ST-601 Inline ClO2 Concentration Probe
Operation Manual

Rev. A

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Pyxis

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-601 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

The Pyxis ST-601 inline probe are uniquely designed to measure the real-time mass/mass concentration of chlorine dioxide (ClO2) in a range of 0.01-0.35%. The ST-601 probes measure the optical absorbance of the ClO2 solution using a 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-601 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-601 probes can be wirelessly accessed via Bluetooth when used in conjunction with the MA-WB Bluetooth Adapter or PowerPACK Series Auxiliary Box and the **uPyxis** App for Mobile phone and PC. Instructions 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 ¼" 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-601

The ST-601 probes include the following features:

- The probe can be conveniently connected to the suction or discharge side of the pump in both inline Tee (ST-001) or ¼" Teflon tubing format with using a union. Both included with probe.
- The probe can be calibrated with Mobile App or PC software via a MA-WB Bluetooth adapter or PowerPACK Series Aux. Box.
- Diagnostic information (probe tubing fouling and failure modes) can be communicated to digital displays via Modbus RTU.
- ST-601 can be wireless calibrated using known chlorine dioxide concentration standards via **uPyxis** App for Mobile phone or PC.

1.2 Specifications

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

Item	ST-601
Target	Chlorine Dioxide (mass/mass)
Range	0.01% - 0.35 %
Resolution	0.01%
Accuracy	±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) 1.5foot Flying Lead Cable w/IP67 Adapter Optional Extension Cables Available
Calibration	Two-point calibration against known ClO2 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 ¾" 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 *(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	

The primary method is to install the ST-601 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 dioxide 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", 3" and 4" inline tee assemblies as an accessory option if required.

ST-601 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 ¼" 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 ¼" OD Compression Fittings to connect desired inlet and outlet chemical line size to the ST-601 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 recommends 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-601 Probe Clear Teflon Tube Adapter for Tubing Installations

3 Quick 4-20mA Start

Follow the wiring table below to connect the ST-601 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 - (green 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-601 probe can be calibrated in a two-point (zero + slope) procedure using a deionized water sample and a standard solution containing a known ClO2 concentration. For ST-601, Pyxis recommends a 0.1% or 0.3% concentration calibration standard. The calibration solution could be the sample itself (ClO2 in the tank), after verified for concentration through titration method or by using a Pyxis SP-910 – ClO2 HIGH RANGE DIRECT reading method.

4.1 Calibration and Diagnosis with uPyxis Mobile App

Connect and power the ST-601 probe using the Pyxis Bluetooth 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-601 sensor.

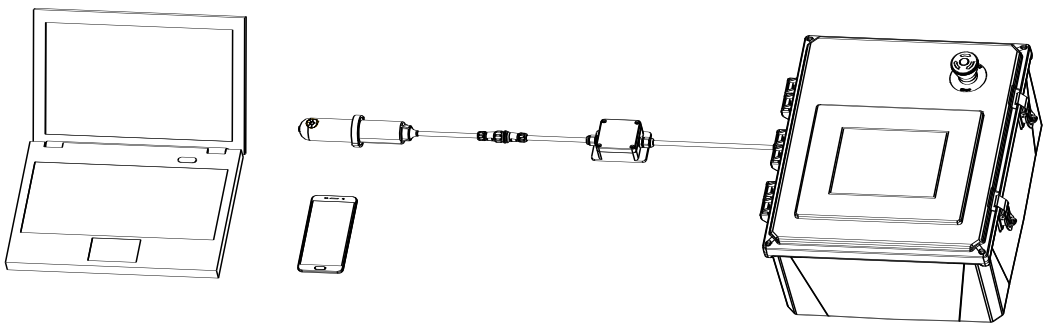

Figure 1.ST-601 and Pyxis Bluetooth adapter (MA-WB) connected in series to controller

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 2).

Tap the discovered ST-601 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-601 as applicable.

As shown in figure 3, the calibration page after uPyxis is connected to the probe via the Pyxis Bluetooth adapter displays the current ClO2 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 ClO2 calibration standard and tap **Slope Calibration** to carry out the slope calibration. Enter the ClO2 concentration in the dialog window as in figure 4. For the best result, the ClO2 standard concentration should be in the range of 1000ppm to 3000ppm for ST-601.

