**Pyxis**

fluid DYNAMICS™

Inline Water Detection System User Manual
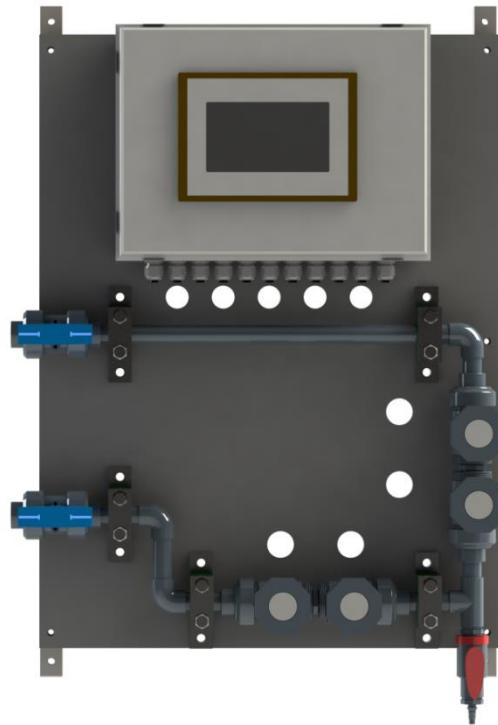
August 2023

General Information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety Information

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger, warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To make sure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

Use of Hazard Information

⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

> Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary Labels

Read all labels and tags attached to the instrument. Physical injury or damage to the instrument could occur if not observed.

⚠️	This symbol, if noted on the instrument, refers to the instruction manual for operation and/or safety information.
⚡	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
⚠️	Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.
🗑	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/98/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user.

Contents

Specifications

ITEM	ST-712	ST-726	ST-772TP	ST-730B
P/N	53003	53114	53721	53202
Range	pH:0-14 ORP:±1500mV	1-300,000 µS/cm	0-20mg/L with ATPC	0-1000NTU
Reproducibility	±0.01pH@25℃ ±1mV@25℃	± 10 µS/cm or 1% of the value	±0.1mg/L or ±1%	±2NTU or ±2%FS
Resolution	0.01pH ±1mV	± 1%	±1%FS	±1NTU
Display	7-inch TFT LCD, 800 x 480 resolution, four-wire resistive touch screen, anti-UV coating			
Data Storage	Built-in 4GB memory, up to 1 million data/event record, CSV upload vis USB disk drive			
Power	100 - 240V AC 50/60Hz, 200 W			
Communication	Modbus RTU /Modbus TCP			
4G Communication	Global 4G communication modem, supporting data upload to cloud servers (optional)			
Operating temperature	5 – 45 ℃			
Storage temperature	Instrument: -20 - +55 ℃; sensor: 0 - +50 ℃			
Protection class	IP65			
Relative humidity	20 % - 90 %			
Product weight	30 kg			
Product Size	H800 x D600 x W220 mm			

*As Pyxis technology is continuously updated, this technical parameter may change at any time without notice

2. System Overview

The system consists of the following major components:

