

Wireless PH Sensor

User Manual

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1. Introduction

RA0708_R72608_RA0708Y is a ClassA device based on the LoRaWAN open protocol.

RA0708_R72608_RA0708Y can be connected to the pH sensor and report the value collected by the sensor to the corresponding gateway.

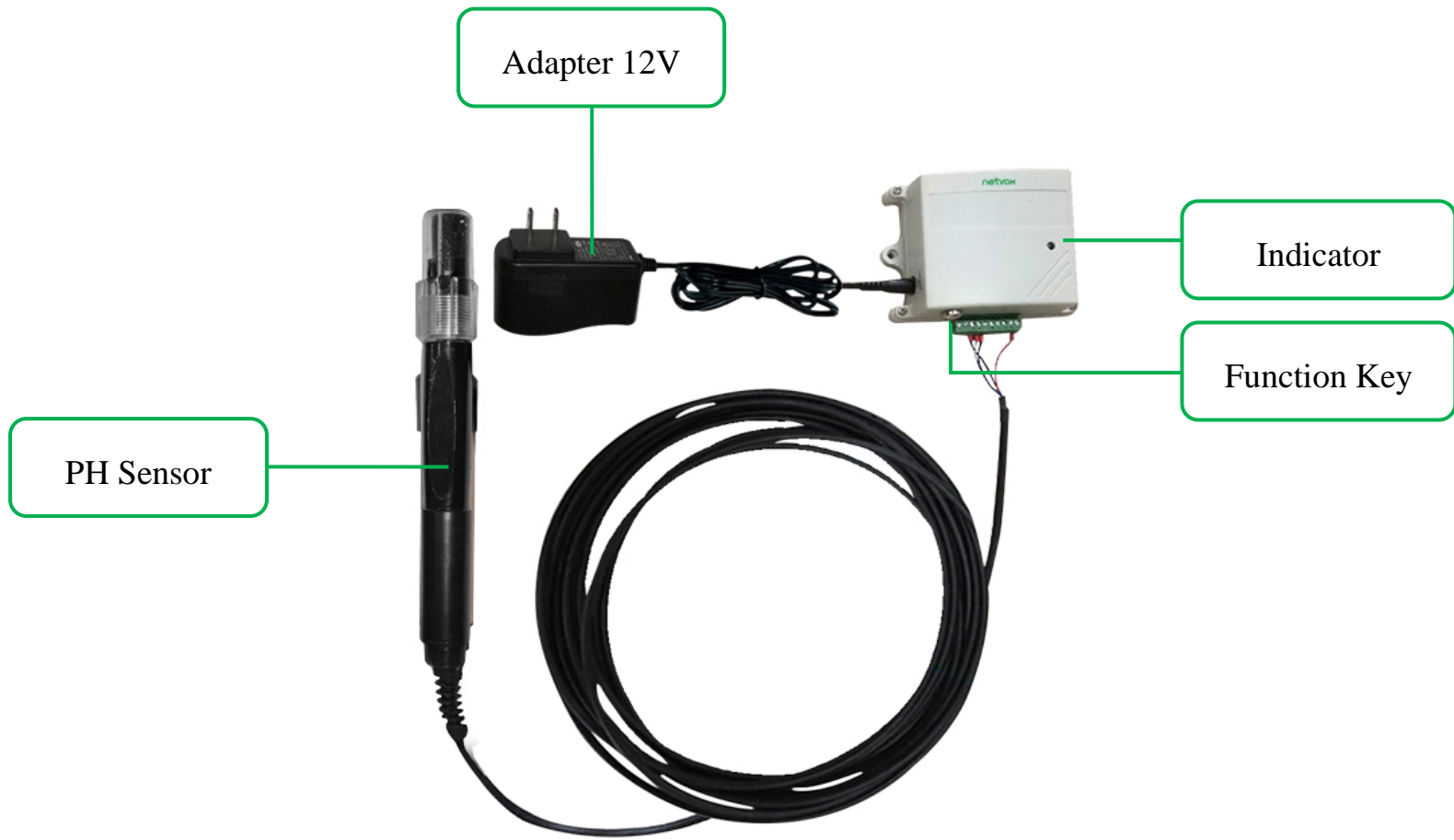
LoRa Wireless Technology:

LoRa is a wireless communication technology dedicated to long distances 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, and industrial monitoring. The main features include small size, low power consumption, transmission distance, and anti-interference ability.

