Pyxis®

ST-605 Inline Chlorine Dioxide Sensor

Inline Direct-Read Chlorine Dioxide Sensor (0–100ppm)

Pyxis Lab® Inc.
21242 Spell Circle
Tomball, TX 77375
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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-605 inline sensor is uniquely designed to measure the real-time concentration of chlorine dioxide (CLO2) in clean water free of suspended solids, turbidity, and color. The ST-605 sensor measures the optical density of the CLO2 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-605 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-605 sensor can be wirelessly accessed via Bluetooth5.0 when used in conjunction with the MA-WB Bluetooth/USB Adapter or PowerPACK Series Auxiliary Box and the **uPyxis® 2.0** 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 in piping format. This method should ideally be 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 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 ¼-inch 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 line sizes.

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-605 sensor includes the following features:

- Can be conveniently installed in both inline Tee (ST-001) or ¼-inch Teflon tubing format with using a union; both included with sensor.
- Can be wirelessly calibrated using a known chlorine dioxide concentration standard with the **uPyxis® 2.0** Mobile or Desktop App via a MA-WB Bluetooth/USB 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-605 Specifications

Specification*	**ST-605**
Part Number (P/N)	54148
Chlorine Dioxide Concentration Range	0.5 - 100 ppm
Chlorine Dioxide Concentration Resolution	0.1 ppm
Chlorine Dioxide Concentration Accuracy	±2% of reading or ±0.1 ppm, whichever is greater
Temperature Output Range	4 mA: 32 °F (0 °C), 20 mA: 212 °F (100 °C)
Method	UV Absorbance
Calibration	Two-point calibration against known ClO2 concentration solution
Outputs	2x 4–20mA Analog Output, RS-485 Digital Output with Modbus protocol
Installation	¼-inch OD (7 mm) Teflon ST-001 tee assembly with ¾-inch female socket & NPT threaded ports
Cable Length	5 ft Bulkhead 7-Pin w/Adapters & 5ft flying lead w/Adapter
Power Supply	22–26 VDC, 2W
Dimension (L x D)	6.8 × 1.44 inch (172.7 x 36.6mm)
Weight	0.37 lbs. (170 g)
Material	CPVC
Operational Temperature	40–120 °F (4–49 °C)
Storage Temperature	20–140 °F (-7–60 °C)
Pressure	Up to 100 psi (0.7 MPa)
Enclosure Rating	IP67
Regulation	CE, RoHS, UKCA

* 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

- One ST-001 Tee Assembly ¾-inch NPT (1x Tee, O-ring, and Nut) (P/N: ST-001)
  - Shipped with ST-600 Series Tee Oring Kit Bleach Compatible (P/N:VIT-KIT)
- One MA-1100 - 7-Pin Flying Leads Cable with Male Adapter (5ft) (P/N: 50747)
- Clear Teflon Tubing ¼-inch OD (6-inches) for Teflon Tube Install Method
- User Manual available online at https://pyxis-lab.com/support/

3.2 Optional Accessories

Table 2

Accessory Name	P/N
Pyxis Probe Cleaning Kit *(Includes Sensor Cleaner 500mL + Accessories)*	SER-01
ST-001 *(Pyxis inline Tee Assembly ¾-inch – Replacement)*	50704
ST Series -2inch Tee Assembly *(Pyxis inline Tee Assembly 2-inch)*	50756
ST Series -3inch Tee Assembly *(Pyxis inline Tee Assembly 3-inch)*	50775
ST-002 Tee Plug *(Plug Insert for ST-001 Allows Sensor Removal)*	ST-002
ST-600 Series Bleach Grade Tee O-ring Kit *(ST-600 series tee O-ring Kit – Replacement compatible with strong oxidizers)*	VIT-KIT
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-1100 *(24' Flying Lead Cable for 7Pin Pyxis Sensors)*	MA-1100
MA-C10 *(10' Extension Cable for 7Pin Pyxis Sensors)*	50738
MA-C50 *(50' Extension Cable for 7Pin Pyxis Sensors)*	50705
SP-910 *(Portable Water Analyzer)*	50603

4 Installation

4.1 In-line Piping Installation Format

The primary method is to install the probe in-line in CPVC piping format. This method should ideally run in a vertical line to avoid chlorine dioxide gas bubble interference. This can be done with the standard ST-001 Inline Tee Assembly (3/4-inch FNPT) provided with each sensor containing the bleach-compatible oring kit (P/N VIT-KIT). Pyxis also offers 2-inch and 3-inch inline tee assemblies as an accessory option if required.

Figure 1. ST-605 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 ¼-inch 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 feed line installations. Users can use conventional ¼-inch OD compression fittings to connect desired inlet and outlet to the ST-605 sensor 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 2.*

Figure 2. ST-605 Sensor Clear Teflon Tube Adapter for Tubing Installations

4.3 Wiring

Follow the wiring tables below to connect the ST-605 probe to a receiving controller.

