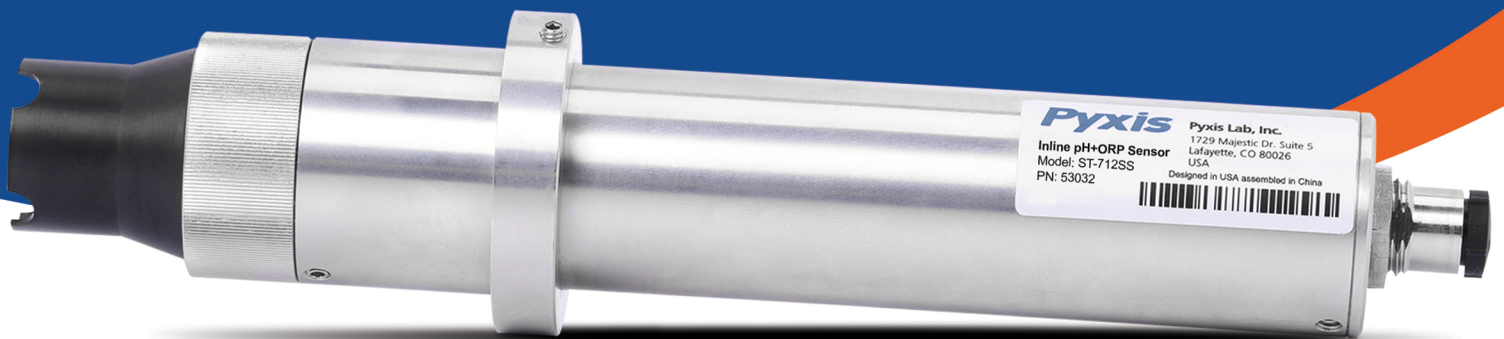


# Pyxis<sup>®</sup>

# ST-712SS

## Stainless Steel pH+ORP Sensor User Manual



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# ST-712SS Stainless Steel pH+ORP Sensor User Manual

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## **Warranty Information**

### **Confidentiality**

The information contained in this manual may be confidential and proprietary and is the property of Pyxis Lab, Inc. Information disclosed herein shall not be used to manufacture, construct, or otherwise reproduce the goods described. Information disclosed herein shall not be disclosed to others or made public in any manner without the express written consent of Pyxis Lab, Inc.

### **Standard Limited Warranty**

Pyxis Lab warrants its products for defects in materials and workmanship. Pyxis Lab will, at its option, repair or replace instrument components that prove to be defective with new or remanufactured components (i.e., equivalent to new). The warranty set forth is exclusive and no other warranty, whether written or oral, is expressed or implied.

### **Warranty Term**

The Pyxis warranty term is thirteen (13) months ex-works. In no event shall the standard limited warranty coverage extend beyond thirteen (13) months from original shipment date.

### **Warranty Service**

Damaged or dysfunctional instruments may be returned to Pyxis for repair or replacement. In some instances, replacement instruments may be available for short duration loan or lease.

Pyxis warrants that any labor services provided shall conform to the reasonable standards of technical competency and performance effective at the time of delivery. All service interventions are to be reviewed and authorized as correct and complete at the completion of the service by a customer representative, or designate. Pyxis warrants these services for 30 days after the authorization and will correct any qualifying deficiency in labor provided that the labor service deficiency is exactly related to the originating event. No other remedy, other than the provision of labor services, may be applicable.

Repair components (parts and materials), but not consumables, provided during a repair, or purchased individually, are warranted for 90 days ex-works for materials and workmanship. In no event will the incorporation of a warranted repair component into an instrument extend the whole instrument's warranty beyond its original term.

### **Warranty Shipping**

A Repair Authorization (RA) Number must be obtained from Pyxis Technical Support before any product can be returned to the factory. Pyxis will pay freight charges to ship replacement or repaired products to the customer. The customer shall pay freight charges for returning products to Pyxis. Any product returned to the factory without an RA number will be returned to the customer. To receive an RMA you can generate a request on our website at <https://pyxis-lab.com/request-tech-support/>.

### **Pyxis Technical Support**

Contact Pyxis Technical Support at +1 (866) 203-8397, [service@pyxis-lab.com](mailto:service@pyxis-lab.com), or by filling out a request for support at <https://pyxis-lab.com/request-tech-support/>.

## 1 Introduction

Pyxis introduces the ST-712SS in-line pH/ORP composite smart sensor with built-in transmitter that supports digital (RS-485) and dual analog (4-20mA) signal outputs, designed to simplify field installation, calibration and use of operations. The ST-712SS pH portion of the sensor is offers a flat-bubble sensor design which is optimally suited for increased fouling resistance. The sensor is designed with a large capacity salt bridge and integrated automatic temperature compensation ensuring a highly accurate, long-life sensor with dramatically reduced field maintenance. The ST-712SS ORP portion of the sensor offers an oversized platinum electrode also instrumental in ensuring long sensor life and superior accuracy in fouled waters.

