Pyxis®

www.pyxis-lab.com

ST-750 Inline APHA Color Sensor
User Manual

Pyxis Lab® Inc.
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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.

Device Warranty Term

The Pyxis warranty term for the ST-750 probe is thirteen (13) months from original shipment from Pyxis. 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 in the course of 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 Number (RA) 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 back 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.

Pyxis Technical Support

Contact Pyxis Technical Support at service@pyxis-lab.com or 1-866-203-8397 (Mo-Fri 7:00AM-5:00PM MT)

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1 Introduction

Product Description

The Pyxis ST-750 inline APHA (Hazen) color sensor is uniquely designed to measure the real-time color in water for use in municipal, industrial and environmental applications. The sensor uses the APHA-Hazen platinum-cobalt (also referred to as Chromaticity) method to measure the color in the sample water and is ideally suitable for clean water and lightly polluted water with a slight to pale yellow tint. This includes relatively clean surface water, groundwater, domestic/drinking water and industrial water. The ST-750 has a built-in primary light source and detector to measure the color content; in addition a built-in reference light source and detector are installed to compensate for mild levels turbidity interference.

The ST-750 offers a combination of fully integrated 4-20mA as well as RS-485 Modbus output signals and is Bluetooth® 5.0 Enabled for wireless cleaning and calibration when used with MA-WB or PowerPACK Series Bluetooth Adapters and the uPyxis APP for Desktop devices. The ST-750 is provided in UPVC with the standard Pyxis ST-001 inline ¾-inch FNPT Tee assembly, 1.5-meter bulk-head cable with quick adapter and 1.5-meter flying lead cable with quick adapter, enabling rapid wiring to any microprocessor controller, PLC or DCS system. The ST-750SS-T is offered in 316L stainless steel for higher pressure applications (<290psi) and must be used with the ST-007 or ST-009 stainless steel tee assemblies, each sold separately.
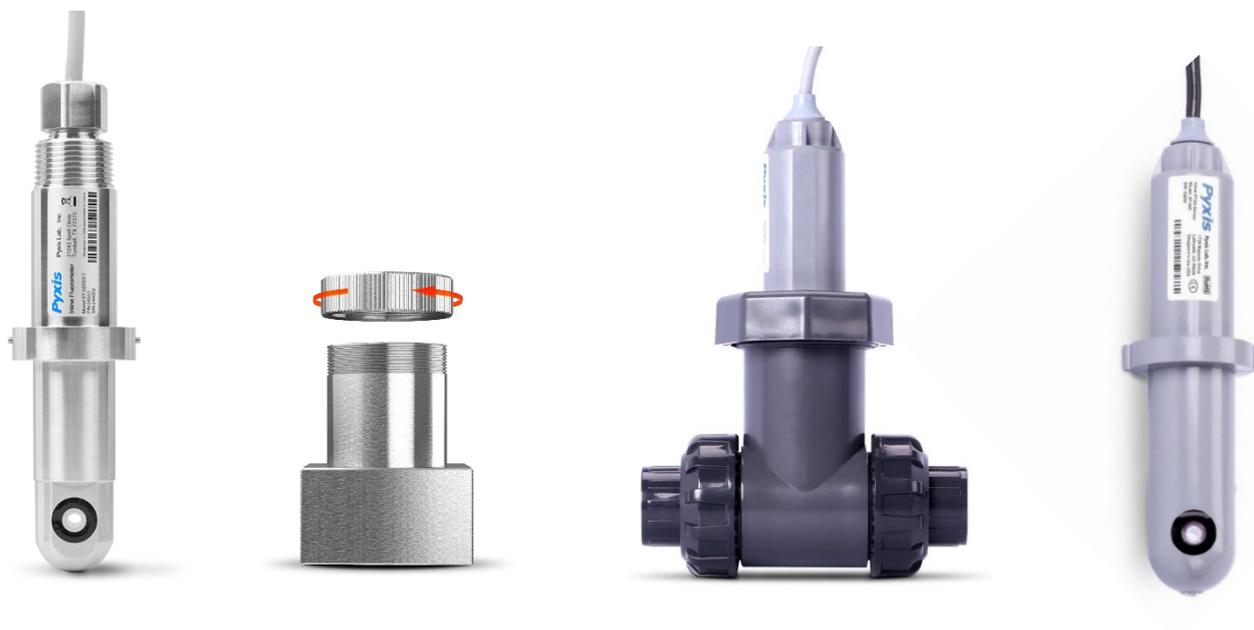

