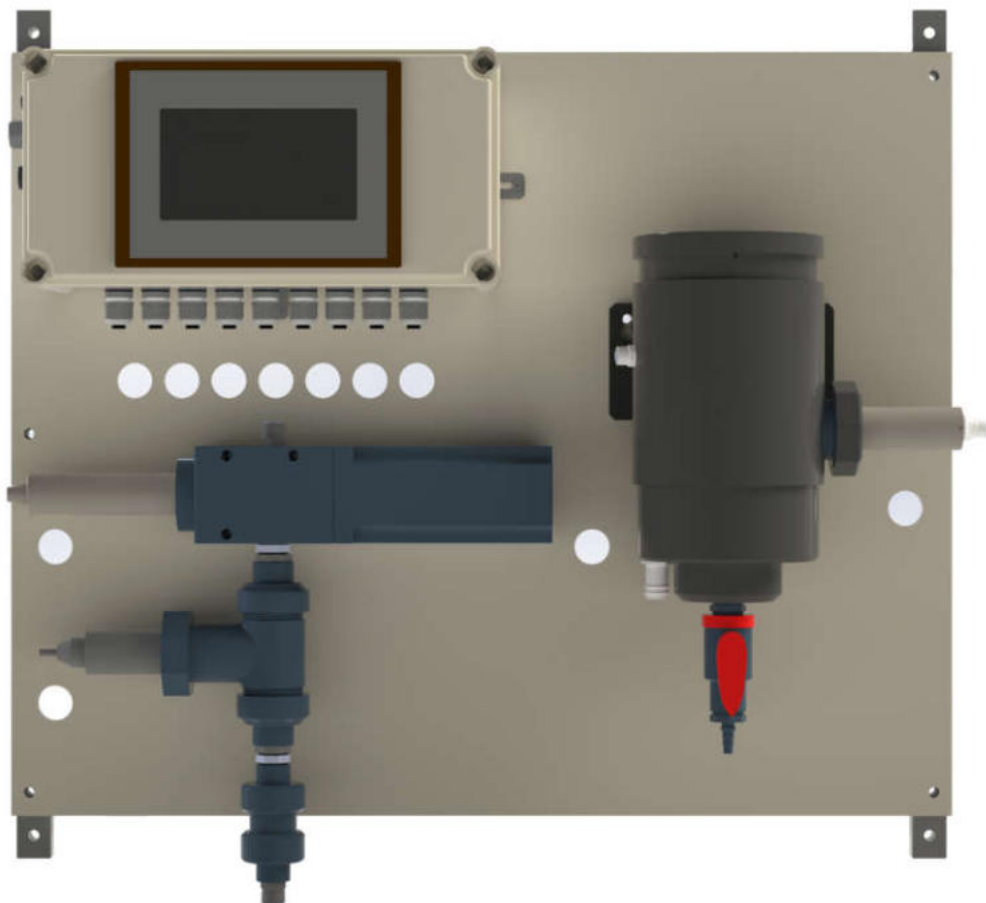**Pyxis**

DW-2100CSG

User Manual

Pyxis

Related Statements

The manufacturer shall not be liable for direct, indirect, special, incidental or consequential damages resulting from any deficiency or omission in this manual. The manufacturer reserves the right to make changes to this manual and the products described in it at any time without notice or liability. Revised versions can be found on the manufacturer's website.

Safety Information

Please read this manual completely before unpacking, installing and operating this equipment. In particular, pay attention to all dangers, warnings and precautions, otherwise, it may cause serious personal injury to the operator or damage to the equipment.

Use of Danger Information

Danger
Indicates a potentially or urgent dangerous situation that, if not avoided, will cause death or serious injury.

Warning
Indicates a potentially or very dangerous situation that, if not avoided, may cause serious personal injury or death.

Warning
Indicates a potentially dangerous situation that may cause a certain degree of personal injury.

Attention
Indicates conditions that if not avoided, will cause damage to the instrument. This is information that needs special emphasis.

Warning Label

Please read all labels and marks attached to the instrument. Failure to follow the instructions on these safety labels may result in personal injury or damage to the instrument.

⚠	If this symbol appears in the instrument, it means refer to the operation and/or safety information in the instruction manual.
⚡	If there is this mark on the instrument housing or insulator, it means there is a risk of electric shock or death from electric shock.
	Static electricity can damage the delicate internal electronic components, resulting in reduced performance or eventual failure of the instrument.
	Electrical equipment marked with this symbol cannot be disposed of through the European public waste system after August 12, 2005. In order to comply with European regional and national regulations (EU Directive 2002 / 98 / EC), European electrical equipment users must now return abandoned or expired equipment to the manufacturer for disposal without any cost.

Table of Contents

1. Specifications

Item	DW-2100CSG
P/N	40904
Turbidity Wavelength	Warm White
Light Source	LED
Turbidity Range	0.001- 40.00 NTU
Turbidity Accuracy	<10 NTU: ±0.001 NTU or ±1% >10 NTU: ±0.01 NTU or ±2%
Turbidity Repeatability	+ 0.001 NTU or 0.5% <10NTU
Free Chlorine Method	Bare Gold - Electrochemical Method
Free Chlorine Range	0.01– 5.00 ppm FCl2
Selectivity	Non-Selective, cross sensitivity to other oxidizing species
pH Range	0.01-14.00 pH
Measurement Accuracy	0.001NTU or ± 1% Full Scale ±0.01 ppm or 1% Full Scale ±0.01 pH ± 10µS/cm or 1.5%
Minimum Resolution	0.001 NTU / 0.01 ppm FCl / 0.01 pH / 1µs/cm
Compliance	EPA-180.1/334.0
Measurement Interval	Continuous Measurement
Display	7-inch LCD Color Industrial Capacitive Touch Screen
Storage Capacity	Built-In 4GB of Ram for Storing up to 1-Million Data/Event Records
Power Requirement	96-260VAC / 50-60 Hz; 10A Fuse; 200 W
Output	4 x 4-20 mA / RS-485 Modbus - RTU / Modbus TCP
Input	2 x 4-20 mA / RS-485 Modbus - RTU
USB	1 x USB host, for data downloading and screen upgrade
Internet	RJ-45 socket, Modbus-TCP
Panel Operational Temperature	40-113ºF (4-45 ºC)
Storage Temperature	Instrument: -4-131ºF (-20-55ºC) / Sensors 32-122ºF (0-50ºC)
Sample Water Temperature	40-104ºF (4-40ºC)
Sample Water Pressure	7.25-100 psi (0.05-0.69MPa)
FR-100 Sample Water Flow Rate	200-1,800mL / Minute
FR-100 Line Size	¼--inch Overflow / 20mm Outlet / ½-inch Drain
Rating	IP-65 Panel-Display / IP-67 Sensors
Regulation	CE / RoHS
Relative Humidity	20% - 90% (No Condensation)
Altitude	<6,561 feet (<2,000 Meter)
Dimensions (HxWxD)	Panel (DW-2100CSG) 690H x 800W x 243.5D mm
Approximate Product Weight	DW-2100CSG ~ 20 kg
Pyxis 4G CloudLink™	Included
CloudLink™ Bands	*Global B1/2/3/4/5/7/12/13/14/20/28/66/7*
CloudLink™ Protocols	IP/TCP/UDP/HTTP/HTTPS/Modbus

NOTE *- Pyxis Lab is consistently updating technologies, as such, specifications may change without notice.*

2. Product Description

The DW-2100CSG are multi-parameter inline water analyzers specifically designed as a 'Turn-Key' monitoring solution for clean water applications including drinking water networks, secondary water supply and decorative/swimming water applications. The DW-2100CSG offers highly accurate, real-time measurement, display and data-logging of Turbidity, Free Chlorine, pH and Conductivity utilizing proprietary Pyxis Lab smart sensor technology, coupled with a Pyxis touch screen display and data logging terminal. The DW2100CSG is offered in a convenient and easy to integrate panel mounted format for rapid installation and simple maintenance.

DW-2100CSG

3. Features

- Pyxis Lab's advanced research and development sensor technologies to achieve highly accurate and stable measurement of Turbidity, Free Chlorine, pH and Conductivity.

- The Pyxis ST-765SS-FCL (Free Chlorine + pH/Temperature/ORP) is multi-parameter composite sensors used for the measurement residual Free Chlorine, as well as pH,ORP and temperature in compliance with USEPA 334.0 and ISO-7393 guidelines. The sensors advanced PCB offers built-in temperature and pH parameter compensation (up to pH 9.0+) algorithms eliminating the need for a supplemental pH sensor and controller. Unique Bare-Gold electrode technology for residual oxidizer measurement eliminates membranes and electrode solution replenishment commonly associated with conventional sensors. The ST-765SS Series has a uniquely designed flat bubble pH electrode design for reduced fouling potential. Reduce your maintenance and cost versus colorimetric chlorine measurement or conventional electrochemical sensors by utilizing Pyxis replaceable Electrode Head (EH-765-01) for this sensor allowing for years of reliable service. The ST-765SS Series may be calibrated in-situ after cleaning via DPD Free Chlorine, Total Chlorine, Bromine or Chlorine Dioxide wet chemistry test measurement of active sample.

- The Pyxis FR-300-PLUS is a magnetic coupling motorized brush flow assembly that provides an inline mechanical cleaning of the ST-765SS Series bare gold electrode enabling sensor accuracy in challenging industrial cooling and process waters. This unique device enhances the convective mass transport of the oxidizer analyte to the sensor surface eliminating the need for precision flow control commonly required for other amperometric sensors on the market. The FR-300-PLUS also provides supplemental deactivation protection of the bare gold electrode for long life, stability and accuracy. The FR-300-PLUS also contains a 'chemical detergent injection port' in the assembly housing allowing for the optional injection of cleaning agents at the brush head for extremely challenged industrial waters containing oils and grease. The FR-300-PLUS may be operated at a broad range of sample flow from 200 and 800mL per minute with an inlet pressure of 7.5 - 60 psi. The FR-300-PLUS outlet flow line may be diverted to atmospheric tank/sump within the process itself for reuse or to a lower pressure zone of the recirculating water network.

