Pyxis®

ST-600 Series Inline Disinfectant Sensors

Inline Bleach Concentration Sensor

Pyxis Lab® Inc.
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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 ST-600 Series inline sensor is uniquely designed to measure the real-time mass/mass concentration of bleach (sodium hypochlorite) by percentage as Chlorine (Cl_2). The ST-600 Series sensor measures the optical density of the beach solution using a near UV light source. The sensor has a built-in reference light source and a reference light detector in addition to the main light source and main light detector. The ST-600 Series sensor can be connected to any device that accepts an isolated or non-isolated 4–20mA input or RS-485 Modbus. As with all Pyxis inline sensors, the ST-600 Series sensor can be wirelessly accessed via Bluetooth/WiFi when used in conjunction with the MA-WB Bluetooth Adapter or PowerPACK Series Auxiliary Box and the **uPyxis®** Mobile or Desktop App. Directions on this wireless calibration capability are included in this manual.

Primary Installation Format

The primary method is to install the sensor in-line with of the suction side of the chemical feed pump in piping format. This method should ideally in a vertical line run to avoid chlorine gas bubble interference. This can be done with the standard ST-001 Inline Tee Assembly (3/4" FNPT) provided with each sensor. Pyxis also offers 2" and 3" inline tee assemblies as an accessory option if required.

Teflon Tube Installation Format

The second method is to install the sensor in-line using the unique 1/4" OD (7 mm OD) clear Teflon tubing adapter 6 inches in length. This tubing can be passed "THROUGH" the optical channel to allow for use of the sensor with smaller chemical feed line installations on the suction side of the chemical feed pump.

> ***NOTE*** *For enhanced ambient light interference prevention, Pyxis recommends users apply black electrical tape or shrink wrap to allow sample darkening prior to and after the optical channel as seen in Figure 3.*

1.1 Main Features

The ST-600 Series sensor includes the following features:

- Can be conveniently connected to the suction or discharge side of the bleach pump in both inline Tee (ST-001) or 1/4" Teflon tubing format with using a union; both included with sensor.

- Can be wirelessly calibrated using bleach concentration standards with the **uPyxis®** Mobile or Desktop App via a MA-WB Bluetooth/WiFi adapter or PowerPACK Series Auxiliary Box.

- Diagnostic information (sensor tubing fouling and failure modes) can be communicated to digital displays via Modbus RTU.

- Offers an expanded range and a temperature signal communicated via 2-channel 4–20mA outputs and a RS-485 output, Modbus RTU.

- Easy to remove from the system for cleaning and calibration without the need for any tools.

2   Specifications

Table 1. ST-600 Series Specifications

Specification*	ST-600	ST-604
Part Number (P/N)	50231	50219
Sodium Hypochlorite Range	0–16% mass/mass *(RTD Compensated)*	0–2% mass/mass *(RTD Compensated)*
Sodium Hypochlorite Resolution	0.01%	
Sodium Hypochlorite Accuracy	±2% of reading or ±0.1%	
Temperature Output Range	4 mA: 32 °F (0 °C), 20 mA: 212 °F (100 °C)	
Method	UV Absorbance	
Calibration	Two-point calibration against standard solution	
Outputs	2x 4–20mA Analog Output, RS-485 Digital Output with Modbus protocol	
Installation	1/4" OD (7 mm) Teflon tubing for measurement flow and custom tee assembly (P/N: ST-001) with 3/4" female socket & NPT threaded ports	
Cable Length	5 ft with IP67 connectors & 2 ft flying lead with IP67 adapter	
Power Supply	22–26 VDC, 2W	
Dimension (L × Dia)	6.8 × 1.44 inch (172.7 × 36.6 mm)	
Weight	0.37 lbs (170 g)	
Material	CPVC	
Operational Temperature	40–104 °F (4–40 °C)	
Storage Temperature	20–140 °F (-7–60 °C)	
Pressure	Up to 100 psi (0.7 MPa)	
Enclosure Rating	IP67	
Regulation	CE/RoHS	

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

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.