NOTE: *If an insufficient wattage is available from the connected controller (i.e. 2W), 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.*

Table 2

Wire Color	Designation
Red	24 V +
Black*	24 V- Power Ground and 4-20mA-
White	1# 4-20 mA + for CLO2
Green	2# 4-20 mA + for Temperature
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, earth ground

NOTE *4-20mA- and the 24V DC- are internally connected.*

4.4 Connecting via Bluetooth to a Mobile Device

An MA-WB Bluetooth/USB adapter (P/N: MA-WB) can be used to connect a ST-605 sensor to a smart device with the **uPyxis®2.0** Mobile App. The power should be sourced from a 24 VDC power terminal of a connected controller. If a controller is not available, please purchase a Pyxis PowerPack-1 (P/N: MA-BLE-1) or PowerPack-4 (P/N: MA-BLE-4) auxiliary power supply with Bluetooth, or an alternative 24 V power supply that can directly connect to the ST-605 sensor with proper cable connectors from Pyxis.

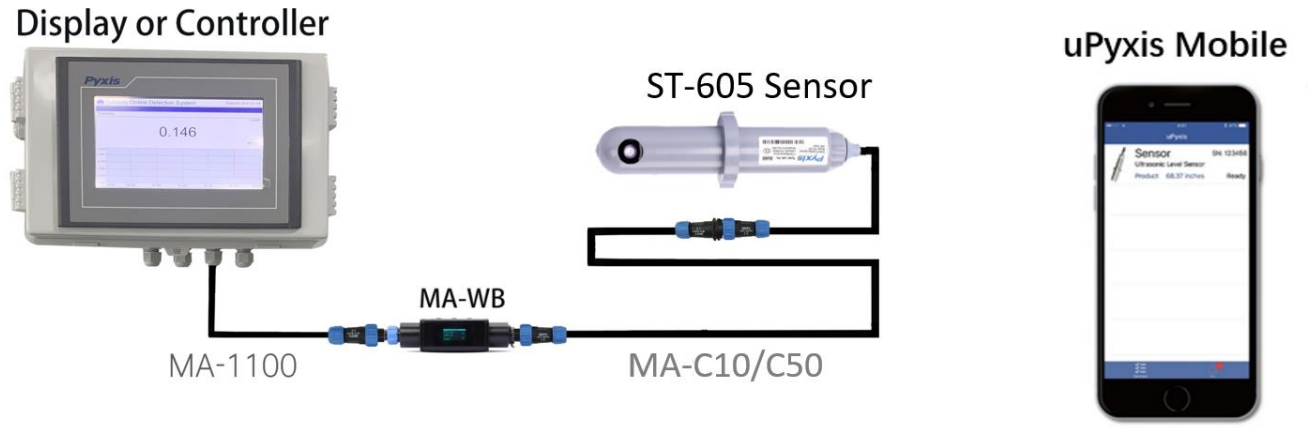

Figure 3. MA-WB Bluetooth connection to 7-Pin Pyxis sensor and uPyxis 2.0 Mobile App

5 Setup and Calibration with uPyxis2.0® Mobile App

The ST-605 sensor can be calibrated in a two-point (zero + slope) procedure using a deionized (DI) water and a known calibration standard. The calibration solution also could be the sample ClO2 itself (in the chemical tank).

IMPORTANT NOTE *Direct sunlight or indoor light on the ST-605 sensor should be avoided although it is not necessary to completely shield the ST-605 sensor from the ambient light during both the zero point and slope calibrations.*

5.1 Download and Connect to the uPyxis® 2.0 Mobile App

Install the MA-WB Bluetooth adapter as outlined in Figure 3.

Download **uPyxis®** Mobile App from **Apple App Store** or **Google Play**. Turn ON the Bluetooth in the smart device being used. Please do not pair your devices Bluetooth to uPyxis, the app will do the pairing. Open the uPyxis app on the device. Click the **Scan Bluetooth** button to scan the available Pyxis Bluetooth devices. The discovered devices will be listed as shown in *Figure 4*. This may take up to one minute.

Tap the discovered ST-605 sensor to connect to the sensor. The uPyxis app will identify the sensor type if multiple Pyxis sensors are discovered in the scan.

As shown in *Figure 5,* uPyxis will default to the **Trend Chart** page after connected to the sensor via the MA-WB Bluetooth adapter. The measurement value will be displayed as a line graph to show the real-time trend.

Tap **Configuration** in the top of the app page to launch the configuration page. Five functional tabs of each are available on this page: Information, Configuration, Calibration, 4-20mA Span and Diagnosis.

Figure 4.

Figure 5.