Figure 1 - ST-750 Series Color Sensor with ST-001 & ST-009 Inline Tee Assemblies

1.1   Features of the Pyxis ST-750

The ST-750 series probes include the following features:

- The probe can be conveniently installed in a bypass flow line using the ¾ inch inline Tee (ST-001) assembly provided. *NOTE* *For ST-750SS-T, the ST-007 or ST-009 stainless steel tee assemblies are sold separately and not provided with the sensor.*
- ST-750 series offer both 4-20mA and RS-485 outputs via 7-pin cable with adapters.
- The probe can be calibrated using a known COLOR concentration standard with the uPyxis Desktop APP via a MA-WB Bluetooth/USB adapter (for sensors) and a USB-C cable connected directly to the PC/Laptop. See section 4.1.
- The probe can be diagnosed via the uPyxis Desktop APP

1.2   Specifications

Specifications are subject to change without notice. Contact Pyxis (service@pyxis-lab.com) for an updated specification list.

Item	ST-750	ST-750SS-T
P/N	53501	55392
Target	APHA / Hazen / Platinum-Cobalt Color	
Output Range *(4-20mA)*	0.10-30.0 Degrees (ppm Pt-Co) *uPyxis APP Adjustable up to 500 Degrees Maximum*	
Lower Detect Limit	0.10 Degrees	
Resolution	0.01 Degrees	
Accuracy	±2% of reading or 0.1 Degrees, whichever is greater	
Methodology	Platinum-Cobalt Color / APHA Color / Hazen Color / Wavelength 365nm	
Power Supply	24 (±2) VDC, 65 mA	
Outputs	Isolated 4-20mA Analog & RS-485 Modbus	
Dimension	Length 6.8 inch (172.7 mm), body diameter 1.44 Inch (36.6 mm)	
Weight	170 g (0.37lbs)	500 g (1.1lbs)
Installation	ST-001 Tee ¾-inch FNPT & Socket Included	ST-007 or ST-009 Stainless Tee Sold Separately
Material	UPVC	316L Stainless Steel
Pressure	100 psi (6.9 Bar)	290 psi (20 Bar)
Temperature	4 °C - 50 °C (40 - 120 °F) Operating -7 °C - 60 °C (20 - 140 °F) Storage	
Cable Length	1.5m – 7Pin Bulkhead Cable w/ IP67 Adapter 1.5m – 7Pin Flying Lead Cable w/IP67 Adapter *Optional Extension Cables Available*	
Calibration	Two-point calibration against DI water and known COLOR Standards	
Rating	IP67	
Regulation	CE / RoHS	
Method Compliance	ASTM-D1209 / ISO-6271	

NOTE *-With constant R&D at Pyxis Lab, specifications may be subject to change without notice.*

1.3 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.

1.4 Standard Accessories

- ST-750 (P/N 53501)
    - ST-001 Tee Assembly ¾-inch FNPT with Union / Thread & Socket Included
- ST-750SS-T (P/N 55392)
    - Tee not included must purchase separately see Optional Accessories
- Bulkhead Cable (1.5m / 7Pin Cable w/Adapters)
- Flying Lead Cable (1.5m / 7Pin Cable w/Adapters)

1.4.1 Calibration Standard Solution

Item	COLOR-30 *APHA Hazen Calibration Standard Solution* *For use with ST-750 Sensor*
Part Number	58000
Concentration	30 Degrees (ppm Pt-Co)
Form	Platinum / Cobalt – APHA Hazen
Shelf Life	6 months
Container	16 oz/500mL Nalgene Amber Narrow Mouth Sample Bottle
Volume (net)	510 +/- 10mL
Weight (net)	510g +/- 10g

