



ST-600 Series Inline Bleach Concentration Probes Operation Manual



Rev. A

Pyxis Lab, Inc
1729 Majestic Dr. Suite 5
Lafayette, CO 80026 USA
www.pyxis-lab.com

© 2020 Pyxis Lab, Inc.
Pyxis Lab Proprietary and Confidential



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.

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-600 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-5PM MT)

Table of Contents

1	Introduction	4
1.1	Features of the Pyxis ST-600 Series	4
1.2	Specifications	5
1.3	Un-packing Instrument	6
1.4	Standard Accessories	6
1.5	Optional Accessories	6
2	Installation	7
3	Quick 4-20mA Start.....	8
4	Calibration and Diagnosis.....	8
4.1	Calibration and Diagnosis with uPyxis Mobile App.....	8
4.1.1	Calibration	9
4.1.2	4-20mA Span Settings	10
4.1.3	Diagnosis	11
4.2	Calibration and Diagnosis with uPyxis Desktop App.....	12
4.2.1	Calibration	15
4.2.2	4-20mA Span Settings	15
4.2.3	Diagnosis	15
4.3	Calibration through the Controller	17
5	Modbus RTU.....	18
6	Probe Cleaning and Maintenance	18
6.1	Cleaning Procedure	18
6.2	Other Common Troubleshooting Issues	19

1 Introduction

The Pyxis ST-600 series inline probes are uniquely designed to measure the real-time mass/mass concentration of bleach (sodium hypochlorite) by percentage as Chlorine (Cl_2). The ST-600 series probes measure the optical density of the bleach solution using a near UV light source. The probes have 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 probes 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 probes 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 APP for Mobile and Desktop devices. Directions on this wireless calibration capability are included in this manual.

PRIMARY INSTALLATION FORMAT

The primary method is to install the probe 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 probe 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 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 commends users apply black electrical tape or shrink wrap to allow sample darkening prior to and after the optical channel as seen in the sensor photo in the Section 2 of this manual.***

1.1 Features of the Pyxis ST-600 Series

The ST-600 series probes include the following features:

- The probe 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 probe.
- The probe can be calibrated with a uPyxis App or PC via a MA-WB Bluetooth/WiFi adapter or PowerPACK Series Aux. Box.
- Diagnostic information (probe tubing fouling and failure modes) can be communicated to digital displays via Modbus RTU.
- ST-600 Series can be wireless calibrated using known Bleach concentration standards via **uPyxis** APP for Smartphone or Dekstop

1.2 Specifications

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

Item	ST-600	ST-604
Target	Sodium hypochlorite	Sodium hypochlorite
Range	0-16 % mass/mass	0-2 % mass/mass
Resolution	0.1 in percentage	0.1 in percentage
Accuracy	±2% of reading or 0.1 percentage, whichever is greater	±2% of reading or 0.1 percentage, whichever is greater
Method	UV Absorbance	
Power Supply	24 (±2) VDC, 65 mA	
Outputs	Isolated 4-20mA Analog Output Isolated RS-485 Digital Output, Supporting MODBUS protocol	
Dimension	Length 6.8 inch, body diameter 1.44 inch	
Weight	0.37 pounds	
Installation Formats	¼" OD (7 mm) Teflon tubing for measurement flow ST-001 Inline Tee ¾" CPVC	
Material	CPVC	
Pressure	100 psi (6.9 Bar)	
Temperature	4 °C - 40 °C (40 - 104 °F) Operating -7 °C - 60 °C (20 - 140 °F) Storage	
Cable Length	5 feet (Bulkhead Cable w/ IP67 Adapter 1.5 foot Flying Lead Cable w/IP67 Adapter Optional Extension Cables Available	
Calibration	Two-point calibration against known Bleach Concentration Standards	
Rating	IP67	
Regulation	CE marked	














1.3 Un-packing 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-001 Tee Assembly $\frac{3}{4}$ " NPT (1x Tee, O-ring, and Nut)
- MA-1100 - Bulkhead Cable (24" 7Pin Cable w/Adapter & Flying Lead)
- Clear Teflon Tubing 6" For Small Line Installations
- The Operation Manual is available from www.pyxis-lab.com/support.html

1.5 Optional Accessories

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

2 Installation

IN-LINE PIPING INSTALLATION FORMAT

The primary method is to install the probe 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.



ST-600 Series Probe w/ST-001 Inline Tee Assembly for Piping Installations

TEFLON TUBING INSTALLATION FORMAT

The second method is to install the probe 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 to allow for use of 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 sensor in this format. As this 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 commends users apply black electrical tape or shrink wrap to allow sample darkening prior to and after the optical channel as seen in the sensor photo in the Section 2 of this manual.**



ST-600 Series Probe Clear Teflon Tube Adapter for Tubing Installations

3 Quick 4-20mA Start

Follow the wiring table below to connect the ST-600 probe to a receiving controller.