The ST-712SS sensor offers an easily replaceable, front loading electrode head for pH and ORP (EH-712) that has been independently developed by Pyxis Lab. The flat front-end design of the ST-712SS makes this platform less prone to contamination and fouling and is easy to clean. The ST-712SS sensor body is composed of 304 stainless steel and is well suited for aggressive industrial applications. The ST-712SS sensor offers both dual 4-20mA and RS-485 Modbus fully integrated output signals and is Bluetooth enabled when used in conjunction with the MA-CR Bluetooth Adapter for wireless data trending, diagnostics and calibration via **uPyxis®** Mobile or Desktop App.

### 1.1 Main Features

The ST-712SS sensor includes the following features:

- Easily replaceable electrode head (EH-712)
- Accurate and stable measurement with ultra-low drift
- Built-in transmitter without preamplifier or meter head
- Dual Outputs both 2x 4-20mA isolated signal or RS-485 Modbus
- Long-distance transmission with higher stability & accuracy
- Wireless Calibration, Diagnostics, Data Trend via **uPyxis®** App when used with MA-CR Adapter

## 2 Specifications

**Table 1.** ST-712SS Specifications

Specification*	ST-712SS
Part Number (P/N)	53032
ORP Range	±1500 mV
Precision	±1 mV or 1% of the value
pH Range (4-20mA Output)	0.00–14.00 <i>With Automatic Temperature Compensation</i>
Precision	±0.01 pH unit or 1% of the value
Response Time	95% within 5 seconds
Power Supply	22–26V DC, Power Consumption 2W
Storage Temperature	-7–60 °C (20–140 °F)
Outputs	Isolated Dual 4–20 mA Analog Output & isolated RS-485 Digital Output
Dimension (L × W × H)	Length 6.8 inch (172.7 mm), body diameter 1.44 Inch (36.6 mm)
Installation	ST-001 Inline Tee (provided) 3/4" FNPT Glue & Thread
Body Material	304 stainless steel
Weight	530 g (1.16 lbs)
Operational Pressure	100 psi (6.9 bar)
Operating Temperature	4–40 °C (40–104 °F)
Wet Material	Quartz & UPVC
Rating	IP67, Fully Dustproof & Waterproof
Regulation	CE Marked
Cable Included	MA-4.9CR Cable (8Pin Male/Female Adapters — 4.9ft) MA-1.5CR Cable (8 Pin Male Adapter / Flying Leads — 4.9ft) <i>Additional Extension Cables Available</i>
Typical Service Life <sup>†</sup>	2 years

\* With Pyxis’s continuous improvement policy, these specifications are subject to change without notice.

<sup>†</sup> Typical life is the sensor at 25 °C temperature under normal use conditions to measure clear water; harsh working conditions or water quality may shorten life.

### 3 Unpacking Instrument

Remove the instrument and accessories from the shipping container and inspect each item for any damage that may have occurred during shipping. Verify that all accessory items are included. If any item is missing or damaged, please contact Pyxis Lab Customer Service at [service@pyxis-lab.com](mailto:service@pyxis-lab.com).

#### 3.1 Standard Accessories

- One **ST-712SS** sensor with one ST-001 (CPVC) Inline Tee Assembly
- One **MA-4.9CR** — (Standard Cable / Male-Female 8-Pin Adapters — 4.9ft)
- One **MA-1.5CR** — (Flying Lead Cable / Male 8-Pin Adapter and Flying Leads — 4.9ft)
- User Manual available online at <https://pyxis-lab.com/support/>