1. PLC and touch screen for controlling, data logging and data display.

2. A Pyxis ST-730B sensor mounting position used as the turbidity sensor.

3. A Pyxis ST-772TP sensor mounting position used as the DO sensor.

4. A Pyxis ST-726 sensor mounting position used as the conductivity sensor.

5. A Pyxis ST-712 sensor mounting position used as the pH & ORP sensor.

6. Two manual PVC ball valves that can be used to throttle the flow.
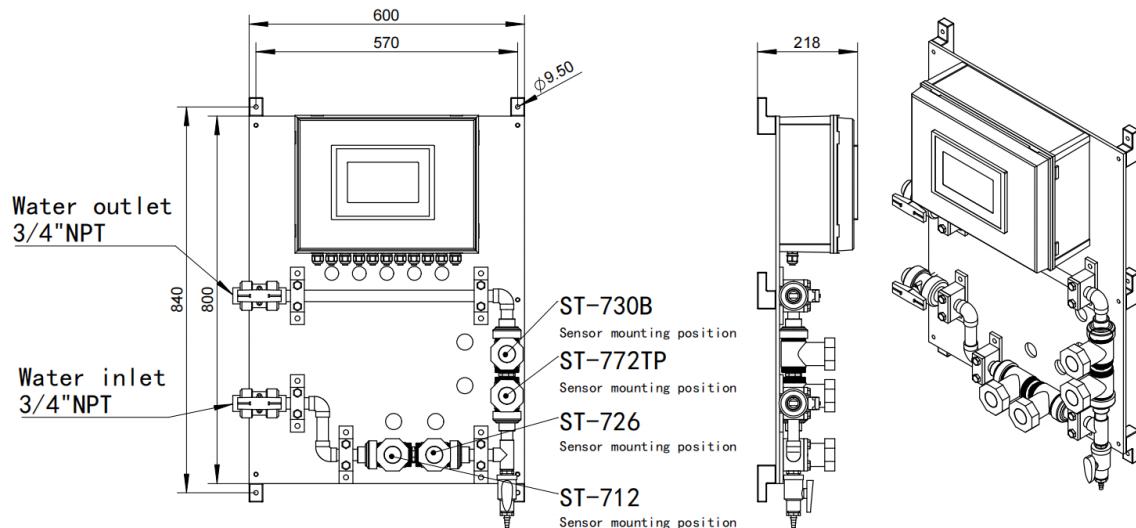
Figure. 1 System Layout

3. Installation and Connection

3.1. Mounting and Sample Installation

Mount the unit to a wall or a mounting frame. Secure the four mounting brackets. Leave 2 feet space on either side for operation access.

Connect the sample water to the ¾ inch sample input ball valve. Make sure the sample pressure is less than 30 PSI. Connect the sample output to a drain line or return the sample to the process. Use the two PVC ball valves to throttle the flow to within 2 GPM.

3.2. Electrical Connection

Connect the power cord included in the package to the power socket on the left side of the PLC enclosure. Plug the power cord to a 110 – 240 VAC outlet.

Failure to follow the electrical operation specifications may cause electric shock injury or even death.
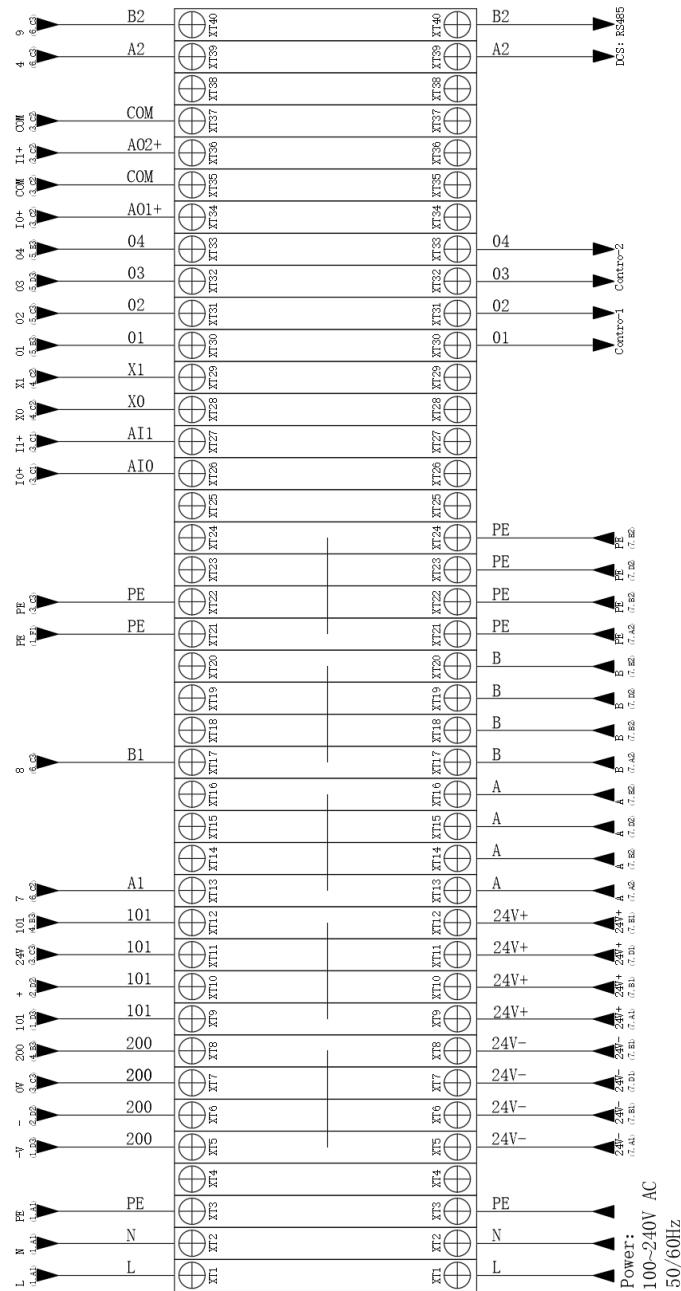
Figure. 2 Terminal wiring diagram