Wire Color	Designation
Red	24 V +
Black	Power Ground
White	4-20 mA +
Green	4-20 mA -, internally connected to power ground
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, Solution ground

***Note*:** The 24V power ground and the 4-20 mA- return are internally connected. If insufficient wattage is available from the connected controller (ie. 1.5-1.6W), Pyxis recommends the PowerPACK Series Auxiliary Power & Communication Box highlighted in the Accessories section of this manual.

If the 24V power ground terminal and the negative 4-20 mA terminal in the controller are internally connected (non-isolated 4-20mA input), it is unnecessary to connect the 4-20 mA - (blue wire) to the 4-20 mA negative terminal in the controller. If a separate DC power supplier 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-600 series probes can be calibrated in a two-point (zero + slope) procedure using a deionized water sample and a standard solution containing a known bleach concentration. For ST-600, Pyxis recommends a 5% or 10% concentration calibration standard. For ST-604, Pyxis recommends a 1% concentration calibration standard. The probes can also be calibrated by a single point method if desired. The calibration solution could be the sample itself (bleach in the tank), after verified for concentration through titration method or by using a Pyxis SP-910 – BLEACH DIRECT reading method.

4.1 Calibration and Diagnosis with uPyxis Mobile App

Connect and power the ST-600 series probe using the Pyxis Bluetooth/WiFi adapter (P/N: MA-WB) as shown in the following connection diagram. The power should be sourced from a 24 VDC power terminal of a controller. If sufficient controller power is not available, please purchase a PowerPACK Series Auxiliary Box from Pyxis Lab as an alternative to the MA-WB Bluetooth adapter. PowerPACK will provide ample power supply, sensor output signal passthrough and Bluetooth access to the ST-600 series sensor.

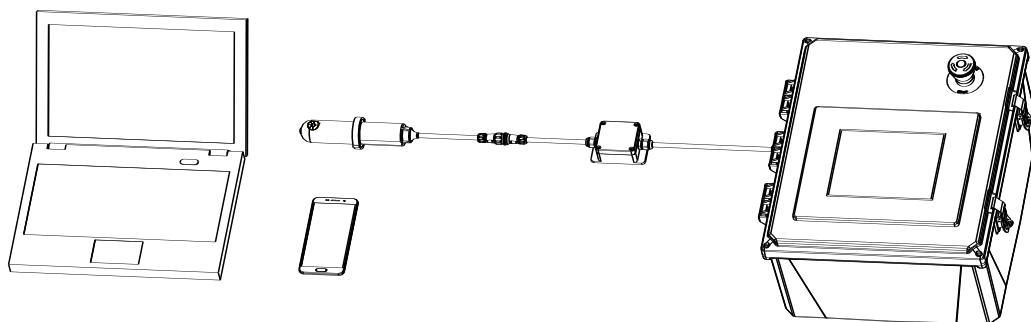


Figure 1. ST-600 Series and Pyxis Bluetooth/WiFi adapter (MA-WB) connected in series to controller

Download and install the uPyxis app from **App Store** or **Google Play**.

Turn on Bluetooth in the phone (please do not pair your device Bluetooth to MA-WB directly, the uPyxis APP will do the pairing). Open the uPyxis app in the phone. Swipe downward to refresh the phone screen to scan the available Pyxis Bluetooth devices. The discovered devices will be listed (Figure 3).



Tap the discovered ST-600 series probe to connect to the probe. uPyxis app can identify the probe type if multiple Pyxis probes are discovered in the scan. For legacy old generation probes, a dialog message window will be displayed to ask the user to tell the app the probe type. In this case, please select ST-600 or ST-604 as applicable.

As shown in figure 4, the calibration page after uPyxis is connected to the probe via the Pyxis Bluetooth adapter displays the current bleach concentration. Three functional tabs are available in this page: **Zero Calibration**, **Slope Calibration**, and **4-20mA Span**.

4.1.1 Calibration

Place the probe in deionized water and tap **Zero Calibration** to carry out the zero-point calibration.

Place the probe in a known bleach calibration standard and tap **Slope Calibration** to carry out the slope calibration. Enter the bleach concentration in the dialog window as in figure 5. For the best result, the bleach standard concentration should be in the range of 5% to 16% for ST-600 and 1-2% for ST-604.

The calibration solution could be the sample bleach itself (in the chemical tank). The concentration of bleach in the sample water can be determined with using a Pyxis SP-910 Handheld meter using BLEACH Direct Read method, or by conventional titration method.