LoRaWAN:

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

2. Appearance



RA0708



R72608

3. Features

- Compatible with LoRaWAN
- RA0708 and RA0708Y use DC 12V adapter power supply
- R72608 uses solar panel and rechargeable lithium batteries
- Simple operation and setting
- pH value and temperature detection
- SX1276 wireless communication module
- Frequency Hopping Spread Spectrum (FHSS)
- Available third-party platform: Actility/ThingPark, TTN, MyDevices/Cayenne

4. Set up Instruction

On/Off

Power on	RA0708 and RA0708Y are connected to the DC 12V adapter for power-on R72608 applies solar and rechargeable lithium batteries.
Turn on	Power on to turn on.
Restore to factory setting	Press and hold the function key for 5 seconds until green indicator flashes for 20 times.
Power off	Remove power
Note	<ol style="list-style-type: none"> 1. Engineering test modes require the burning engineering test software. 2. On/off interval is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components.

Network Joining

Never joined the network	<u>Turn on the device to search the network.</u> The green indicator stays on for 5 seconds: Success The green indicator remains off: Fail
Had joined the network (Not reset back to factory setting)	<u>Turn on the device to search the previous network.</u> The green indicator stays on for 5 seconds: Success The green indicator remains off: Fail
Fail to join the network	Please check the device verification information on the gateway or consulting your platform server provider.

Function Key

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

Low Voltage Threshold (R72608)

Low Voltage Threshold	10.5 V
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Restore to Factory Setting

Instruction	<p>RA0708_R72608_RA0708Y has a network information memory function when power-down. This function is turned off by default, that is, it will be re-joined every time it is powered on. This function can be turned on by the ResumeNetOnOff command.</p> <p>At this time, each time the power is rewritten, the last network joining information will be recorded (including saving the network address information assigned to it, etc., if you want to join a new network, you need to perform a factory resetting operation first.)</p> <p>It will not be re-joined the previous network.</p>
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5. Data Report

The device will immediately send a version packet report along with an uplink packet including water temperature, voltage, and pH value.

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

Default setting:

MaxTime:

RA0708 and RA0708Y: 0x00B4 (180s)

R72608: 0x0708 (1800s)

//Value must be greater than $ReportMinTime \geq ReportType\ count * ReportMinTime + 10$, units: seconds

MinTime:

US915, AU915, KR920, AS923, IN865: 0x001E (30s)

EU868: 0x0078 (120s)

ReportType count = 1

Note:

- (1) The device report interval will be programmed based on the default firmware which may vary.
- (2) The interval between two reports must be the Maxtime.
- (3) ReportChange is not supported by RA0708_R72608_RA0708Y (Invalid configuration).
- (4) Report cycle will be based on ReportMaxTime period when sending data packet (beginning to the end of the first data as a period).
- (5) Data packet: Water temperature, voltage and PH value.
- (6) The device also supports Cayenne's TxPeriod cycle configuration instructions. Therefore, the device can also perform a report according to the cycle time of the TxPeriod value; and whether the report period is ReportMaxTime or TxPeriod will be depending on which cycle time is configured last time.
- (7) It would take about **35 seconds** for the PH sensor to sample and process the collected PH value if you were to manually trigger the device by pressing the button, please be patient.

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

<http://www.netvox.com.cn:8888/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 bytes –0x01—the Version of NetvoxLoRaWAN Application Command Version

DeviceType – 1 byte – Device Type of Device

ReportType – 1 byte – the Presentation of the NetvoxPayLoadData , according the devicetype

NetvoxPayLoadData – Fixed bytes (Fixed =8bytes)

Tips

1. Battery Voltage

(a) The voltage value is bit 0 ~ bit 6, bit 7=0 is normal voltage, and bit 7=1 is low voltage.