4. Touch Screen Operation

4.1. Initial Screen

After the system is powered on, the initial screen is shown.

Figure. 3 Initial screen

4.2. Real-Time Monitoring

Click "Enter" to enter the main interface, where the real-time reading value of each sensor will be displayed. The user can also select the temperature reading source sensor in the upper right corner of the temperature menu selection bar.
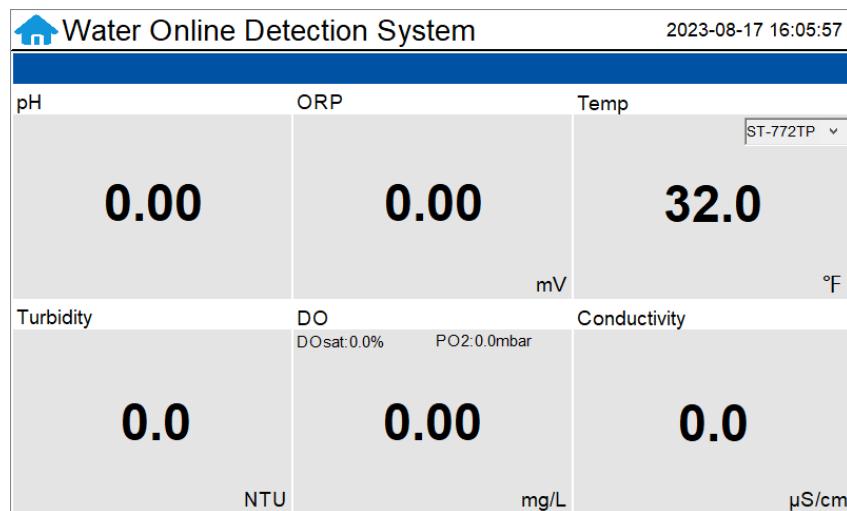

Figure. 4 Main screen

4.3. Menu Bar

Click the "⌂" button in the upper left corner of the screen to enter the system menu interface, where the user can select the desired operation interface.
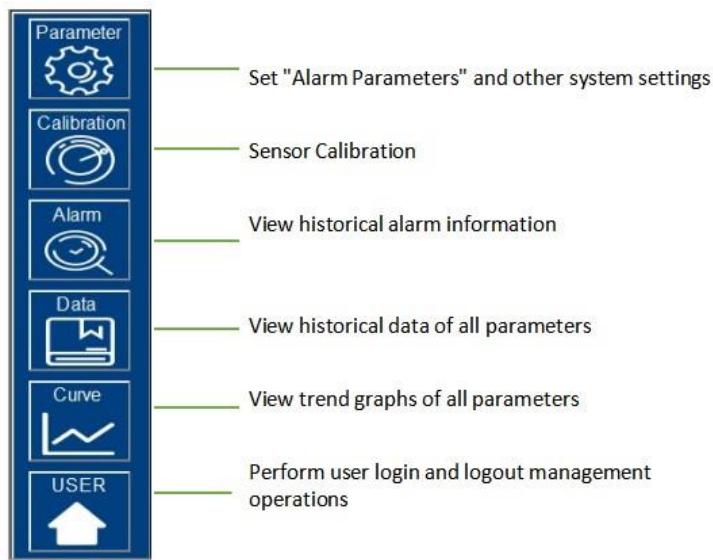
Figure. 5 Menu