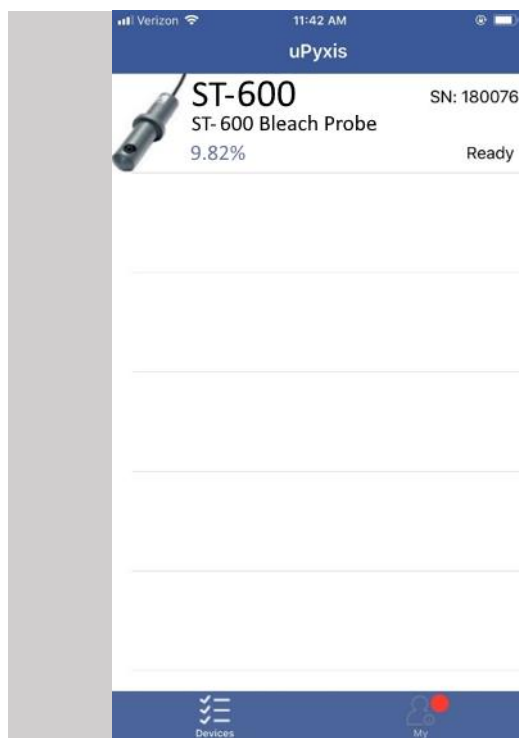


Figure 2. A ST-600 discovered by Bluetooth scan



Figure 3. Calibration page

4.1.2 4-20mA Span Settings

The default 4-20mA span is 20 mA = 16% bleach and 4 mA = 0 bleach. Users may alter the output scale using **4-20mA Span** to change the bleach value corresponding to the 20mA output (Figure 6). The maximum upper limitation of the 20mA output for ST-600 is 16% and ST-604 is 2% when using this function.

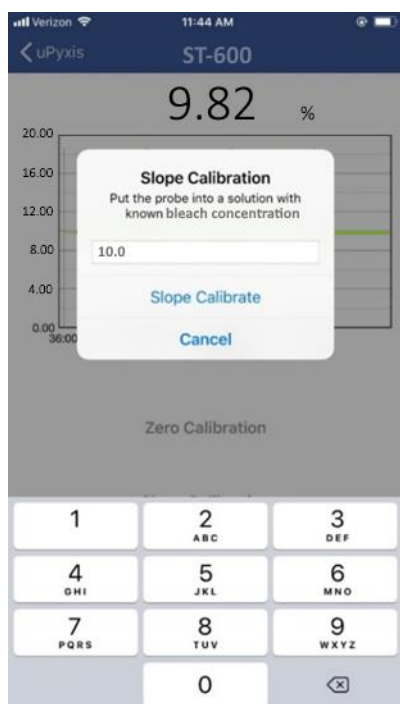


Figure 4. Enter Bleach concentration

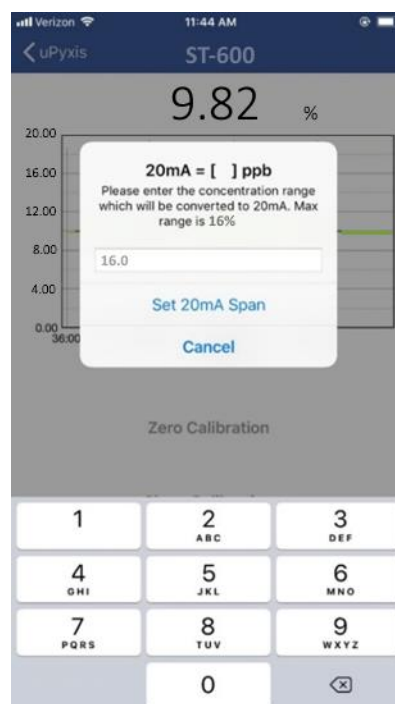


Figure 5. Enter Bleach concentration to set 4-20mA

4.1.3 Diagnosis

Tap **Diagnosis** in the bottom of the app page to launch the diagnosis page (Figures 7 and 8).