NOTE - *Calibration Standard Solution must be Purchased Separately*

Figure 2 - COLOR-30 Calibration Std

1.5 Optional Accessories

Optional Accessories Information	P/N
ST-001 Inline Tee Assembly Spare *(3/4- inch FNPT Inline Tee Assembly)*	50704
ST-007 Inline Stainless Steel Tee Assembly *(1/4-inch OD Compression)*	50700-A51
ST-009 Inline Stainless Steel Tee Assembly *(3/4-inch FNPT)*	22624
COLOR-30 *(Color Calibration Standard 30 Degree / 500mL)*	58000
Pyxis Probe Cleaning Kit *(Includes Sensor Cleaner 500mL + Accessories)*	SER-01
MA-WB Bluetooth/USB Adapter *(Pyxis Bluetooth/USB Adapter for 7Pin Pyxis Sensors)*	MA-WB
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
MA-C10 *(10' Extension Cable for 7Pin Pyxis Sensors)*	50738
MA-C50 *(50' Extension Cable for 7Pin Pyxis Sensors)*	50705

2 Installation

PRIMARY INSTALLATION FORMAT

The recommended installation method for ST-750 should be a bypass flow arrangement in a vertical line to eliminate air bubble interference. This can be done with the standard ST-001 Inline Tee Assembly (3/4-inch FNPT) provided with each sensor. ***NOTE*** _The ST-750SS-T in stainless steel requires the use of the ST-007 or ST-009 stainless steel tee assemblies, both sold separately._ The sensor will function in stagnant water conditions and as high as 8-gpm maximum flow while installed in the ST-001 inline tee assembly. During installation, it is suggested that isolation valves upstream and downstream of the sensor be installed to allow flow regulation for optimum sensor accuracy, as well as for sensor removal, cleaning and calibration. Pyxis also offers 2-inch, 3-inch and 4-inch inline tee assemblies. For alternative inline tee assembly details please contact Pyxis Lab at service@pyxis-lab.com
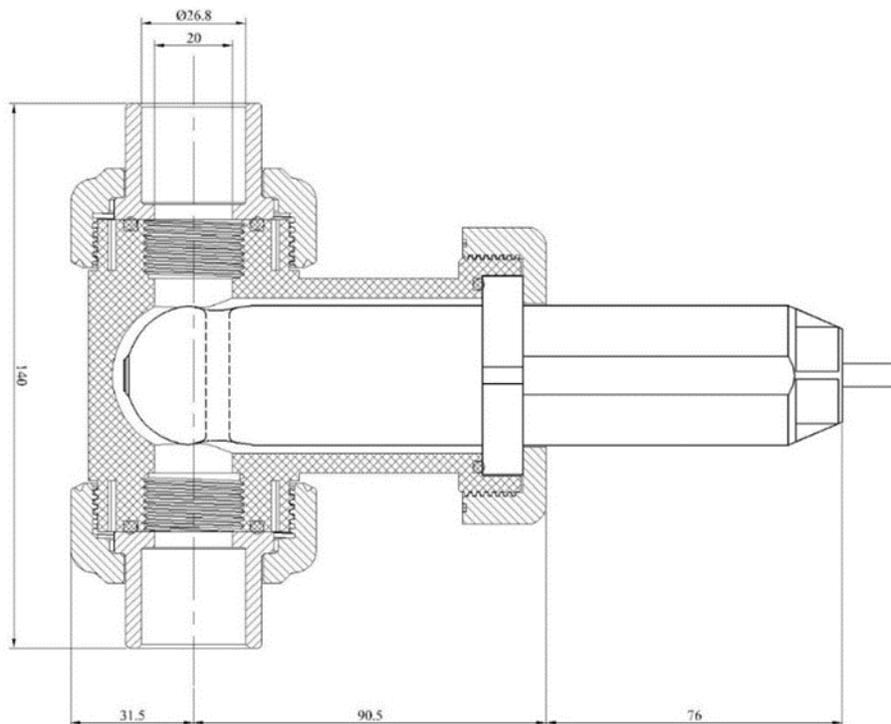

Figure 3 - ST-750 Probe / ST-001 Inline Tee Assembly Diagram

3 Quick 4-20mA Start

Follow the wiring table below to connect the ST-750 probe to a receiving controller. **<u>*IMPORTANT NOTE*</u>** there are two wiring tables for sensors. The Green and White wires (4-20mA values) are different between each table. Listed above each table the specific serial # roll in representing when this change occurred.