4.4. User Login

The user must log in with the username and password to be able to change the system parameters. Without login, the user can only view the readings on the main interface. Click the "User Login" button, a user login window will be prompted, Select the user "**pyxis**", enter the password: "**888888**" in the user password field. New users can be set up in User Management.
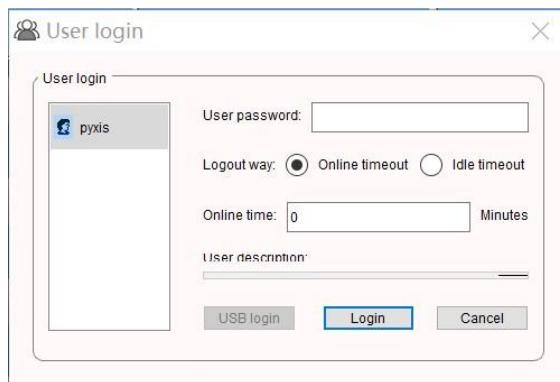

Figure. 6 User Login

4.5. Parameter Setting

Click the "Parameter" button in the menu bar, Select sub menu items: Alarm Parameters, Name Definition and so on.
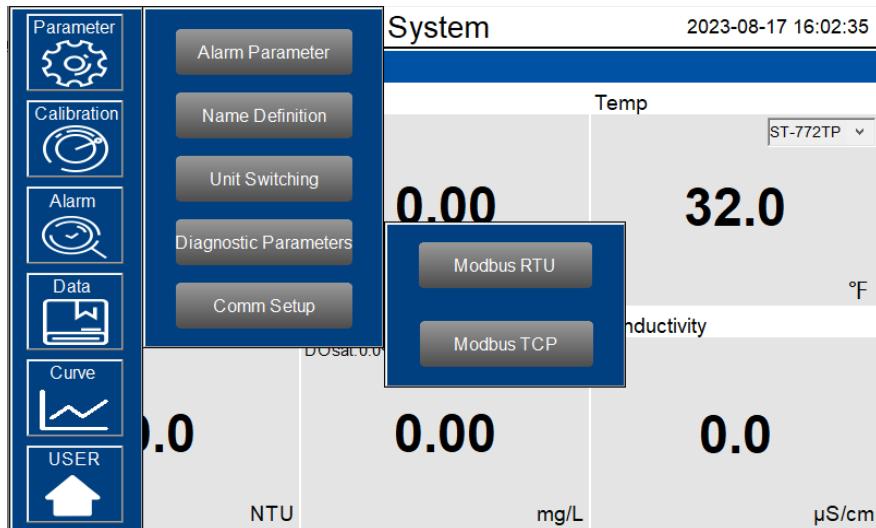
Figure. 7 Parameter Settings

Alarm Parameter Setting

When the online user has the right to operate, the upper and lower alarm limits can be set. Click "Alarm Parameter " to enter the interface of alarm parameter setting. Here you can set the alarm upper limit and lower limit of each sensor. When the measured value is lower than the set lower limit, "XX lower limit" alarm will be displayed on the real-time monitoring screen. When the measured value is greater than the set upper limit value, the "XX upper limit" will be displayed. Users can also select to turn on or off the alarm display function in the upper right of the corresponding parameter list.
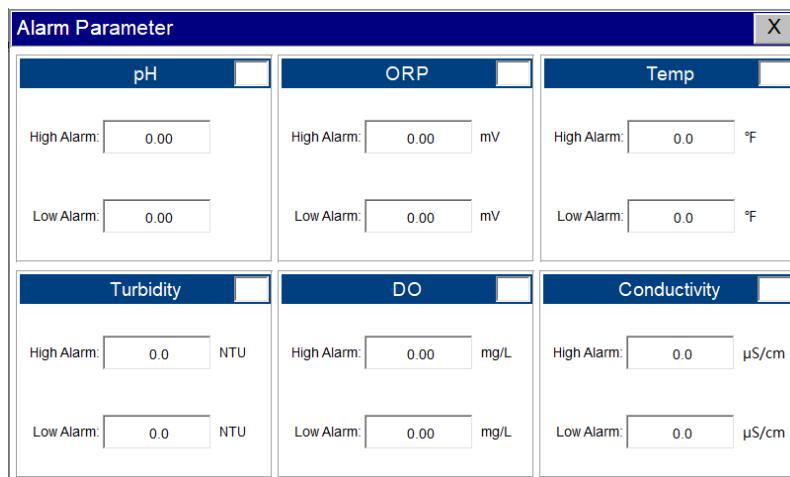
Figure. 8 Alarm Parameter setting

