Wireless Capacitive Proximity Sensor

R718VA
User Manual

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1. Introduction

R718VA is a device to detect the status of toilet water, hand sanitizer level, presence or absence of tissue.

This device is connected with a non-contact capacitive sensor can be mounted to the exterior of the container, without direct contact with the object to be detected, which may detect the current water level of positions mounted, or the presence or absence of liquid soap or tissue; the detected data is transmitted to other devices through the wireless network. It uses the SX1276 wireless communication module.

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

Indicator

Function Key

Capacitive Proximity Sensor
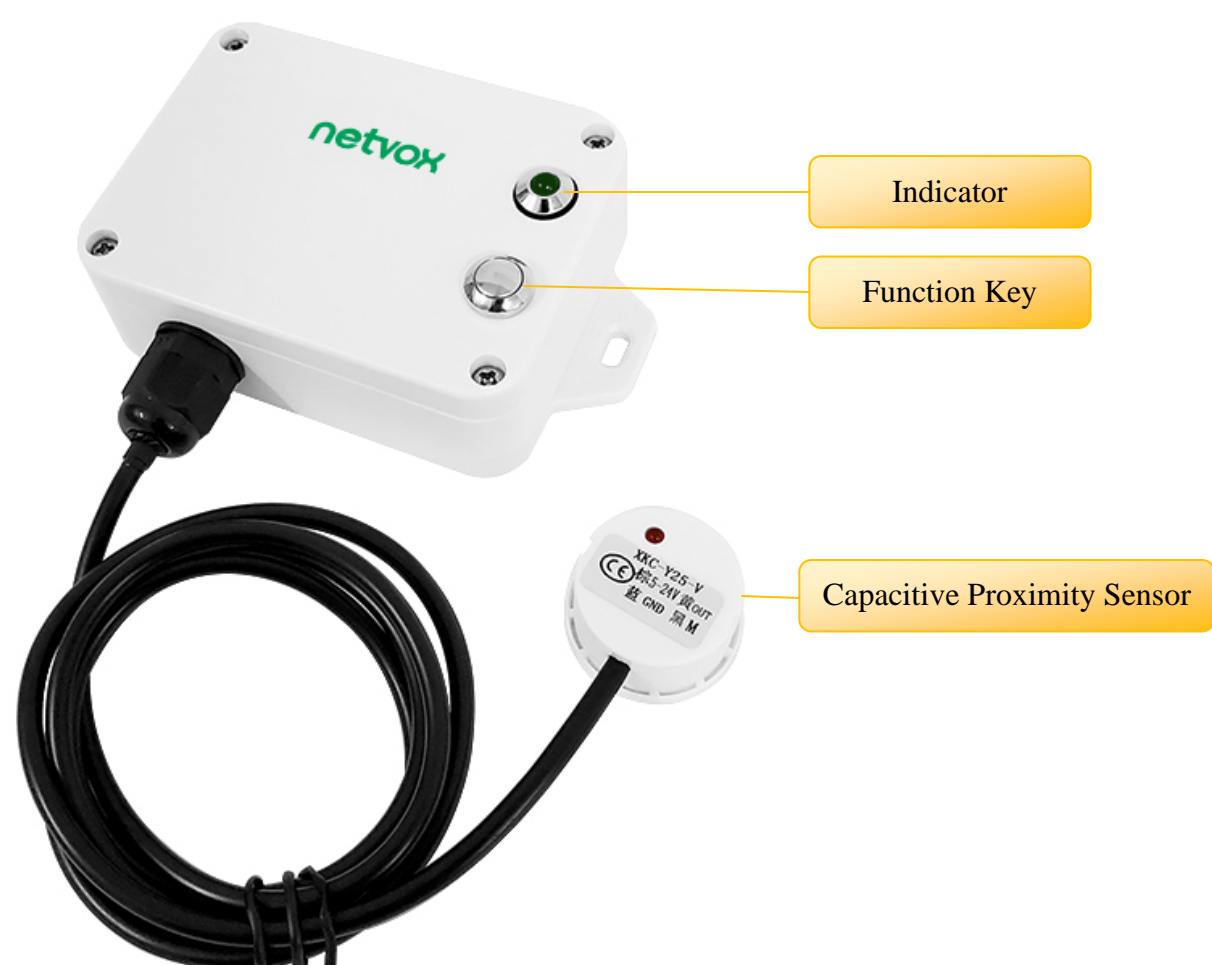
3. Main Features

- Adopt SX1276 wireless communication module

- 2 ER14505 battery AA SIZE (3.6V / section) parallel power supply

- Non-contact capacitive sensor

- Equipment body protection grade IP65/IP67 (optional), and the sensor probe part protection grade is IP67

- The base is attached with a magnet that can be attached to a ferromagnetic material object

- Compatible with LoRaWAN^{TM} Class A

- Frequency hopping spread spectrum technology

- 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 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. Application

- The water level of the toilet tank
- The level of hand sanitizer
- Presence or absence of tissue

5. 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 for 20 times.
Power off	Remove Batteries.
Note:	1. Remove and insert the battery; 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	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 yet restore to 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 (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	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: the 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: 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

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: 15min

Minimum time: 15min (Detect the current voltage value and liquid level status by default setting)

BatteryVoltageChange: 0x01 (0.1V)

R718VA detection status:

The distance between liquid level and sensor reaches the threshold will report, and the threshold can adjust sensitivity

The device will detect the status regularly at the MinTime interval.