Wiring Table for Sensors <u>BEFORE</u> Serial # - 210011

Wire Color	Designation
Red	24 V +
Black	Power Ground
White	Not Used
Green	4-20 mA for COLOR
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, Solution ground
4mA Value	0.1 Degrees (ppm Pt-Co)
20mA Value	30.0 Deg

Wiring Table for Sensors <u>INCLUDING and AFTER</u> Serial # - 210011

Wire Color	Designation
Red	24 V +
Black	Power Ground
White	4-20 mA for COLOR
Green	Not Used
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, Solution ground
4mA Value	0.1 Degrees (ppm Pt-Co)
20mA Value	30.0 Degrees (ppm Pt-Co)

NOTE: <u>The 24V power ground and the 4-20 mA- return are internally connected.</u> *If insufficient wattage is available from the connected controller (ie. 1.5-1.6W), Pyxis recommends the* **PowerPACK Series** *Auxiliary Power & Bluetooth Communication Adapters highlighted in the Optional Accessories section of this manual. 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 @ 65mA. Detailed wiring diagrams for common controllers are available from* www.pyxis-lab.com.

4 Calibration and Diagnosis

The ST-750 probe can be calibrated in a two-point (zero + slope) procedure using a deionized water sample and a standard solution containing a known COLOR standard solution. **For ST-750, Pyxis recommends 30 deg COLOR calibration standard with Platinum/Cobalt formulation. Pyxis item COLOR-30 (P/N 58000).**

4.1 Calibration and Diagnosis with 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-WB and to the USB port of the laptop or computer. This will provide power the MA-WB from the laptop/computer.   Connect the MA-WB to the ST-750 sensor. The MA-WB Bluetooth adapter will boost the 5V of the regular USB to 24V to power the sensor for use with uPyxis Desktop.
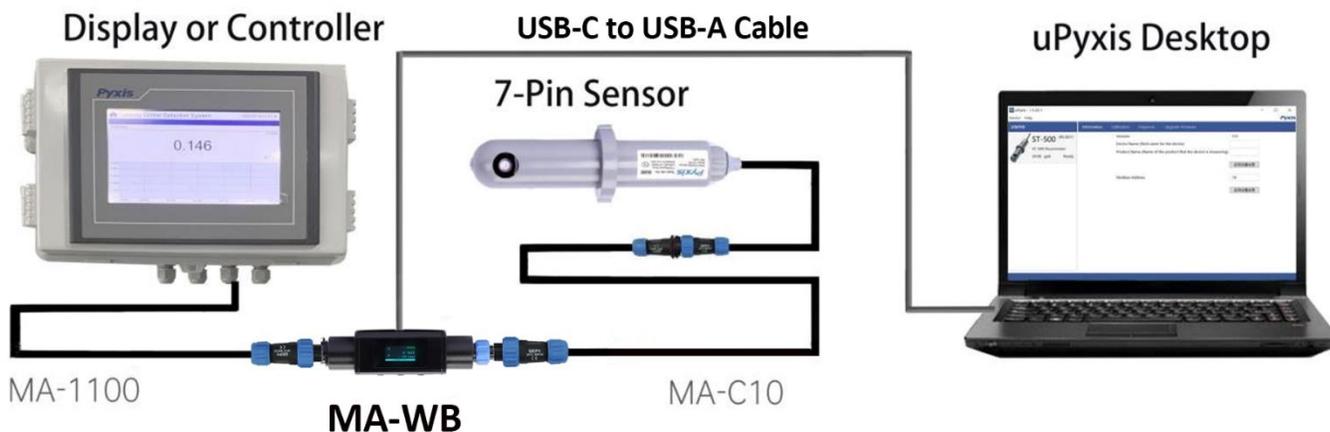

Figure 4 - MA-WB Bluetooth Adapter – Bottom USB-C Port

Figure 5 - ST-750 Probe / MA-WB / 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, <u>you may connect to uPyxis</u>.