- Pyxis LT-739 (EPA) and LT-739B (ISO) ultra-low resolution turbidity sensors offer a detection light source using warm white LED in 90-degree surface scatter format in accordance with USEPA 180.1 standards or Infra-Red

860nm in accordance with ISO-7027.1 standards. The turbidity sensors are mounted in the unique Pyxis FR-200 dual sensor flow reservoir enabling the highest resolution possible of 0.001NTU with unmatched stability. The LT-739 and LT-739B offers simple calibration via the Pyxis T-CAL Solid State Turbidity Calibration Kit (no Formazin needed) or the Pyxis L-CAL Portable Liquid Turbidity Calibration Kit (uses 500mL per calibration)

- DW-2100CSG contains the Pyxis 4G CloudLink^{TM} and global SIM card as a comprehensive data gateway to cloud device for live mobile APP trend view, data download and reporting. Contact Pyxis for details.

- Pyxis FR-100 Sensor flow reservoir provides sample calming for dissipation of air-bubbles and settling of suspended solids, foam or other impurities commonly observed in drinking water influent with a recommended flow range of 600–1,000mL/minute. This unique flow reservoir design results in the highest level of turbidity resolution on the market and greatly extends the maintenance cycle of the sensor while providing a large buffer capacity to mitigate pressure fluctuations. The minimum inlet pressure of FR-100 flow reservoir is only 7.5 psi (0.05mpa) making it highly suitable for the end of pipe networks and secondary supply influent sampling.

- Simple sensor removal and replacement. Three sensors are connected to the display/data logger via RS-485 Modbus (RTU) allowing for integrated sensor calibration interface and diagnostics within the display touch screen.

- Convenient and simple to install Back-Panel for rapid and easy installation. Truly a plumb and power to go platform with intense factory setup, testing and sensor calibration prior to shipment.

- Touch screen display/data logger interface with sensor calibration integrated. Display/data logger offers 2x 4-20mA I/O as well as RS-485 and TCP-IP with remote diagnosis and parameter adjustment. Pyxis CloudLinkTM 4G Gateway version available.

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4. Part Numbers & Ordering Details

Please find a table below outlining ordering details and part numbers for The IK-765SS-FCL-BPM Series of analyzers and replacement-spart parts.

Order Information	P/N
DW-2100CSG *(UC-100A+ST-765SS-FCL+FR-300PLUS+ST-720+ST-001+LT-739+FR-100+panel)*	40904
Optional / Replacement Accessories Information	**P/N**
ST-765SS-FCL *(Free Chlorine + pH + Temperature Sensor w/Internal Compensation-Sensor Only)*	53607-NFR
EH-765 *(Replacement Electrode Head for ST-765SS-Series Sensors)*	53061
FR-300-PLUS *(Replacement FR-300-PLUS Auto-Brushing Flow Assembly Replacement)*	50700-A44
FRP-300-01 *(Replacement Brush Assembly Kit for FR-300-PLUS)*	50700-A49
LT-739 *(Ultralow Turbidity 0-40 NTU - Warm White Light - 3200K)*	53221
ST-720 *(Inline Conductivity Water Sensor (1-100,000uS) + Temp)*	53101
Pyxis pH Combo Calibration Pack *(pH 4-7-10 Calibration Solution 3-Pack - 500mL ea.)*	57007
Pyxis Zero Oxidizer Calibration Standard *(0ppm Oxidizer Solution – 500mL)*	21022
Pyxis Probe Cleaning Kit *(Probe Cleaning Solution, Brush, Qtips & Jar – 500mL)*	SER-01
L-CAL Kit *(Liquid - 500mL Calibration Kit for all LT-Series Turbidity Sensors)*	53247

5. Analyzer Dimension and Mounting
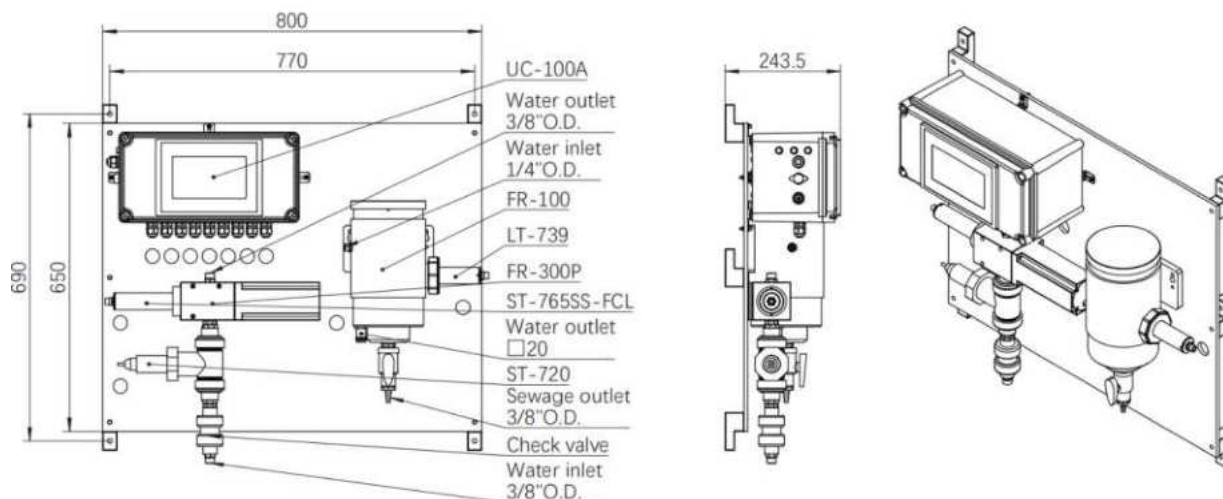
Figure. 1 - DW-2100CSG

6. Analyzer Installation

6.1. Installation Requirements

Power Supply: 96-260VAC / 50-60 Hz; 60 W

Inlet Water Supply: The inlet water pressure should be from 7.25 – 60 psi (0.05-0.413MPa) with a 3/8" O.D. quick connector and a 1/4" O.D. quick connector. ***NOTE*:** *The recommended inlet sample water flow should be between 200-800ml/min.*

Outlet Water Line: The outlet is a 3/8" O.D. quick connector and a 20mm diameter pagoda-shape connector. This line should be returned to atmospheric sump or lower pressure recirculation line of the analyzed system water network.

Wall Mount Space: The DW-2100CSG analyzer panel size is roughly 650H x 800W x 243.5D (mm) in dimension. Please leave at least 0.5m of installation space around the equipment for later maintenance.

Wall Mount Weight: Approximately 10kg. Please use appropriate mounting hardware.

6.2. Sample Water Connection

1. **Process Water Inlet:** Connect the inlet water to 3/8" O.D. quick connector and 1/4" O.D. quick connector.

![Pyxis logo]

2. **Water Outlet:** Connect the outlet water to 3/8" O.D. quick connector and 20mm diameter pagoda-shape connector.
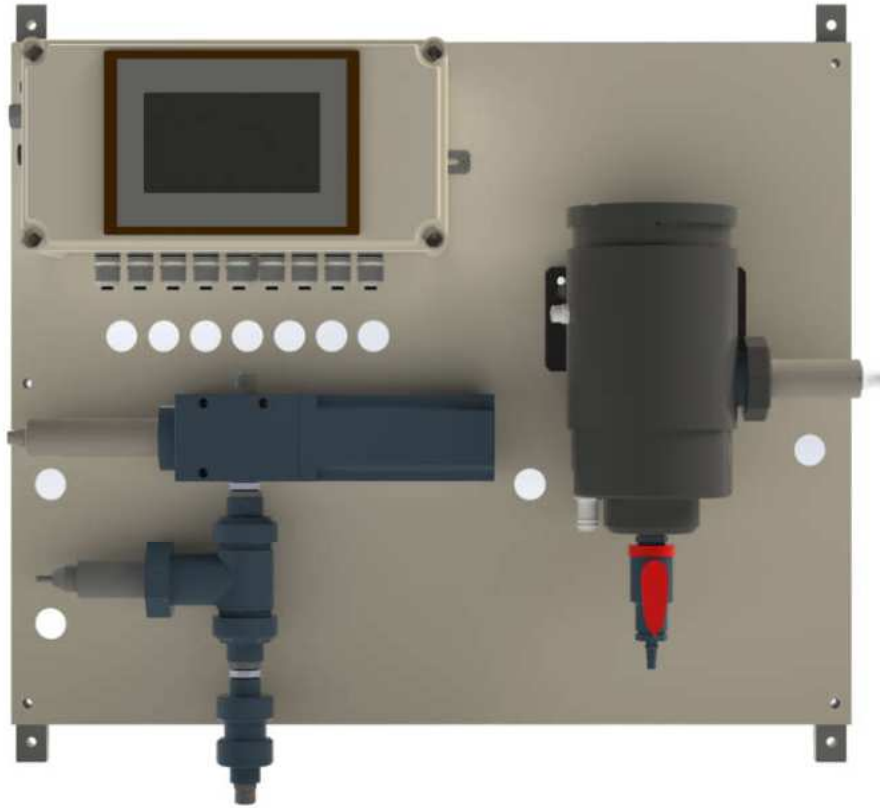
Figure. 2 The DW-2100CSG Diagram Overview