The calibration solution could be the sample ClO2 itself (in the chemical tank). The concentration of CLO2 in the sample water can be determined with using a Pyxis SP-910 Handheld meter using ClO2 High Range Direct Read method (0-1,500ppm), or by conventional titration method.

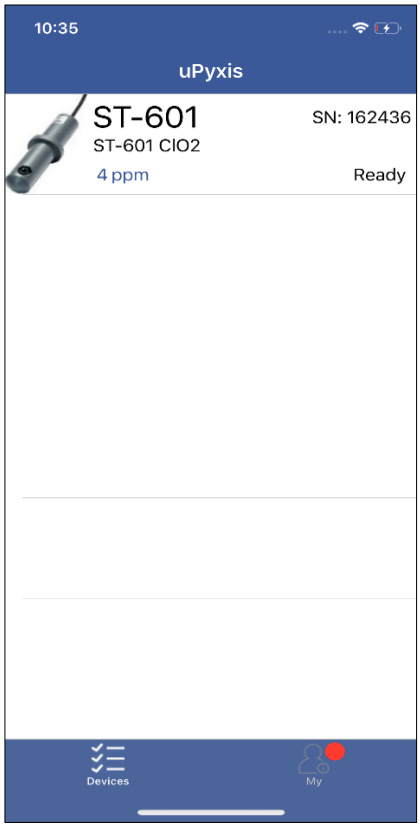

Figure 2. A ST-601 discovered by Bluetooth scan

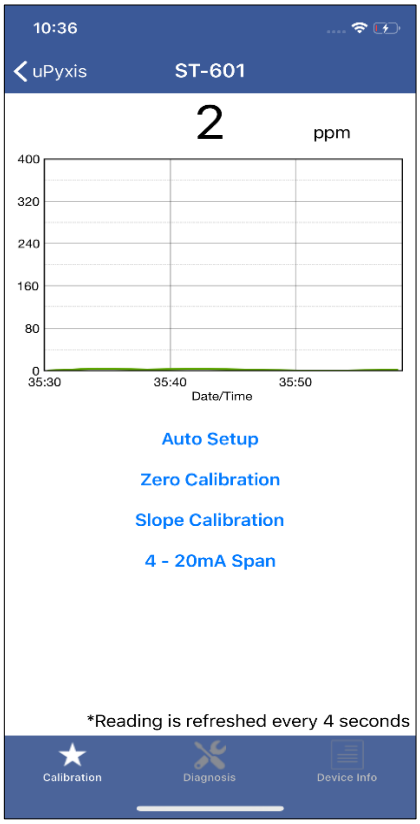

Figure 3. Calibration page

4.1.2 4-20mA Span Settings

The default 4-20mA span is 20 mA = 3000ppm CLO2 and 4 mA = 0 ppm. Users may alter the output scale using **4-20mA Span** to change the CLO2 value corresponding to the 20mA output (Figure 5). The maximum upper limitation of the 20mA output for ST-601 is 4000ppm when using this function.