3.1   Standard Accessories

- Tee Assembly 3/4" NPT (1x Tee, O-ring, and Nut)   P/N: ST-001

- 7-Pin Female Adapter/Flying Leads Cable (5 ft)   P/N: MA-1100

- Clear Teflon Tubing 1/4" OD (6") Adapter

- User Manual available online at https://pyxis-lab.com/support/

3.2   Optional Accessories

PYXIS INLINE SENSOR ACCESSORIES - SELECT*A*GUIDE

Accessory Name/Description	Part Number	Photo
Pyxis ST Series Cleaning Kit *(includes 500mL Sensor Cleaner / Qtips & Pipe Cleaners)*	SER-01	
0.75" NPT Inline Sensor Tee Assembly *(All ST Series Sensors)*	50704	
2.0" NPT Inline Sensor Tee Assembly *(All ST Series Sensors)*	50756	
3.0" NPT Inline Sensor Tee Assembly *(All ST Series Sensors)*	50775	
ST-002 Inline Sensor Removal PLUG *(Allows ST Sensor Removal)*	ST-002	
ST Sensor Tee Replacement O-Ring *(All ST Series Tee's)*	MA-150	
MA-WB Bluetooth Adapter for All ST Series Sensors *(4-20mA & RS-485)*	MA-WB	
MA-485 USB Adapter for All ST Series Sensors *(4-20mA RS-485)*	MA-485	
Bluetooth PC to Handheld Adapter *(For uPyxis Firmware Updates)*	MA-NEB	
PowerPack 1 *(Single Channel Power Supply w/Bluetooth)*	MA-BLE-1	
PowerPack 4 *(Four Channel Power Supply w/Bluetooth)*	MA-BLE-4	
MA-1100 *(24" Flying Lead Cable for All ST Sensors)*	MA-1100	
MA-C10 *(10' Extension Cable for All ST Sensors)*	50738	
MA-C50 *(50' Extension Cable for All ST Sensors)*	50705	

Figure 1.

4   Installation

4.1   In-line Piping Installation Format

The primary method is to install the probe in-line with the suction side of the chemical feed pump in piping format. This method should ideally run in a vertical line to avoid chlorine gas bubble interference. This can be done with the standard ST-001 Inline Tee Assembly (3/4" FNPT) provided with each sensor. Pyxis also offers 2" and 3" inline tee assemblies as an accessory option if required.

Figure 2. ST-600 Series Sensor w/ST-001 Inline Tee Assembly for Piping Installations

4.2   Teflon Tubing Installation Format

The second method is to install the sensor in-line using the unique 1/4" OD (7mm OD) clear Teflon tubing adapter 6 inches in length. This tubing can be passed "THROUGH" the optical channel allowing to use the sensor with smaller chemical feed line installations on the suction side of the chemical feed pump. Users can use conventional 1/4" OD Compression Fittings to connect desired inlet and outlet bleach line size to the ST-600 Series sensors in this format. As with the inline Pipe installation method, Pyxis recommends installation on a vertical run, ideally on the suction side.

> ***NOTE*** *For enhanced ambient light interference prevention, Pyxis recommends users to apply black electrical tape or shrink wrap to allow sample darkening prior to and after the optical channel as seen in Figure 3.*

Figure 3. ST-600 Series Sensor Clear Teflon Tube Adapter for Tubing Installations

4.3 Wiring

If insufficient wattage is available from the connected controller (ie. 2.0 W), Pyxis recommends the Power-PACK Series Auxiliary Power & Communication Box highlighted in the **Optional Accessories** section.