4) Open the desktop uPyxis APP.
5) Click Device to launch the connection option menu.
6) Select Connect via USB-RS485 *(Figure 6)*.
7) Select the Comm Port to make a connection. Normally only one Comm port is identified by uPyxis. 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.
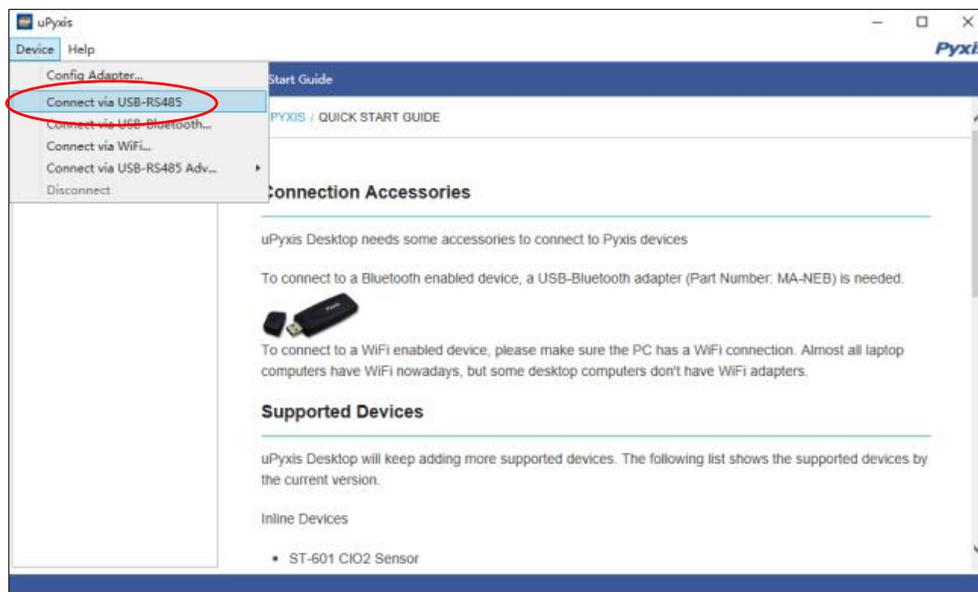
Figure 6. Connect to ST-750 via USB-Bluetooth option

After the connection is established, the ST-750 probe series number and current COLOR reading are displayed on the left of the information page (Figure 7). In this page, a nickname can be assigned to the probe. The probe Modbus address can be changed in this page.
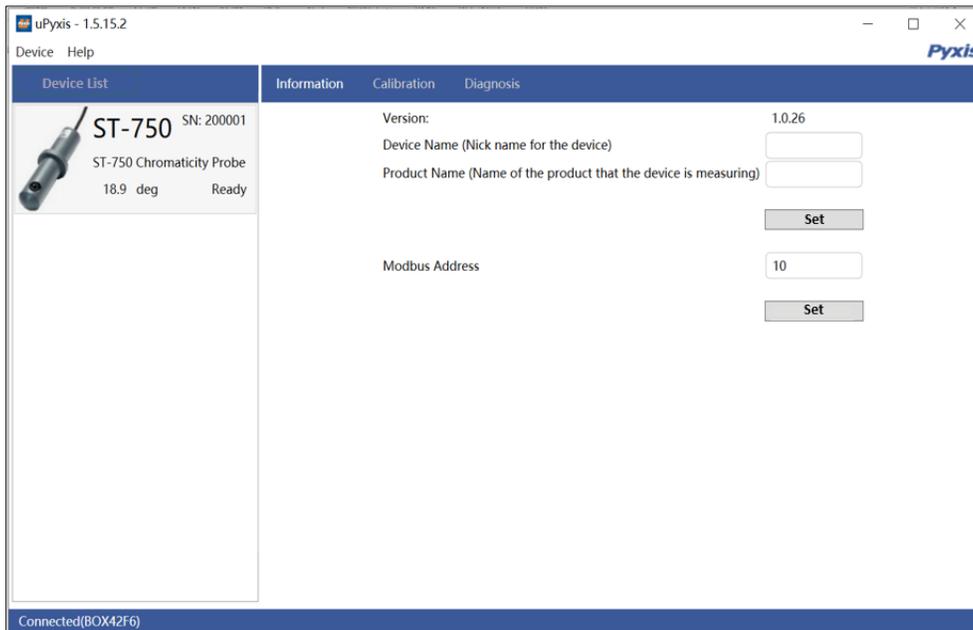