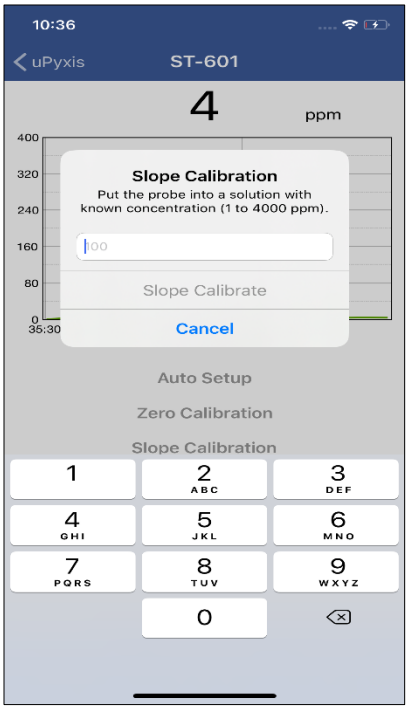

Figure 4. Enter CLO2 concentration

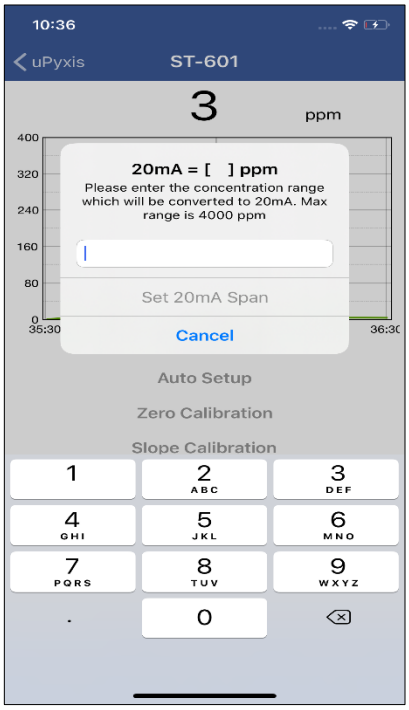

Figure 5. Enter CLO2 concentration to set 4-20mA

4.1.3 Diagnosis

Tap **Diagnosis** in the bottom of the app page to launch the diagnosis page (Figures 6).

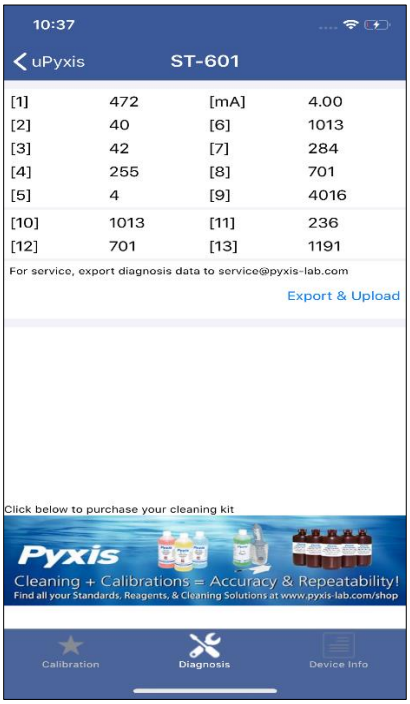

Figure 6. Select diagnosis condition

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 ClO2 standard, and in the sample that the probe is intended for.

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-1.5.9.2.zip

Connect and power the ST-601 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-601 probe communication hardware.**

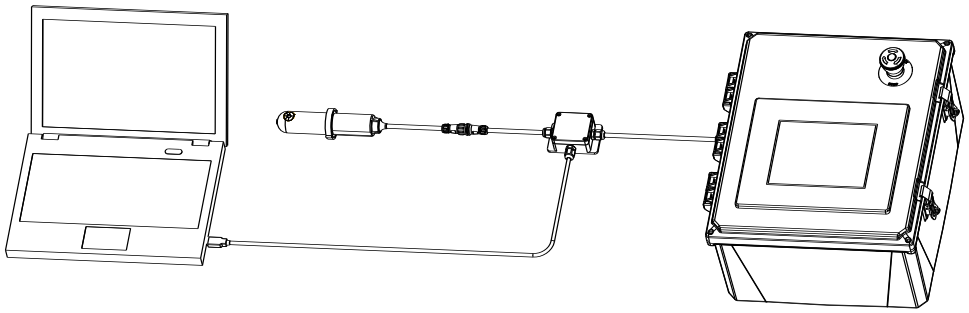

Figure 7. ST-601 and Pyxis Sensor/USB adapter (MA-485) connected in series to controller

Establish connection between uPyxis desktop and the ST-601 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 8).
4. Select the Comm Port to make a connection (Figure 9) (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-601 probe series number and current CLO2 reading are displayed on the left of the information page (Figure 10). In this page, a nickname can be assigned to the probe. The probe Modbus address can be changed from its default 32.