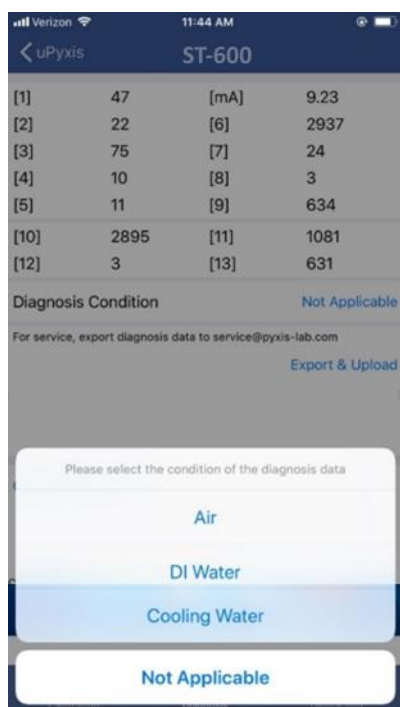


Figure 7. Select diagnosis condition

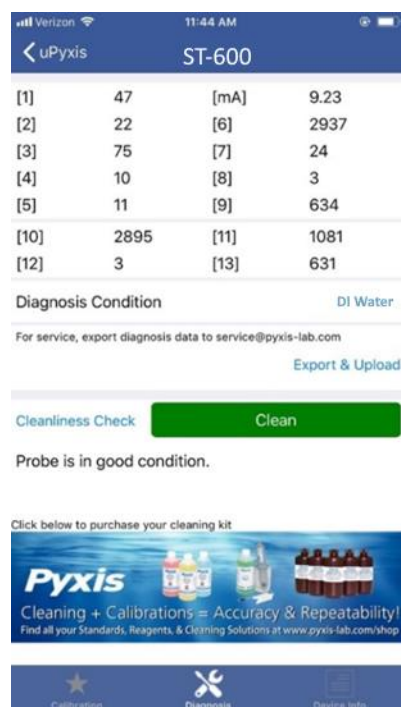


Figure 8. Cleanliness check result and raw data

In this page, the raw data measured by the probe is displayed. To help troubleshooting possible issues with the probe, please save images of these data when the probe is respectively placed in a clean water (tap water or deionized water), in a bleach standard, and in the sample that the probe is intended for.

In the diagnosis page, the probe cleanliness check can be performed. Please place the probe in the known bleach standard or sampled bleach available and select the sensor condition by tapping **Diagnosis Condition** (Figure 7). Tap **Cleanliness Check** to carry out the check. If the probe is clean, a green **Clean** message tab will be shown (Figure 8). If the probe is severely fouled, a red **Dirty** message tab will be shown. In this case, please clean the probe according to the procedure in Section 6. If the probe is partially fouled, a yellow **Becoming Dirty** message tab will be shown.

4.2 Calibration and Diagnosis with uPyxis Desktop App

Download and install the uPyxis desktop app from

https://www.pyxis-lab.com/resource/software_driver/uPyxis.Setup-1.5.4.7.zip

Connect and power the ST-600 series probe to a computer via the Pyxis Sensor/USB adapter (P/N MA-485) according to connection diagram below. ***NOTE* Using other USB-485 adapters may result in permanent damage of the ST-600 series probe communication hardware.**

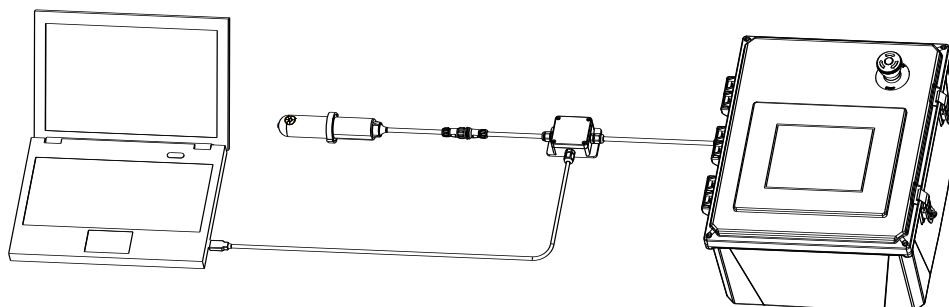


Figure 6. ST-600 Series and Pyxis Sensor/USB adapter (MA-485) connected in series to controller

Establish connection between uPyxis desktop and the ST-600 through the following steps:

1. Open the desktop uPyxis app.
2. Click **Device** tap to launch the connection option menu.
3. Select **Connect via USB-RS485** (Figure 10).
4. Select the Comm Port to make a connection (Figure 11) (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 used.)

After the connection is established, the ST-600 probe series number and current bleach reading are displayed on the left of the information page (Figure 12). In this page, a nickname can be assigned to the probe. The probe Modbus address can be changed from its default 32.