Battery=0xE9, binary=1110 1001, if bit 7= 1, it means low voltage.

The actual voltage is 0110 1001 = 0x69 = 105, 105*0.1v =10.5v.

(b) If the battery is equal to 0x00, it means that the device is powered by a DC power supply.

2. Version Packet

When Report Type=0x00 is the version packet, such as 0105000D04202101060000, the firmware version is 2021.01.06

3. Data Packet

(a) When Report Type=0x08 is data packet.

(b) When NetvoxPayLoadData field=0xFFFF, it means that RA0708/R72608/RA0708Y does not support the connected device or sensor malfunction.

4. Signed Value:

When the temperature is negative, 2's complement should be calculated.

Device	Device Type	Report Type	NetvoxPayLoadData				
RA07 Series	0x05	0x00	SoftwareVersion (1Byte) Eg.0x0A—V1.0	HardwareVersion (1Byte)	DateCode (4Bytes, eg0x20170503)	Reserved (2Bytes, fixed 0x00)	
R726 Series RA07xxY Series	0x09 0x0D	0x08	Battery (1Byte, unit:0.1V)	PH (2Byte ,0.01pH)	Temperature with PH (Signed 2Bytes, unit: 0.01°C)	ORP (Signed2Byte,1mv)	Reserved (1Byte, fixed 0x00)

(1) Example of RA0708 Uplink: 0105080002B40866FFFF00

1st byte (01): Version

2nd byte (05): DeviceType 0x05 — RA07 series

3rd byte (08): ReportType

4th byte (00): Battery — DC power supply

5th 6th byte (02B4): pH — 6.92pH, 02B4 (Hex) = 692 (Dec), $692 * 0.01 \text{pH} = 6.92 \text{pH}$

7th 8th byte (0866): Temperature with PH — 21.50°C, 0866(Hex)=2150(Dec), $2150 * 0.01 \text{°C} = 21.50 \text{°C}$

9th 10th byte (FFFF): ORP — N/A

11th byte (00): Reserved

(2) Example of R72608 Uplink: 0109087802B40866FFFF00

1st byte (01): Version

2nd byte (09): DeviceType 0x09 — R726 Series

3rd byte (08): ReportType

4th byte (78): Battery — 12v , 78 Hex=120 Dec $120 * 0.1 \text{v} = 12 \text{v}$

5th 6th byte (02B4): pH — 6.92pH, 02B4 (Hex) = 692 (Dec), $692 * 0.01 \text{pH} = 6.92 \text{pH}$

7th 8th byte (0866): Temperature with PH — 21.50°C, 0866(Hex)=2150(Dec), $2150 * 0.01 \text{°C} = 21.50 \text{°C}$

9th 10th byte (FFFF): ORP — N/A

11th byte (00): Reserved

(3) Example of RA0708Y Uplink: 010D080002B40866FFFF00

1st byte (01): Version

2nd byte (0D): DeviceType 0x0D — RA07xxY Series

3rd byte (08): ReportType

4th byte (00): DC power supply

5th 6th byte (02B4): pH — 6.92pH, 02B4 (Hex) = 692 (Dec), $692 * 0.01 \text{pH} = 6.92 \text{pH}$

7th 8th byte (0866): Temperature with PH — 21.50°C, 0866(Hex)=2150(Dec), $2150 * 0.01 \text{°C} = 21.50 \text{°C}$

9th 10th byte (FFFF): ORP — N/A

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	Cmd ID	Device Type	NetvoxPayloadData		
ConfigReportReq	RA07 Series R726 Series R727 Series	0x01	0x05	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	Reserved (5Bytes,Fixed 0x00)
ConfigReportRsp		0x81		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)	
ReadConfigReportReq		0x02	0x09	Reserved (9Bytes,Fixed 0x00)		
ReadConfigReportRsp		0x82	0x0D	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	Reserved (5Bytes,Fixed 0x00)

