Pyxis®

ST-723 Inline Conductivity Sensor

High Temperarure Conductivity Sensor for Boiler and Process Water

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, or by filling out a request for support at https://pyxis-lab.com/request-tech-support/.

1   Introduction

The Pyxis Lab ST-723 is an industrial grade in-line high temperature conductivity sensor specially designed for boiler water and other high-temperature process applications. Common uses include conductivity measurement of boiler feedwater, boiler blowdown, condensate water and other process applications. ST-723 is a 'smart sensor' with a built-in transmitter supporting digital and analog signal outputs and is designed to simplify field installation, calibration, and operation. The sensor is offered with ¾-inch MNPT thread installation and is constructed with a Hastelloy electrode and stainless-steel body with integrated cooling fins. The ST-723 sensor can be wirelessly calibrated with uPyxis 2.0 app for mobile or desktop devices when used with the MA-CR Bluetooth-USB adapter. The sensor provides two 4-20mA analog outputs, one for conductivity and one for temperature, as well as RS-485 Modbus output for a broad array of installations that desire to connect the smart sensor directly to receiving controller, PLC or DCS network. The ST-723 sensor has built-in RTD for the automatic compensation of sample temperature.

ST-723 Conductivity Sensor

1.1   Features

The ST-723 includes the following features:

- Designed for boiler, feedwater, and process conductivity monitoring.

- Heat dissipation fins for stable operation of the transmission module under high temperature conditions.

- Front-end fully digital detection technology

- Easy installation into ¾-inch FNPT standard pipe Tee

- Built-in PT-100 temperature measurement

- The latest short pulse type detection method technology

- Built-in transmitter without preamplifier or meter head

- 2x 4–20mA isolated analog and RS-485 Modbus digital outputs with anti-interference design

- Specially designed electrode greatly improves the long-term stability reduces cleaning and maintenance.

NOTE *The output conductivity value is not temperature compensated and user needs to compensate the conductivity value according to the actual working conditions. To reduce errors, calibration should be performed at room temperature (25 ° C).*

2   Specifications

Table 1. ST-723 Specifications

Item	ST-723
P/N	53106
Conductivity Range	0 - 15,000.0 μS /cm
Conductivity Precision	±10% μS /cm or ± 3.5% FS, whichever is greater
4-20mA Range for Temp	32 - 392 °F (0 - 200 °C)
Temperature Method	PT-100
Cell Constant (K)	0.3
Power Supply	22 – 26V DC, Power Consumption 2W
Dimension (L x W x H)	Length 8.46 inch (298 mm), body diameter 1.32 Inch (47mm)
Installation	¾-inch NPT
Body Material	304 Stainless Steel
Weight	1290 g (2.84 lbs.)
Operational Pressure	≤2.0 MPa（300psi）@199°C
Operating Temperature	41 - 392 °F (5 - 200 °C)
Storage Temperature	-4 - 392 °F (-20 - 200 °C)
Outputs	8Pin - Isolated 4 – 20 mA Analog Output & Isolated RS-485 Digital Output
Electrode Material	HASTELLOY
Rating	IP67, Fully Dustproof & Waterproof
Regulation	CE, RoHS, UKCA Marked
Cables Provided	8-Pin Bulkhead 4.9 ft (1.5 m) / 8-Pin Flying Lead 4.9 ft (1.5 m) (Extension Cables Sold Separately)

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

3   Unpacking ST-723

Remove the instrument and find the standard accessories from the shipping container as listed below. 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

3.1 Standard Accessories

- One **ST-723** (P/N – 53106) sensor

- One **MA-1.5CR** Cable (1.5 m/4.9 ft 8-Pin Male Adapter/Flying Lead)

- One **MA-4.9CR** Cable (1.5 m/4.9 ft Extension Cable for 8Pin Pyxis Sensors)

- User Manual is also available for download at https://pyxis-lab.com/support/

3.2 Optional Accessories

The following optional accessories can be purchased via your Regional Sales contact or Pyxis Customer Service at order@pyxis-lab.com.

Table 2. Optional Accessories

Accessory Name	P/N
MA-CR Bluetooth/USB Adapter *(Pyxis Bluetooth/USB Adapter for 8Pin Pyxis Sensors)*	MA-CR
Conductivity Reference Standard 1,000uS/cm *(Calibration Solution 500mL)*	507008
MA-C50 *(50' Extension Cable for 8Pin Pyxis Sensors)*	50743
MA-C100 *(100' Extension Cable for 8Pin Pyxis Sensors)*	50744
Pyxis Probe Cleaning Kit *(Includes Sensor Cleaner 500mL + Accessories)*	SER-01
Power*PACK-1* *(Single Chanel Auxiliary Power Supply w/Bluetooth for Pyxis Sensors)*	MA-BLE-1
Power*PACK-4* *(Four Chanel Auxiliary Power Supply w/Bluetooth for Pyxis Sensors)*	MA-BLE-4