Name Definition

Click the orange dialog box to customize the sensor name.
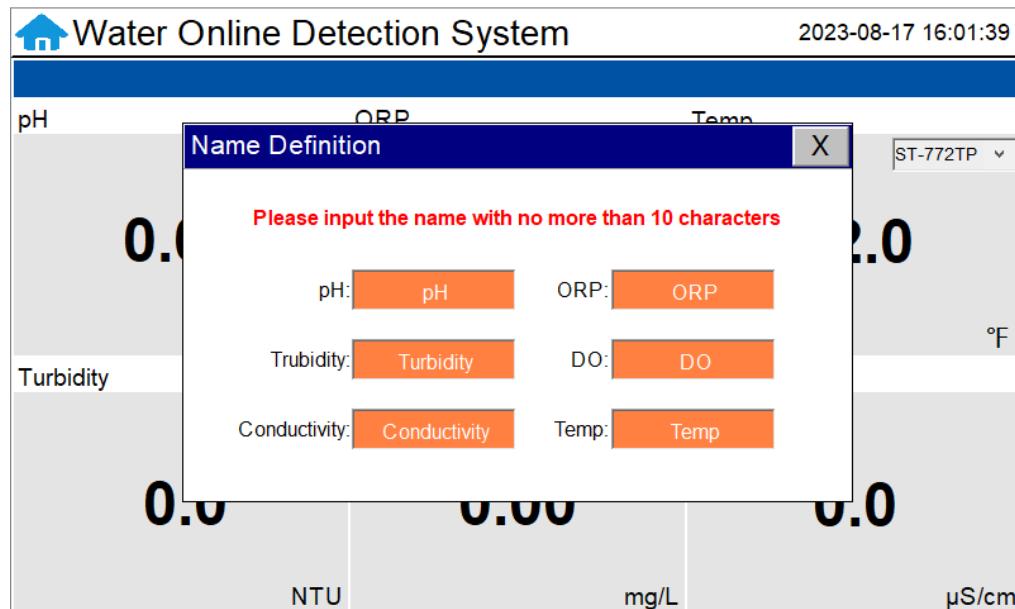
Figure. 9 Name Definition

Unit Switching

This screen allows you to select the unit of temperature display.
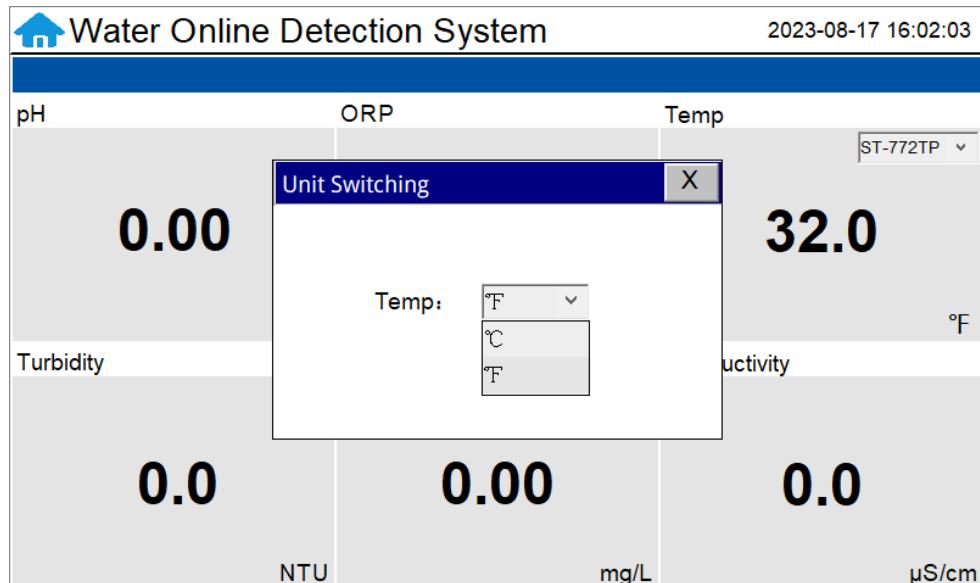
Figure. 10 Unit Switching