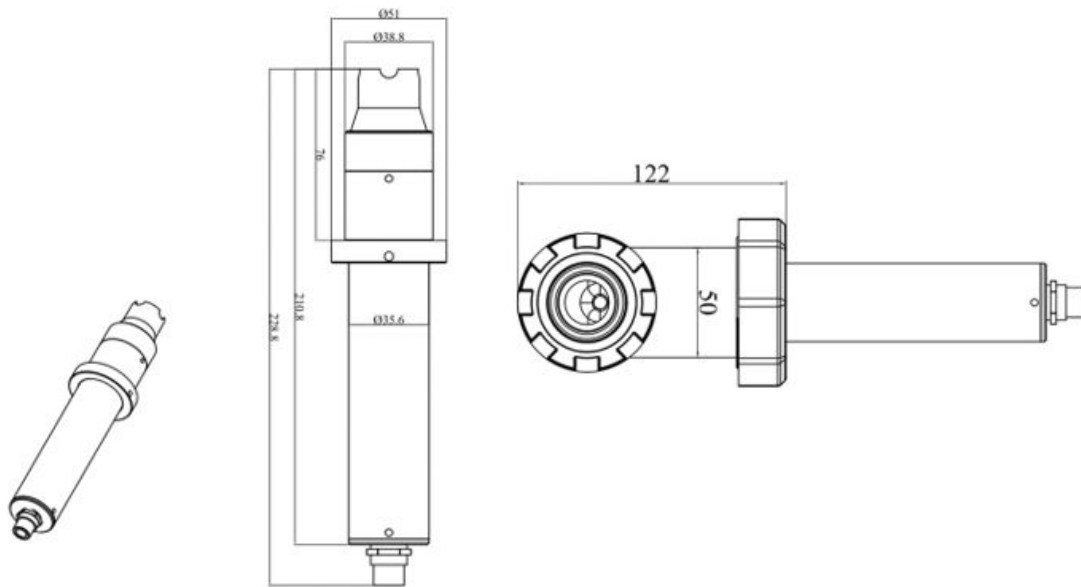
#### 3.2 Optional Accessories

The following optional accessories can be ordered from Pyxis Customer Service ([order@pyxis-lab.com](mailto:order@pyxis-lab.com)) or Pyxis E-Store at <https://pyxis-lab.com/shop/>.

**Table 2.** Optional Accessories

Accessory Name/Description	Part Number
EH-712 <i>(Replacement pH + ORP Electrode Head for ST-712SS)</i>	53035
ST-007 <i>(Stainless Steel Inline Tee Assembly ¼-inch Swagelok Inlet/Outlet)</i>	50700-A51
MA-CR <i>(Bluetooth Adapter For use with Pyxis 8-Pin Sensors)</i>	MA-CR
MA-NEB <i>(USB Bluetooth Adapter for use with Laptop or Desktop)</i>	MA-NEB
MA-50CR <i>(8-Pin Extension Cable-50 feet)</i>	50743
PowerPACK-2 <i>(Dual Channel Powered Bluetooth Adapter w 2x 4-20mA Pass Through)</i>	MA-BLE-2
ORP-200mV Calibration Standard Solution <i>(Calibration Solution 500mL)</i>	57020
4-7-10 Combination pH Calibration Kit <i>(4-7-10 pH Calibration Solution 500mL Each)</i>	57007

## 4 Installation

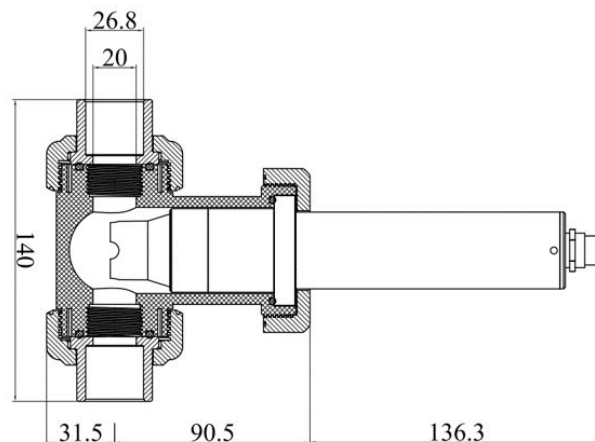


**Figure 1.** Dimension of the ST-712SS sensor (mm)

### 4.1 Piping

The provided ST-001 Tee Assembly can be connected to a pipe system through the 3/4" female ports, either socket or NPT threaded. To properly install the ST-712SS sensor into the ST-001 Tee Assembly, follow the steps below:

1. Insert the provided O-ring into the O-ring groove on the tee.
2. Insert the ST-712SS sensor into the tee.
3. Tighten the tee nut onto the tee to form a water-tight, compression seal.



**Figure 2.** Installation structure diagram of ST-712SS



### 4.2 Wiring

If the power ground terminal and the negative 4–20mA terminal in the controller are internally connected (non-isolated 4–20mA input), it is unnecessary to connect the 4–20mA negative wire (gray) to the 4–20mA negative terminal in the controller. If a separate DC power supply other than that from the controller is used, make sure that the output from the power supply is rated for 22–26 VDC @ 85 mA.