4 Dimension & Installation

The dimensional drawing of the ST-723 is as follows.
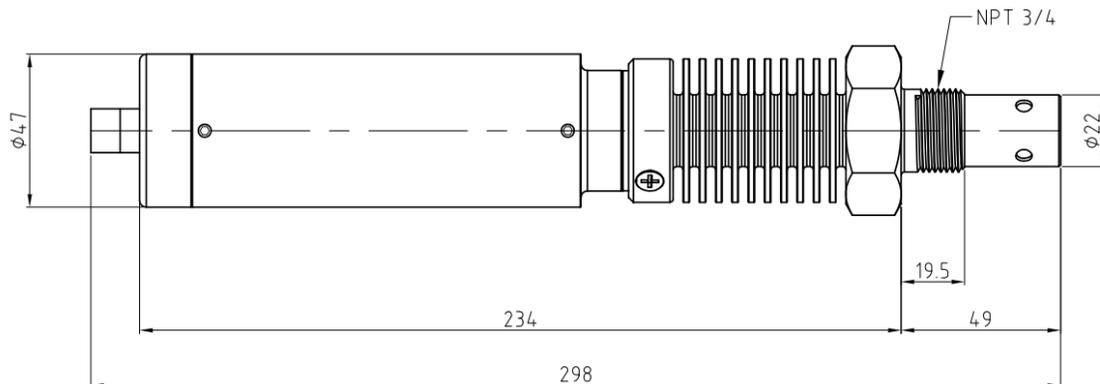
Figure 1. Dimension of the ST-723 (mm)

4.1   Piping Installation Guidelines

Proper Installation Methods:

•   Water flowing <u>from the bottom up</u> in the pipe keeps the conductivity cell flooded and prevents air bubbles and air pockets while ensuring accurate measurement. As shown in Figure 2.

•   The conductivity cell is located <u>at the bottom</u> of the water stream and is less likely to accumulate air. However, it is worth noting that this type of installation should avoid the conductivity cell from reaching in too short and forming a dead zone. As shown in Figure 3.

•   The conductivity cell is located on the side of the pipe, which avoids the accumulation of air to a greater extent and is less susceptible to contaminant deposits and ensures accurate measurement as shown in Figure 4.
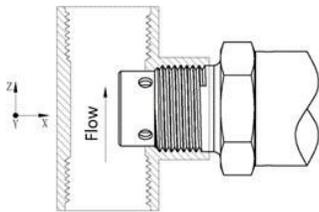
Figure 2. Installation Method (1)   **Figure 3.** Installation Method (2)   **Figure 4.** Installation Method (3)
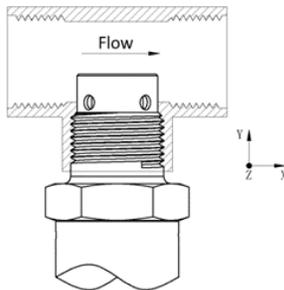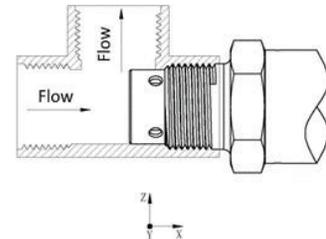
Improper Installation Methods

The following 3 installation methods <u>should be avoided</u>. These installation methods can easily produce air bubbles and air accumulation leading to unstable measurement. As shown in Figure 5.
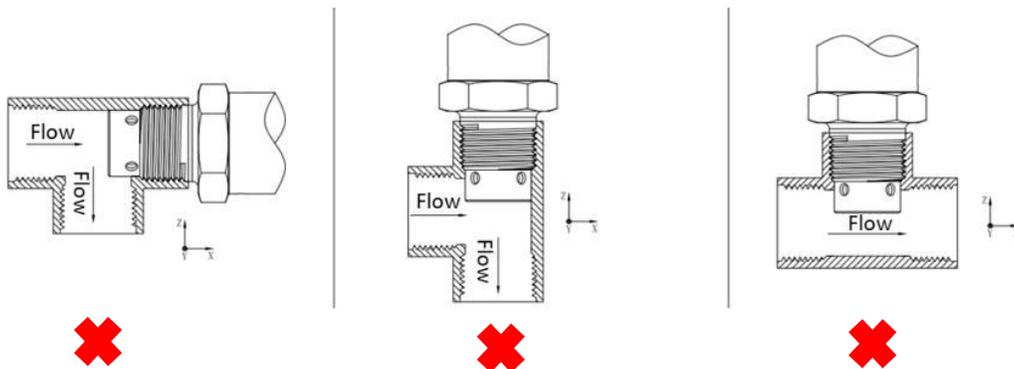
Figure 5. Installation methods <u>to be avoided</u>.

4.2 Wiring

The ST-723 sensor provides passive 4-20mA outputs. They should not be connected to a loop powered input. 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.

Follow the wiring table below to connect the ST-723 sensor to a receiving controller:

Table 3.