Figure 7 - Connected to a ST-750 probe and information page

Figure 8 - Calibration Page

4.1.1 Calibration

Click Calibration to launch the calibration page (Figure 9). Place the probe in deionized water and click Zero Calibration to start the zero-point calibration.
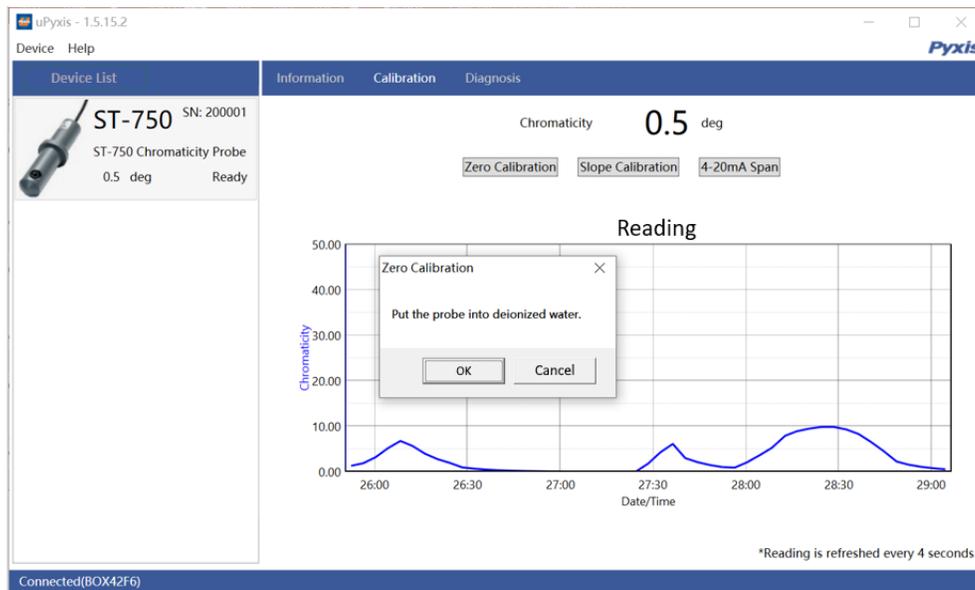

Figure 9 - Zero Calibration

Place the probe in a known COLOR calibration solution and click **Slope Calibration** to start the slope calibration. Enter the COLOR concentration in the dialog window as in Figure 10.
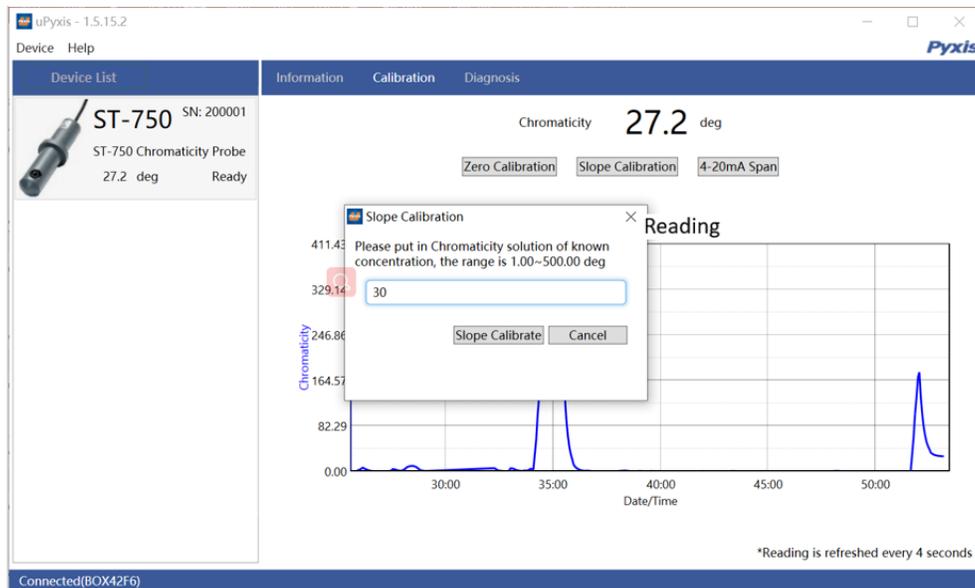