> **∗NOTE∗** *There is <u>no</u> 4–20mA negative wire to the controller, please connect controller 24V power ground terminal to controller 4–20mA negative terminal with a short wire.*

Follow the wiring table below to connect the ST-600 and ST-604 probes to a receiving controller. *IMPORTANT NOTE* 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 for each sensor type representing when this change occurred

Table 2. ST-600 Wiring Table for Sensors BEFORE Serial # — 210044,
ST-604 Wiring Table for Sensors BEFORE Serial # — 210016

Wire Color	Designation
Red	24V +
Black	24V Power ground
White	4–20mA + for Temperature
Green	4–20mA + for Bleach
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, earth ground

Table 2. ST-600 Wiring Table for Sensors INCLUDING & AFTER Serial # — 210044
ST-604 Wiring Table for Sensors INCLUDING & AFTER Serial # — 210016

Wire Color	Designation
Red	24V +
Black	24V Power ground
White	4–20mA + for Bleach
Green	4–20mA + for Temperature
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, earth ground

4.4 Connecting via Bluetooth

A Bluetooth adapter (P/N: MA-WB) can be used to connect a ST-600 Series sensor to a smart phone with the **uPyxis®** Mobile App or a computer with the **uPyxis®** Desktop App.

Figure 4. Bluetooth connection to ST-600 Series sensor

4.5 Connecting via USB

A USB-RS485 adapter (P/N: MA-485) can be used to connect a ST-600 Series sensor to a computer with the **uPyxis®** Desktop App.

> **∗NOTE∗** *Using non-Pyxis USB-RS485 adapters may result in permanent damage of the ST-600 Series sensor communication hardware.*
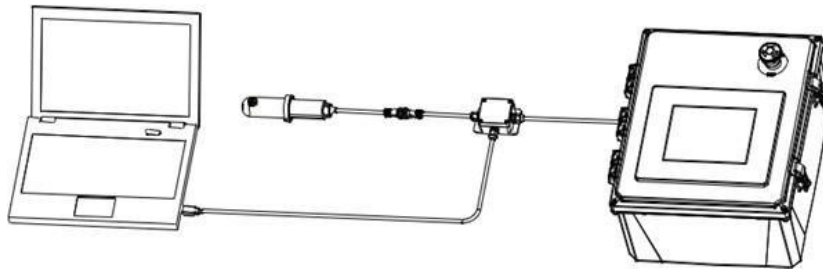

Figure 5. USB connection to ST-600 Series sensor

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 6. uPyxis® Mobile App installation

5.2 Connecting to uPyxis® Mobile App

Connect the ST-600 Series 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-600 Series and its Serial Number (SN) will be displayed (Figure 7).

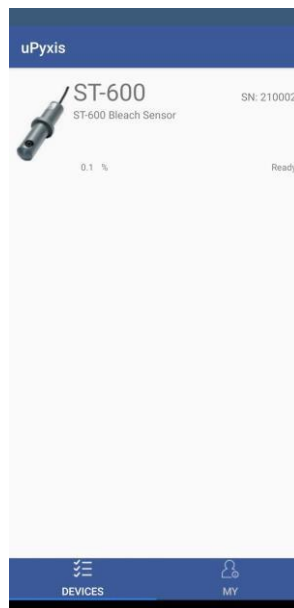4. Press on the **ST-600 Series sensor image**.

Figure 7.

5.3   Calibration Screen and Reading

When connected, the **uPyxis®** Mobile App will default to the **Calibration** screen. From the **Calibration** screen, you can perform calibrations by pressing on **Zero Calibration**, **Slope Calibration**, and **4–20mA Span**. Follow the screen instructions for each calibration step.
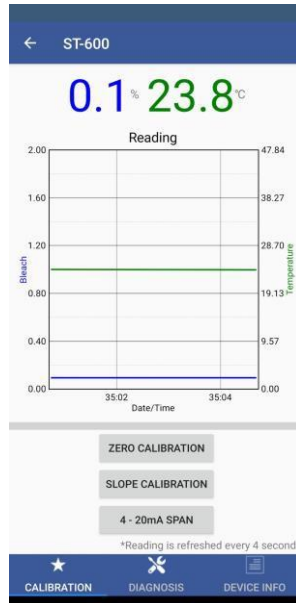

Figure 8.