**\*NOTE\*** *The negative 24V power terminal (power ground) and the negative 4–20mA terminal on the ST-712SS sensor are internally connected.*

Follow the wiring table below to connect the ST-712SS sensor to a controller:

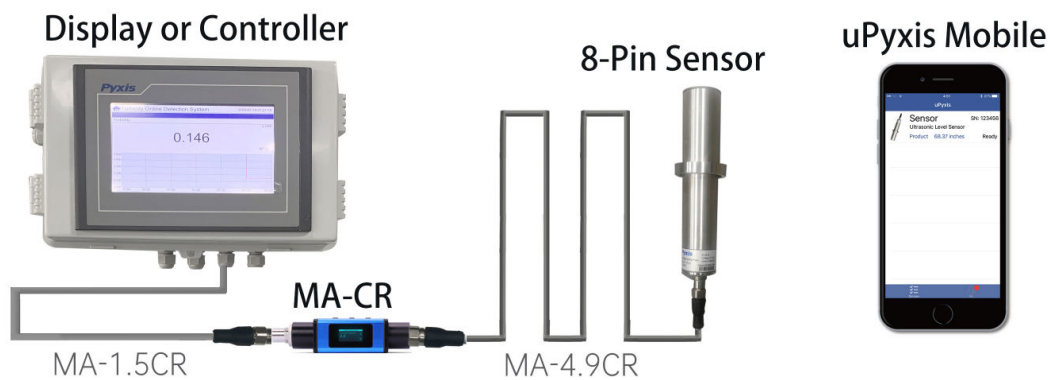
**Table 3.**

Wire Color	Designation
Red	24V +
Brown	24V Power ground
White	pH 4–20mA +
Gray*	4–20mA -
Blue	RS-485 A
Yellow	RS-485 B
Pink	ORP 4–20mA +
Green	Earth ground
Black	Shield, solution ground

\* Internally connected to the power ground

### 4.3 Connecting via Bluetooth

Connect and power the ST-712SS sensor with the Pyxis Bluetooth adapter (P/N: MA-CR) installed as shown in the following connection diagram. The power should be sourced from a 24 VDC power terminal of a controller. If a controller is not available, please purchase a 24 V power supply. Alternatively, you may purchase a Pyxis PowerPACK-1 Auxiliary Bluetooth Adapter that can provide power supply, Bluetooth access, and 4-20mA signal passthrough to the ST-712SS sensor. See **Optional Accessories** section for details.



**Figure 3.** Bluetooth connection to ST-710SS sensor with MA-CR and uPyxis Mobile App.

## 5 Setup and Calibration with uPyxis® Mobile App

### 5.1 Download uPyxis® Mobile App

Download uPyxis® Mobile App from [Apple App Store](#) or [Google Play](#).

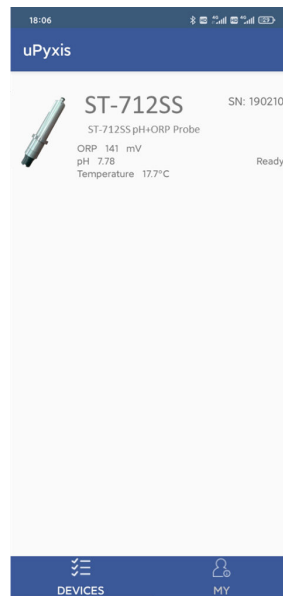


Figure 4. uPyxis® Mobile App installation

## 5.2 Connecting to uPyxis® Mobile App

Connect the ST-712SS sensor to a mobile smart phone according to the following steps:

1. Open **uPyxis®** Mobile App.
2. On **uPyxis®** Mobile App, pull down to refresh the list of available Pyxis devices.
3. If the connection is successful, the ST-712SS and its Serial Number (SN) will be displayed (Figure 5).
4. Press on the **ST-712SS sensor image**.



**Figure 5.**

### 5.3 Calibration Screen and Reading

The ST-712SS pH/ORP sensor is rigorously calibrated before leaving the Pyxis factory. As such, users should not need to calibrate the sensor for a period of three months up to one year if the sensor is maintained in clean operable condition. In applications where the sensor may become dirty or fouled (i.e. Cooling Towers) users can calibrate the sensor according to their needs and as desired.

The ST-712SS sensor requires calibration for pH/ORP. The pH/ORP can be calibrated with a standard solution containing a known pH/ORP or with the sample water itself. The pH/ORP of the sample water should be determined with a properly calibrated benchtop or portable pH/ORP analyzer, such as the Pyxis SP-600 (Portable Water Multimeter). Before calibration, the ST-712SS sensor should be cleaned with Pyxis Probe Cleaning Solution (P/N: SER-01) if heavily fouled then thoroughly rinsed with deionized water taking special care to avoid direct contact with the electrode by the fingers or hand.