Figure 10 - Slope Calibration

4.1.2 4-20mA Span Settings

The default 4-20mA span is 20 mA = 500 deg and 4 mA = 0.1 deg. Users may alter the output scale using **4-20mA Span** to change the COLOR value corresponding to the 20mA output (Figure 11). ***NOTE* the 20mA value span adjustment may only be equal to or lower than the upper range detection limit of the sensor.**
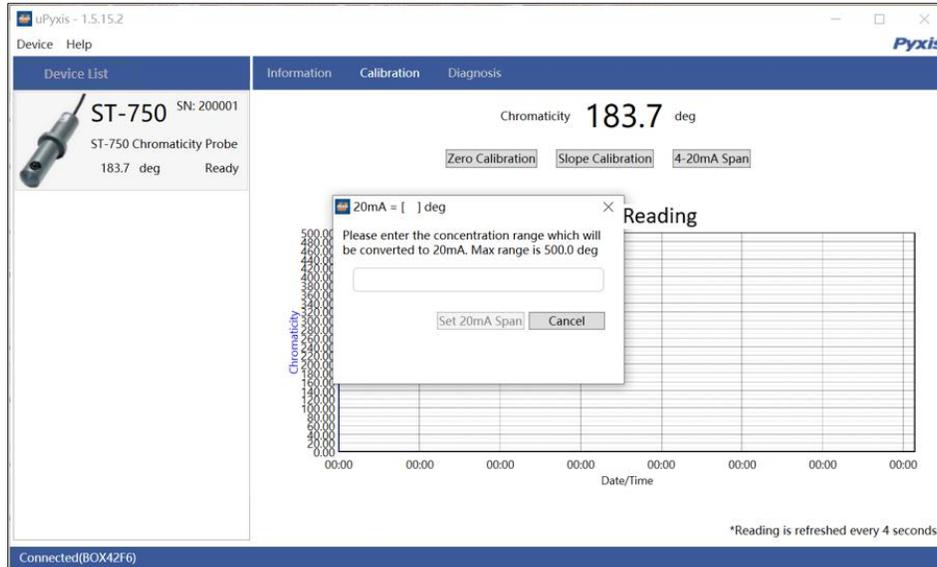