5.4   Diagnosis Screen

To perform a sensor diagnosis and cleanliness check, first insert the sensor into a beaker of DI water or clean tap water and cover the sensor with a towel to protect from ambient light. Select the **Diagnosis Condition** which defines the fluid type that the ST-600 series sensor in currently measuring, then click **Cleanliness Check**. If the sensor is clean, a green **Clean** message will be shown. If the sensor is severely fouled, a red **Dirty** message will be shown. In this case, follow the procedure in the **Methods to Cleaning the ST-600 Series Sensor** section of this manual. From the **Diagnosis** screen, you view and take a screen shot of the diagnosis condition data values. This feature may be used for technical support when communicating with service@pyxis-lab.com.
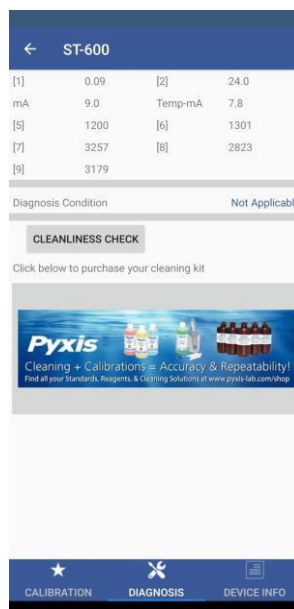

Figure 9.

5.5　Device Info Screen

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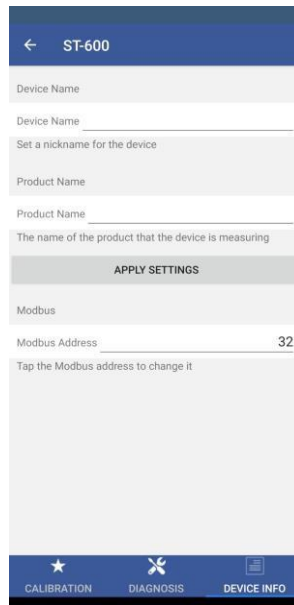

Figure 10.

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.
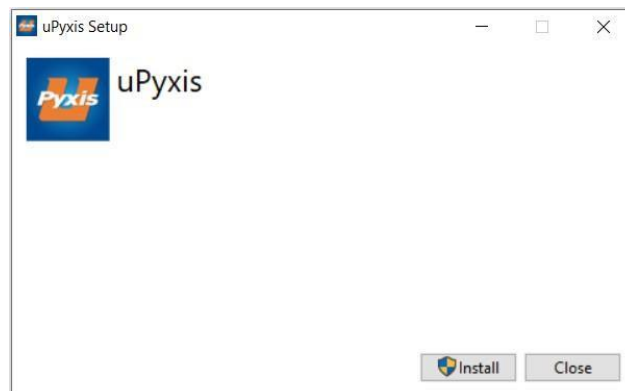

Figure 11. uPyxis® Desktop App installation

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-600 Series sensor to a Windows computer using either a Bluetooth/USB adapter (P/N: MA-NEB) or a USB-RS485 adapter (P/N: MA-485) according to the following steps:

1. Plug the Bluetooth/USB adapter or USB-RS485 adapter into a USB port in the computer.

2. Launch **uPyxis®** Desktop App.

3. On **uPyxis®** Desktop App, click Device → **Connect via USB-Bluetooth** or **Connect via USB-RS485** (Figure 12).

4. If the connection is successful, the ST-600 Series sensor 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.*
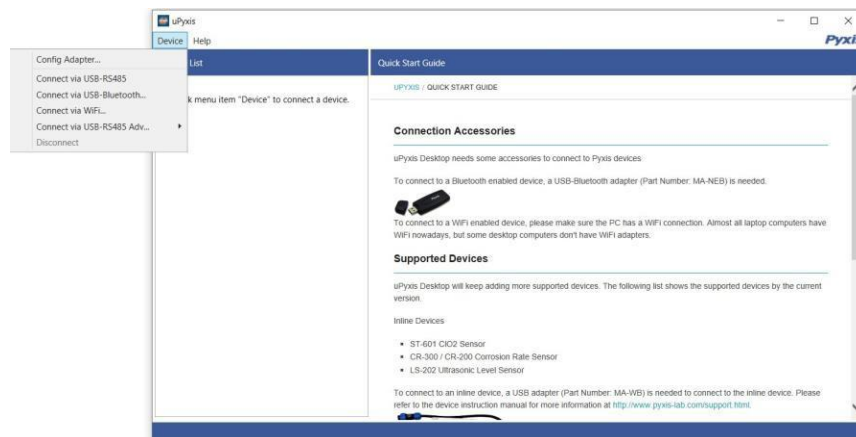

Figure 12.

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.
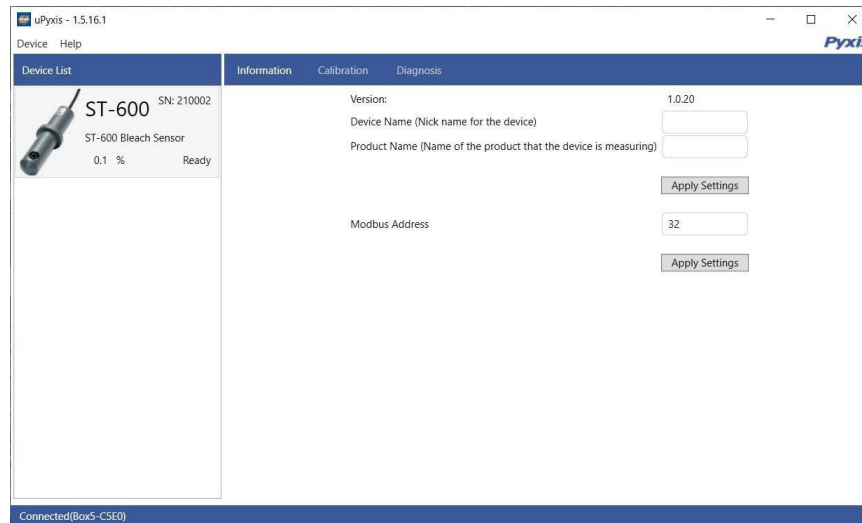

Figure 13.

6.4   Calibration Screen

To calibrate the device, click on **Calibration**. On the **Calibration** screen there are three calibration tabs, **Zero Calibration**, **Slope Calibration**, and **4-20mA Span**. The screen also displays the reading of the device. The reading refresh rate is every 4 seconds.
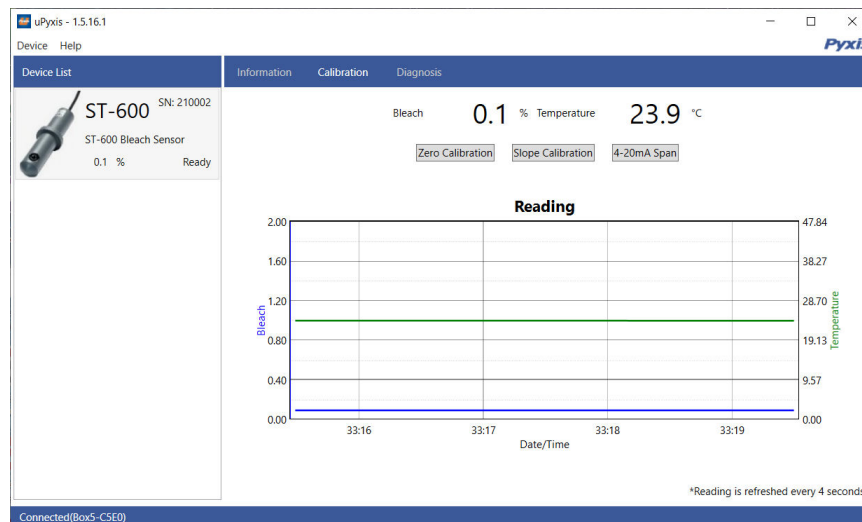

Figure 14.