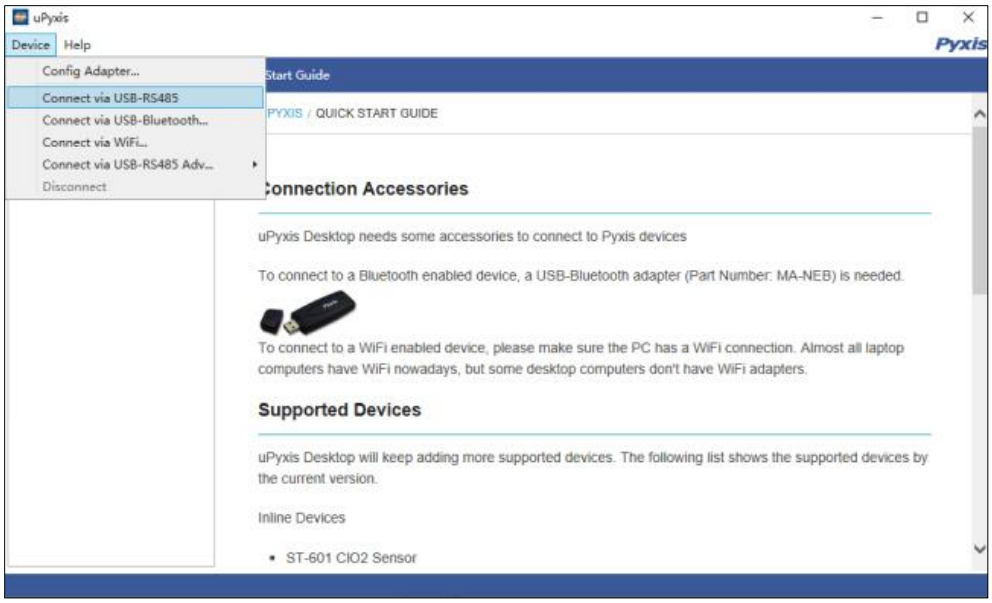

Figure 8. Connection Options

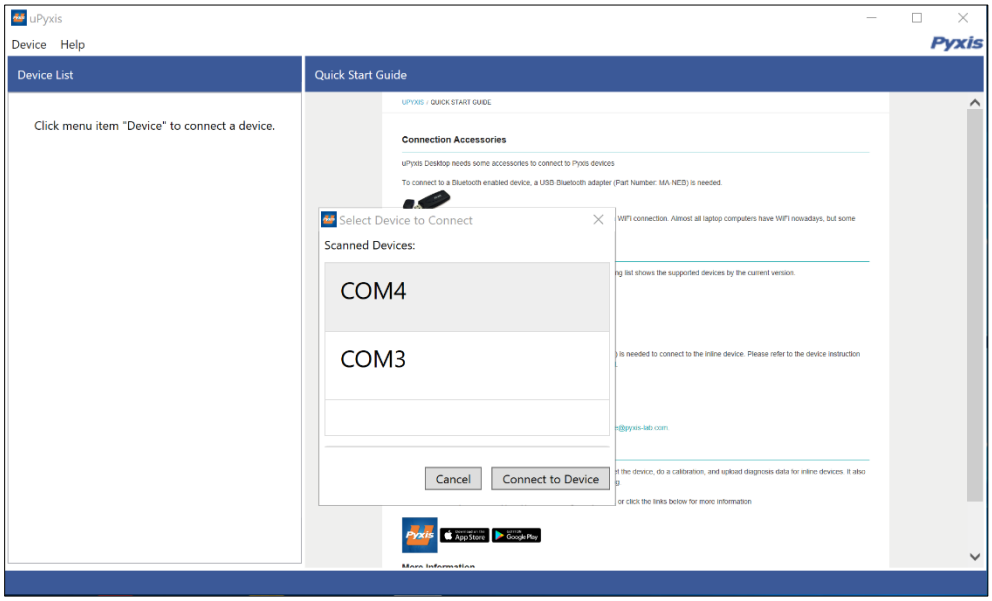

Figure 9. Select a Comm port

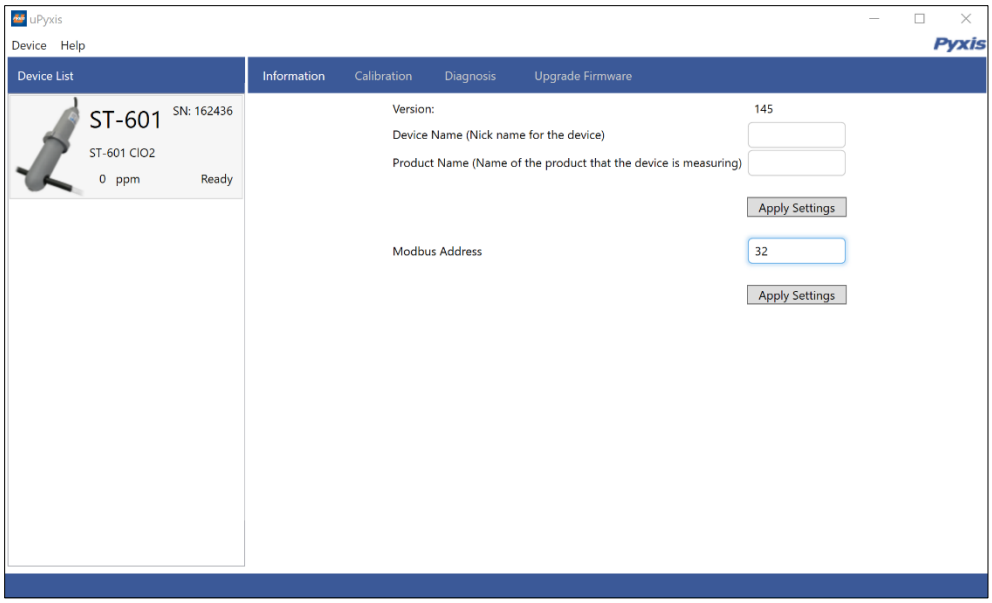

Figure 10. Connected to a ST-601 probe and information page

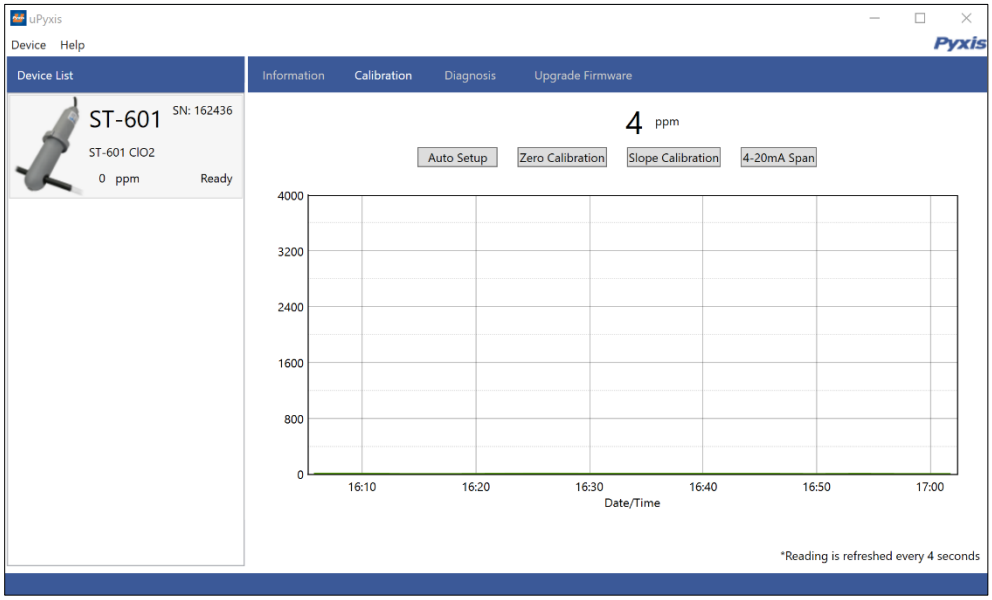

Figure 11. Calibration page

4.2.1 Calibration

Click **Calibration** to launch the calibration page (Figure 11). Place the probe in deionized water and click **Zero Calibration** to carry out the zero-point calibration.

Place the probe in a known ClO2 calibration standard and tap **Slope Calibration** to carry out the slope calibration. Enter the ClO2 concentration in the dialog window as in Figure 12. For the best result, the ClO2 standard concentration should be in the range of 1000ppm to 3000ppm for ST-601.