6.3. Terminal Wiring

The DW-2100CSG analyzer has universal AC power supply equipment allowing users simply to plug the power supply into a 100~240V AC 50/60Hz power outlet for normal operation.
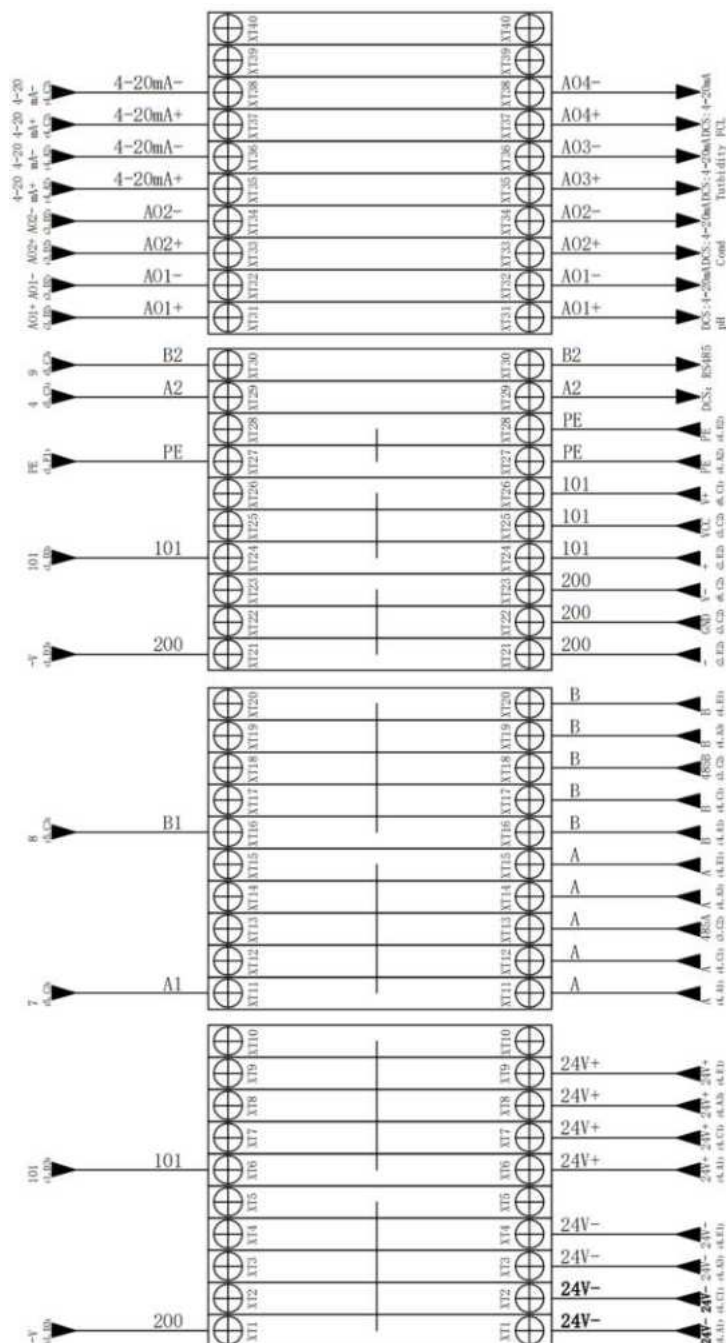
Figure. 3 - Terminal Wiring Diagram

WARNING - The process of electrical connection to contact the 96-260VAC single-phase power supply, should be operated by personnel with an electrician's license. Failure to operate according to the electrical code of practice may result in electric shock injury or even death.

7. Analyzer Components & Dimensions

7.1. UC-100A Display & Data Logging Terminal (mm)
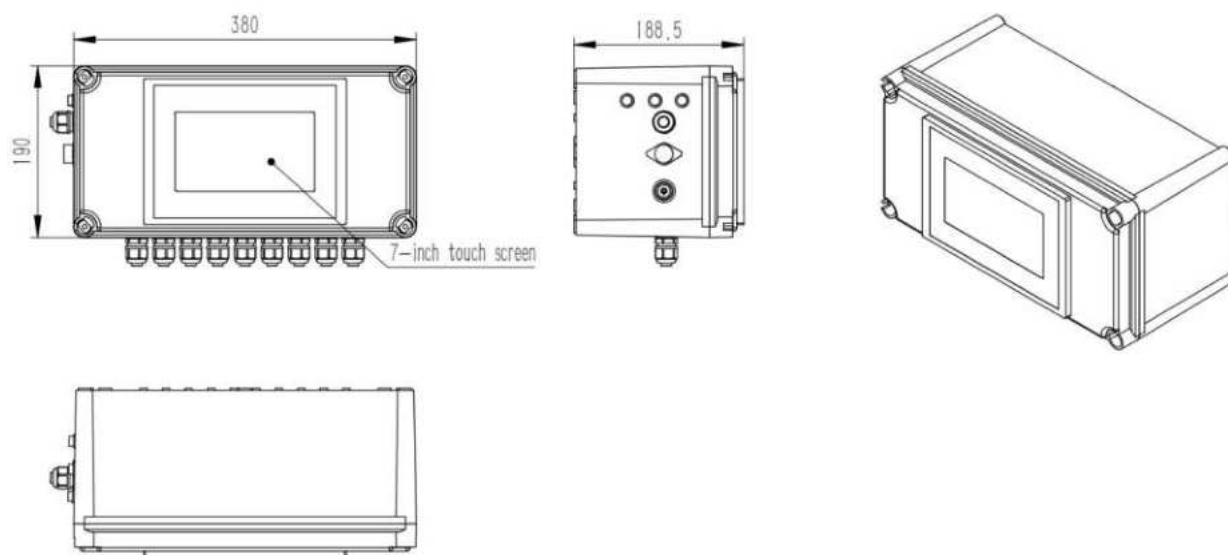
7.2. FR-300-PLUS Automatic Brushing Flow Assembly (mm)
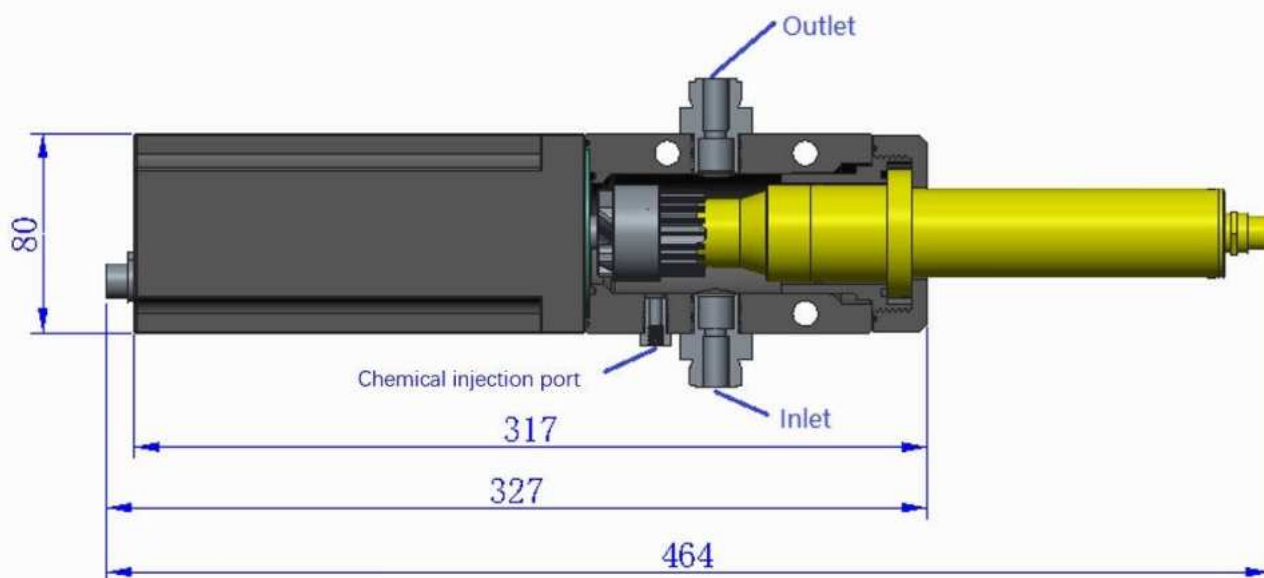
7.3. ST-765SS Series Sensor (mm)
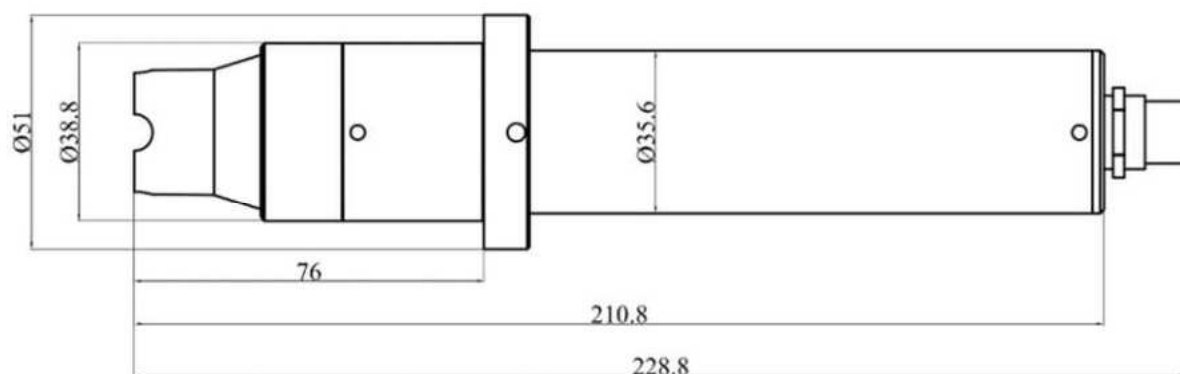
7.4. LT-739 Sensor (mm)