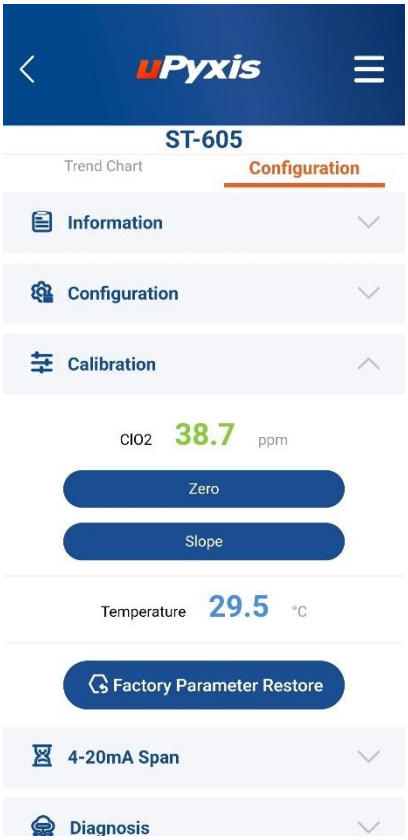

Figure 6.

5.2 CLO2 Calibration via uPyxis 2.0 Mobile App

Single Point (In-Situ) CLO2 Calibration

1. Verify that the ST-605 sensor is clean using the Cleanliness Check Function of the Diagnostic tab within uPyxis 2.0 (see section 5.4).

2. Determined the concentration of CLO2 in the sample water using a Pyxis SP-910 Handheld meter using ClO2 Medium Range Direct Read method (7.3-50ppm), or by conventional titration method.

3. Once the displayed CLO2 and temperature values are stable, click Slope Calibration to carry out the slope calibration. Tap **Slope CALIBRATION** and enter the CLO2 value (10-100 ppm), then hit confirm.

NOTE *If the sensor is dirty, it must be removed for proper optical channel cleaning with the Pyxis Probe Cleaning Solution (P/N SER-01) prior to conducting sensor calibration. Confirmation of sensor cleanliness with the uPyxis 2.0 APP Cleanliness Check Function is required before proceeding to sensor calibration.*
See instructional video here https://www.youtube.com/watch?v=hFmk2znyvjs&pp=ygUIcHl4aXMgbWE%3D

Two-Point (Beaker) Calibration

***IMPORTANT NOTE*:** *For best results, the ST-605 sensor should be calibrated in a completely light-proof environment by covering the beaker with a towel.*

1. After confirming sensor cleanliness as outlined above, place the sensor into a beaker containing deionized (DI) water.

2. Tap **ZERO CALIBRATION** in the uPyxis app. Please allow sufficient time (a few minutes) for the sensor to stabilize before performing the calibration.

3. After completing the zero calibration, place the sensor into a known CLO2 standard solution.

4. Determined the concentration of CLO2 standard using a Pyxis SP-910 Handheld meter using ClO2 Medium Range Direct Read method (7.3-50ppm), or by conventional titration method.

5. Once the displayed CLO2 and temperature values are stable, click Slope Calibration to carry out the slope calibration. Tap **SLOPE CALIBRATION** in the uPyxis app. Enter the CLO2 concentration (10-100 ppm) in the dialog window as in *Figure7.*

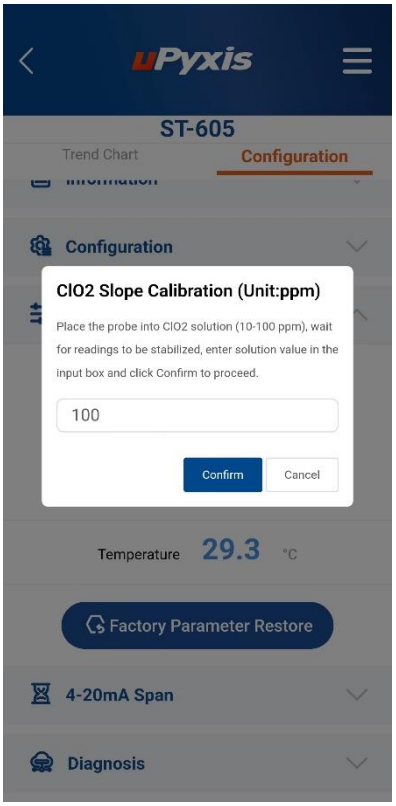

Figure 7.

5.3 Adjusting the 4-20mA Span via uPyxis 2.0 Mobile App

From the Pyxis factory, the 4–20mA output of the ST-605 sensor is scaled as follows:

Unit of Measure	4mA Value	20mA Value
CLO2	0 ppm	100 ppm
Temperature	32°F	212°F

Users may alter the output scale using **4-20mA Span** to change the CLO2 value corresponding to the 20mA output (*Figure 8*).