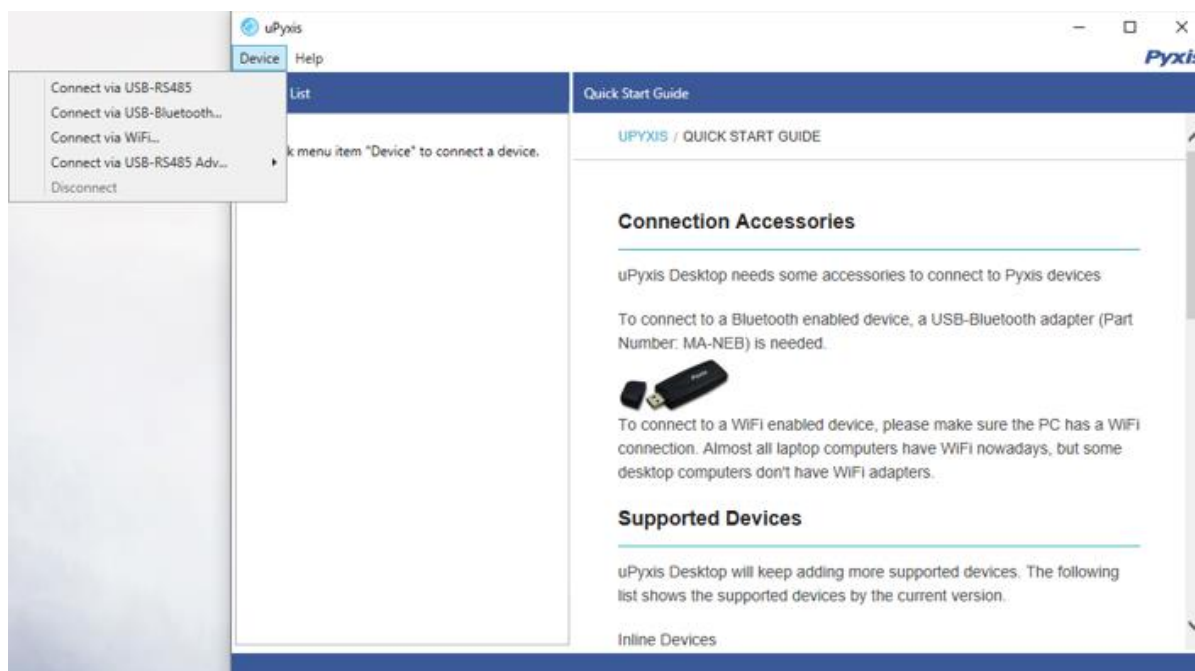


Figure 7. Connection Options

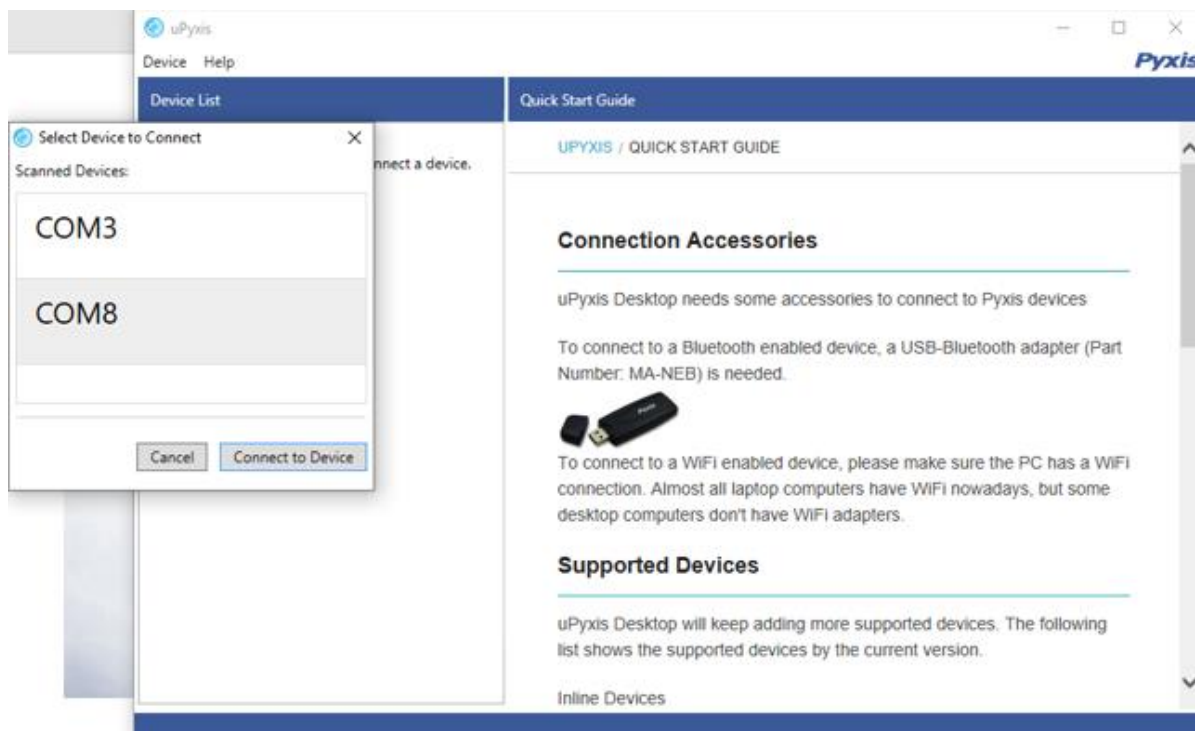


Figure 8. Select a Comm port

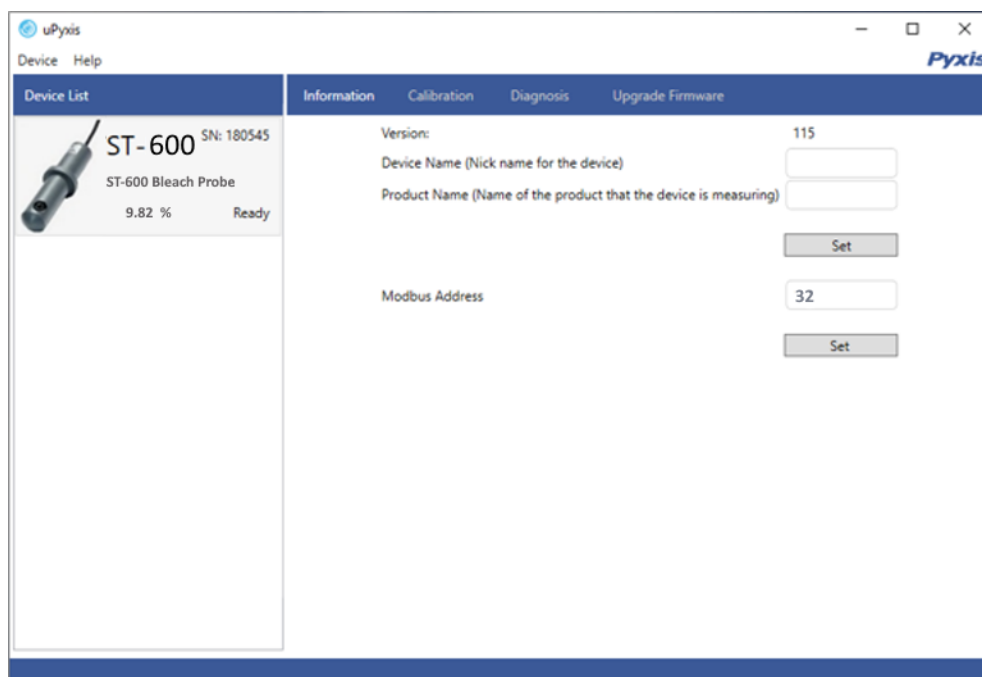


Figure 9. Connected to a ST-600 probe and information page



Figure 10. Calibration page

4.2.1 Calibration

Click **Calibration** to launch the calibration page (Figure 13). Place the probe in deionized water and click **Zero Calibration** to carry out the zero-point calibration.

Place the probe in a known bleach calibration standard and tap **Slope Calibration** to carry out the slope calibration. Enter the bleach concentration in the dialog window as in Figure 14. For the best result, the bleach standard concentration should be in the range of 5% to 16% for ST-600 and 1-2% for ST-604.

The calibration solution could be the sample bleach itself (in the chemical tank). The concentration of bleach in the sample water can be determined with using a Pyxis SP-910 Handheld meter using BLEACH Direct Read method, or by conventional titration method.

4.2.2 4-20mA Span Settings

The default 4-20mA span is 20 mA = 16% and 4 mA = 0 bleach. Click **4-20mA Span** to change the bleach value corresponding to the 20 mA output (Figure 15). The maximum upper limitation of the 20mA output for ST-600 is 16% and ST-604 is 2% when using this function.

4.2.3 Diagnosis

Click **Diagnosis** to the diagnosis page (Figures 16 and 17). In the diagnosis page, the raw data measured by the probe is displayed. To help troubleshoot possible issues with the probe, please save an image of this data 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.

In the diagnosis page, the probe cleanliness check can be performed. Please place the probe in the known bleach standard or sampled bleach available and select the sensor condition by tapping **Diagnosis Condition** (Figure 16). Tap **Cleanliness Check** to carry out the check. If the probe is clean, a green **Clean** message tab will be shown (Figure 17). If the probe is severely fouled, a red **Dirty** message tab will be shown. In this case, please clean the probe according to the procedure in Section 6. If the probe is partially fouled, a yellow **Becoming Dirty** message tab will be shown.