(1) Configure RA0708 device parameters MinTime = 30s, MaxTime = 3600s (3600>30*1+10)

Downlink: 0105001E0E100000000000

Device returns:

8105000000000000000000 (configuration successful)

8105010000000000000000 (configuration failed)

(2) Read RA0708 device parameters

Downlink: 0205000000000000000000

Device returns:

8205001E0E100000000000 (device current parameter)

Note:

The value of ReportMaxTime should be greater than (ReportType count *ReportMinTime+10) (Unit: second)

ReportType Count = 1 (The MinTime of EU868 cannot be less than 120s.)

5.3 Example of GlobalCalibrateCmd

Port:0x0E

Remain the last configuration when the device is reset back to factory setting.

Description	Cmd ID	Sensor Type	PayLoad(Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	pH Sensor 0x13	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_Channel 1, 1_Channel 2,etc	Status (1Byte,0x00_success)		Reserved (7Bytes,Fixed 0x00)	
GetGlobal CalibrateReq	0x02	Temperature 0x3D	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)		

Note: GlobalCalibrateCmd supports calibration of positive and negative numbers. Negative values use the 2's complement.

(1) Set the temperature calibration to increase by 1°C.

Sensor type=0x3D, Channel 1=0x00, Multiplier=0x0001, Divisor=0x0001, Delt Value=0x0064

Downlink: 013D000001000100640000 // The temperature unit is 0.01°C. 100*0.01°C =1°C

Device returns:

813D00000000000000000000 (configuration successful)

813D00010000000000000000 (configuration failed)

(2) Set the pH calibration to decrease by 0.1 pH.

Sensor type=0x13, Channel 2=0x01, Multiplier=0x0001, Divisor=0x0001, Delt Value=0xFFFF6

Downlink: 01130100010001FFF60000 // The pH unit is 0.01pH. -10*0.01pH = -0.1pH

Device returns:

811301000000000000000000 (configuration successful)

811301010000000000000000 (configuration failed)

(3) Clear the temperature calibration.

Downlink: 0300000000000000000000

Response: 8300000000000000000000 (Current configuration)

6. Installation

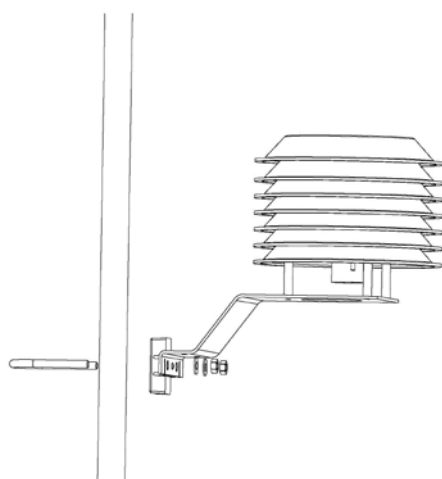
6.1 RA0708

RA0708 does not have a waterproof function. After the network joining is completed, please place it indoors.

6.2 R72608

R72608 product is waterproof. After the network-joining is completed, please leave it outdoors.

- (1) In the position to be installed, loosen the U-shaped screw of the bottom of the R72608 and the mating washer nut, and fix the U-shaped screw through the appropriate size cylinder on the R72608 fixed strut piece. Install the washer nut in order, and lock the nut until the R72608 body is stable and does not shake.
- (2) At the upper side of the fixed position of R72608, loosen the two U-shaped screws on the side of the solar panel and the mating washer nut. Fix the U-shaped screw through the appropriate size cylinder on the main bracket of the solar panel, and install the gasket in sequence. Lock the nut until the solar panel is stable and does not shake.
- (3) Adjust the angle of the solar panel. After the adjustment is completed, lock the nut.
- (4) Connect the R72608 top waterproof cable to the solar panel wiring and lock it tight.