Wire Color	Designation
Red	24 V +
Brown	24V Power ground
White	1#4–20mA + for Conductivity
Pink	2# 4–20mA + for Temperature
Gray*	4–20mA -
Blue	RS-485 A
Yellow	RS-485 B
Green	RS-485 C, earth ground

* 4-20mA- and Power Ground are internally connected

ST-723 Sensor 4-20mA Scaling		
Unit of Measure	4mA Value	20mA Value
Conductivity	0 us/cm	15,000 us/cm
Temperature	32 °F	392 °F

NOTE: The 24V power ground and the 4-20 mA- return are internally connected. If insufficient wattage is available from the connected controller (i.e., up to combined 2W maximum at 20mA reading for both conductivity and temperature), Pyxis recommends the **PowerPACK** Series Auxiliary Power & Bluetooth Communication Adapters highlighted in the Optional Accessories section of this manual.

5 Calibration and Diagnosis

The ST-723 conductivity sensor is rigorously calibrated before leaving the Pyxis Lab factory. As such, users do not need to calibrate the probe for a period of one year if the sensor is maintained clean. Users can however calibrate the probe according to their needs and as desired using the MA-CR Bluetooth/USB adapter and uPyxis 2.0 app for mobile or desktop devices.

The ST-723 sensor requires a slope calibration for conductivity. The conductivity can be calibrated with a **Pyxis conductivity standard** or with the **sample water itself**. The conductivity concentration of the sample water can be measured using the Pyxis SP-600 Portable Water Multimeter (P/N – 50353). Before calibration, the sensor should be cleaned with deionized water at a minimum, and if deposition exists on the electrode, please conduct a thorough electrode cleaning with Pyxis Probe Cleaning Solution (P/N – SER-01) as outlined in Section 7.1 of this user manua..

 ٭NOTE٭ *Please take special care to avoid direct contact of the sensor electrode with the hand or fingers.*

5.1 Calibration and Diagnosis by uPyxis 2.0 Mobile App

Install the MA-CR Pyxis Bluetooth adapter (P/N: MA-CR) between the ST-723 bulkhead cable and flying lead cable connected to the display or controller, using the 8-pin adapters as shown in the following connection diagram. The power should be sourced from a 24 VDC power terminal of the display or controller. If not available, please purchase a 24VDC power supply or use the Pyxis PowerPACK Series Bluetooth adapters (See Section 3.2 Optional Accessories)

MA-CR Bluetooth/USB Adapter

Figure 6. Power the ST-723 via Controller with the MA-CR Bluetooth Adapter inserted between Bulkhead & Flying Lead Cables

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Download and install the **uPyxis2.0** app from **Apple Store** or **Google Play**. Turn on the Bluetooth in the smart device (please do not pair your device Bluetooth to uPyxis, the app will do the pairing). Open the uPyxis 2.0 app in the device. Click Scan Bluetooth button to scan the available Pyxis Bluetooth devices. The discovered devices will be listed as shown in Figure 7. This may take up to one minute.

NOTE To use uPyxis 2.0® please enable Bluetooth® and location permissions on your mobile device.

Tap the discovered ST-723 sensor to connect to the sensor. The uPyxis 2.0 app can identify the sensor type if multiple Pyxis sensors are discovered in the scan.

As shown in Figure 8, uPyxis 2.0 will default to **Trend Chart** page after connected to the sensor via the MA-CR Bluetooth adapter. The measurement value will be displayed as a line graph to show the real-time trend.

Tap **Configuration** in the top right side of the app page to launch the configuration page. Five functional tabs of each are available in this page: Information, Configuration, Calibration, 4-20mA Span and Diagnosis.
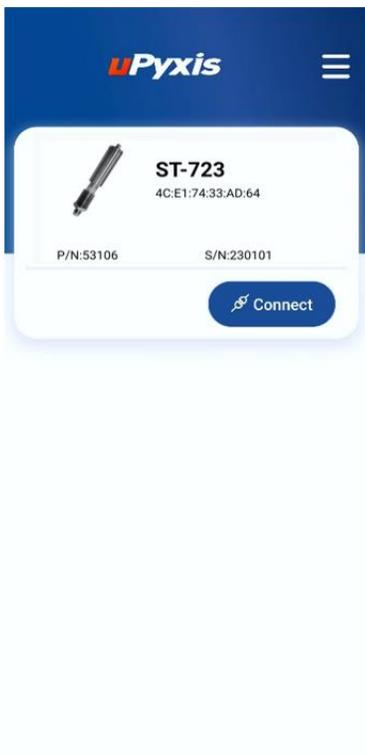
Figure 7. ST-723 Discovered via Bluetooth   **Figure 8.** Trend Chart Page   **Figure 9.** Configuration Page
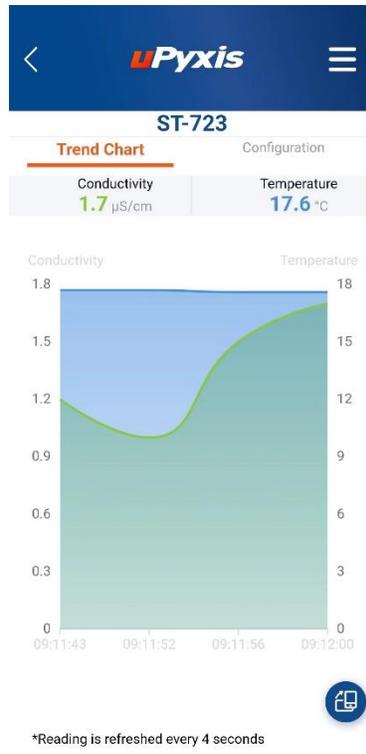
5.1.1 Conductivity Calibration