When connected, the **uPyxis®** Mobile App will default to the **Calibration** screen. From the **Calibration** screen, you can perform calibrations by pressing on **pH Low Calibration**, **pH 7 Calibration**, **pH High Calibration**, and **ORP Calibration**. Follow the screen instructions for each calibration step.

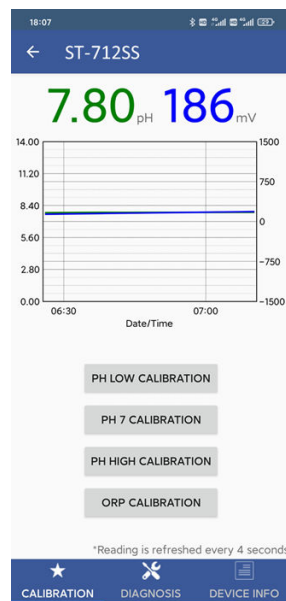


Figure 6.

## 5.4 Diagnosis Screen

From the **Diagnosis** screen, you can check the diagnosis condition. This feature may be used for technical support when communicating with [service@pyxis-lab.com](mailto:service@pyxis-lab.com).

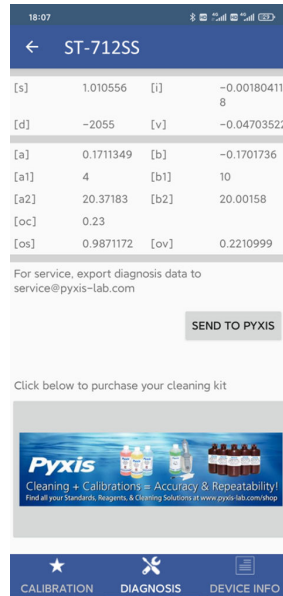
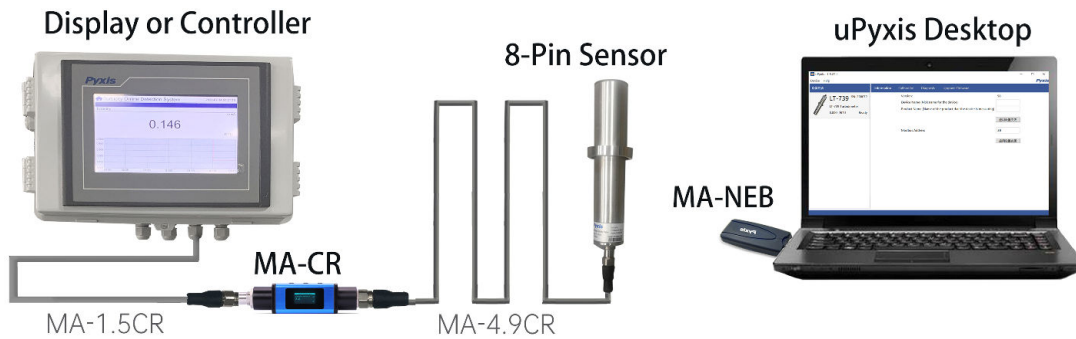


Figure 7.

## 5.5 Device Info Screen

From the **Device Info** screen. You can name the Device or Product as well as set the Modbus address.

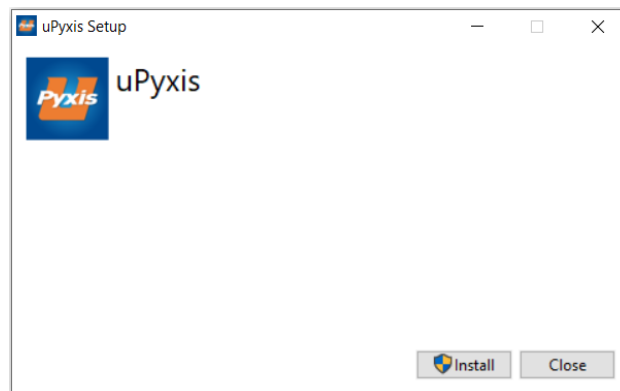


**Figure 8.** Bluetooth connection to ST-710SS Sensor with MA-CR and MA-NEB and uPyxis Desktop.

## 6 Setup and Calibration with uPyxis® Desktop App

### 6.1 Install uPyxis® Desktop App

Download the latest version of uPyxis® Desktop software package from: <https://pyxis-lab.com/upyxis/> this setup package will download and install the Microsoft.Net Framework 4.5 (if not previously installed on the PC), the USB driver for the USB-Bluetooth adapter (MA-NEB), the USB-RS485 adapter (MA-485), and the main uPyxis® Desktop application. Double click the **uPyxis.Setup.exe** file to install.



**Figure 9.** uPyxis® Desktop App installation

Click **Install** to start the installation process. Follow the screen instructions to complete the USB driver and uPyxis® installation.