NOTE *The 20mA value span adjustment may only be equal to or lower than the upper range detection limit of the sensor.*

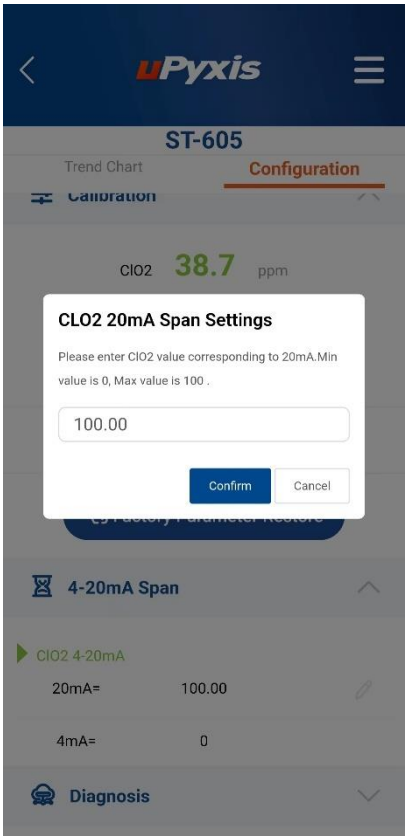

Figure 8 – Adjust 20mA Setting for CLO2

5.4 Diagnosis & Cleanliness Check

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-605 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-605 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

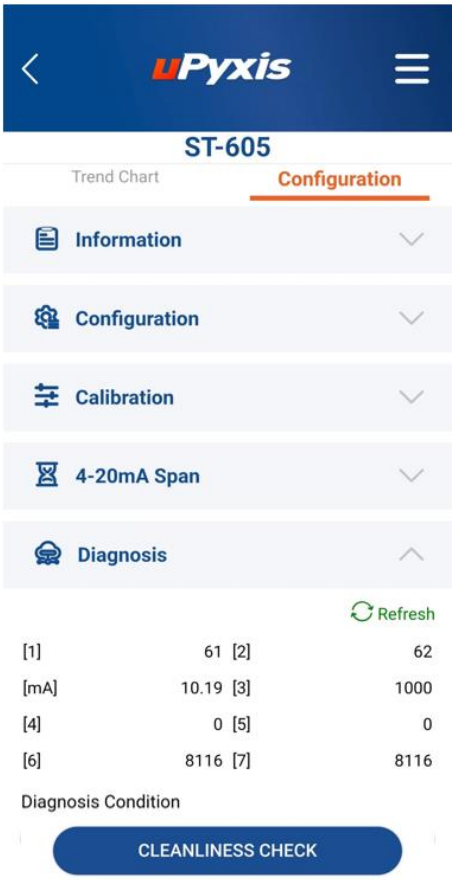

Figure 9.

6 Setup and Calibration with uPyxis® Desktop App

6.1 Install uPyxis® Desktop App

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

2. Connect a USB Type-C cable to the port at the bottom of the MA-WB and to the USB port of the laptop or computer. This will provide power to the MA-WB from the laptop/computer. Connect the MA-WB to the ST-605 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.

MA-WB Bluetooth Adapter – Bottom USB-C

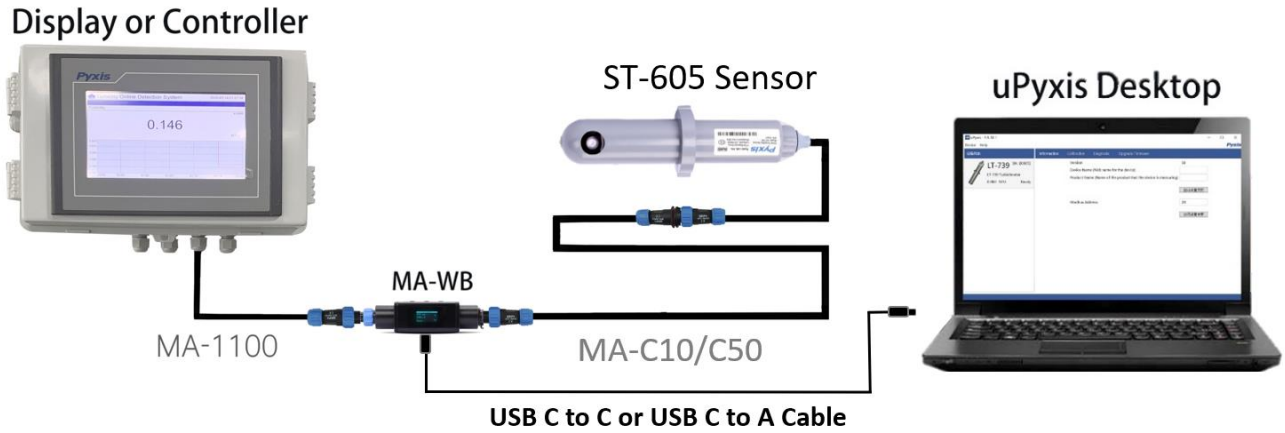

Figure 10 – 7-Pin Pyxis Sensor / MA-WB / USB-C Cable connected to uPyxis Desktop

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

   a. Once the MA-WB screen is powered Press ◀ or ▶ until you arrive at (USB to RS485) screen.
   b. Press the **OK** Button.
   c. Follow Prompts below to Enable USB feature. Once enabled, you may connect to uPyxis.