6.5 Diagnosis Screen

To perform a sensor diagnosis and cleanliness check, first insert the sensor into a beaker of DI water or clean tap water and cover the sensor with a towel to protect from ambient light. Select the **Diagnosis Condition** which defines the fluid type that the ST-600 series sensor in currently measuring, then click **Cleanliness Check**. If the sensor is clean, a green **Clean** message will be shown. If the sensor is severely fouled, a red **Dirty** message will be shown. In this case, follow the procedure in the **Methods to Cleaning the ST-600 Series Sensor** section of this manual. From the **Diagnosis** screen, you view and take a screen shot of the diagnosis condition data values. This feature may be used for technical support when communicating with service@pyxis-lab.com.
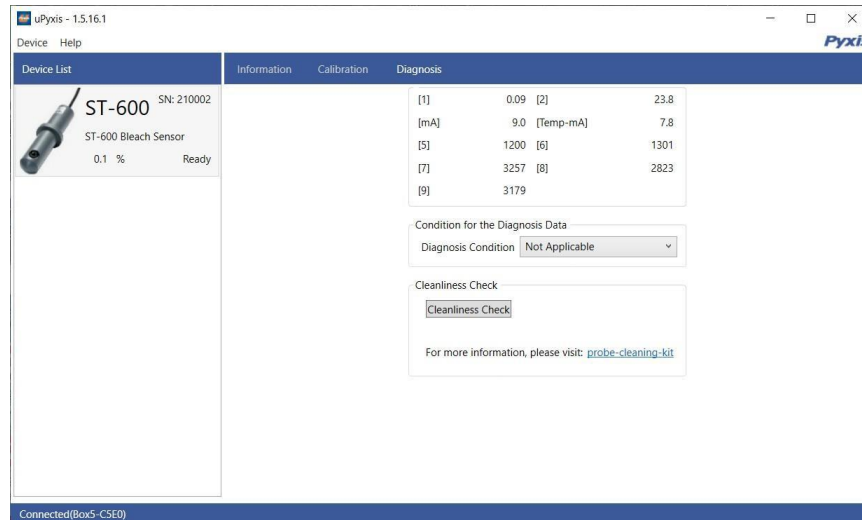

Figure 15.

7 Outputs

7.1 4–20mA Output Setup

The 4–20mA output of the ST-600 sensor is scaled as:

- Sodium Hypochlorite:

  - 4 mA = 0%
  - 20 mA = 16%

- Temperature:

  - 4 mA = 32 °F (0 °C)
  - 20 mA = 212 °F (100 °C)

The 4–20mA output of the ST-604 sensor is scaled as:

- Sodium Hypochlorite:

  - 4 mA = 0%
  - 20 mA = 2%

- Temperature:

  - 4 mA = 32 °F (0 °C)
  - 20 mA = 212 °F (100 °C)