## 6.2 Connecting to uPyxis® Desktop App

Connect the ST-712SS sensor to a Windows computer using a Bluetooth/USB adapter (P/N: MA-NEB) according to the following steps:

1. Plug the Bluetooth/USB adapter into a USB port in the computer.
2. Launch uPyxis® Desktop App.
3. On uPyxis® Desktop App, click Device → **Connect via USB-Bluetooth** (Figure 9).
4. If the connection is successful, the ST-712SS and its Serial Number (SN) will be displayed in the left pane of the uPyxis® window.

**\*NOTE\*** After the sensor and Bluetooth is powered up, it may take up to 10 seconds for the adapter to establish the wireless signal for communication.

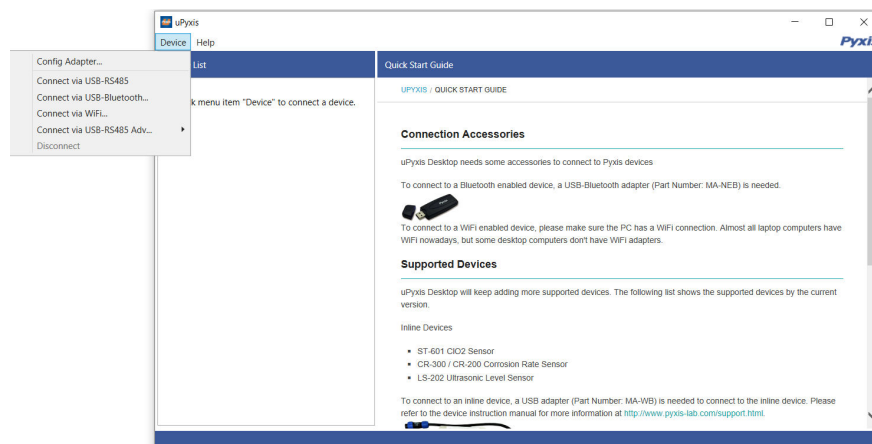


Figure 10.

### 6.3 Information Screen

Once connected to the device, a picture of the device will appear on the top-left corner of the window and the uPyxis® Desktop App will default to the **Information** screen. On the **Information** screen you can set the information description for **Device Name**, **Product Name**, and **Modbus Address**, then click **Set** to save.

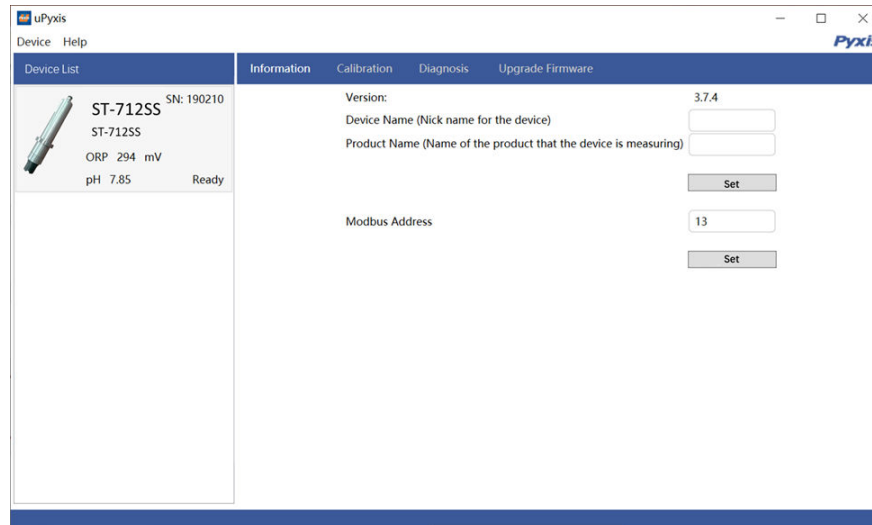


Figure 11.



## 6.4 Calibration Screen

The ST-712SS pH/ORP sensor is rigorously calibrated before leaving the Pyxis factory. As such, users should not need to calibrate the sensor for a period of three months up to one year if the sensor is maintained in clean operable condition. In applications where the sensor may become dirty or fouled (i.e. Cooling Towers) users can calibrate the sensor according to their needs and as desired.

The ST-712SS sensor requires calibration for pH/ORP. The pH/ORP can be calibrated with a standard solution containing a known pH/ORP or with the sample water itself. The pH/ORP of the sample water should be determined with a properly calibrated benchtop or portable pH/ORP analyzer, such as the Pyxis SP-600 (Portable Water Multimeter). Before calibration, the ST-712SS sensor should be cleaned with Pyxis Probe Cleaning Solution (P/N: SER-01) if heavily fouled then thoroughly rinsed with deionized water taking special care to avoid direct contact with the electrode by the fingers or hand.