4. Open the desktop uPyxis APP.
5. Click Device to launch the connection option menu.
6. Select Connect via USB-RS485 (*Figure 11*).
7. Select the Comm Port to make a connection. Normally only one Comm port is identified by uPyxis (*Figure 12).* 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.

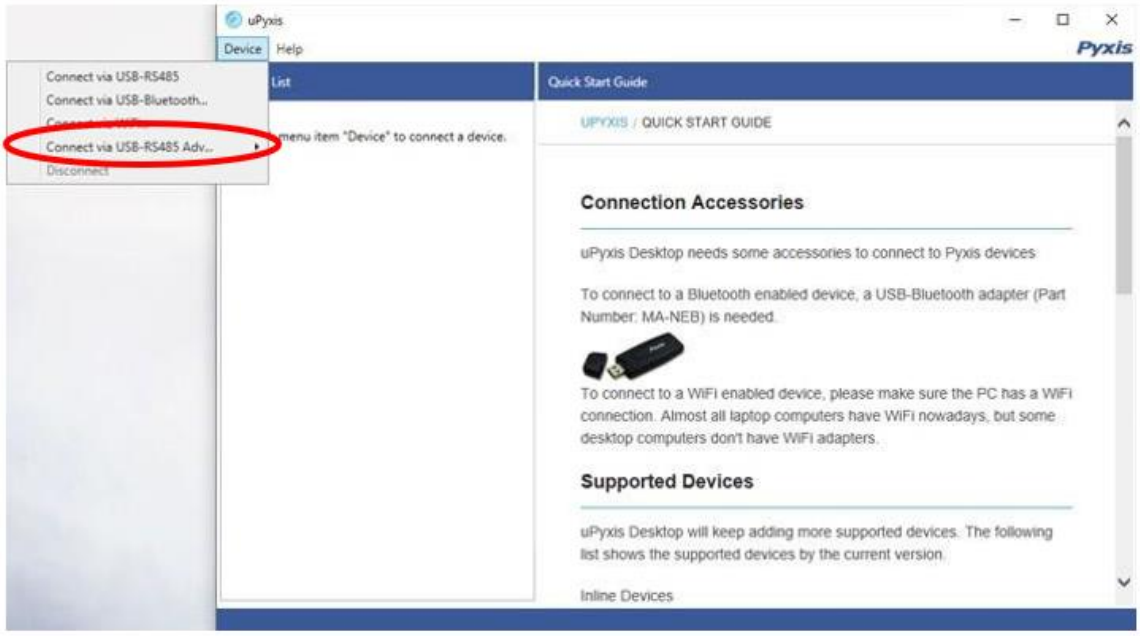

Figure 11. Connection Options

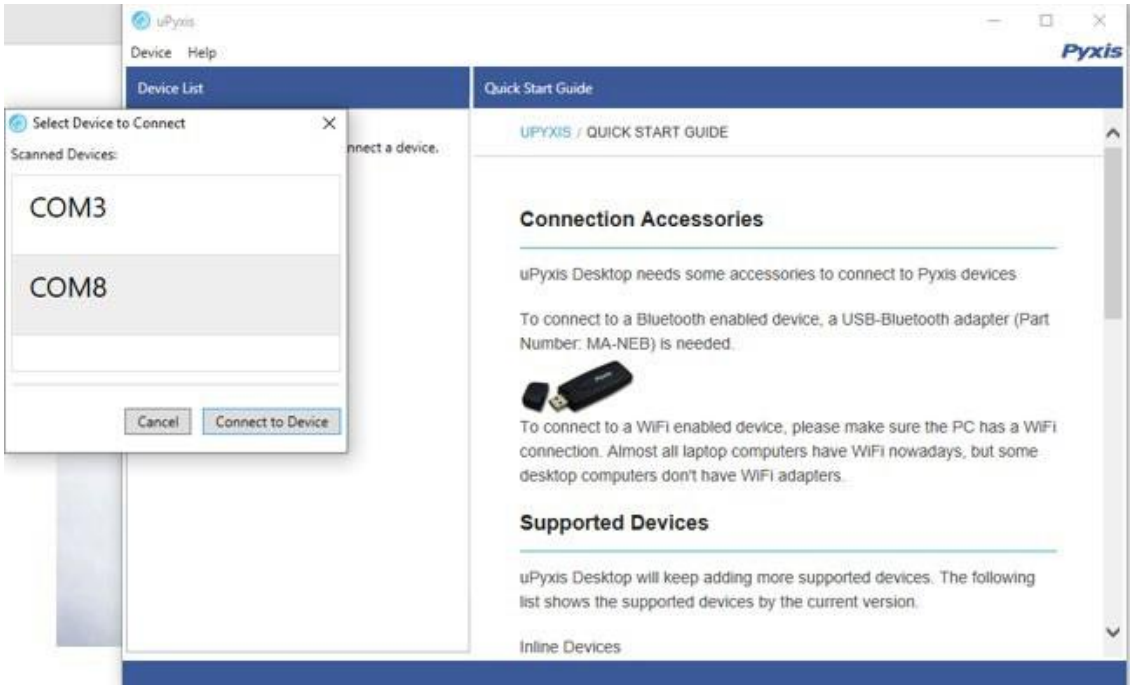

Figure 12. Select a Comm port

6.2 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 **Apply Settings** to save.