When the device detects liquid level, status = 1

When the device does not detect liquid level, status = 0

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. (1→0)

　　b. 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.

For the analysis of the data command reported by the device, refer to the Netvox LoRaWAN Application Command document and http://www.netvox.com.cn:8888/page/index.

Note:

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

The interval between two reports must be the minimum time.

Example for Report Configuration:

Fport：0x07

Description	Device	CmdID	DeviceType	NetvoxPayLoadData			
ConfigReportReq		0x01		MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	BatteryChange (1byte Unit:0.1v)	Reserved (4Bytes,Fixed 0x00)
ConfigReportRsp	R718VA	0x81	0x9F	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, MaxTime = 1min, BatteryChange = 0.1v

  Downlink: 019F003C003C0100000000

  The device returns:

    819F000000000000000000 (The configuration succeeded)

    819F010000000000000000 (The configuration failed)
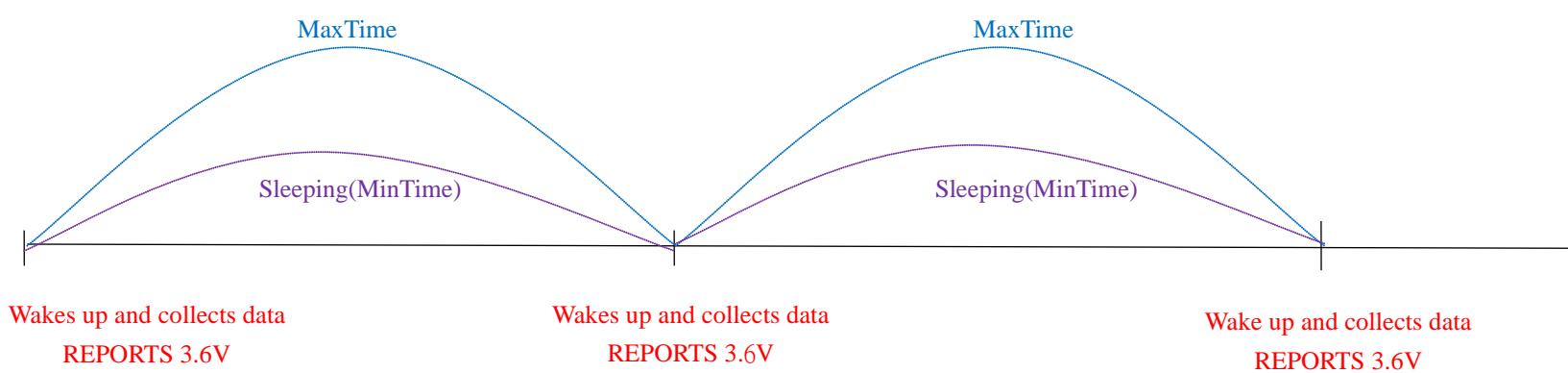
(2) Read the device configuration parameters

  Downlink: 029F000000000000000000

  The device returns:

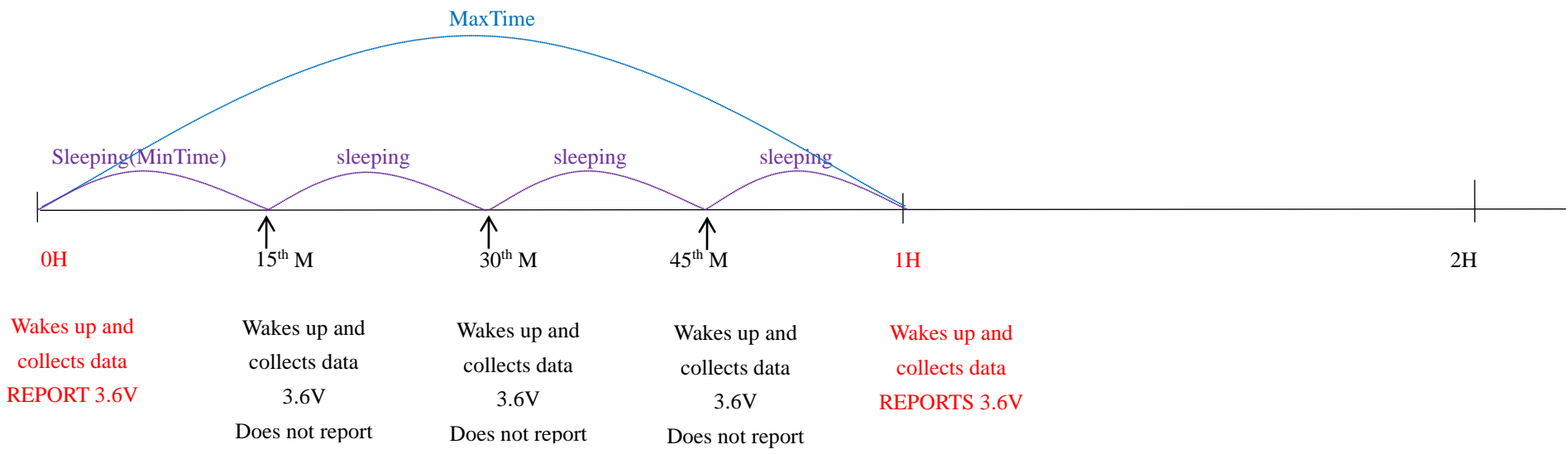   829F003C003C0100000000 (current configuration parameters)