7.5. ST-720 Sensor (mm)

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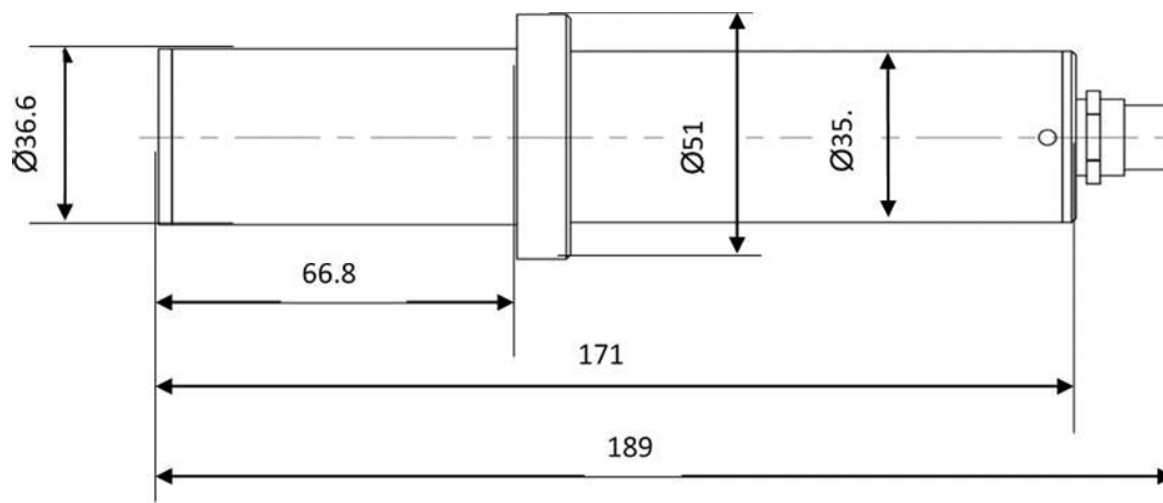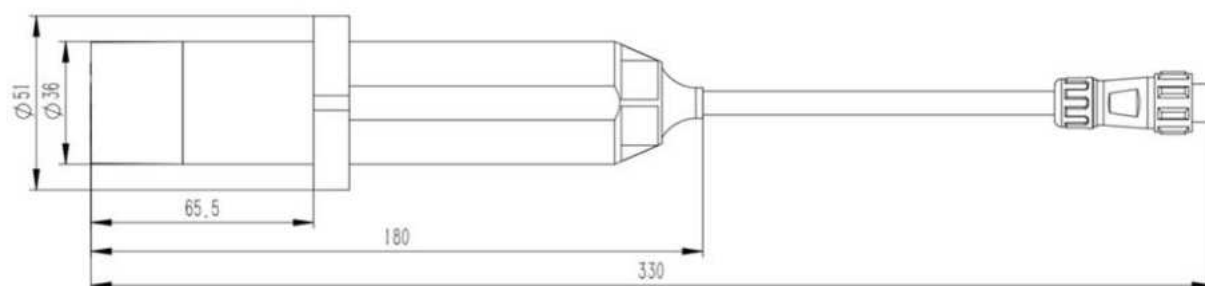
8. UC-100A Display Touch Screen Operation

8.1. Main Screen

After the system is powered on an initial screen allows the user to log into the system.
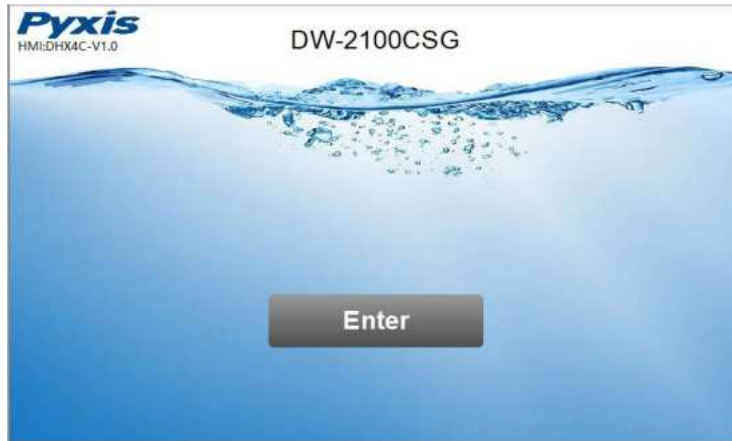
Figure. 4 - Main Screen

8.2. User Login & Password

After powering on the system, log in with the user name and password to be able to change system settings. Click the **"User Login"** button, select the user "**pyxis**", enter the password: "**888888**" in the user password field. A new user can be added via "User Management" in interface of the menu.
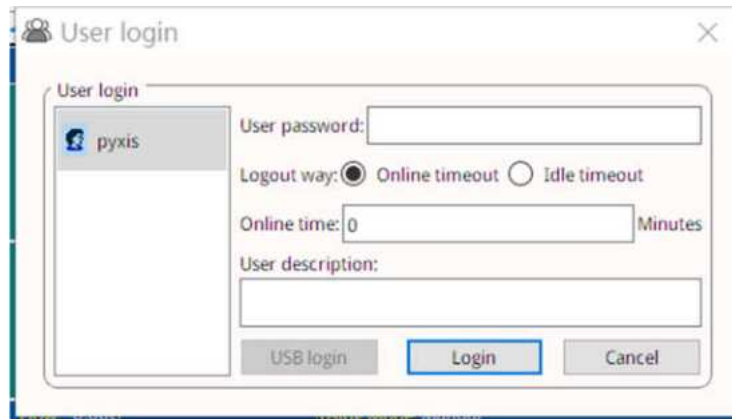
Figure. 5 - User Login Screen

If you do not need a password, or want to change the user, you can enter the system and manage in the **"User Management"** screen of the menu.

8.3. Real-Time Monitoring

Click the **"Enter System"** button on the main interface to enter the real-time monitoring screen of the system. The data detected by the Pyxis sensors will be displayed in real-time.See a functional overview of each section of this screen highlighted below.

Figure. 6 - Real-time monitoring screen

Click on the time in the upper right corner, the screen pops up the time setting window.

Figure. 7 - Time Setting

After clicking on the small orange icon screen below the FCL, the display screen will go to the Real-time Curve screen.

Figure. 8 - Real-time Curve

Clicking on the orange icon in the upper left corner, the user can set the Y-axis range of the parameter.

Figure. 9 – Y-axis Range

8.4. Menu Bar

Click the button in the upper left corner of the screen to enter the system's menu interface, where the user can select to enter the desired operation interface.

Figure. 10 - Menu Bar

8.5. Configurable Parameters

Click the **"Parameter"** button in the menu bar. Here you can select a list of options to include enter **Settings Interface / User Defined/Cleaning Parameters/ Diagnostic Parameters / 4-20mA Output** and **Comm Setup**.
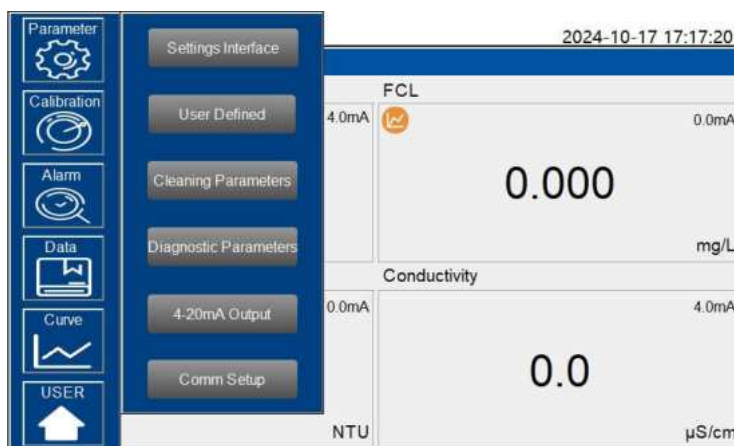
Figure. 11 - Parameter Settings Menu

8.5.1. Settings Interface

Clicking on **" Settings Interface "** opens a sub-menu for **Alarm Parameters** and **Sensor Parameters**.
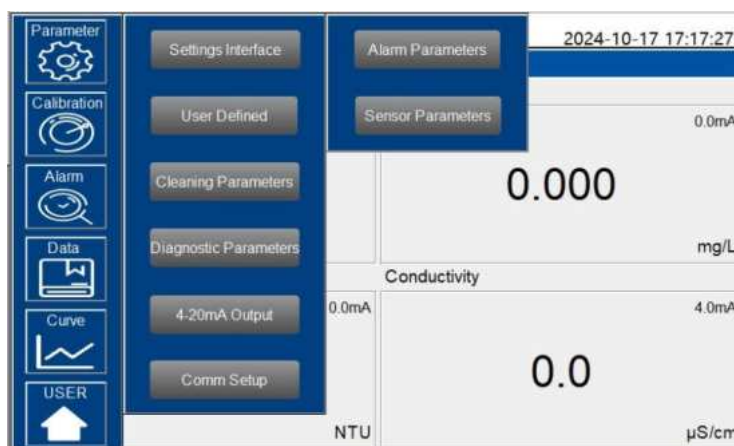
Figure. 12 - Control Interface

Alarm Parameters

Users can set the upper and lower alarm limits. Click **"Alarm Parameters"** to enter the alarm parameter settings. When the measured sensor value is lower than the set lower limit (the XX lower limit alarm) or when the measured value is higher than the set upper limit (the XX upper limit alarm), the corresponding sensor alarm will

be displayed on the real-time monitoring screen. The user can also choose to turn the alarm display on or off at the top right of the corresponding parameter list.

Figure. 13 - Alarm Parameter Setting

Sensor Parameters

In **"Sensor Parameters"** within the "**Settings Interface"** field of the **"Parameter"** menu, users can set the smoothing coefficient for the sensor. Usually the oxidant concentration (e.g., free chlorine) is a very small signal, which is easily subject to external interference. The ST-765SS Series sensors adopt a continuous smoothing and averaging algorithm to filter out these minor interferences. A suitable smoothing factor setting can allows users to obtain a high-quality measurement and suitable dynamic response based on the application needs. The smoothing factor setting regulates the speed of sensors response.

The higher the smoothing factor value, the faster the sensor response and the lower the interference and noise suppression enabling a more rapid response to any changes of the real value. The lower the smoothing factor value, the slower the sensor response and the better the interference and noise suppression, but the slower the response to the real value change.

Figure. 14 - Settings & Sensor Parameters Interface

Pyxis Lab uses the term "T90" when the measured value of the sensor reaches 90% of the true value to describe the speed of the sensor response in seconds. The <u>default smoothing factor</u> of ST-765SS Series sensor is **0.0024 (T90≈4 minutes)**. The available setting range of the smoothing factor is 0.001 to 0.9. The following table outlines the comparison between the smoothing factor and T90 for the ST-765SS Series sensor and should be used if considering an adjustment to the smoothing factor settings.