7.2   Adjusting 4–20mA Span

Users may adjust the output scale using 4–20mA Span to change the bleach % value corresponding to the 20 mA output via **uPyxis®**. For the **uPyxis®** Mobile App, press **4-20mA Span** found on the **Calibration and Reading Screen**, shown in Figure 16. For the **uPyxis®** Desktop App, click **4-20mA Span** found on the **Calibration Screen**, shown in Figure 17.
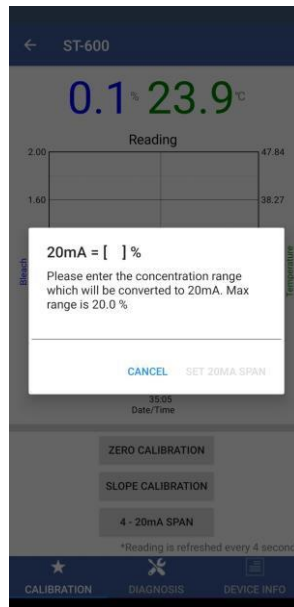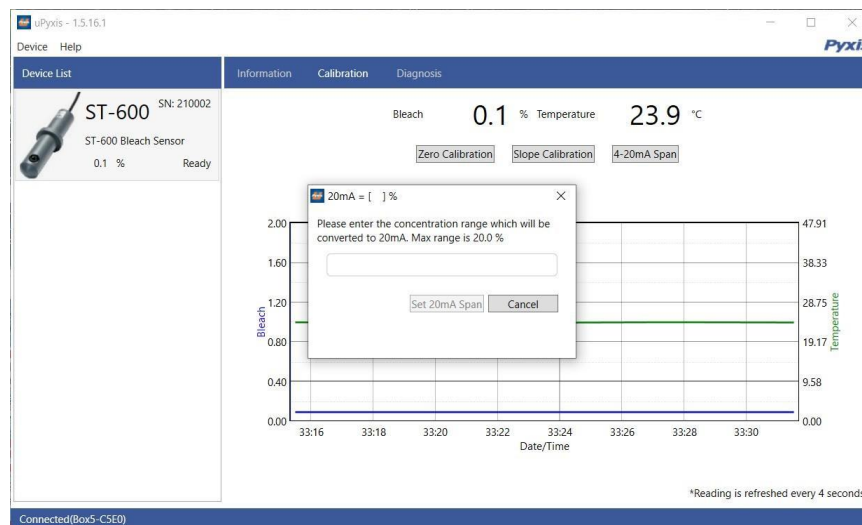

Figure 16.

Figure 17.

7.3   Communication using Modbus RTU

The ST-600 Series sensor is configured as a Modbus slave device. In addition to the bleach % 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.

8 Sensor Maintenance and Precaution

The ST-600 Series sensor is designed to provide reliable and continuous bleach readings even when installed in moderately contaminated industrial cooling waters. Although the optics are compensated for the effects of moderate fouling, heavy fouling will prevent the light from reaching the sensor, resulting in low readings and the potential for product overfeed if the ST-600 Series sensor is used as part of an automated control system. When used to control product dosing, it is suggested that the automation system be configured to provide backup to limit potential product overfeed, for example by limiting pump size or duration, or by alarming if the pumping rate exceeds a desired maximum limit.

The ST-600 Series sensor is designed to be easily removed, inspected, and cleaned if required. It is suggested that the ST-600 Series sensor be checked for fouling and cleaned/calibrated on a monthly basis. Heavily contaminated waters may require more frequent cleanings. Cleaner water sources with less contamination may not require cleaning for several months.

8.1 Methods to Cleaning the ST-600 Series

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 Estore/Catalog https://pyxis-lab.com/product/probe-cleaning-kit/

Figure 18. Inline Probe Cleaning Solution Kit

To clean the ST-600 Series sensor, soak the lower half of the sensor in 100 mL inline sensor cleaning solution for 10 minutes. Rinse the ST-600 Series sensor with distilled water and then check for the flashing blue light inside the ST-600 Series sensor quartz tube. If the surface is not entirely clean, continue to soak the ST-600 Series sensor for an additional 10 minutes. Use the small, soft bristle brush and Q-Tips cotton swabs as necessary to remove any remaining contaminants in the ST-600 Series sensor quartz tube.

8.2   Storage

Avoid long term storage at temperature over 100 °F. In an outdoor installation, properly shield the ST-600 Series sensor from direct sunlight and precipitation.

9   Troubleshooting

If the ST-600 Series sensor output signal is not stable and fluctuates significantly, make an additional ground connection — connect the clear (shield, earth ground) wire to a conductor that contacts the sample water electrically such as a metal pipe adjacent to the ST-600 Series tee.

Carry out routine calibration verification against a qualified bleach standard. After properly cleaning the ST-600 Series sensor, carry out the zero-point calibration with distilled water and slope calibration using the qualified bleach standard.

10   Contact Us

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