Breaker Conductivity Calibration

Remove the ST-723 sensor from the pipe tee and use deionized water to clean the sensor. If severely fouled, conduct a cleaning using Pyxis Probe Cleaner (P/N – SER-01) as outlined in Section 7.1. After cleaning, place the sensor into a beaker containing **Pyxis 1,000us/cm Conductivity Standard**, then tap **Calibration** in the uPyxis app. Enter the conductivity value 1,000 in the dialog window as in Figure 10. Please allow sufficient time (a few minutes) for the sensor to stabilize before performing the calibration.
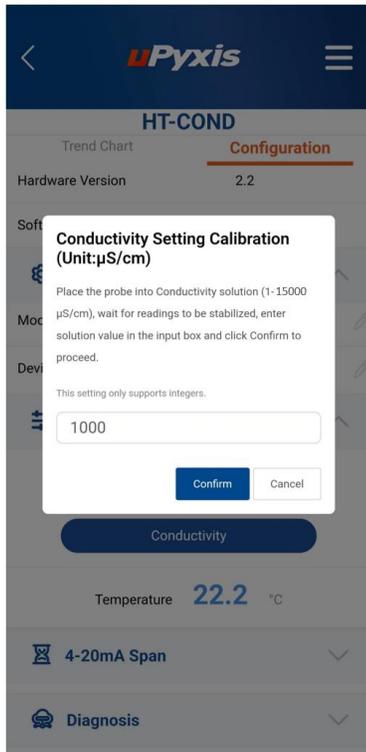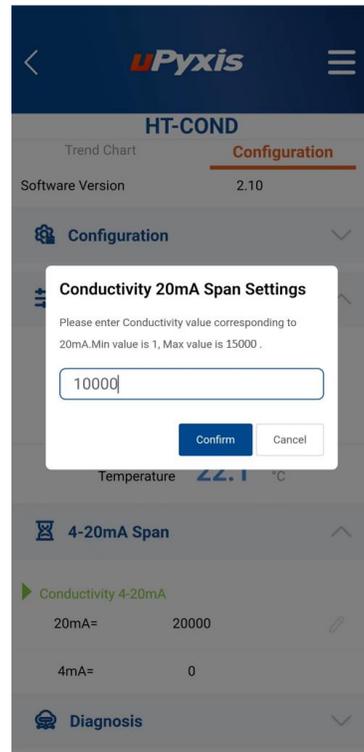
| Figure 10. | Figure 11 |

5.1.2 4-20mA Span

From the Pyxis factory, the 4–20mA output of the ST-723 sensor is scaled as follows:

ST-723 Sensor 4-20mA Scaling		
Unit of Measure	**4mA Value**	**20mA Value**
Conductivity	0 us/cm	15,000 us/cm
Temperature	32 °F	392 °F

Users may alter the output scale using **4-20mA Span** to change the conductivity value corresponding to the 20mA output as shown in Figure 11. ***NOTE*** *The 20mA value span adjustment may only be* <u>*equal to or lower than*</u> *the upper range detection limit of the sensor.*

5.1.3 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
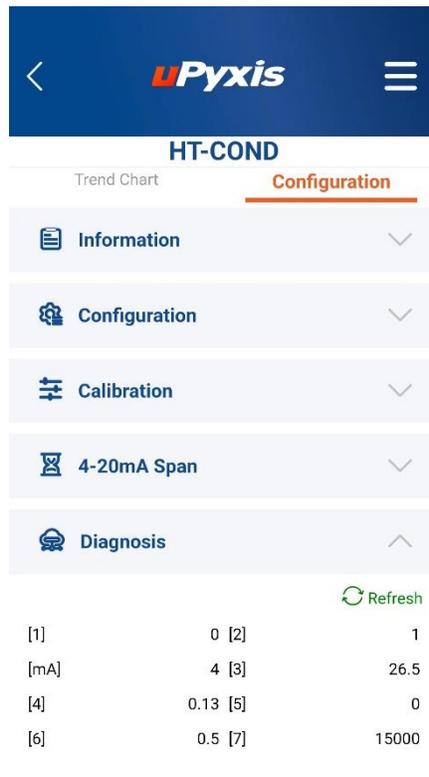
Figure 12.