Figure 11 - Set 4-20mA Span

4.1.3 Diagnosis

Click **Diagnosis** to display the diagnosis page (Figures 12). In this page, the raw data measured by the probe is displayed. To help troubleshoot possible issues with the probe, please save an image of this page when the probe is placed in a clean water (tap water or deionized water), in a standard, and in the sample that the probe is intended.
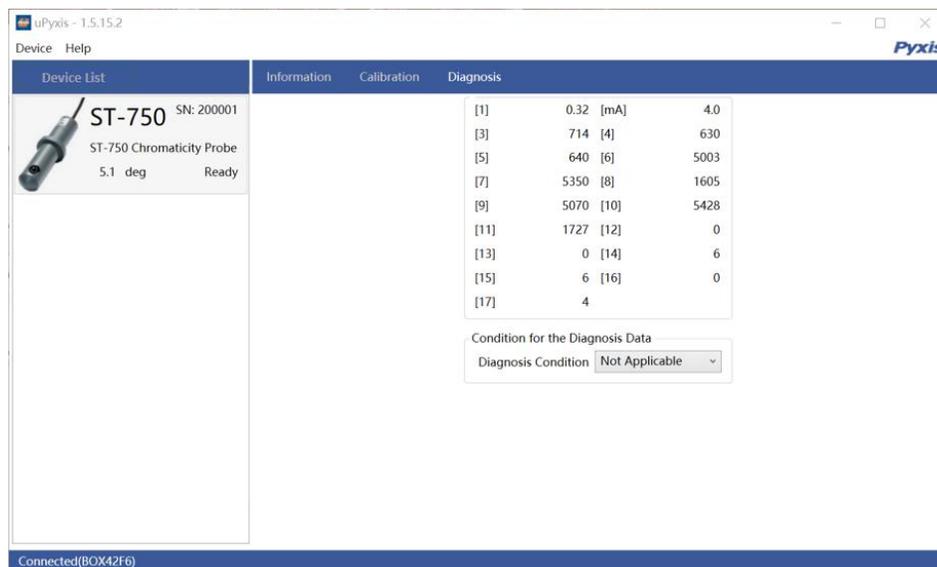

Figure 12 - Diagnosis Page

4.2   Calibration through the Controller

It is recommended that ST-750 calibration is carried out using the uPyxis app as demonstrated in the sections above.   Alternatively, a single point calibration can be carried on the receiving controller by adjusting the mA-to-deg COLOR ratio. A two-point calibration could also be carried out on the controller by adjusting both the mA-to- deg COLOR ratio and the zero-point 4-20mA current value. Please follow the controller manufacturer's procedure to carry the 4-20mA calibration. With the default probe settings, the controller should be set up to convert 4 mA = 0.1 deg and 20 mA = 30.0 deg for ST-750. It is critical that the sensor optical channel be properly cleaned prior to sensor calibration. Please refer to Section 6.0 for proper cleaning procedures.

5   Modbus RTU

The ST-750 probes are configured as a Modbus slave device. In addition to the COLOR 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.

6 Probe Cleaning and Maintenance

The ST-750 probes are designed to provide reliable and continuous COLOR concentration readings even when installed in moderately contaminated samples. Although the optics are compensated for the effects of moderate fouling, heavy fouling will prevent the light from reaching the sensor, resulting in false readings.

The ST-750 probes are designed to be easily removed, inspected and cleaned if required. It is suggested that the ST-750 probes be checked for fouling and cleaned/calibrated on a monthly basis. Heavily contaminated samples may require more frequent cleanings.

6.1 Cleaning Procedure

A light deposit inside the probe quartz tube can be cleaned by a Q-tip. Aged heavy deposition, especially carbonate and iron oxide deposits, can be removed using a cleaning solution that is capable of removing these inorganics, such as the Pyxis Probe Cleaning Solution Kit (P/N SER-01) available from Pyxis online EStore Inline Sensor Cleaning Kit | Pyxis Lab® (pyxis-lab.com).

Soak the lower half of the ST-750 probe in 100 mL probe cleaning solution for 10 minutes. Scrub the internal surfaces of the quartz optical channel aggressively with the pipe-cleaner brush and Q-tip provided with the kit. Allow the sensor to soak in the cleaning solution for an additional 5-10 minutes. Remove and rinse the ST-750 probe with distilled water or clean tap water and then check for the flashing blue light inside the ST-750 probe quartz tube. If the surface is not entirely clean, continue to soak the ST-750 probe for an additional 10 minutes or until clean. Repeat as needed.

Figure 13 – Pyxis Probe Cleaning Kit (P/N – SER-01)

6.2 Other Common Troubleshooting Issues

If the ST-750 probe output signal is not stable and fluctuates significantly, make an additional solution ground connection - connect the clear solution ground wire to a conductor that contacts the sample water electrically such as a brass pipe near the ST-750 probe.

Contact us

Contact us if you have questions about the use or maintenance of the ST-750 probe:

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