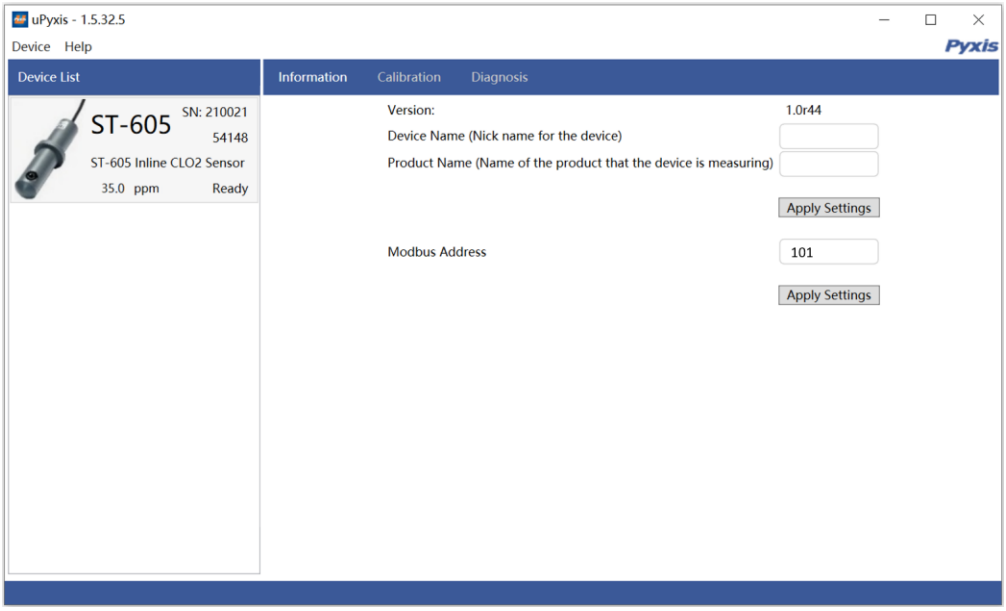

Figure 13.

6.3 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.

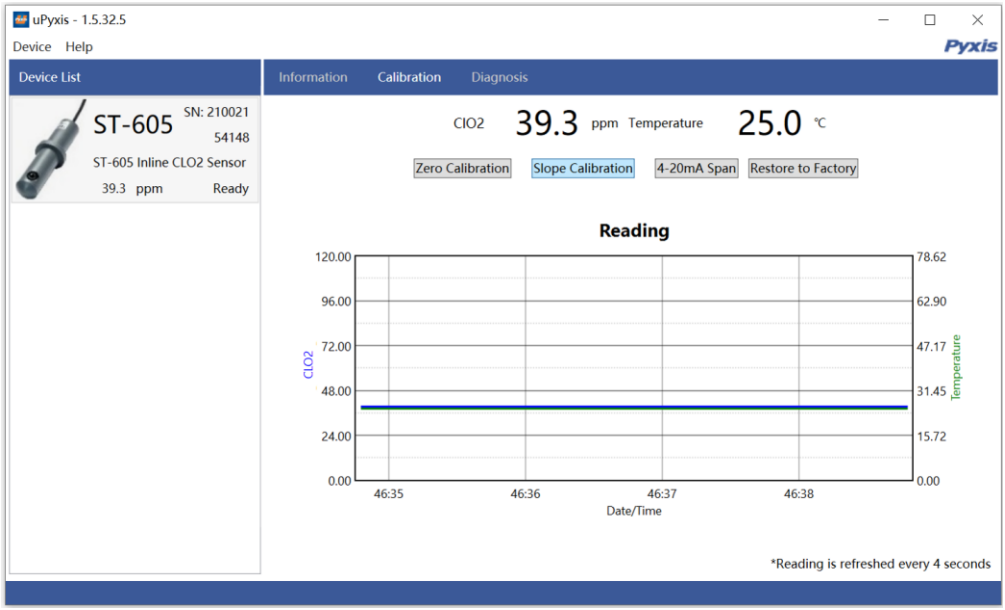

Figure 14.

6.4 CLO2 Calibration via uPyxis Desktop App

Single Point (In-Situ) CLO2 Calibration

1. Verify that the ST-605 sensor is clean using the Cleanliness Check Function of the Diagnostic tab within uPyxis 2.0 (see section 5.4).
2. Determined the concentration of CLO2 in the sample water using a Pyxis SP-910 Handheld meter using ClO2 Medium Range Direct Read method (7.3-50ppm), or by conventional titration method.
3. Once the displayed CLO2 and temperature values are stable, click Slope Calibration to carry out the slope calibration. Tap **Slope CALIBRATION** and enter the CLO2 value (10-100 ppm), then hit confirm.