Example for MinTime/MaxTime logic:

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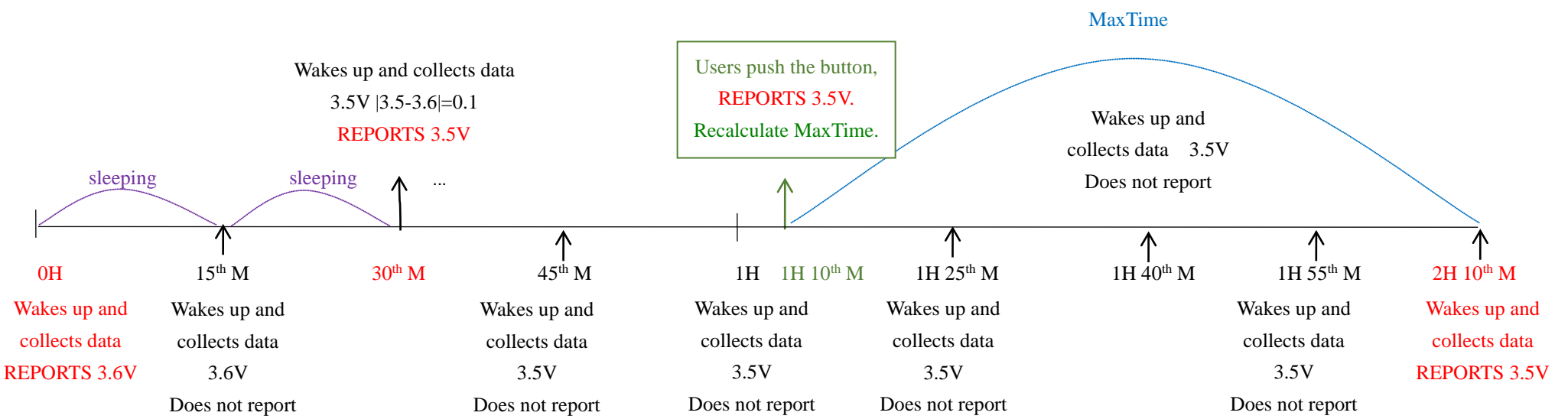

Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange

value.

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

MaxTime

Sleeping(MinTime)　　sleeping　　　　sleeping　　　　sleeping

0H　　　　　　15th M　　　　30th M　　　45th M　　　　1H　　　　　　　　　　　2H

Wakes up and collects data REPORT 3.6V

Wakes up and collects data 3.6V Does not report

Wakes up and collects data 3.6V Does not report

Wakes up and collects data 3.6V Does not report

Wakes up and collects data REPORTS 3.6V

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

MaxTime

Wakes up and collects data 3.5V |3.5-3.6|=0.1 REPORTS 3.5V

Users push the button, REPORTS 3.5V. Recalculate MaxTime.

Wakes up and collects data 3.5V Does not report

sleeping　　　　sleeping　　　...

0H　　15th M　　30th M　　45th M　　1H　1H 10th M　1H 25th M　1H 40th M　1H 55th M　2H 10th M

Wakes up and collects data REPORTS 3.6V

Wakes up and collects data 3.6V Does not report

Wakes up and collects data 3.5V Does not report

Wakes up and collects data 3.5V Does not report

Wakes up and collects data 3.5V Does not report

Wakes up and collects data 3.5V Does not report

Wakes up and collects data REPORTS 3.5V

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 <u>reported</u>. 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 Scenario

When the use case is for detecting 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 back.

When using it, the back of it can be adsorbed a ferromagnetic material object, or the two ends can be fixed to the wall with screws (should be purchased)

Note:

Do not install the device in a metal shielded box or other electrical equipment around it to avoid affecting the wireless transmission of the device.