Diagnostic Parameters

Click "Diagnosis Parameters" to 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 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 for.
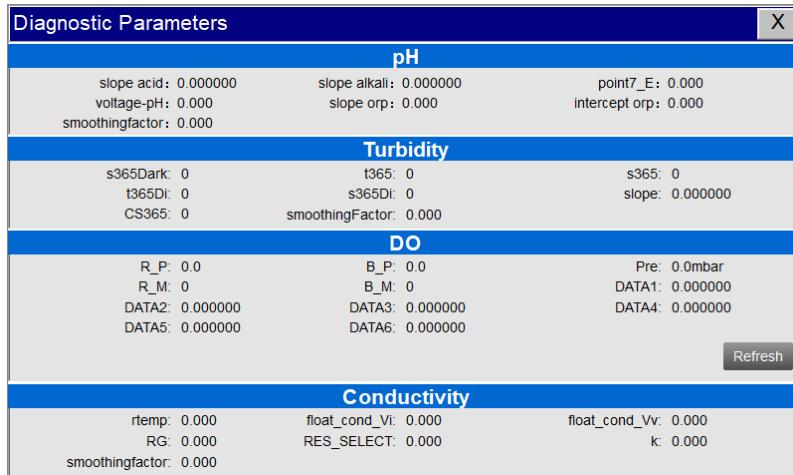
Figure. 11 Diagnostic Parameters

Communication Setting

If the site needs to use DCS to read device information, just connect the master station device to the controller through the terminal (see the attached electrical diagram for the terminal), and read the data according to the parameter register table (see address table).
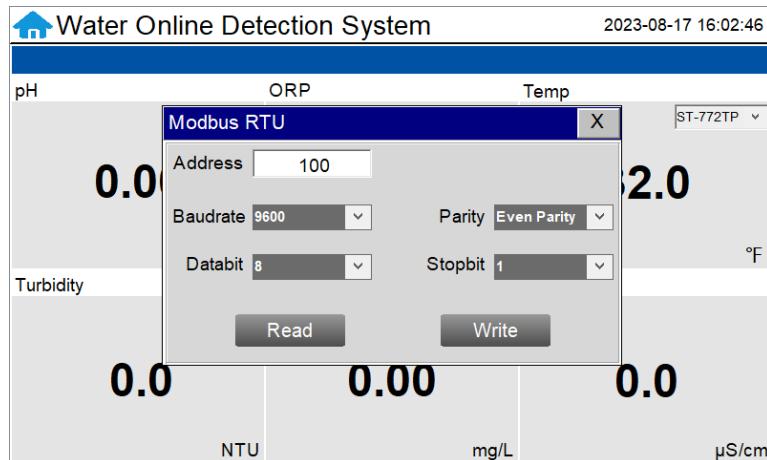
Figure. 12 Modbus RTU