NOTE *If the sensor is dirty, it must be removed for proper optical channel cleaning with the Pyxis Probe Cleaning Solution (P/N SER-01) prior to conducting sensor calibration. Confirmation of sensor cleanliness with the uPyxis 2.0 APP Cleanliness Check Function is required before proceeding to sensor calibration.*
See instructional video here https://www.youtube.com/watch?v=hFmk2znyvjs&pp=ygUIcHl4aXMgbWE%3D

Two-Point (Beaker) Calibration

***IMPORTANT NOTE*:** *For best results, the ST-605 sensor should be calibrated in a completely light-proof environment by covering the beaker with a towel.*

1. After confirming sensor cleanliness as outlined above, place the sensor into a beaker containing deionized (DI) water.
2. Tap **ZERO CALIBRATION** in the uPyxis app. Please allow sufficient time (a few minutes) for the sensor to stabilize before performing the calibration.
3. After completing the zero calibration, place the sensor into a known CLO2 standard solution.
4. Determined the concentration of CLO2 standard using a Pyxis SP-910 Handheld meter using ClO2 Medium Range Direct Read method (7.3-50ppm), or by conventional titration method.
5. Once the displayed CLO2 and temperature values are stable, click Slope Calibration to carry out the slope calibration. Tap **SLOPE CALIBRATION** in the uPyxis app. Enter the CLO2 concentration (10-100 ppm) in the dialog window as in *Figure15.*

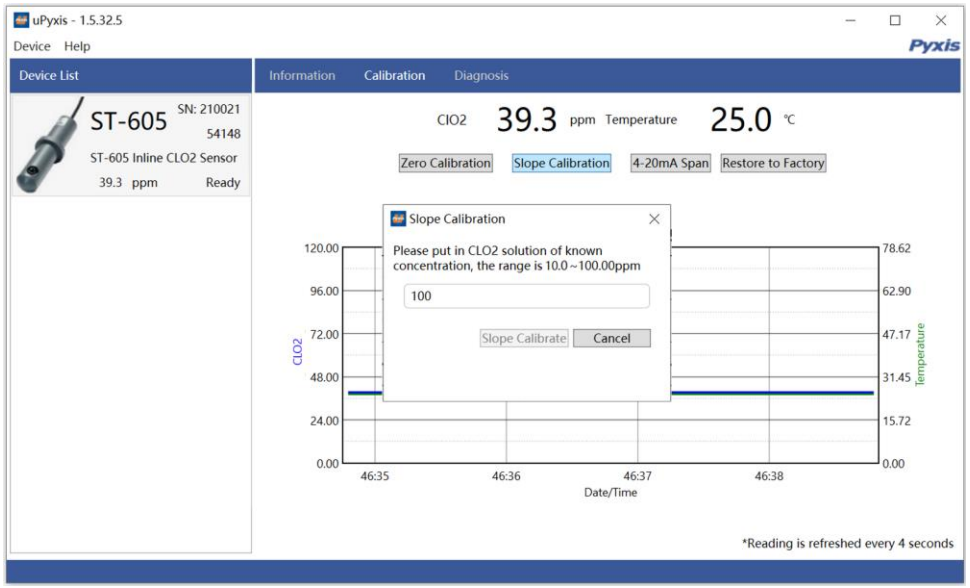

Figure 15.

6.5 Diagnosis & Cleanliness Check

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-605 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-605 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.