Fixed with screws
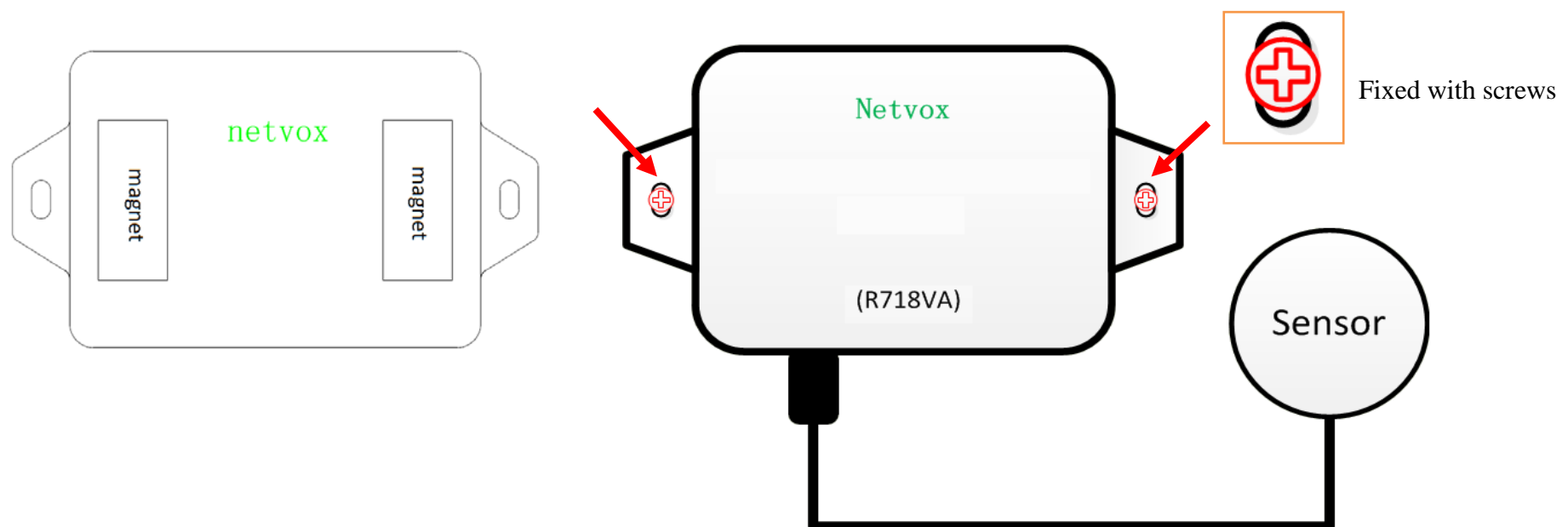
8.1 Measured liquid medium viscosity

8.1.1 Dynamic viscosity:

A. Less Than 10mPa·s when the normal measurement.

B. 10mPa < Dynamic viscosity < 30mPa·s would affect the detection

C. Greater than 30mPa·s due to a large amount of liquid attached to the container wall, cannot be measured.

Note:

With the temperature rise viscosity decreases, most of the high viscosity of the liquid by the temperature is more obvious, so when measuring

the viscosity of the liquid when the liquid temperature attention.

8.1.2 Dynamic (absolute) viscosity Explanation:

Dynamic (absolute) 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.

8.1.3 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 Requirements of container and Installation Instruction

The tested container is divided into 3 categories: insulation materials, metal, water-absorbing non-metallic

1. Could either glue the probe or use a support to fix the probe on the outside of the container.

2. Avoid metal materials at the probe mounting site so as not to affect the detection.

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 low-level probe is directly facing, so as not to affect the detection.

8.2.1 The first usage: Insulation Materials container

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.

Install method:

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: 0－20mm

3. Tank type: spherical tank, horizontal tank, vertical tank, etc.

4. The container of this kinds of materials is as following Picture 1:
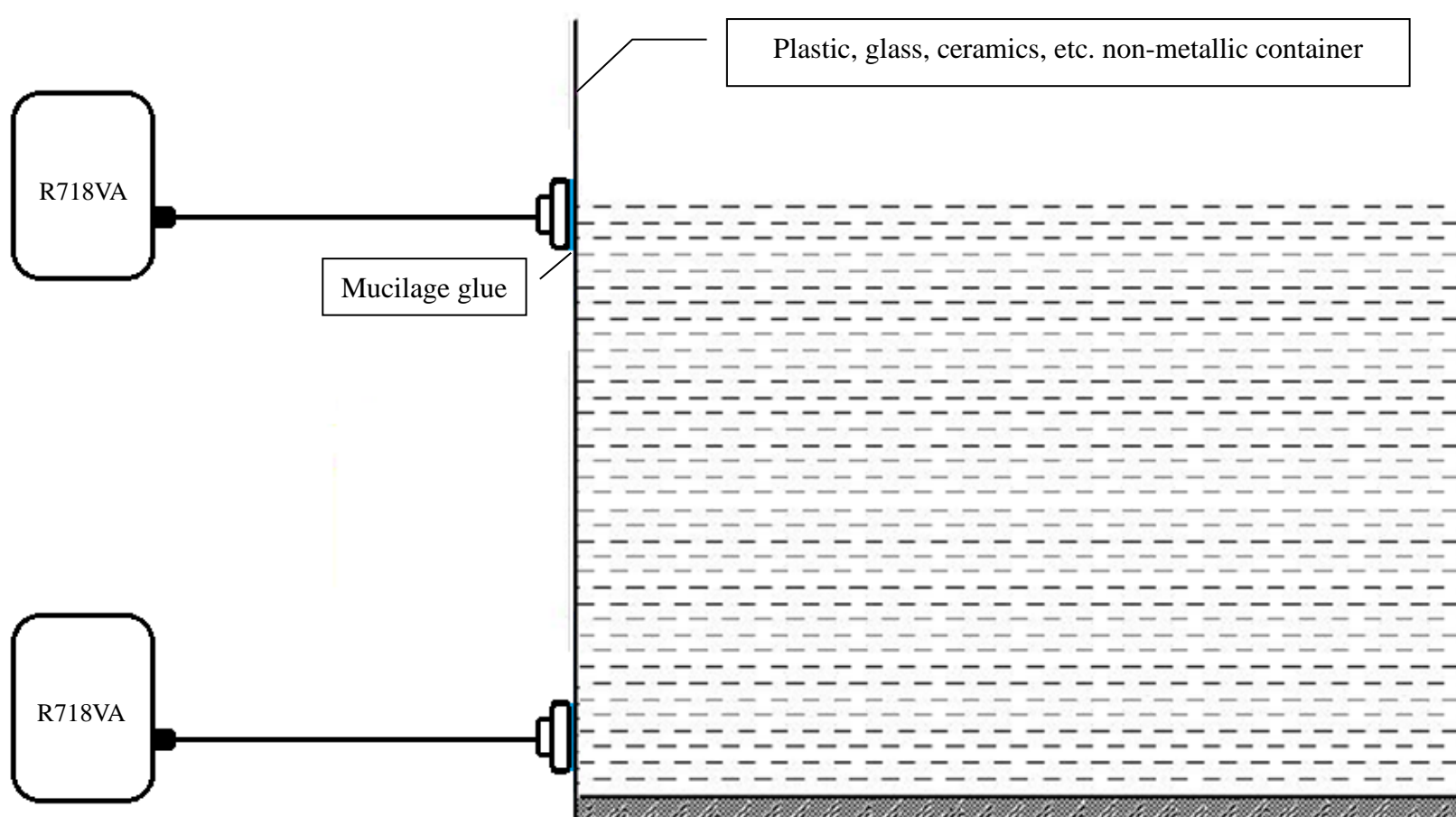
Picture 1 Example of the installation method of the sensor with the non-metallic container

8.2.2 The second usage: Metal 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, such containers cannot be directly glued on the outside of the container. Therefore, for containers of this type of material, it is needed to drill holes on the container, and the installation method is as follows.

Install method:

1. Prepare 2 rubber plugs and the needed tools for drilling holes.

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 support. Make sure the glue has solidified before removing the support. Example

of the installation method of the sensor with the metallic container is as follow Picture 2.
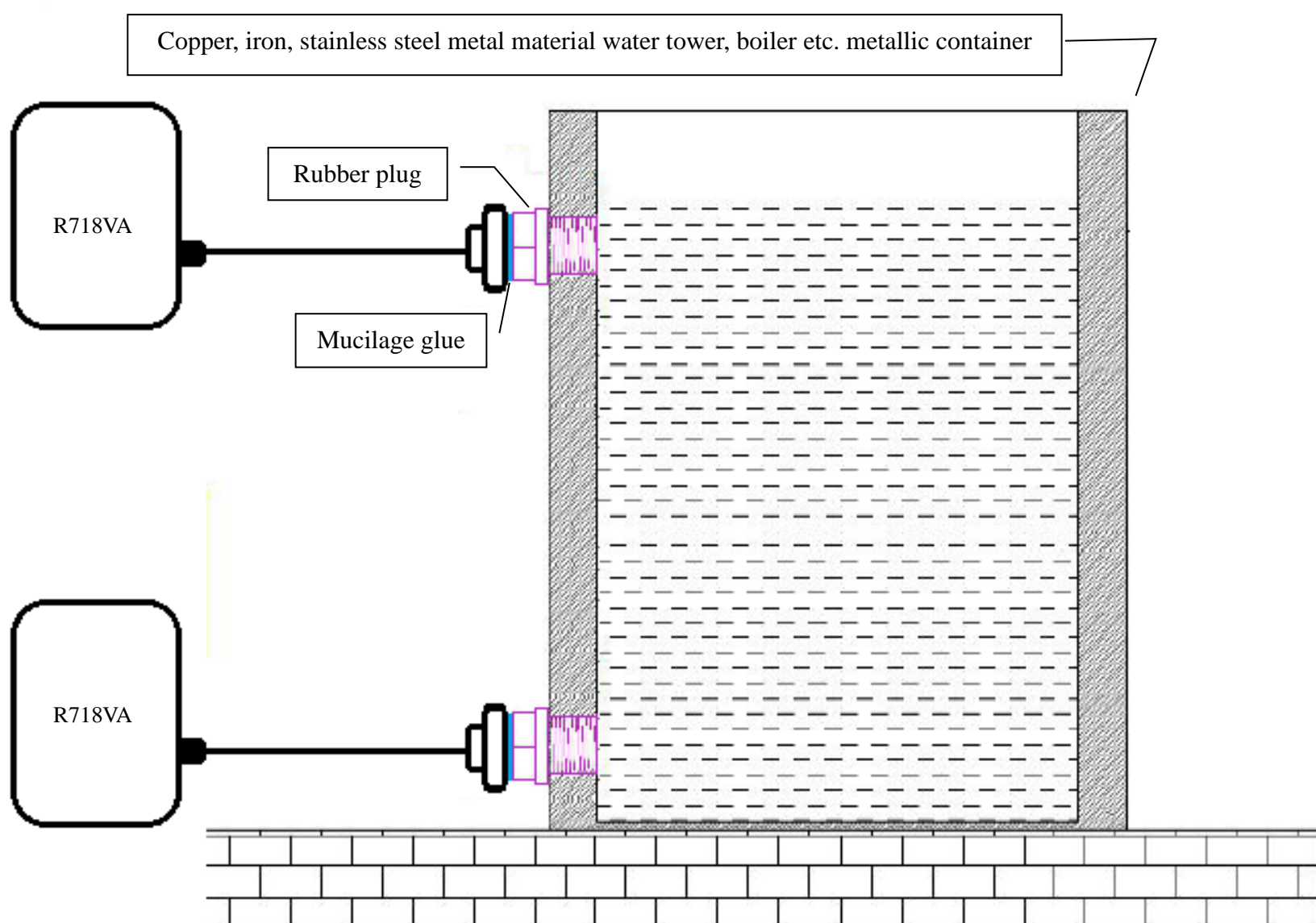
Picture 2   Example of the installation method of the sensor with the metallic container