Smoothing Factor	T90 (Seconds)
0.1	5.5
0.09	6
0.08	7
0.07	8
0.06	9.25
0.05	11.25
0.04	14
0.03	19
0.02	28.5
0.01	57.25
0.009	63.75
0.008	71.75
0.007	82
0.006	97.5
0.005	114.75
0.004	143.5
0.003	191.5
0.002	287.5

$$T_{90} \approx 0.538 * Smooth\_factor^{-1.013}$$

NOTE *The smoothing coefficient* <u>*is not available when the sensor is in calibration mode*</u>.

8.5.2. User Defined

Clicking on **" User Defined "** opens a sub-menu for **Name Definition** and **Unit Switching**.
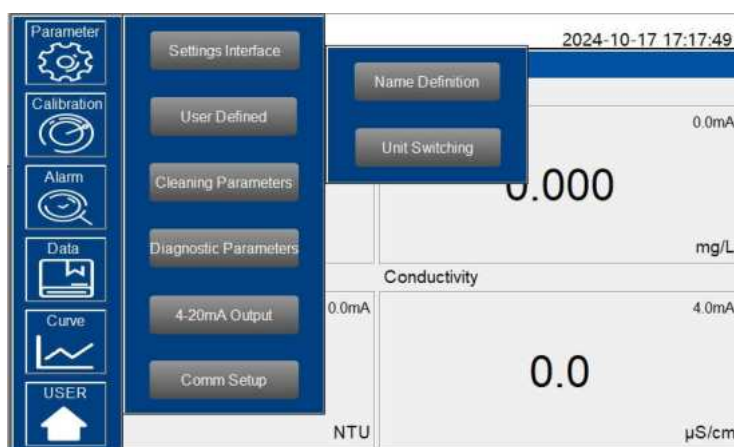
Figure. 15 – User Defined Settings

Parameter Name Definition

Click the orange dialog box to customize the sensor name.
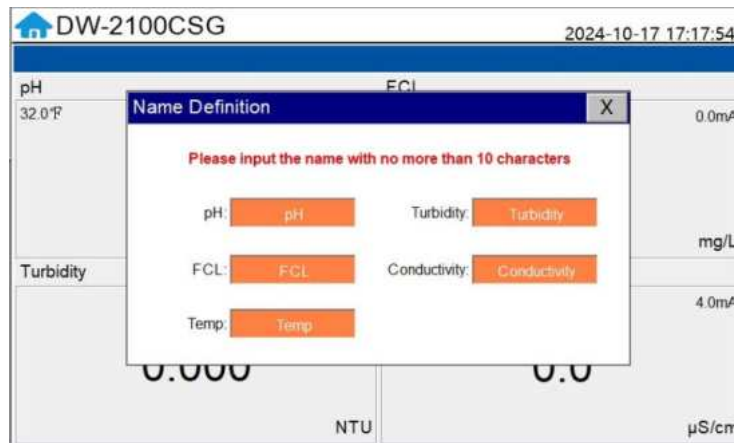
Figure. 16 - Name Definition

Unit of Measure Switching

Users can change the unit of temperature in **"Unit Switching"**.
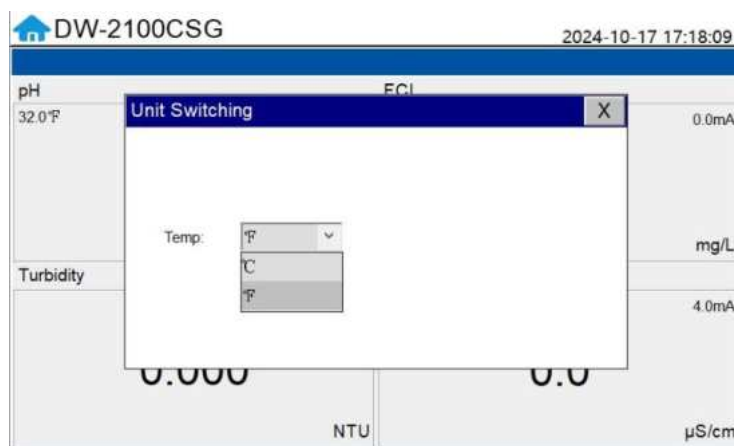
Figure. 17 - Unit Switching

8.5.3. Cleaning Parameters

The DW-2100CSG has the function of self-cleaning. The user can manually control the wash on/off status and the speed of running.
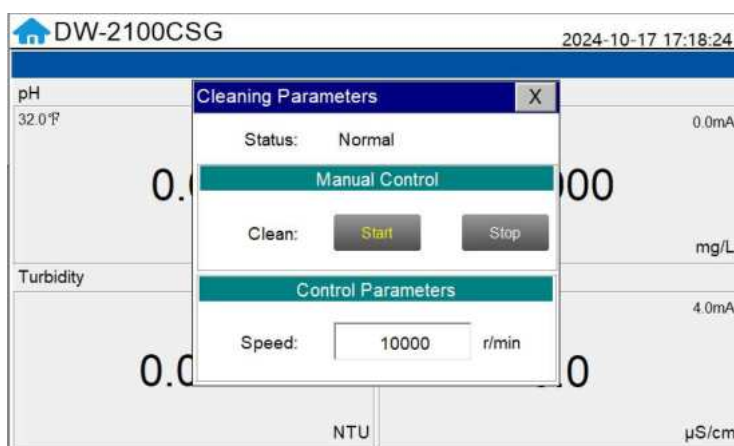
Figure. 18 –Cleaning Control

8.5.4. Diagnostic Parameters

Click **"Diagnosis Parameters"** to enter the diagnosis page. In the diagnosis page, the raw data measured by the probe is displayed. To help troubleshooting possible issues with the probe, please take 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 for. These images may be sent to service@pyxis-lab.com for troubleshooting support.

Figure. 19 - Diagnostic Parameters

Click on **"Diagnostic History Data"** in the <u>lower right corner</u> to access to view previous diagnostic parameters. Data can also be exported and made available for support from the Pyxis Lab Service Department.

Figure. 20 - Diagnostic History Data

Figure. 21 - Diagnostic History Data Query

8.5.5. 4-20mA Output

Click **"4-20mA Output"** to enter the 4-20mA output parameter setting interface. The 4mA and 20mA output values should correspond to the default lower and upper limits of the sensor range. These values may be adjusted by the user as desired. ***NOTE*** *The closer the value is set to the measurement value the more accurate the data. It is recommended to set according to the range of the sensor.*

Figure. 22 - 4-20mA Output Setting

8.5.6.   Comm Settings

If the site desires to connect the UC-80 outputs to a DCS (Distributed Control System) for the purposes of information and process control, users can connect the master station device to the UC-80 through the HMI (Human Machine Interface) terminal and read the data according to the parameter register table provided in Section 10.1 of this manual)

Modbus RTU (RS-485) and **Modbus TCP** and **Ethernet Address** settings are preset but may be altered by the user as desired.

Figure. 23 - Modbus RTU

Figure. 24 - Modbus TCP

8.6. Sensor Calibration

Click on the **"Calibration"** button in the menu bar and select the sensor function desired for calibration.

Figure. 25 - Sensor Calibration

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8.6.1. pH Calibration

The pH function is thoroughly calibrated at the Pyxis Lab factory prior to shipment. After removing the sensor and checking it with a pH standard buffer solution in a beaker, if the sensor value has shifted, then the user may choose from single-point, two-point or three-point calibration to re-calibrate the pH portion of the ST-765SS sensor as desired. Pyxis Combo pH 4-7-10 Calibration Standard Kit (P/N:57007) or similar is suggested.

NOTE *Click the Recovery button in the calibration interface of the sensor to restore the factory calibration settings if a user error is made during calibration and other operations. This will restore the factory settings of the sensor through this function.*

Figure. 26 - pH Calibration

Single Point pH Calibration

Remove the ST-765SS sensor and rinse 3x with DI water ensuring there is no debris or fouling of the sensor electrode head. Submerge the sensor into a beaker with pH=7 buffer solution. Click **"pH7 calibration"**. A dialog box will pop up to confirm whether to perform this operation, click **"OK"** if the calibration operation is confirmed, if the calibration is successful the dialog box will show **"Calibration Success"**.

Figure. 27 - pH Calibration Prompt

A **Process Calibration** can be used if the pH calibration standard is not readily available for high, mid, and low calibration, or if there is a fixed deviation between the actual water sample and the true value after the user has

done the calibration test. The pH process calibration is actually a correction (-0.5 to 0.5 pH units) made to the true pH value as measured by the sensor. Anything outside this range will require a formal calibration using pH calibration standard solution.

Two Point pH Calibration

Remove the ST-765SS sensor and rinse 3x with DI water ensuring there is no debris or fouling of the sensor electrode head. Submerge the sensor into a beaker with pH=7 buffer solution. Click **"pH7 calibration"**. A dialog box will pop up to confirm whether to perform this operation, click **"OK"** if the calibration operation is confirmed, if the calibration is successful the dialog box will show **"Calibration Success"**.

After pH7 is successfully calibrated, you can choose Acid Calibration or Alkali Calibration for the second calibration point. If you choose Acid Calibration, clean beaker 3x with deionized water. Fill the beaker with pH=4 buffer solution. Enter the value 4 in the calibration value dialog box, and click **"Acid Calibration"**, then a dialog box will pop up to confirm whether to perform this operation. Click **"OK"** if the calibration operation is confirmed and the dialog box will show **"Calibration Successful"** if the calibration is successful. Similarly a pH=10 buffer solution can be selected for the second point calibration if desired.

Three Point pH Calibration

Remove the ST-765SS sensor and rinse 3x with DI water ensuring there is no debris or fouling of the sensor electrode head. Submerge the sensor into a beaker with pH=7 buffer solution. Click **"pH7 calibration"**. A dialog box will pop up to confirm whether to perform this operation, click **"OK"** if the calibration operation is confirmed, if the calibration is successful the dialog box will show **"Calibration Success"**.