- (5) R72608 has a battery compartment inside. Users can buy and install rechargeable 18650 lithium battery, 3 sections total. A single rechargeable lithium battery voltage is 3.7V, and the capacity is recommended at 5000mah.

The installation of rechargeable lithium battery steps are as follows:

- 1: Remove the four screws around the battery cover
- 2: Insert three 18650 lithium batteries. (Please make sure the battery is positive and negative)
- 3: Press the activation button on the battery pack for the first time.
- 4: After activation, close the battery cover and lock the screws around the battery cover.

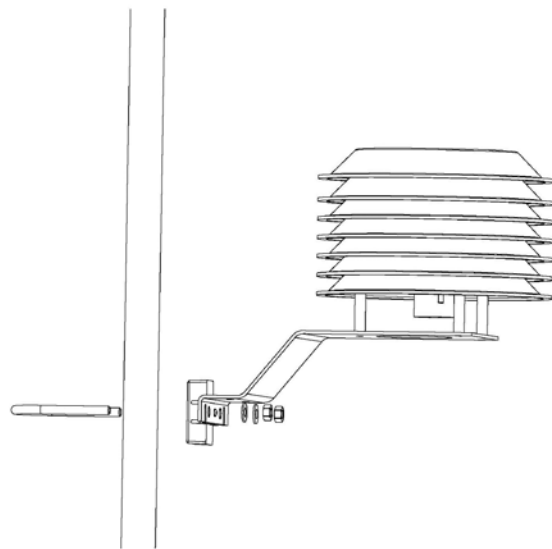


¹¹activation button

6.3 RA0708Y

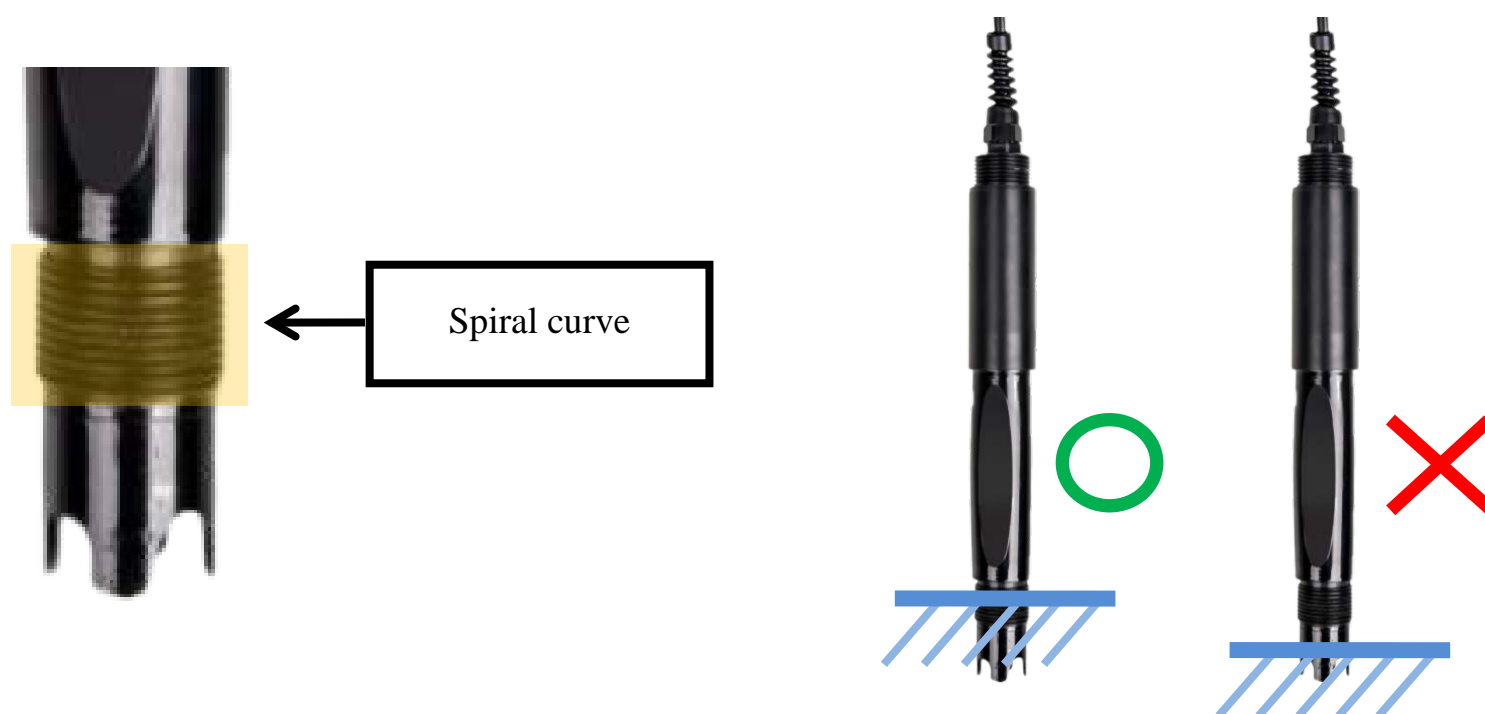
RA0708Y product is waterproof and can be placed outdoors after the network joining is completed.