**8.2.3 The third usage: Water absorption container**

Containers made of ceramics, tiles, bricks, tiles, cement, wooden boards and other materials are insulators or weakly conductive. This type of container without water or dry, they may not be detected when the water level sensor is approached, but 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 you want to use the sensor on a container of this kind of material, the installation method should follow the "Installation method of the metal container". For the installation method, see 8.2.2 and Picture 2, or install the sensor by external piping. See Picture 3 and Picture 4 for example.
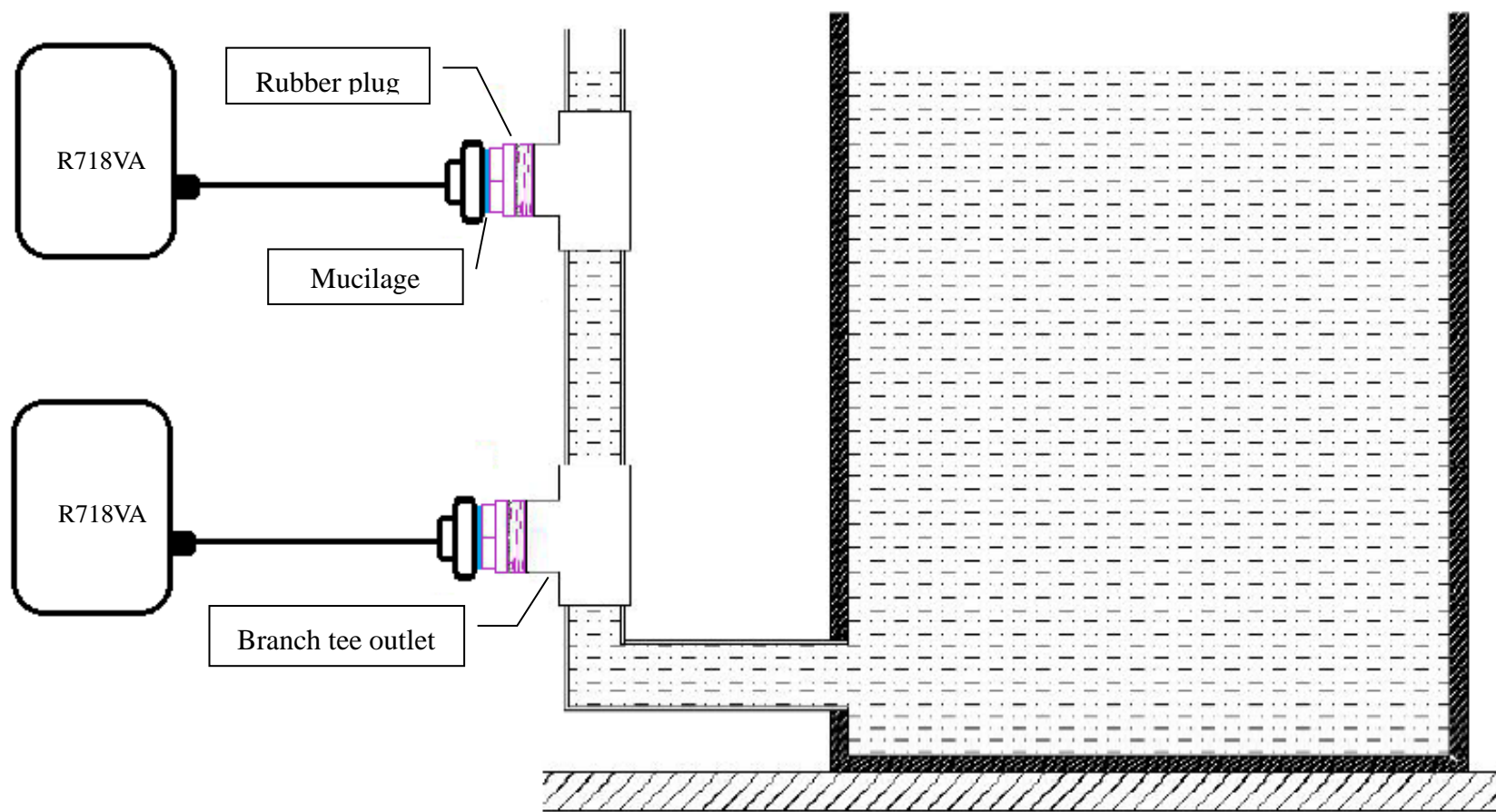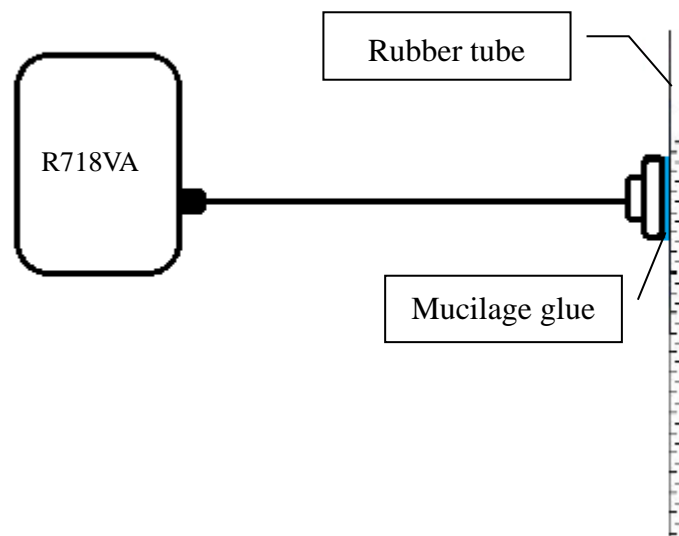