5.2 Install uPyxis® Desktop App

1) Download and install uPyxis Desktop APP from
https://upyxis.pyxis-lab.com.cn/release/pc/uPyxis.Setup-latest.zip

2) Connect a USB Type-C cable to the port at the bottom of the MA-CR and to the USB port of the laptop or computer. This will provide power to the MA-CR from the laptop/computer.   Connect the MA-CR to the ST-723 sensor. The MA-CR Bluetooth adapter will boost the 5V of the regular USB to 24V to power the sensor for use with uPyxis Desktop.

MA-CR

Bluetooth Adapter – Bottom USB-C Port
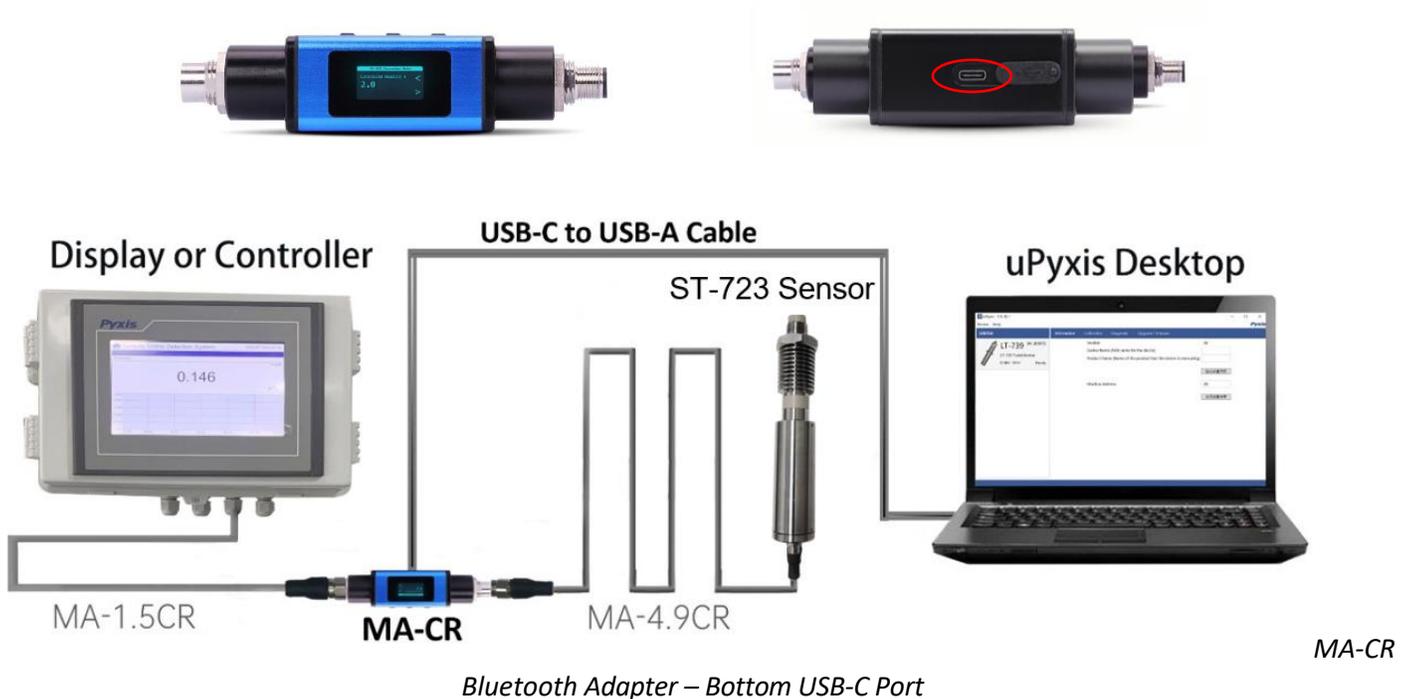
Figure 13. ST-723 Probe / MA-CR / USB-C Cable connected to uPyxis Desktop.

3) Set the MA-CR to operate in USB Mode by following the steps below.

   a) Once the MA-CR screen is powered Press ◀ or ▶ until you arrive at (USB to RS485) screen.

   b) Press the **OK** Button.

   c) Follow Prompts below to Enable USB feature. Once enabled, you may connect to uPyxis.

4) Open the desktop uPyxis APP.

5) Click Device to launch the connection option menu.

6) Select Connect via USB-RS485 (Figure 14).