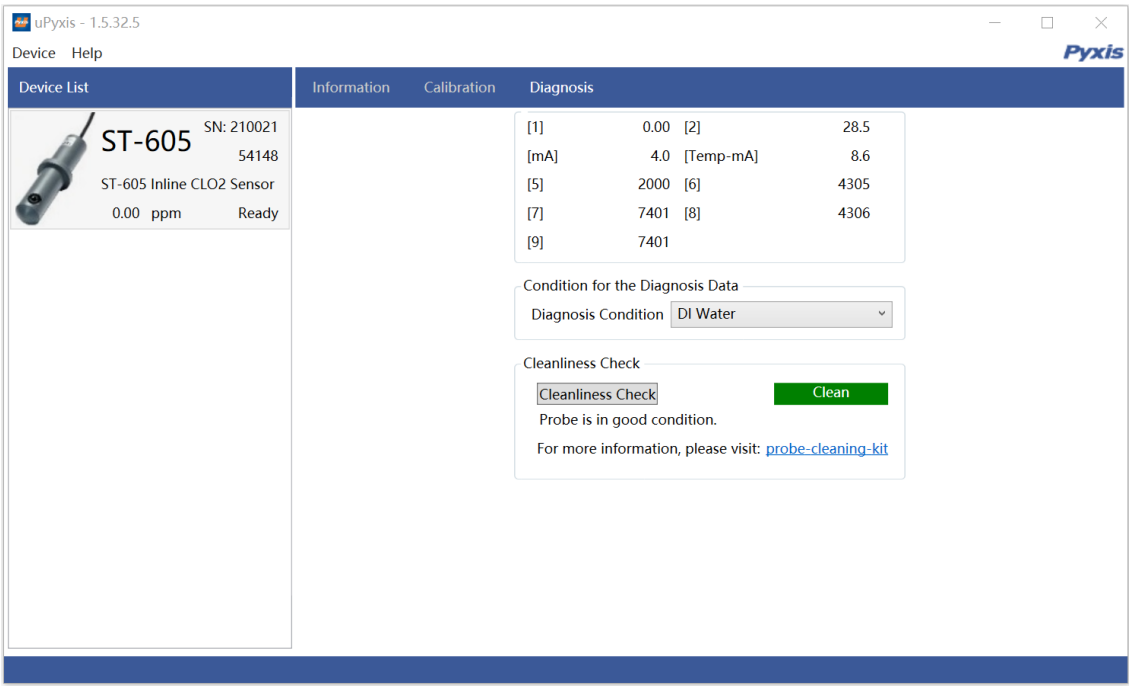

Figure 16.

7 Outputs

7.1 4–20mA Output Setup

The 4–20mA output of the ST-605 sensor should be scaled as outline below.

Unit of Measure	4mA Value	20mA Value
CLO2	0 ppm	100 ppm
Temperature	32°F	212°F

7.2 Adjusting 4–20mA Span

Users may adjust the output scale using 4–20mA Span to change the CLO2 value corresponding to the 20mA output via **uPyxis®**. For the **uPyxis®** Desktop App, click **4-20mA Span** found on the **Calibration Screen**, shown in Figure 17.

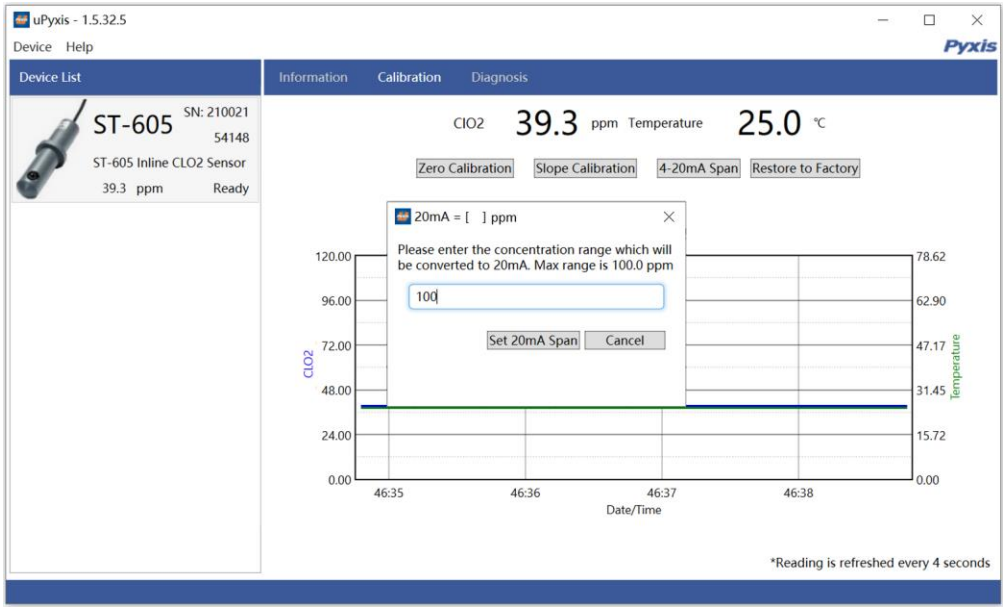

Figure 17.

7.3 Communication using Modbus RTU

The ST-605 sensor is 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.

8 Sensor Maintenance and Precaution

The ST-605 sensor is designed to provide reliable and continuous ClO2 readings when installed in moderately "clean" waters of tap quality. Background color and turbidity may impede the precise measurement of ClO2. 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-605 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-605 sensor is designed to be easily removed, inspected, and cleaned if required. It is suggested that the ST-605 sensor be checked for fouling and cleaned/calibrated on a monthly basis.

8.1 Methods to Cleaning the ST-605 Sensor

Any equipment in contact with water 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/

To clean the ST-605 sensor, soak the lower half of the sensor in 100 mL inline sensor cleaning solution for 10 minutes. Rinse the ST-605 sensor with distilled water and then check for the flashing blue light inside the ST-605 sensor quartz tube. If the surface is not entirely clean, continue to soak the ST-605 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-605 sensor quartz tube.

Figure 18. Inline Probe Cleaning Solution Kit

8.2 Storage

Avoid long term storage at temperature over 100 °F. In an outdoor installation, properly shield the ST-605 sensor from direct sunlight and precipitation.

9 Troubleshooting

If the ST-605 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-605 tee.

Carry out routine calibration verification against a qualified bleach standard. After properly cleaning the ST-605 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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