The calibration solution could be the sample ClO2 itself (in the chemical tank). The concentration of CLO2 in the sample water can be determined with using a Pyxis SP-910 Handheld meter using CLO2 High Range Direct Read method (0-1,500ppm), or by conventional titration method.

4.2.2 4-20mA Span Settings

The default 4-20mA span is 20 mA = 3000ppm CLO2 and 4 mA = 0 ppm. Users may alter the output scale using **4-20mA Span** to change the CLO2 value corresponding to the 20mA output (Figure 13). The maximum upper limitation of the 20mA output for ST-601 is 4000ppm when using this function.

4.2.3 Diagnosis

Click **Diagnosis** to the diagnosis page (Figures 14). 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.

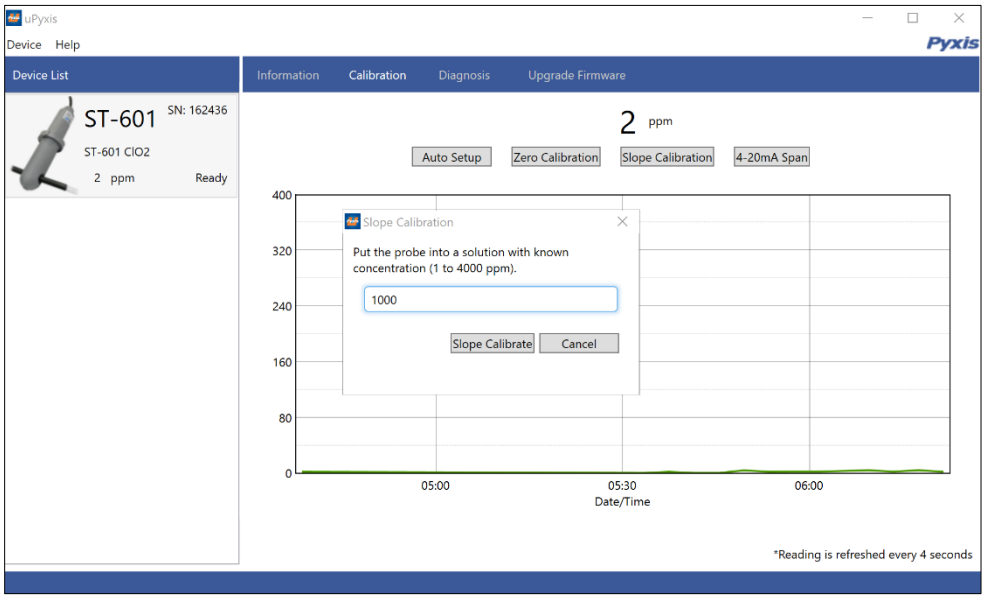

Figure 12. Enter ClO2 concentration for slope calibration

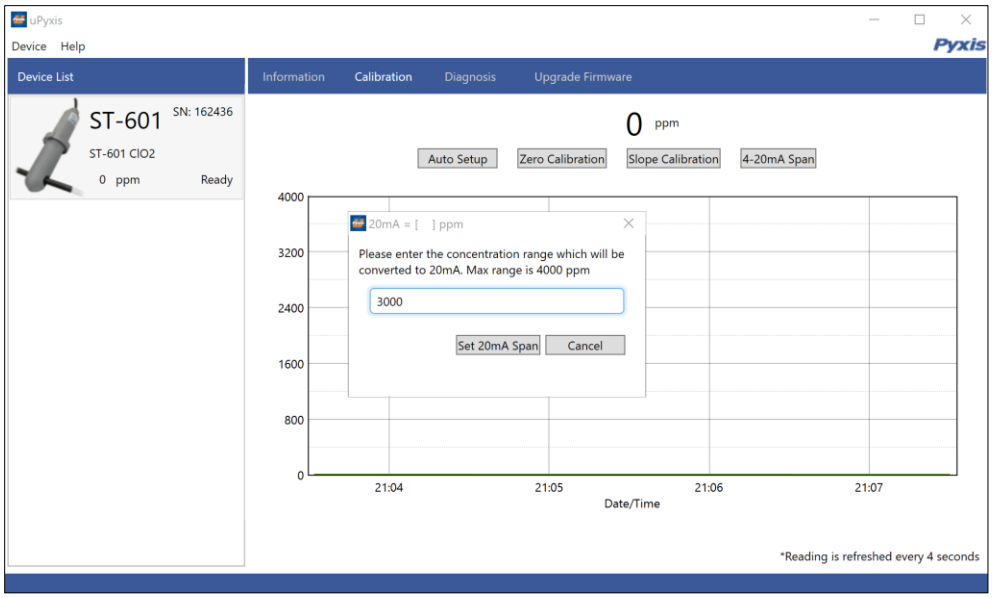

Figure 13. Set 4-20mA span

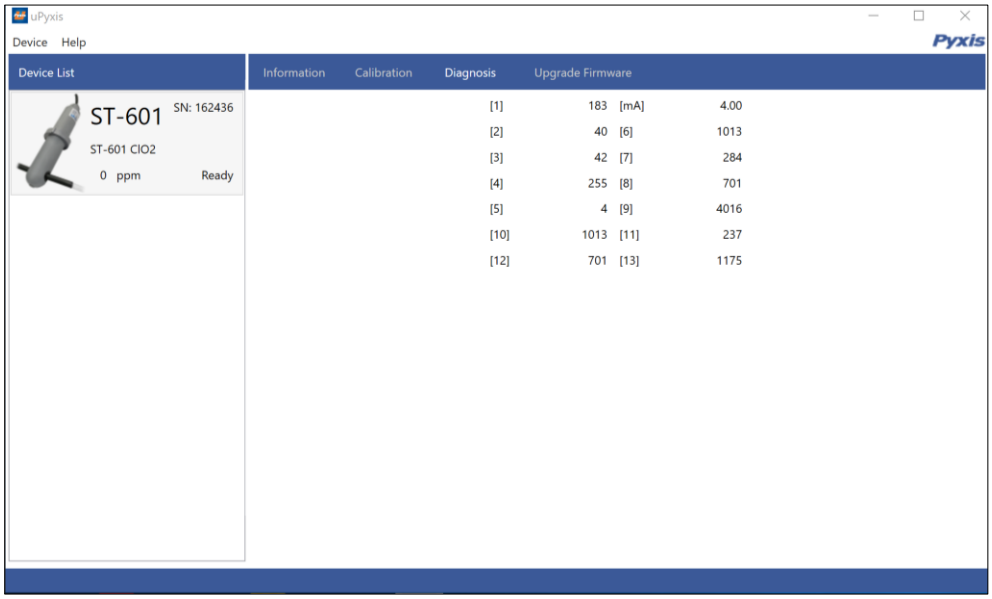

Figure 14. Select diagnosis condition before cleanliness check

4.3 Calibration through the Controller

It is recommended that ST-601 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-ppm CLO2 ratio. A two-point calibration could also be carried out on the controller by adjusting both the mA-to- ppm CLO2 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 ppm and 20 mA = 3000ppm for ST-601 concentrations.

For the single calibration involving the CLO2 sample itself, please determine the CLO2 concentration in the sample by using the Pyxis SP-910 CLO2 High Range Direct Read method (0-1,500ppm) or by conventional titration method.

5 Modbus RTU

The ST-601 probes are configured as a Modbus slave device. In addition to the ClO2 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-601 probes are designed to provide reliable and continuous ClO2 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-601 probes are designed to be easily removed, inspected, and cleaned if required. It is suggested that the ST-601 probes be checked for fouling and cleaned/calibrated on a monthly basis. Heavily contaminated samples may require more frequent cleanings however most ClO2 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-601 probe in 100 mL probe cleaning solution for 10 minutes. Rinse the ST-601 probe with distilled water and then check for the flashing blue light inside the ST-601 probe quartz tube. If the surface is not entirely clean, continue to soak the ST-601 probe for an additional 10 minutes. Repeat as needed.

6.2 Other Common Troubleshooting Issues

If the ST-601 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-601 probe.

Contact us

Contact us if you have questions about the use or maintenance of the ST-601 probe:

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