7) Select the Comm Port to make a connection. Normally only one Comm port is identified by uPyxis (Figure 15*). If more than one Comm port listed in the selection dropdown, you may try to select each one to see if a connection can be made. Alternatively, you may use the Windows Device Manager to identify the Comm Port that the Pyxis USB adapter is using.
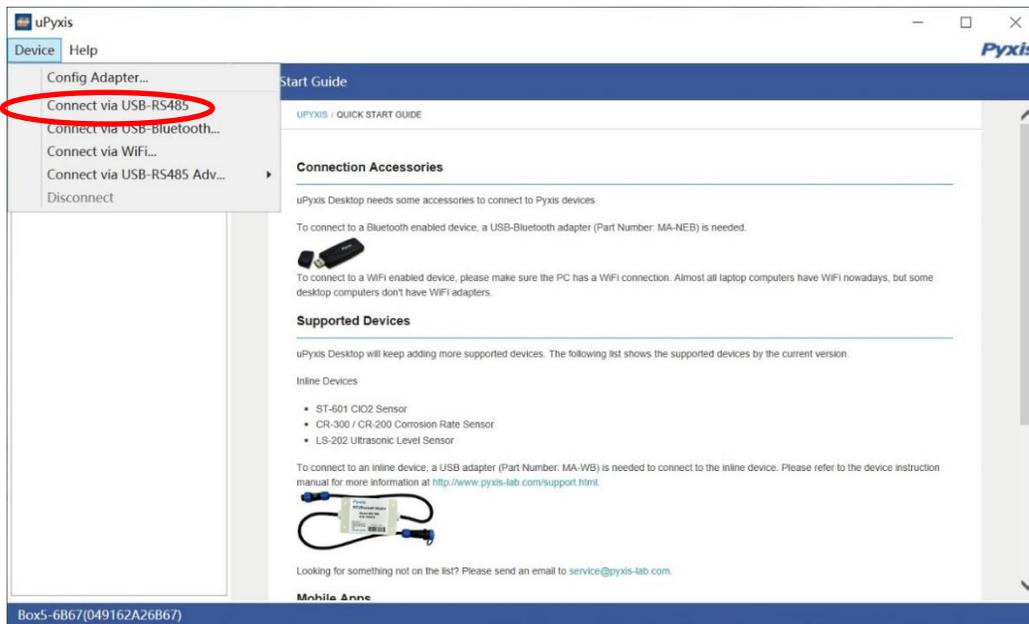
Figure 14. Connection Options
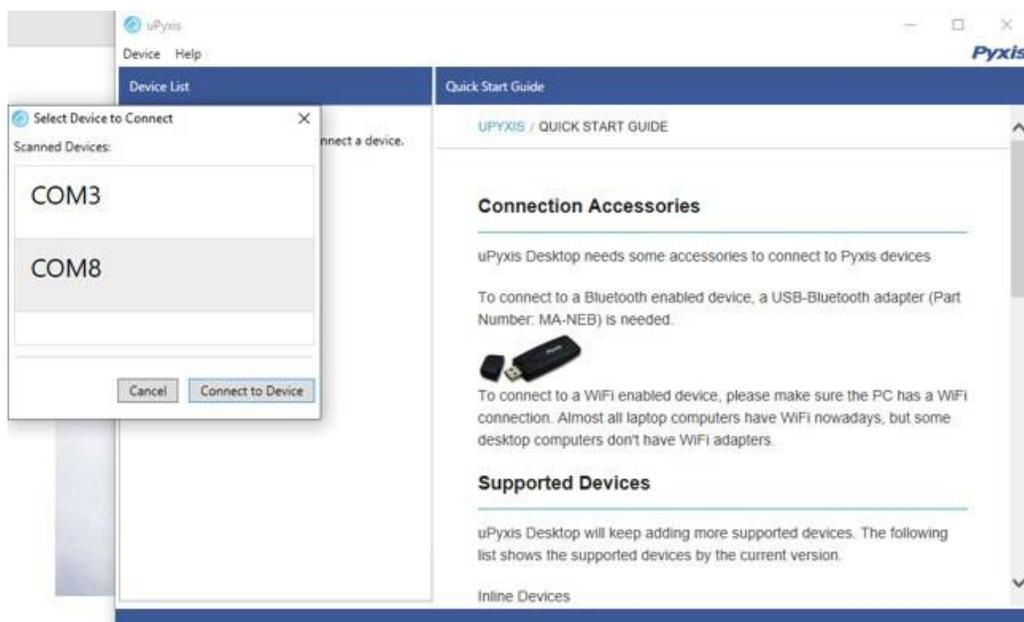
Figure 15. Select a Comm port

After the connection is established, the ST-723 probe series number and current conductivity readings are displayed on the left of the information page (Figure 16). In this page, you can set the information description for **Device Name**, **Product Name**, and **Modbus Address**, then click **Apply Settings** to save.

Figure 16.