Picture 3   The installation example of the sensor installed on the branch tee outlet
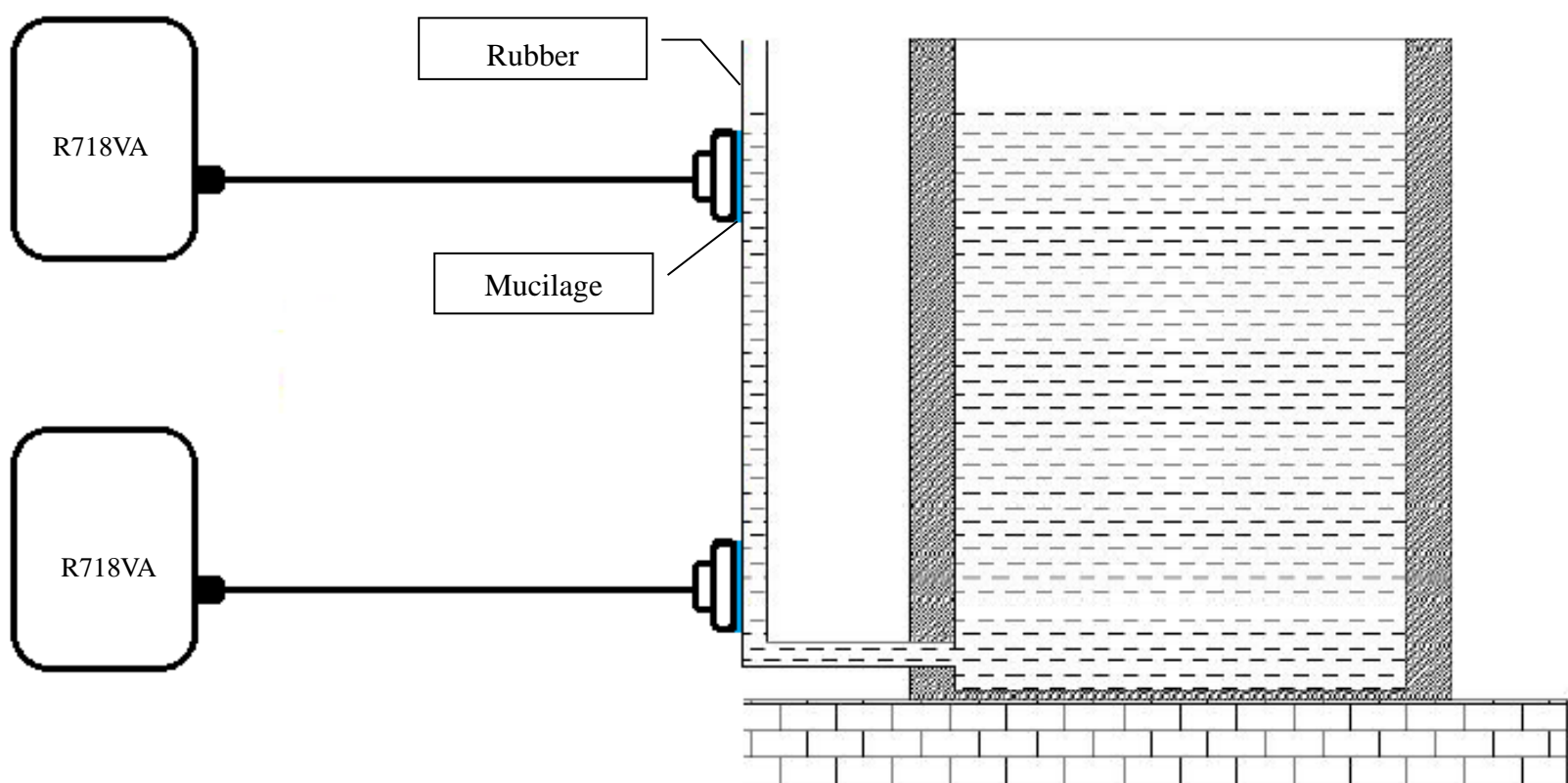
Picture 4 The installation example of the sensor glue on the outside of the external pipeline
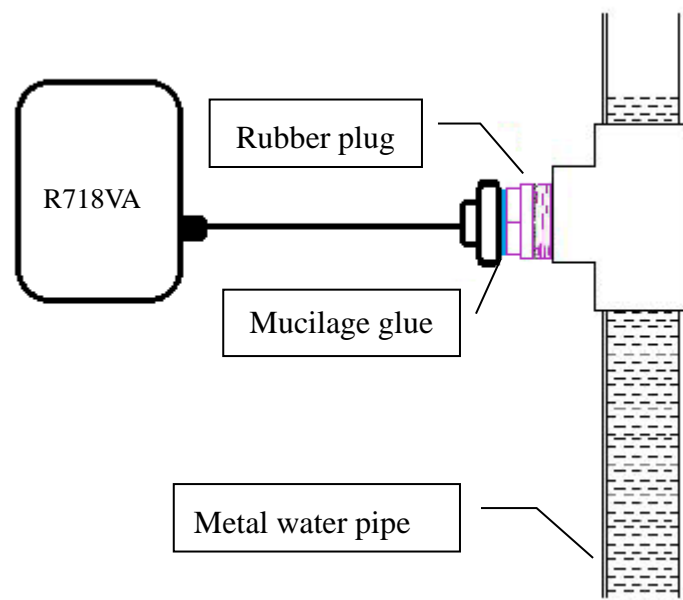
Picture 5   The installation example of the sensor installed on the branch tee outlet of metal water pipes