- (1) In the position to be installed, loosen the bottom U-shaped screw of the RA0708Y and the mating washer nut, and fix the U-shaped screw through the appropriate size cylinder on the RA0708Y fixed strut piece. Install the washer nut in order, lock the nut until RA0708Y body is stable and does not shake.
- (2) Loosen the M5 nut at the bottom of the RA0708Y matte and take the matte together with the screw.
- (3) Insert the power DC plug from the center through hole of the RA0708Y bottom cover, and insert it into the RA0708Y DC socket, and then return the mating screw to the original position and lock the M5 nut tight.



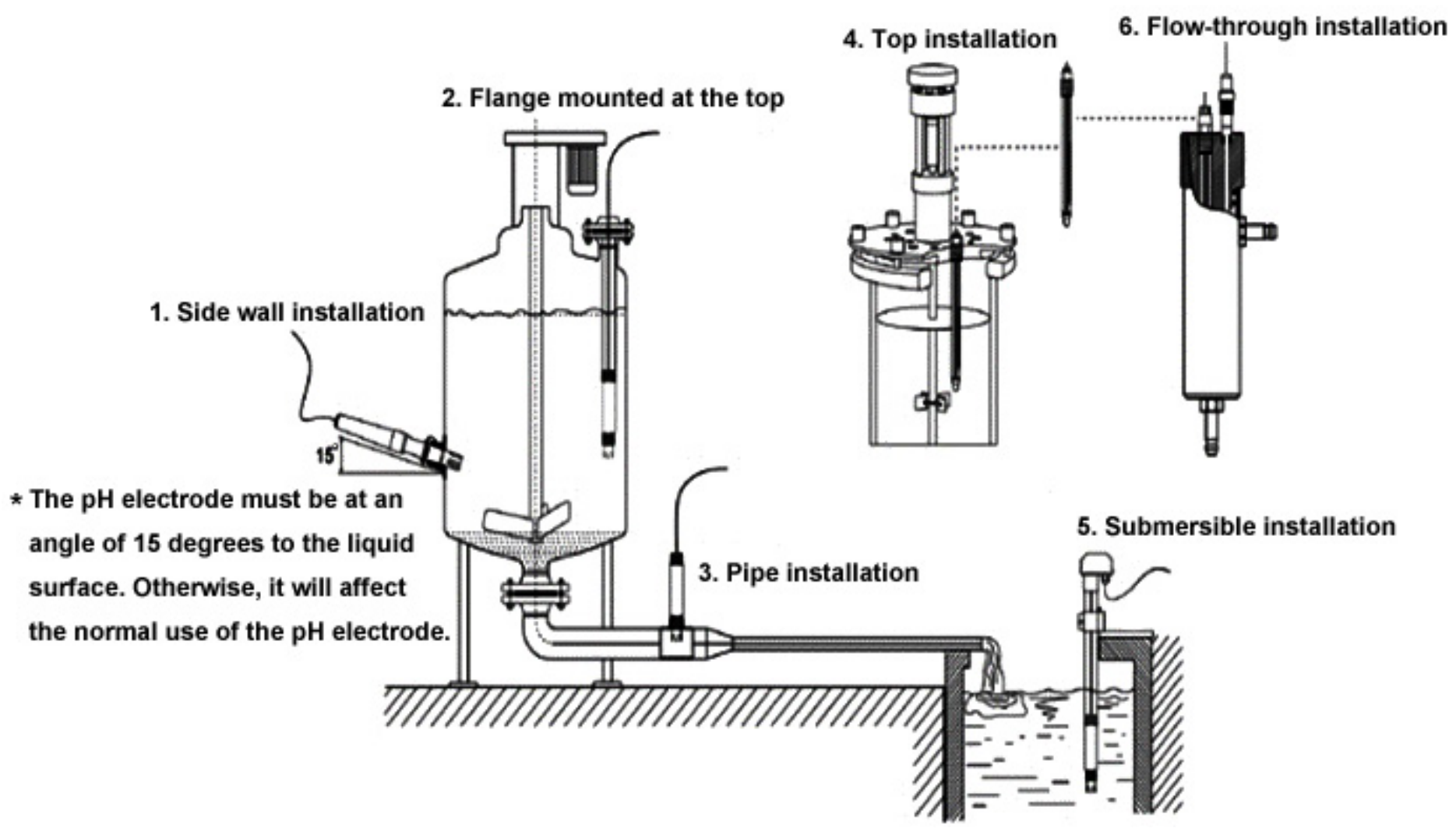
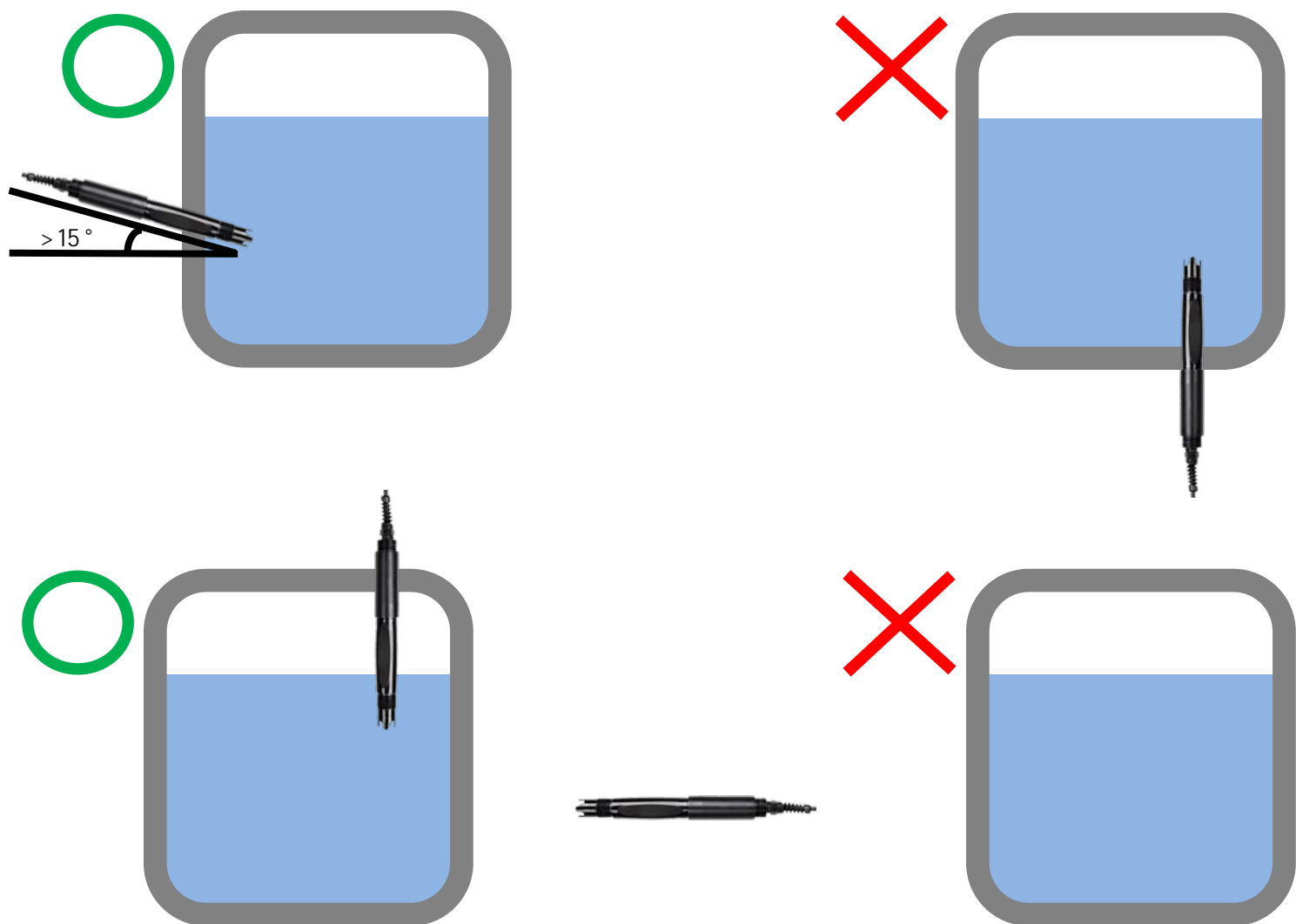
6.4 PH Sensor Use