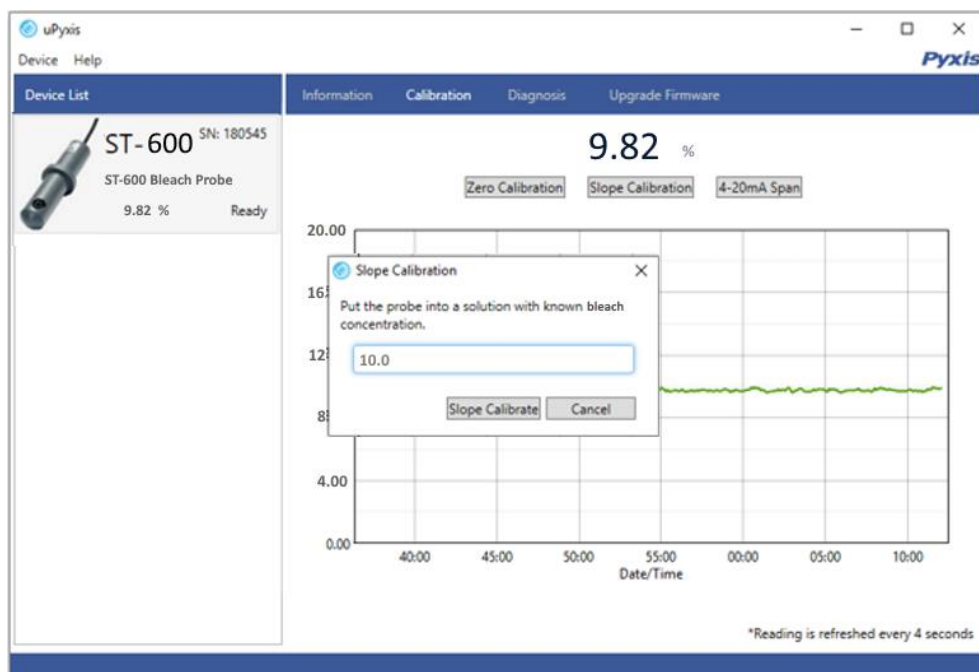


Figure 11. Enter Bleach concentration for slope calibration

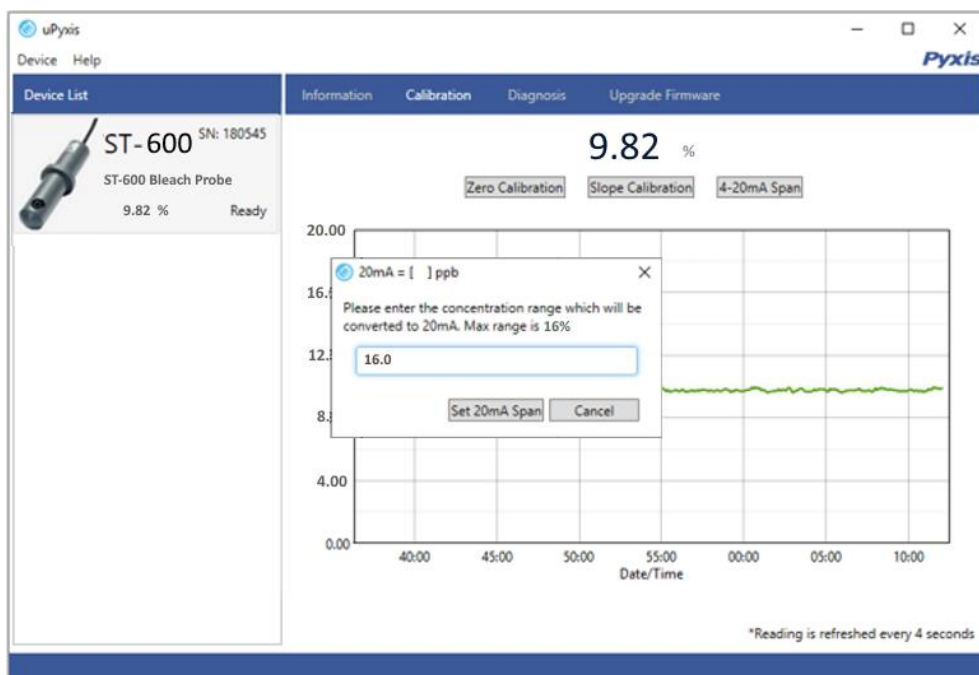


Figure 12. Set 4-20mA span

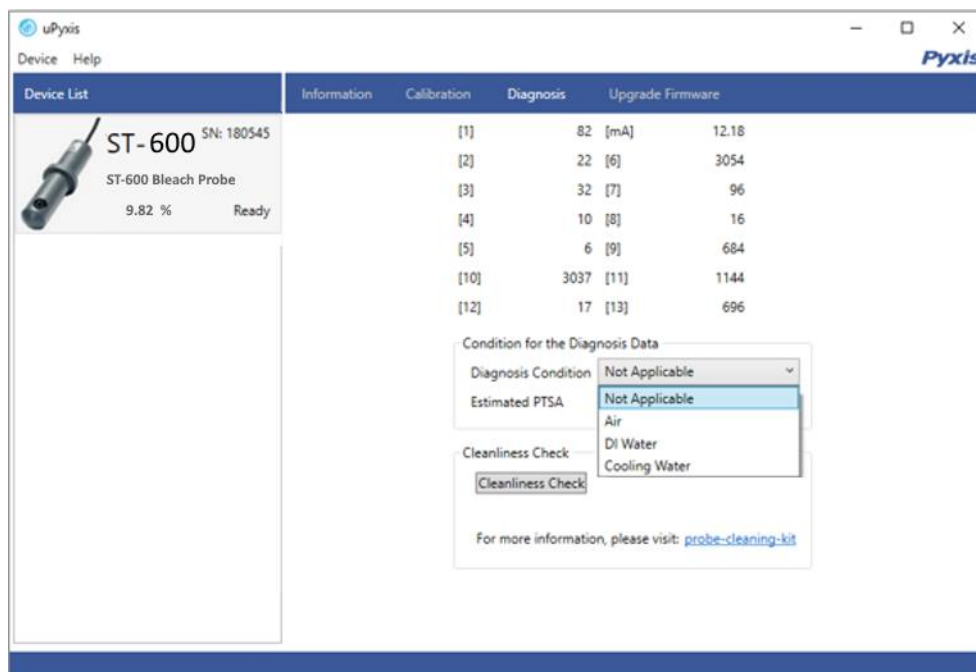


Figure 13. Select diagnosis condition before cleanliness check

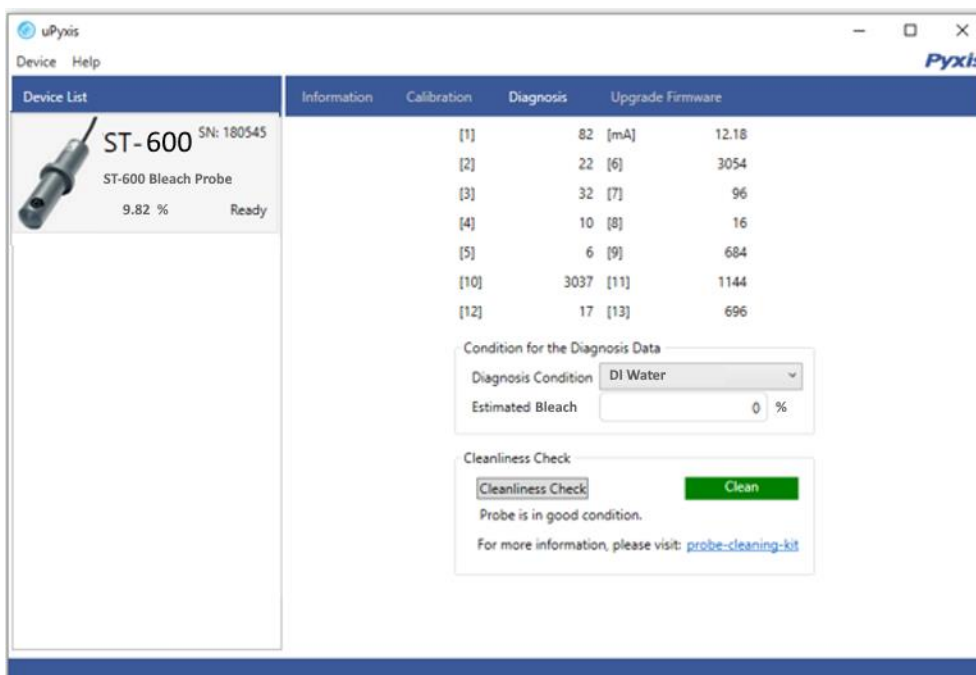


Figure 14. Cleanliness check and raw diagnosis data

4.3 Calibration through the Controller

It is recommended that ST-600 series calibration is carried out using 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-% bleach ratio. A two-point calibration could also be carried out on the controller

by adjusting both the mA-to-% bleach 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% and 20 mA = 16% for ST-600 and 4 mA = 0% and 20 mA = 2% for ST-604 bleach concentrations.

For the single calibration involving the bleach sample itself, please determine the bleach concentration in the sample by using the Pyxis SP-910 BLEACH direct read method or by conventional titration method.

5 Modbus RTU

The ST-600 series probes are 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.

6 Probe Cleaning and Maintenance

The ST-600 series probes are designed to provide reliable and continuous bleach 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-600 series probes are designed to be easily removed, inspected, and cleaned if required. It is suggested that the ST-600 series probes be