After pH7 is successfully calibrated, you can choose Acid Calibration or Alkali Calibration for the second calibration point. If you choose Acid Calibration, rinse the beaker 3x with deionized water. Fill the beaker with pH=4 buffer solution. Enter the value 4 in the calibration value dialog box, and click **"Acid Calibration"**, then a dialog box will pop up to confirm whether to perform this operation. Click **"OK"** if the calibration operation is confirmed and the dialog box will show **"Calibration Successful"** if the calibration is successful.

After successful Acid Calibration, select pH=10 for Alkali Calibration. Rinse the beaker 3x with deionized water. Fill the beaker with pH=10 buffer solution. Enter the value 10 in the calibration value dialog box, and click **"Alkali Calibration"**, then a dialog box will pop up to confirm whether to perform this operation. Click **"OK"** if the calibration operation is confirmed and the dialog box will show **"Calibration Successful"** if the calibration is successful. The three-point calibration is completed.

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8.6.2. Turbidity Calibration

The LT-739 Ultra Low Turbidity Sensor is rigorously calibrated at the Pyxis Lab factory. If the sensor is kept clean, the user will not need to calibrate the sensor for one year of operation. However, the user may calibrate the sensor as desired.

Figure. 28 - Turbidity Calibration Screen

<u>Low-Range Calibration Procedure DI Water in the Pyxis L-CAL Portable Turbidity Calibration Kit:</u>

Isolate the panel and drain the piping and inline Tee assemblies. Remove the LT-739 sensor from the FR-100 flow tee. Triple rinse the LT-739 sensor surface, the FR-100 flow tee internals and the L-CAL Portable Turbidity Calibration Kit (P/N 53247) vessel with Deionized water. Insert the cleaned LT-739 turbidity sensor into the L-CAL calibration vessel and positon the L-CAL vessel vertically (with the sensor inserted in a horizontal position to the ground as shown in the step-by-step images provided on page 21 of this manual). Remove the top cap and fill the L-CAL vessel with 500mL of bubble free deionized water. After the displayed turbidity data is stable, enter "0.05" for the low-range calibration value and click on "Low Range Calibration", a dialog box will pop up to confirm whether to perform this operation. Click "OK", if the calibration is successful, the dialog box will show "Calibration successful". ***NOTE*** Because there is no global standard for zero turbidity in the industry, Pyxis recommends 0.05 NTU as a target for Low-Point Calibration while using Bubble-Free DI Water.

<u>Mid-Range Calibration using the L-CAL Portable Turbidity Calibration Kit:</u>

After the low range calibration has been completed, rinse the L-CAL vessel with Deionized water and refill with 500mL of known turbidity standard solution between 5NTU and 10NTU for mid-range calibration (see page 19). After the displayed data is stable, enter the medium turbidity standard solution value and click on "Mid Range Calibration", a dialog box will pop up to confirm whether to perform this operation. Click "OK", if the calibration is successful, the dialog box will show "Calibration successful".

<u>High-Range Calibration using the L-CAL Portable Turbidity Calibration Kit:</u>

If a high-range calibration is not required, the user does not need to perform a high-range calibration of the LT-739 series sensor. If a high calibration is required, proceed by rinsing the L-CAL vessel with deionized water and refill with known turbidity standard solution between 20NTU and 40NTU for high-range calibration (see page 19). After the displayed data is stable, enter the high turbidity standard solution value and click on "High Range

Calibration", a dialog box will pop up to confirm whether to perform this operation. Click "OK", if the calibration is successful, the dialog box will show "Calibration successful".

Troubleshooting Calibration Failed Messages

If you receive a "Calibration Fails" message during the calibration steps above, the following items should be checked:

1) Ensure your source of Deionized water is not contaminated with turbidity

2) Ensure your turbidity calibration standard solutions have not been contaminated

3) Esnure the LT-739 sensor distillate end is not contaminated with debris or other substances

4) Ensure the flow reservoir is not contaminated or circulation blocked by debris or other materials.

Figure. 29 - Awaiting execution Screen of Turbidity Calibration

LT-739 Calibration using L-CAL Portable Turbidity Calibration Kit

As an alternative to using the flow reservoir for LT-739 sensor calibration, Pyxis Lab has developed a portable and reusable liquid-state turbidity calibration kit for rapid calibration of the all LT-73X Series inline ultra-low turbidity sensors. The L-CAL calibration kit allows users to calibrate all LT-73X Series ultra-low turbidity sensors using smaller volumes of Formazin turbidity calibration standards providing an affordable and reusable solution for long term sensor reliability. The unique design of the L-CAL liquid calibration kit allows the LT-73X sensor to be easily inserted and calibrated with the sensor in a horizontal position, allowing air bubbles to be evacuated through the integrated air-vent line ensuring superior accuracy of the sensor calibration. The L-CAL has an easy to remove lid allowing users to fill and empty the calibration kit with DI water for vessel/sensor cleaning and Formazin calibration standards for sensor calibration.

L-CAL Liquid Turbidity Calibration Kit (P/N 53247)

Turbidity Calibration Principals & Considerations

The precision, resolution and the low detection limit of the LT-73X Series sensors are not affected by the calibration method, regardless of using certified Formazin standards and the L-CAL kit. The calibration only affects the turbidity sensor accuracy. The nature of turbidity measurement makes an absolute turbidity value not easily obtainable for any sensor manufacturer although proper standards and methods are followed. For example, turbidity values greater than 1.0 NTU measured on real-world samples with different sensors, even from the single manufacturer, could differ significantly. For ultra-low turbidity (less than 0.3 NTU) measurement using the same methods (ISO-7027 or EPA-180.1), it is likely that the values from different sensors can agree within 0.05 NTU. As such, the user should choose a calibration method and remain with the same calibration method for consistency.

L-CAL Specifications

Item	L-CAL Portable Liquid Formazin Calibration Kit
P/N	53247
Sensor Name	LT-739
Calibration	**Recommended Calibration Standard Solution Range**
Low-Range (0.05NTU Recommended for Calibration)	Bubble Free DI Water or Sample <0.1 NTU
Mid-Range	5 – 10 NTU
High-Range	20 – 40 NTU

L-CAL Portable Liquid Formazin Calibration Kit Use Method

After removing the LT-73X sensor, gently wipe off the flat distal end with a soft cloth to ensure it is clean. The LT-73X Sensor should then be calibrated using the L-CAL portable liquid calibration kit using the following steps, and wirelessly calibrated via the uPyxis Mobile or Desktop APP. Please refer to LT-73X Series Operation Manual for details.

Insert LT-73X Sensor → **Tighten Sensor Nut** → **Position Vertically and Remove Lid**

Preclean by adding DI-Water (200mL) → **Insert Lid** → **Gently Shake Then Empty Contents**

Add Calibration Standard (500mL) → **Insert Lid and Remove Air Bubble Vent Line Cap** → **FOLLOW CALIBRATION STEPS**

NOTE Sensor Brace Included with L-CAL Kit for Stability

You Tube WATCH PROCEDURE VIDEO https://www.youtube.com/watch?v=1MuJM5Q5VB4

8.6.3. FCL Calibration

The oxidizer measurement module of the ST-765SS sensor is thoroughly calibrated at the Pyxis Lab factory according to the specific oxidant being measured. The IK-765SS-FCL-BPM is offered in <u>Free Chlorine</u> sensor formats based on sensor type.

To calibrate the sensor, the user can perform a <u>Single-Point</u> or <u>Two-Point</u> calibration according to the requirements of the application. (USEPA-334.0 / ISO-7393 compliant methodology).

Single Point Oxidizer Calibration (In-Situ)

Use a portable or laboratory colorimeter (ie. Pyxis OxiPocket SP-200, Pyxis SP-800 or similar) to test the oxidizer concentratoin value of the active (flowing) water sample in The IK-765SS-FCL-BPM flow reservoir. DPD methodology is recommended. Once you have tested and confirmed the oxidizer concentration value in the active (flowing) flow reservoir, enter the test result value of the colorimeter into the calibration screen in the **Process Calibration**. Please note, the label name of oxidizer being measured will be displayed in the upper left corner of this screen based on the model of The IK-765SS-FCL-BPM and ST-765SS sensor format (ie. FCL for Free Chlorine) Once the measured oxidizer value has been entered, click **"Process Calibration"**. A dialog box will pop up to confirm whether to perform this operation. If the calibration operation is confirmed, click **"OK"**, and if the calibration is successful, the dialog box will show **"Calibration Success"**.

NOTE *Click the <u>Recovery</u> button in the calibration interface of the sensor to restore the factory calibration settings if a user error is made during calibration and other operations. This will restore the factory settings of the sensor through this function.*

Figure. 30 – Free Chlorine Calibration of ST-765SS-FCL   Figure. 31 – In Progress Screen of Free Chlorine Calibration

Two Point Oxidizer Calibration

NOTE *Under normal operational use of the ST765SS Series sensor, Pyxis Lab <u>does not suggest</u> a Zero-Point calibration by the user and the preprogrammed factory zero should remain unaltered. Only Slope calibration is recommended as a standard practice.*

<u>Zero-Point Calibration Procedure:</u>

If a zero calibration is necessary, close the water inlet valve and remove the ST-765SS sensor and rinse 3x with DI water ensuring there is no debris or fouling of the sensor electrode head. Submerge the sensor into a beaker filled with Pyxis Zero Oxidizer Calibration Solution (P/N:21022) or with 100µS/cm Conductivity Standard Solution.

Either will work. Wait for the ST-765SS sensor oxidizer value to stabilize on the touch-screen display. Sensor stabilization should occur within few minutes. Click **"Zero Calibration"** and a dialog box will pop up to confirm whether you desire to perform this operation. Click **"OK"** to confirm the calibration operation. If the calibration is successful, the dialog box will show **"Calibration Success"**. The sensor is now zero-calibrated to the known zero calibration solution.