To calibrate the device, click on **Calibration**. On the **Calibration** screen there are three calibration options: **Slope Calibration**, **4-20mA Span** and **Restore to Factory**

The Restore to Factory function can be used to restore factory calibration to the sensor if user error occurs during the calibration process. The screen also displays the reading of the device, the reading refresh rate is every 4 seconds.
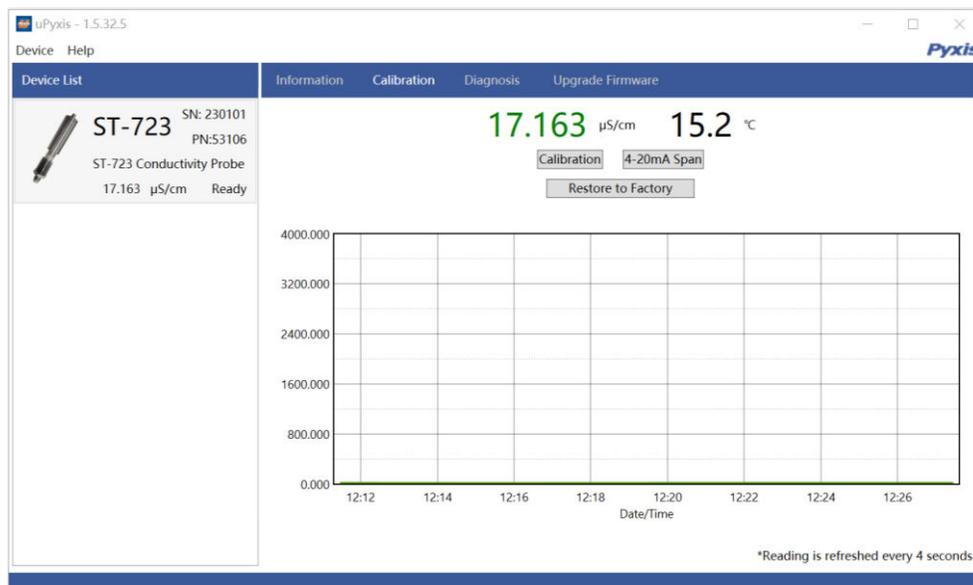
Figure 17.

5.2.1 Conductivity Calibration

<u>Breaker Conductivity Calibration</u>

Remove the ST-723 sensor from the pipe tee and use deionized water to clean the sensor. If severely fouled, conduct a cleaning using Pyxis Probe Cleaner (P/N – SER-01) as outlined in Section 7.1. After cleaning, place the sensor into a beaker containing **Pyxis 1,000us/cm Conductivity Standard**, then tap **Calibration** in the uPyxis app. Enter the conductivity value 1,000 in the dialog window as in Figure 18. Please allow sufficient time (a few minutes) for the sensor to stabilize before performing the calibration.
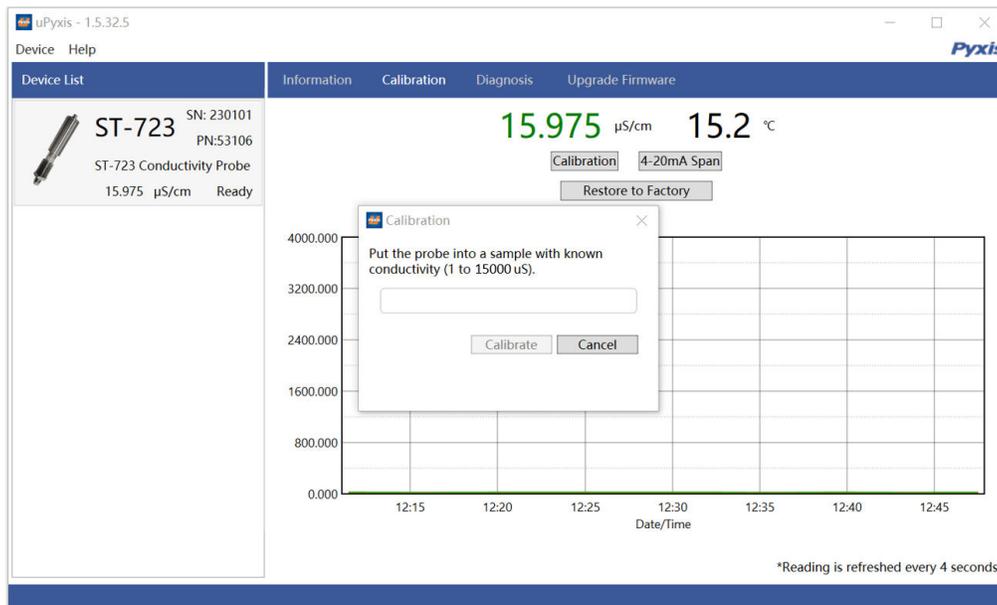
Figure 18.

5.2.2 4-20mA Span

From the Pyxis factory, the 4–20mA output of the ST-723 sensor is scaled as follows:

ST-723 Sensor 4-20mA Scaling		
Unit of Measure	**4mA Value**	**20mA Value**
Conductivity	0 us/cm	15,000 us/cm
Temperature	32 °F	392 °F