Picture 6   The sensor is directly attached to the rubber tube

8.3 Adjust sensitivity

Open the back cover of the sensor head, adjust the sensitivity knob with a small screwdriver, rotate counterclockwise to increase the sensitivity, and rotate clockwise to decrease the sensitivity (sensitivity from high to low 12 cycles in total.).

Rotate counterclockwise to increase the sensitivity
Rotate clockwise to decrease the sensitivity
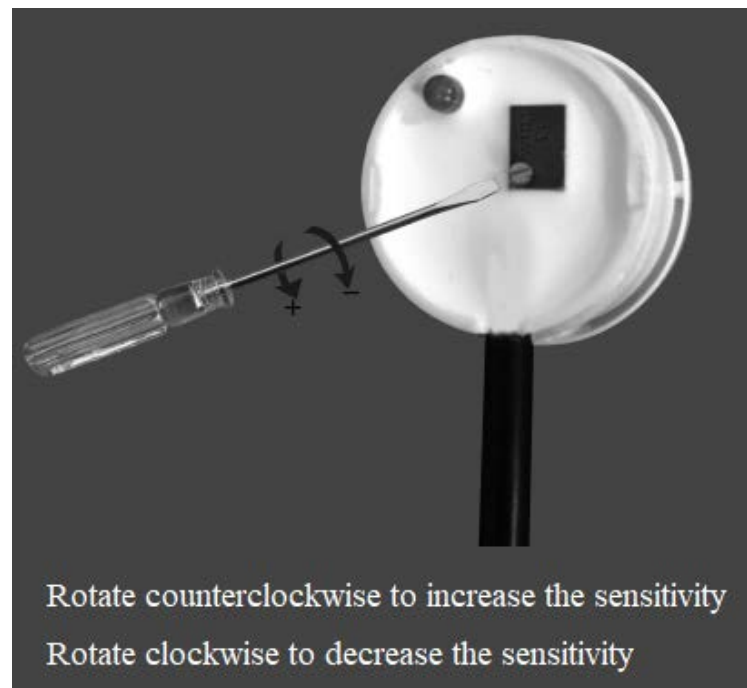
8.4 Information about Battery Passivation

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.

*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.

*How to activate the battery

1) Connect a battery to a 68ohm resistor in parallel

2) Keep the connection for 6~8 minutes

3) The voltage of the circuit should be $\geq$ 3.3V

9. 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 excessive heat condition. High temperature 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 in 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.