It is also possible to connect based on the Ethernet address
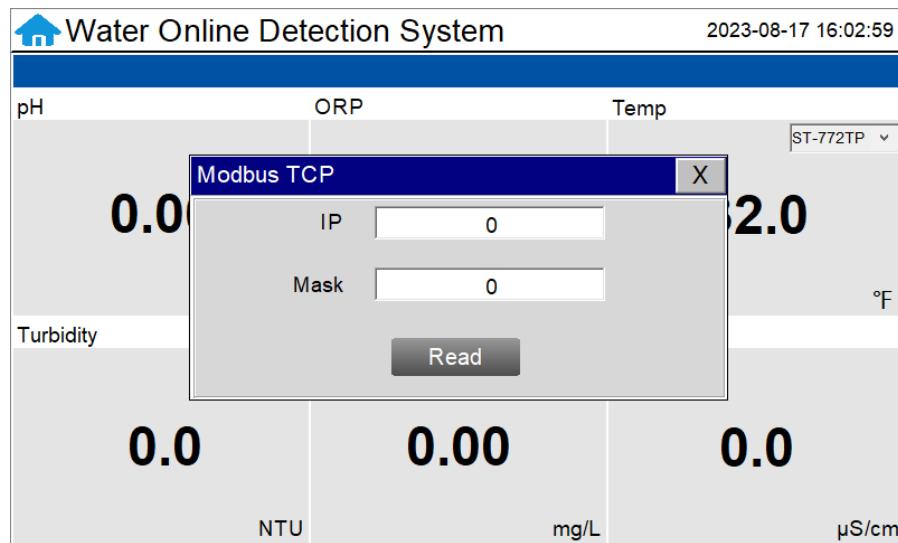
Figure. 13 Modbus TCP

4.6. Calibration

Click on the "Calibration" button in the menu bar and select the sensor to be calibrated.
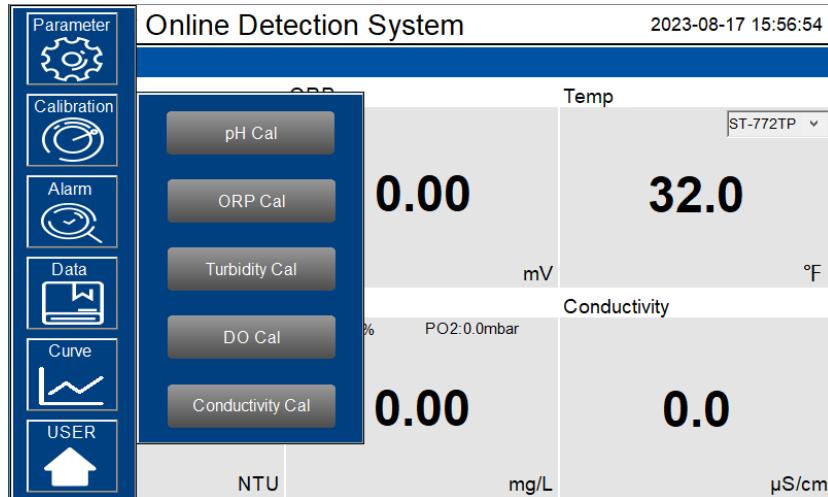
Figure. 14 - Sensor Calibration

pH Calibration

The pH function is thoroughly calibrated at the Pyxis Lab factory. After checking with a pH standard buffer solution, 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-712 sensor as desired.
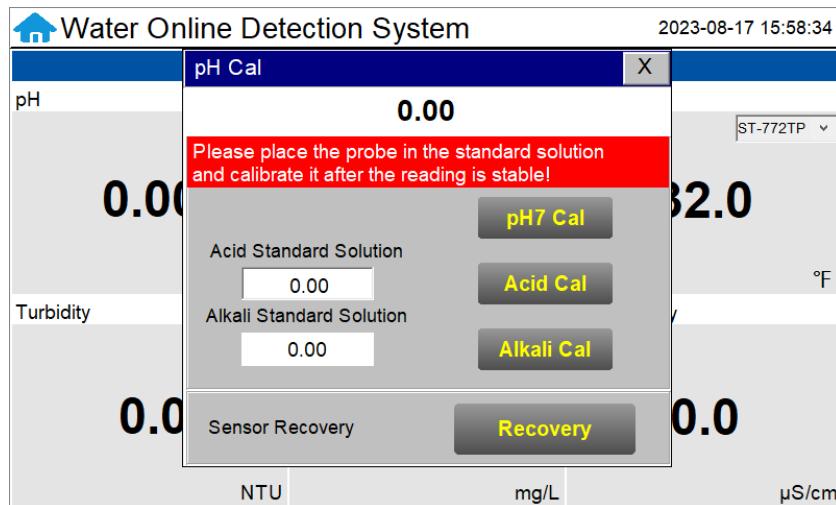
Figure. 15 - pH Calibration