To calibrate the device, click on **Calibration**. On the **Calibration** screen there is are four calibration buttons, **pH 7 Calibration**, **pH Low Calibration**, **pH High Calibration**, and **ORP Calibration**. The screen also displays the reading of the device. The reading refresh rate is every 4 seconds. Follow the screen instructions for each calibration step.

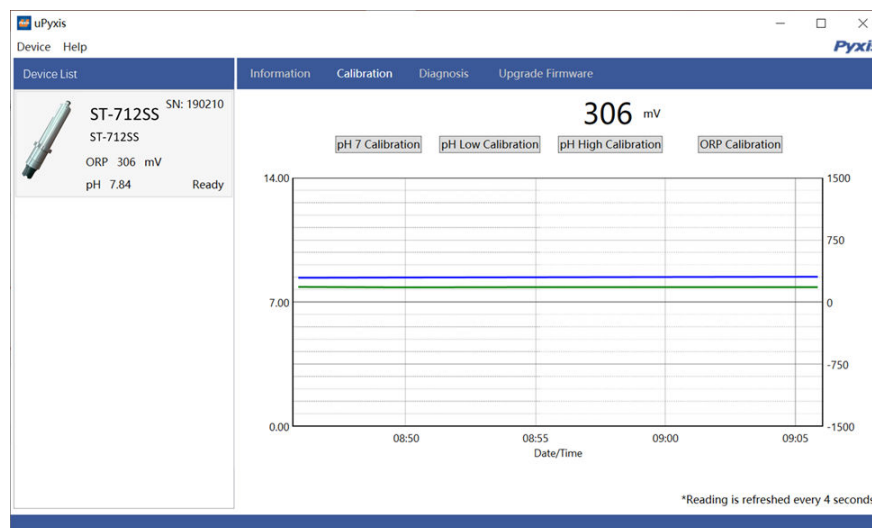


Figure 12.

## 6.5 Diagnosis Screen

After the device has been calibrated and installation has been completed, to check diagnosis, click on **Diagnosis**. When in the **Diagnosis** screen you can view the Diagnosis Condition of the device. This feature may be used for technical support when communicating with [service@pyxis-lab.com](mailto:service@pyxis-lab.com).

Device List	Information	Calibration	Diagnosis	Upgrade Firmware
ST-712SS SN: 190210 ST-712SS ORP 341 mV pH 7.81 Ready			[s] 1.010556 [i] -0.001804118 [d] -2036 [v] -0.04660034 [a] 0.1711349 [b] -0.1701736 [a1] 4 [b1] 10 [a2] 20.37183 [b2] 20.00158 [oc] 0.23 [os] 0.9871172 [ov] 0.3456116	

Figure 13.

## 7 Outputs

### 7.1 4–20mA Output Setup

The 4–20mA output of the ST-712SS sensor is scaled as:

- pH:
  - 4 mA = 0
  - 20 mA = 14
- ORP:
  - 4 mA = -1500 mV
  - 20 mA = 1500 mV

### 7.2 Communication using Modbus RTU

The ST-712SS sensor is configured as a Modbus slave device. In addition to the pH value and ORP mV value, many operational parameters, including warning and error messages, are available via a Modbus RTU connection. Contact Pyxis Lab Customer Service ([service@pyxis-lab.com](mailto:service@pyxis-lab.com)) for more information.

## 8 Sensor Maintenance and Precaution

### 8.1 Methods to Cleaning the ST-712SS Sensor

Any equipment in contact with industrial cooling systems is subject to many potential foulants and contaminants. Our inline sensor cleaning solutions below have been shown to remove most common foulants and contaminants. A small, soft bristle brush, Q-Tips cotton swab, or soft cloth may be used to safely clean the sensor housing and the quartz optical sensor channel. These components and more come with a Pyxis Lab **Inline Probe Cleaning Solution Kit** (P/N: SER-01) which can be purchased at our online E-Store <https://pyxis-lab.com/product/st-series-probe-cleaning-kit/>



**Figure 14.** Inline Probe Cleaning Solution Kit

To clean the ST-712SS sensor, soak the lower half of the sensor in 100 mL inline sensor cleaning solution for 10–15 minutes. Rinse the ST-712SS sensor with distilled water. If the surface is not entirely clean, continue to soak the ST-712SS sensor for an additional 10–15 minutes. Use the small, soft bristle brush and Q-Tips cotton swabs as necessary to remove any remaining contaminants on the ST-712SS sensor surface.