Users may alter the output scale using **4-20mA Span** to change the conductivity value corresponding to the 20mA output (Figure 19). ***NOTE*** *The 20mA value span adjustment may only be <u>equal to or lower than </u>the upper range detection limit of the sensor.*
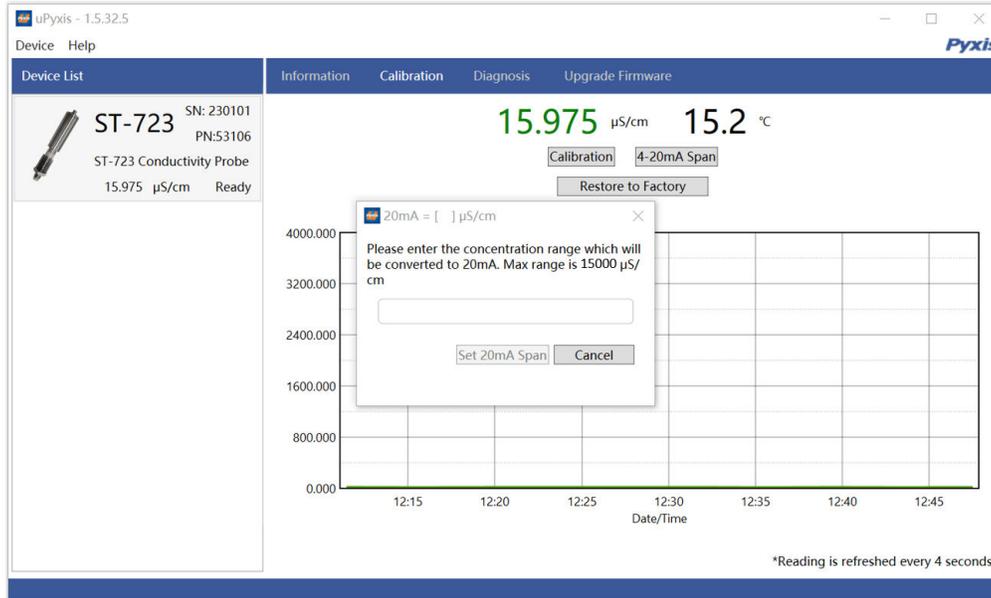
Figure 19.

5.2.3 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.
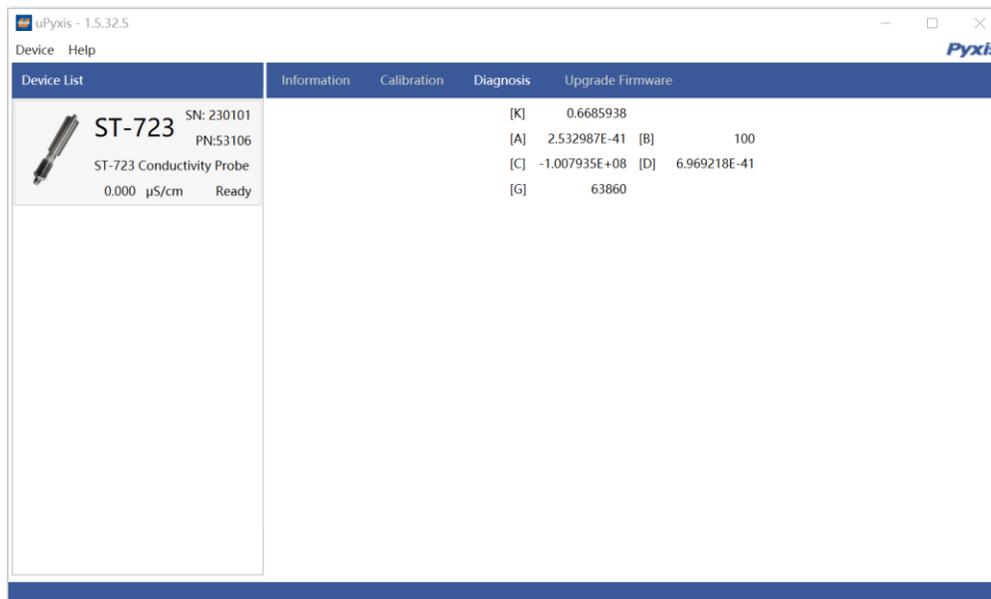
Figure 20.

6. Communication using Modbus RTU

The ST-723 sensor is configured as a Modbus slave device. In addition to the µS/cm conductivity 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) for more information.

7. Sensor Maintenance and Precaution

7.1 Methods to Cleaning the ST-723 Sensor

The ST-723 sensor is designed to provide stable conductivity measurements in pure water, so in general, the sensor is less likely to become contaminated. If scaling occurs, particularly iron oxide deposits, they can be removed using a cleaning solution capable of removing iron, such as the 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 21. Inline Probe Cleaning Solution Kit

To clean the ST-723 sensor, soak the lower half of the sensor in 100 ml of in-line sensor cleaning solution for 10 minutes or longer (the cleaning solution should completely submerge the front electrode). After soaking, gently scrub the electrode surface with a cotton swab. *NOTE* *The cleaned sensor should be thoroughly cleaned with DI water and calibrated before use after the probe cleaning solution is used.*

8. Troubleshooting

If the ST-723 sensor output signal is not stable and fluctuates significantly, make an additional ground connection — connect the green (earth ground) wire to a conductor that contacts the sample water electrically such as a metal pipe adjacent to the ST-723 tee.

9.   Contact Us

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