Slope-Point Calibration Procedure:

After successful zero calibration, insert the ST-765SS Series sensor back into the FR-300-PLUS and open the sample water supply valve allowing the sensor to read and stabilize after a few minutes of observation. Use a portable or laboratory colorimeter (ie. Pyxis OxiPocket SP-200, Pyxis SP-800 or similar) to test the oxidizer concentration value of the active (flowing) water sample in The IK-765SS-FCL-BPM flow reservoir. DPD methodology is recommended. Once you have tested and confirmed the oxidizer concentration value in the active (flowing) flow reservoir, enter the test result value of the colorimeter into the calibration screen in the **Process Calibration**. Please note, the label name of oxidizer being measured will be displayed in the upper left corner of this screen based on the model of The IK-765SS-FCL-BPM and ST-765SS sensor format (ie. FCL for Free Chlorine) Once the measured oxidizer value has been entered, click **"Process Calibration"**. A dialog box will pop up to confirm whether to perform this operation. If the calibration operation is confirmed, click **"OK"**, and if the calibration is successful, the dialog box will show **"Calibration Success"**.

NOTE *Click the* <u>*Recovery*</u> *button in the calibration interface of the sensor to restore the factory calibration settings if a user error is made during calibration and other operations. This will restore the factory settings of the sensor through this function.*
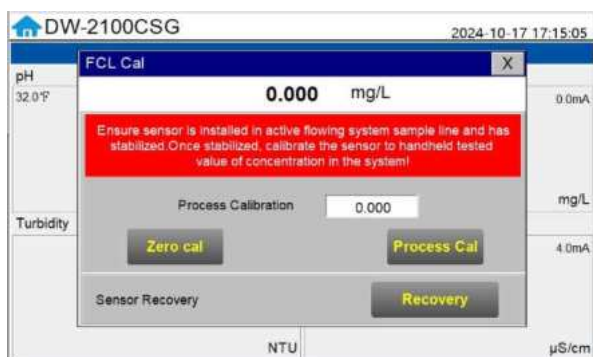
8.6.4.   Conductivity Calibration

The conductivity sensor only needs to be calibrated once, put the sensor into the standard solution with known standard solution value, enter the standard solution value in the interface, then click calibration, wait for the calibration completion prompt to pop up, which means the calibration is successful.
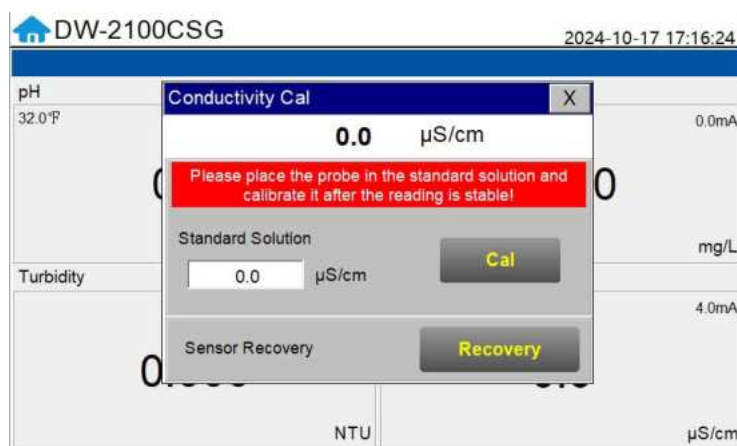

Figure. 32 - Conductivity Calibration

8.7. Alarm

Click the **"Alarm"** button on the main screen to enter the alarm view screen.

Figure. 33 - Alarm View

Figure. 34 - Alarm Data Query Screen

In this screen users can browse all logged alarms. Drag the right scroll bar up and down to view the history of alarms. Click **"Previous"** and **"Next"** to advance to the next page. Click **"Query"** then enter the alarm number in the pop-up box to query that alarm. The Delete button in the lower left corner will delete all alarm records. After clicking delete, you must exit the screen and reenter before the historical data within the data report will be cleared.

8.8. Data

Click on **"Data"** to view historical data and calibration logs.

Figure. 35 – Data

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Historical Data

Click the **"Historical Data"** button in the menu bar to enter the data report interface.

Figure. 36 - Historical Data Screen

In the data report, the user can view the stored data of all parameters. The system records sensor readings every 4 seconds by default but this can be edited by the user if desired. Drag the scroll bar on the right to slide up or down or click **"Previous"** and **"Next"** to view historical data records. The data record can save up to 100,000 data entries. New data will overwrite the previously saved data after recording 100,000 data entries. The user can click the **"Periodicity"** button to change the data recording time interval. Click **"Delete"** in the lower left corner. After entering the retention time, click the **"Delete"** button to clear all historical data within the retention time range.

Figure. 37 - Data Storage Cycle Time Setting Figure.

Figure. 38 - History Data Deletion Screen

![Pyxis logo]

Click the **"Query"** button in the lower right corner, enter the start time and end time and then click the **"Query"** button.***NOTE*** *The start time and end time must be filled in exactly and completely according to the system time format of Year / Month / Day / Hours / Minutes / Seconds.*

Figure. 39 - Historical Data Query and Export Screen

Insert a USB disk behind the HMI display screen and enter the time range of the data to be exported in the query area. Click on the **"Data Export"** to download the data to the USB disk. The data quantity will be shown as a positive number if data export is successful. If the data export was not successful, please check whether the time format is correct. ***NOTE*** *Please be sure to use and empty (no saved files) FAT32 formatted USB disk with data capacity of 32-64GB.*

When a **Quantity** value appears, refer to the following table to troubleshoot the issue.

Quantity	Description
-1001	Progress or control data object type is incorrect
-1004	Group object name does not exist or the group object does not have the save property
-1020	The start time of the export is greater than the end time
-1021	USB flash drive is not inserted
-1022	Only one export task is allowed at the same time
-1023	The number of records read is 0
-1024	File operation failed
-1025	Export path is empty
-1026	Export path is not legal
-1027	Incorrect time format
-1028	Unsupported export mode

Calibration Log

The calibration log can be viewed in the calibration log interface, and when the export operation is performed, the diagnostic parameters, historical data, and calibration log will be exported simultaneously.

Figure. 40 - Calibration Log

Figure. 41 - Calibration Log Query/Export

8.9. Curves

Click the **" Curve"** button in the menu bar to enter the trend curve interface. You can click the buttons below the X-axis to browse and view the values in a different time range. Click on Y-axis Range to change the minimum and maximum Y-axis values for a proper range.
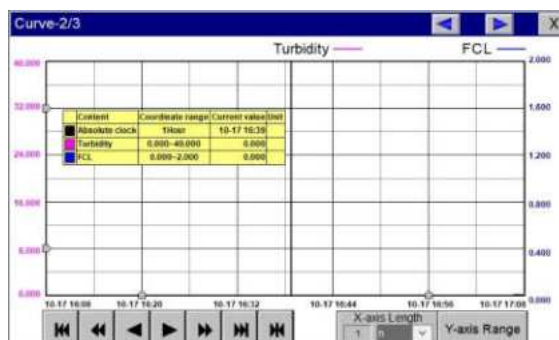

Figure. 42 - History Curve Screen 1-3
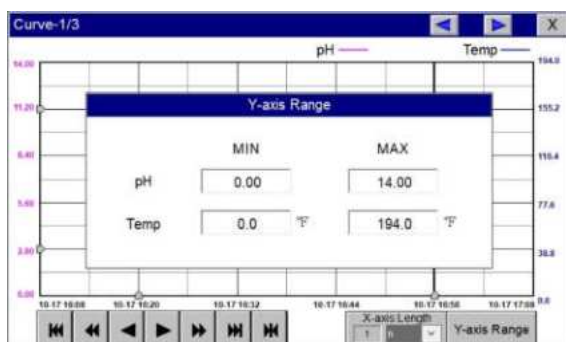

Figure. 43 - History Curve Screen 2-3

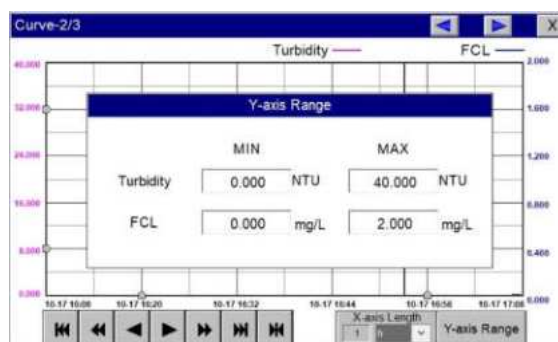Figure. 44 - Y-axis Range Setting 1-2

Figure. 45 - Y-axis Range Setting 2-2

Please refer to the button description overview for Historical Curve Function navigation.

⏮	The curve will scroll back (to the left of the X-axis) one page
⏪	The curve will scroll back (to the left of the X-axis) half the page of the curve
◀	The curve will scroll backward (to the left of the X-axis) to a position where the main line is drawn
▶	The curve will scroll forward (to the right of the X-axis) to a position where the main line is drawn
⏩	The curve will scroll forward (to the right of the X-axis) half the page of the curve
⏭	The curve will scroll forward (to the right of the X-axis) one page
⏮	A dialog box will pop up to reset the starting time of the curve

Figure. 46 - Button Function Review

8.10.   User

Click the **"User"** button on the menu bar and then you can select **"Login"**, **"Logout"** and **"Manage"** operations.