checked for fouling and cleaned/calibrated on a monthly basis. Heavily contaminated samples may require more frequent cleanings however most bleach storage tanks are quite clean internally and periodic sensor cleanliness checks with uPyxis will help validate the actual application need for cleaning and calibration.

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 ST Series Sensor Cleaning Solution Kit (P/N SER-01) available from Pyxis online EStore /Catalog <https://pyxis-lab.com/product/st-series-probe-cleaning-kit/>. The

Soak the lower half of the ST-600 series probe in 100 mL probe cleaning solution for 10 minutes. Rinse the ST-600 series probe with distilled water and then check for the flashing blue light inside the ST-600 series probe quartz tube. If the surface is not entirely clean, continue to soak the ST-600 series probe for an additional 10 minutes. Repeat as needed.

The diagnosis function in uPyxis App in a smartphone or a PC can be used to check the cleanliness of the probe before and after cleaning as described in Section 4 of this manual.

6.2 Other Common Troubleshooting Issues

If the ST-600 series 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-600 probe.

Contact us

Contact us if you have questions about the use or maintenance of the ST-600 probe:

Pyxis Lab, Inc.

1729 Majestic Dr. Suite 5

Lafayette, CO 80026 USA

1-866-203-8397

www.pyxis-lab.com

service@pyxis-lab.com