## 8.2 Replacing pH+ORP Electrode Head (EH-712)

The ORP electrode head of ST-712SS can be purchased as a spare accessory under the name EH-712 (P/N: 53035) can be replaced when the original electrode head reaches the end of its working life. Order a replacement electrode head (EH-712) from Pyxis and follow instructions as below:

1. Turn off the sensor if it is powered on.
2. Make sure there is no water on the sensor.
3. Hold the ST-712SS main body with one hand and use the other hand to twist the stainless-steel locking ring connecting the black electrode counterclockwise, until the front end of the black electrode is completely unscrewed, as shown in Figure 15-2.
4. Pull out the electrode head as show in Figure 15-3.
5. Gently loosen the electrode plug connector and remove the electrode head as show in Figure 15-4.
6. To assemble the new electrode head, gently insert the plug connector and push the wires into the main housing. Gently insert the new electrode head into the sensor main body. The two protrusions on the electrode head should be aligned with the notch in the sensor main housing.
7. Then twist the stainless-steel lock ring of ST-712SS in a clockwise direction until the threads of the electrode head basically enter the ST-712SS housing, as shown in 15-1.

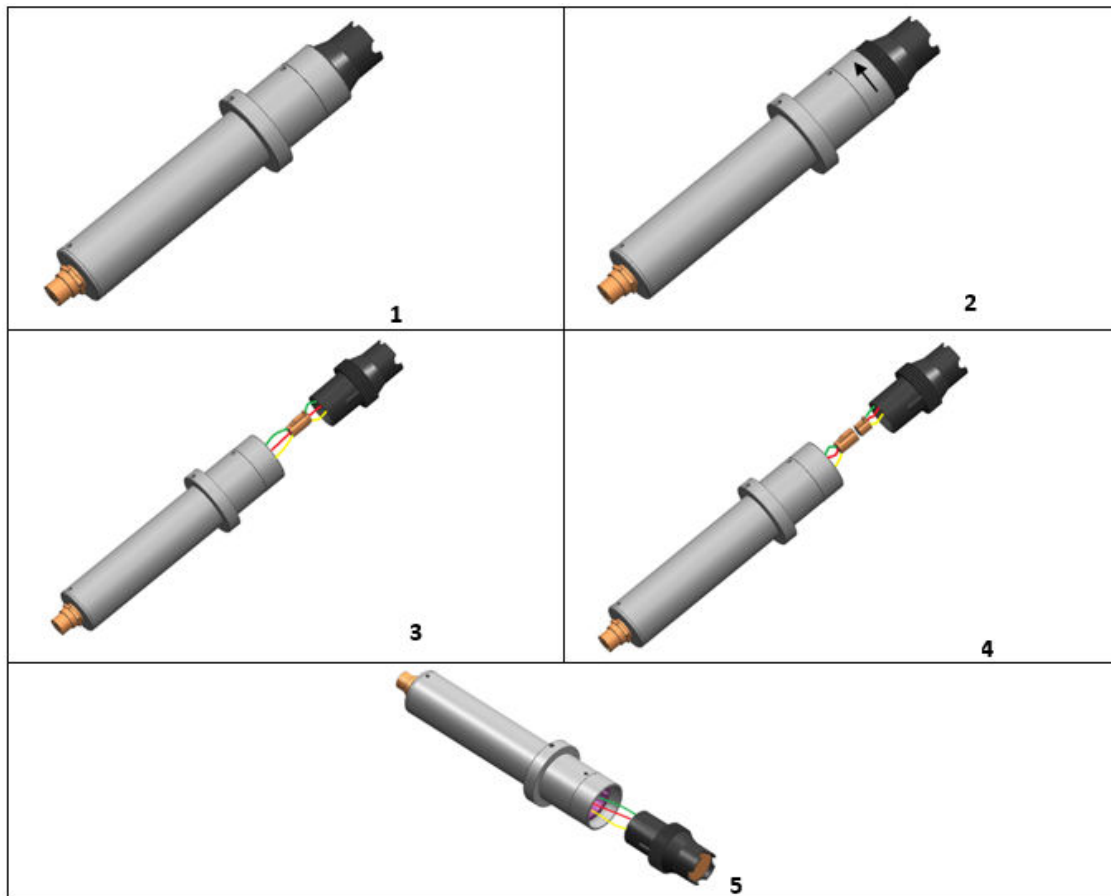


Figure 15. Replacing EH-711 — ORP Electrode Head

## 9 Troubleshooting

If the ST-712SS sensor output signal is not stable and fluctuates significantly, make an additional ground connection — connect the black (shield, solution ground) wire to a conductor that contacts the sample water electrically such as a metal pipe adjacent to the ST-712SS tee.

## 10 Contact Us

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