Figure. 47 - User Management

Logout enables the user to log out of the logged-in state and only view the real-time readings, but cannot perform operations such as parameter settings. Click **"Manage"** to enter the user management interface, where you can add users, change passwords and other operations. Users can set their own user name and password and select the user group they belong to. Only users in the administrator group can set parameters such as calibration.
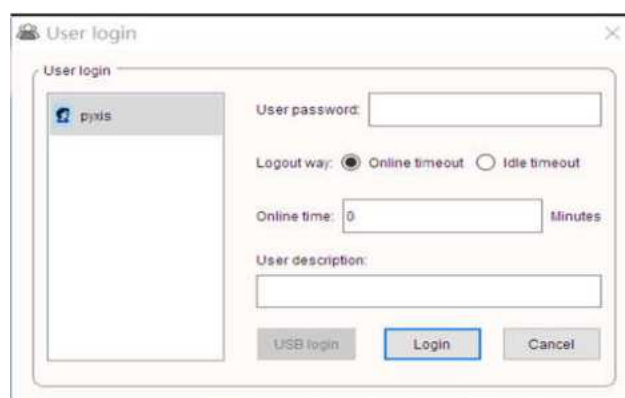

Figure. 48 -   Modifying the User Screen

Modify Password: Select the user you want to change, then click **"Modify User"** button, enter the user's own password in the User Password column and Confirm Password column, and click **"Confirm"** to modify successfully.

NOTE *If you do not want to set the password, you can delete the password and save it.*

9. Modbus Register Table & Analyzer Maintenance
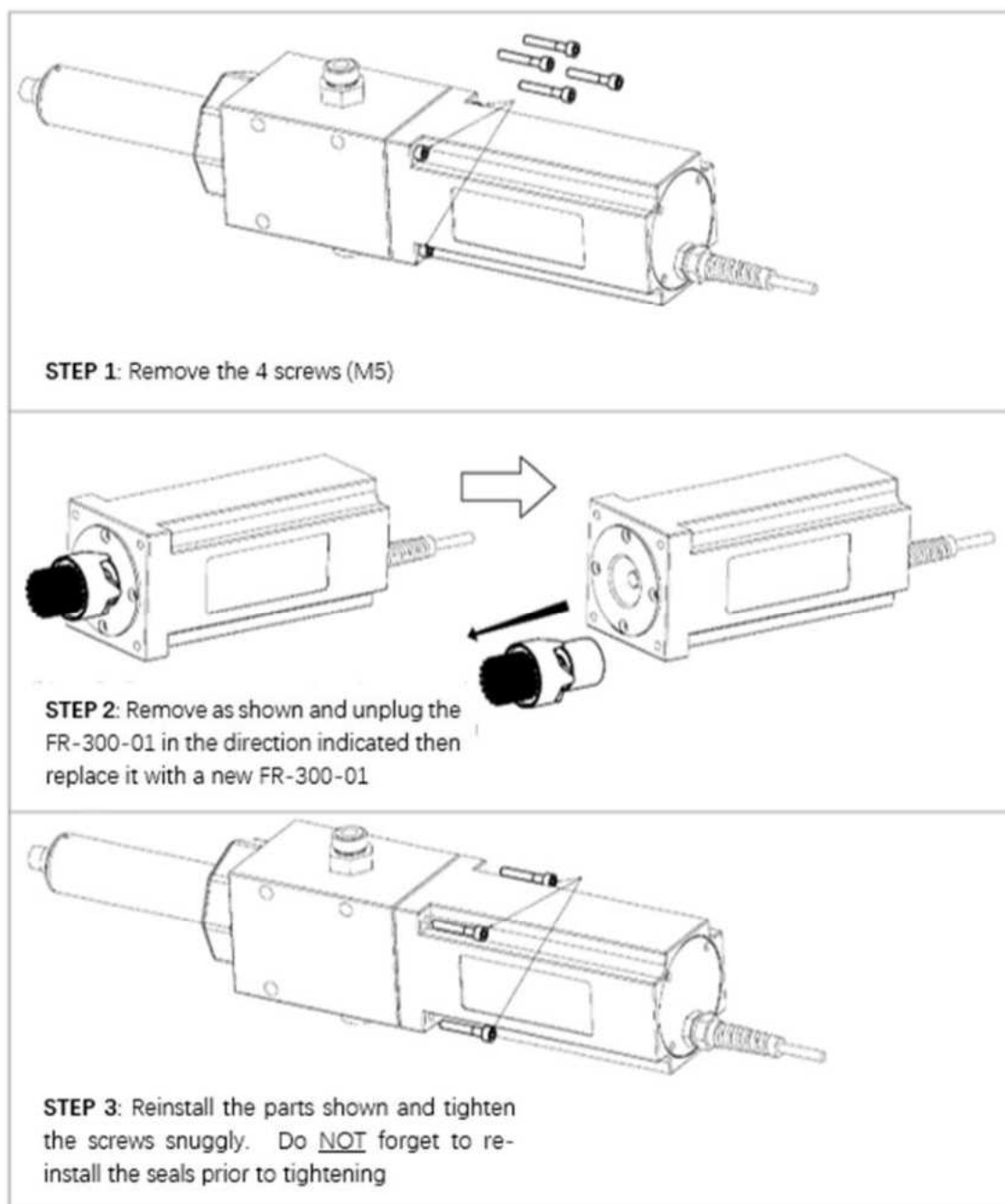
9.1. Modbus Correspondence Address

Serial Number	Definition	Address	Format	Mode	Unit	Note
1	pH	1	float	read-only		Data Format ABCD
2	Turbidity	3	float	read-only	NTU	
3	FCL	5	float	read-only	mg/L	
4	Conductivity	7	float	read-only	μS/cm	
5	Temp	9	float	read-only	℃/℉	
6	pH Upper Limit Alarm	11	uint	read-only		0: Normal 1: Alarm
7	pH Lower Limit Alarm	12	uint	read-only		
8	Turbidity Upper Limit Alarm	13	uint	read-only		
9	Turbidity Lower Limit Alarm	14	uint	read-only		
10	FCL Upper Limit Alarm	15	uint	read-only		
11	FCL Lower Limit Alarm	16	uint	read-only		
12	Conductivity Upper Limit Alarm	17	uint	read-only		
13	Conductivity Lower Limit Alarm	18	uint	read-only		
14	FCL Sensor Communication Abnormal	19	uint	read-only		
15	Turbidity Sensor Communication Abnormal	20	uint	read-only		
16	Conductivity Sensor Communication Abnormal	21	uint	read-only		
17	Brush Communication Abnormal	22	uint	read-only		
18	Brush Failure	23	uint	read-only		
19	Analog Module Mommunication Abnormal	24	uint	read-only		

Communication Protocol: Standard Modbus-RTU

Communication Parameters: Baud Rate - 9600 / Data Bit - 8 / Stop Bit -1 / Parity Bit - Even

Station Number: 100

Communication Protocol: Standard Modbus-TCP

Communication Parameters: IP: 192.168.0.3 (can be set); port: 502

Station Number: 1

Table. 1 - Modbus Correspondence Address

10. Replacement Maintenance

10.1. Replacing the FR-300-PLUS Brush Assembly

Under normal application use, the FR-300-PLUS brush replacement should be done every 2-years. This may vary depending on application and water quality. Please refer to the following process steps for replacement of the FR-300-01 (P/N : 50700-A49) brush assembly.

STEP 1: Remove the 4 screws (M5)

STEP 2: Remove as shown and unplug the FR-300-01 in the direction indicated then replace it with a new FR-300-01

STEP 3: Reinstall the parts shown and tighten the screws snuggly. Do NOT forget to re-install the seals prior to tightening

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10.2. Replacing pH and Oxidizer Electrode Head

The EH-765 electrode head (P/N: 53061) of the ST-765SS Series sensors can be replaced when the original electrode heads have reached the end of their working life. The typical working life of the electrode can be as long as 2-years under normal operating conditions. Please refer to the following steps to replace the electrode head of your sensor.

1. Place sensor power in Flow Interlock <u>Manual Mode</u> and then <u>Power OFF</u> the sensor (see Section 9.7.1) remove and make sure there is <u>no water on the sensor</u>.

2. Hold the sensor main body with one hand and use the other hand to twist the locking ring <u>counterclockwise</u> until the front end of the black electrode is completely unscrewed, as shown in Figure 67-2. ***NOTE* The sensor electrode head should be oriented towards the ground to avoid residual water getting into the sensor.**

3. Thoroughly wipe the electrode head with a dust-free cloth or paper-towel then pull out the electrode head as shown in Figure 67-3.

4. Gently loosen the electrode plug connector and remove the electrode head, as show in Figure 67-4.

5. To install the new electrode head, please use the mounting hook to securely plug in the wiring connector, as shown in Figure 67-5. ***NOTE* Before connecting the electrode head, please make sure that the new electrode head <u>gasket is properly installed at the base of the electrode head</u> thread to ensure a watertight seal, as shown in Figure 67-5.**

6. Then reconnect, insert the new electrode head into the main sensor housing and ensure that the two alignment protrusions on the electrode head are aligned with the notches in the sensor body housing, as shown in Figure 67-6. Then twist the lock ring of sensor in a clockwise direction until the threads of the electrode head completely enter the sensor housing as shown in Figure 67-1. ***NOTE* Be sure to return your sensor operation to Flow Interlock Auto Mode (Section 9.7.1)**

Figure. 49 - Replacing EH-765 pH and Oxidizer Electrode Head

10.3. Sensor Cleaning with Pyxis Probe Cleaning Kit

In the event of heavy inorganic deposition on the ST-765SS Series electrode head, users may conduct an off line chemical cleaning using the Pyxis Probe Cleaning Kit (P/N: SER-01). Isolate the FR-300-PLUS flow reservoir from flow. Remove the ST-765SS Series sensor from the reservoir and inspect the internal components of the flow reservoir and brush head with a flash light. If necessary flush thoroughly with clean water until adequately clean. If the FR-300-PLUS brush is in need of replacement, refer to Section 11.1 of this manual.   Soak the lower half of the ST-765S Series sensor in 100 mL Pyxis Probe Cleaning Solution for 10-15 minutes. Gently wipe the sensor electrode head with the provided Q-tips. If the surface is not entirely clean, continue to soak the sensor for an additional time until clean. Rinse the sensor with distilled water. Pyxis Lab Probe Cleaning Kit can be purchased at our online Estore/Catalog at https://www.pyxis-lab.com/product/inline-sensor-cleaning-kit/

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