The water level of the water you plan to measure the pH value of is recommended to be higher than the spiral curve on the pH sensor.



Note:

- (1) The sensor is recommended to be installed with angles higher than 15 degrees.
- (2) Horizontal or upside-down position is not allowed.



6.5 PH Sensor Maintenance

(1) When measuring the pH sensor, it should be cleaned in distilled water (or deionized water), and the filter paper should be used to absorb moisture to prevent impurities from being introduced into the liquid to be tested. 1/3 of the sensor should be inserted into the solution to be tested.

(2) The sensor should be washed when not in use, inserted into a protective sleeve with a 3.5 mol/L potassium chloride solution, or the sensor inserted into a container with a 3.5 mol/L potassium chloride solution.

If the liquid in the cover of the pH sensor dries out, you could replace the liquid with potassium chloride liquid or tap water.

Please do not use purified water or deionized water.

(3) Check if the terminal is dry. If it is stained, wipe it with absolute alcohol and dry it. Avoid long-term immersion in distilled water or protein solution and prevent contact with silicone grease. With a longer sensor, its glass film may become translucent or with deposits, which can be washed with dilute hydrochloric acid and rinsed with water.

(4) Users may need to change the parts when the sensor has passed its lifespan (1 year) and cannot be configured or when the electrode cannot function properly even by following the maintenance instructions.

7. Important Maintenance Instruction

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

- Do not put the device near or submerge into water. Minerals in rain, moisture, and other liquids could cause corrosion of electronic components. Please dry the device, if it gets wet.
- Do not use or store the device in dusty or dirty environments to prevent damage to parts and electronic components.
- Do not store the device in high temperatures. This may shorten the lifespan of electronic components, damage batteries, and deform plastic parts.
- Do not store the device in cold temperatures. Moisture may damage circuit boards as the temperatures rise.
- Do not throw or cause other unnecessary shocks to the device. This may damage internal circuits and delicate components.
- Do not clean the device with strong chemicals, detergents, or strong detergents.
- Do not apply the device with paint. This may block detachable parts and cause malfunction.
- Do not dispose of batteries in fire to prevent explosion.

The instructions are applied to your device, battery, and accessories.

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