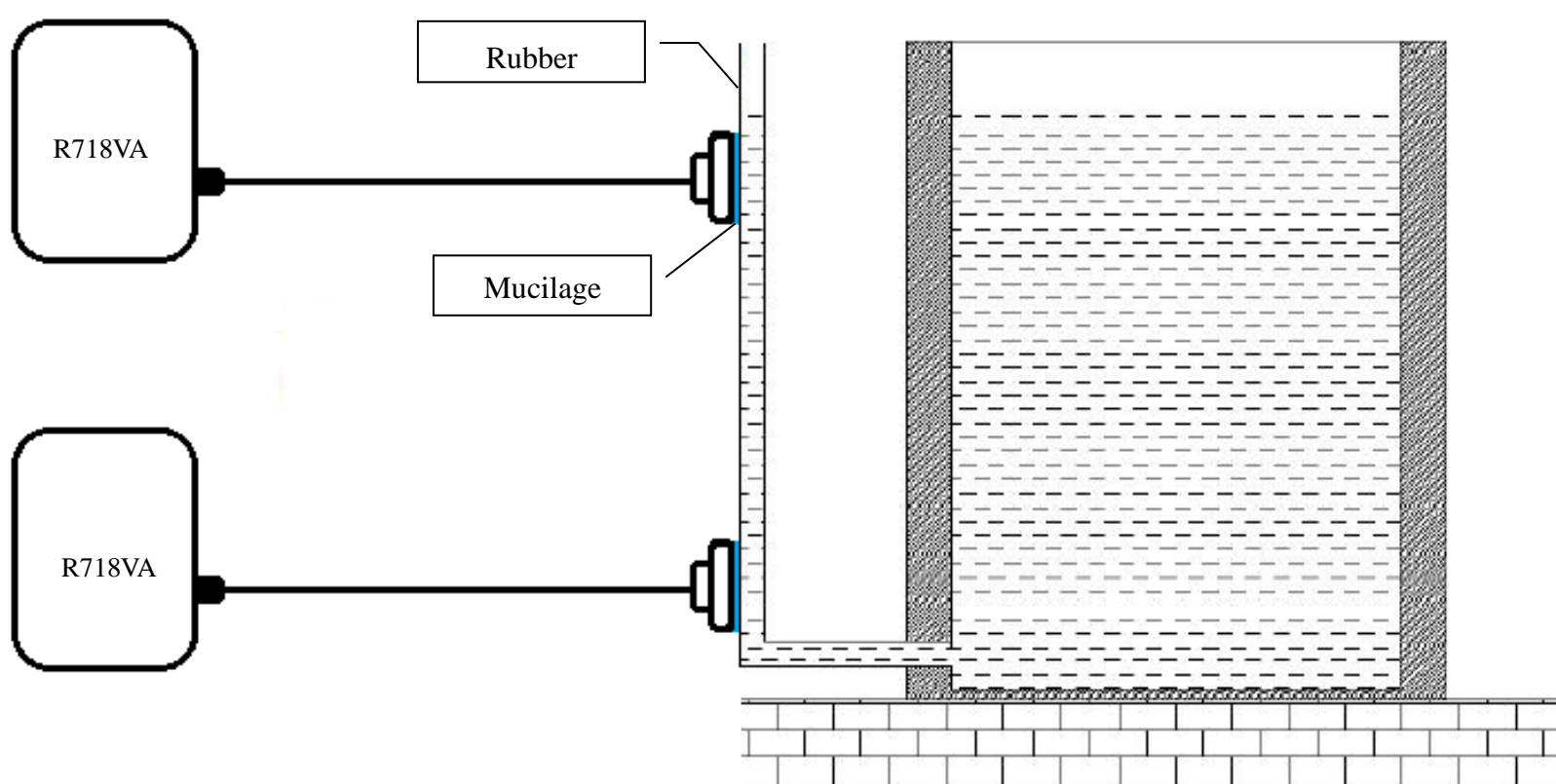


Figure 4. Sensor glued on the outside of the external pipeline

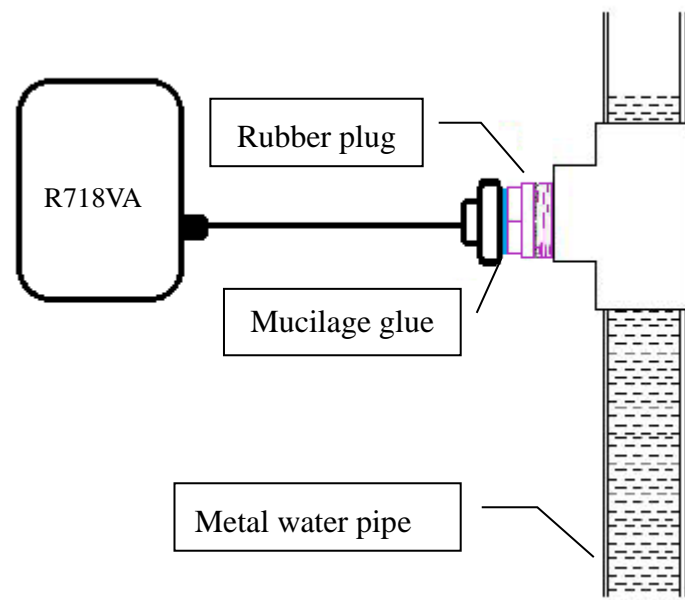


Figure 5. Sensor installed on the branch tee outlet of metal water pipes

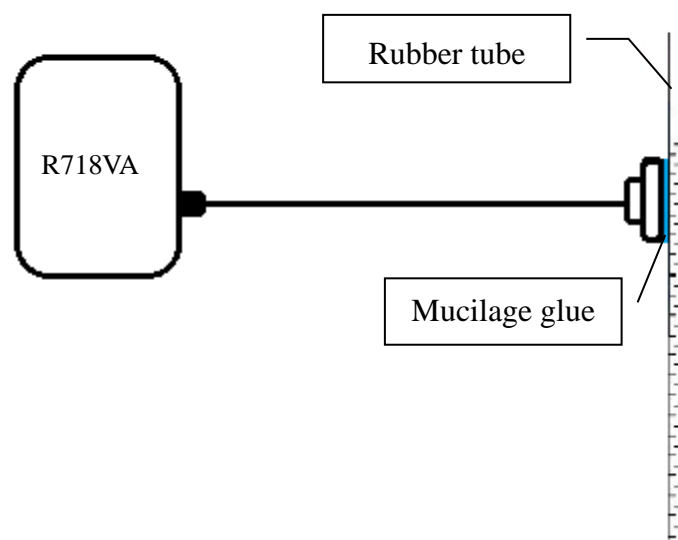
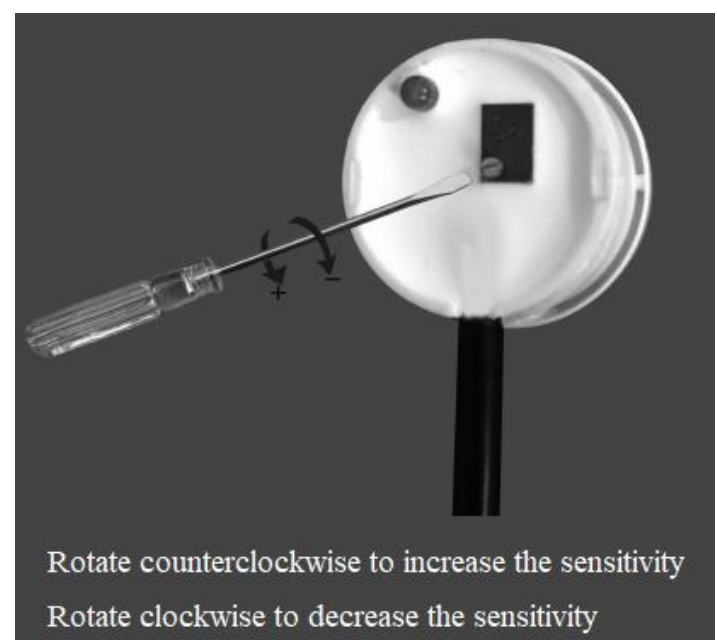


Figure 6. Sensor attached to the rubber tube

8.3 Adjust sensitivity

1. Open the back cover of the sensor head.
2. Adjust the sensitivity knob with a small screwdriver.
3. Rotate counterclockwise to increase the sensitivity or clockwise to decrease the sensitivity

(sensitivity from high to low: 12 circles in total)



9. 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

9.1 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.

9.2 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.

10. 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, 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 dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under excessively hot condition. 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 or 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.

11. Description of Waterproof Grade

1. According to Enclosure Protection Class, this standard is equivalent to IEC 60529:2001 Degrees of Protection Provided by Enclosures (IP Code).
2. The test method of 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 of 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 able to prevent 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 to be used in environments with high water pressure, high temperature, high humidity, or long-time exposure to sunlight and rainstorm. If it is really necessary to install in harsh environments, it is recommended to add rain and sun shields.



Figure 1. Install the device upside down.



Figure 2. Install the device under the rain/sun shield.