Single Point pH Calibration

Remove the pH sensor and rinse 3x with DI water. 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".
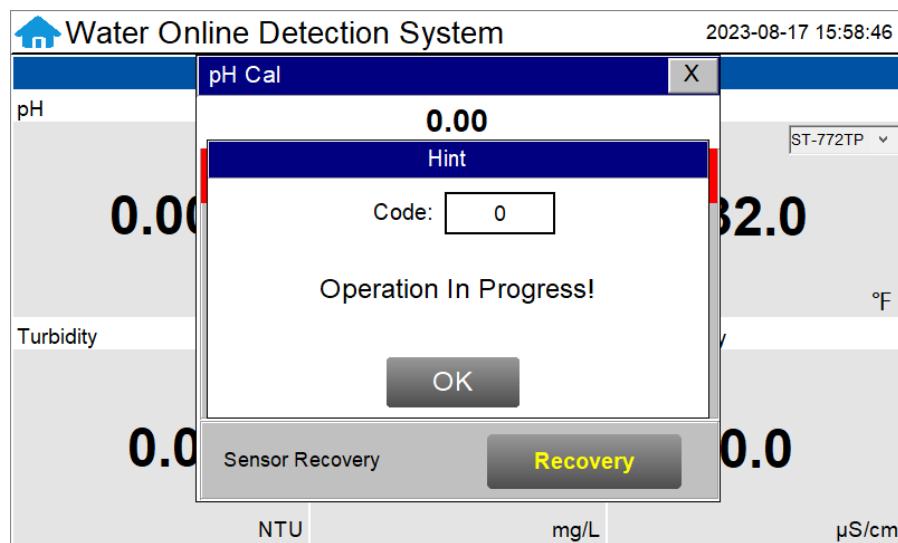
Figure. 16 - pH Calibration Success Prompt

<u>Two Point pH Calibration</u>

Remove the pH sensor and rinse 3x with DI water. 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.

<u>Three Point pH Calibration</u>

Remove the pH sensor and rinse 3x with DI water. 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 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. Clean 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.

ORP Calibration

The ORP sensor only needs to be calibrated once, put the sensor into the known value of the standard solution, enter the value of the standard solution in the interface, and then click on the calibration, wait for the calibration completion prompt to pop up showing the calibration was successful.
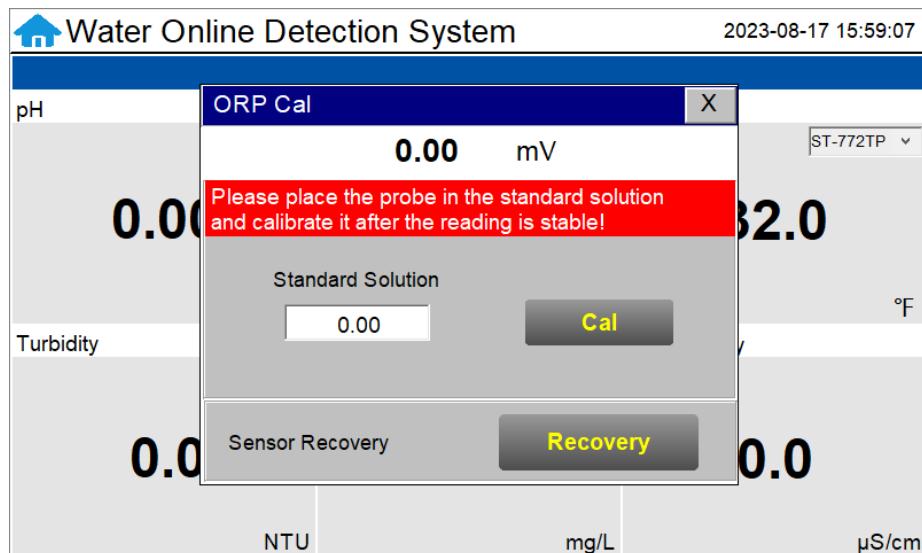
Figure. 17 ORP Calibration

Turbidity Calibration using L-CAL Portable Calibration Kit

The 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 using the L-CAL portable turbidity calibration kit as outlined in this section.
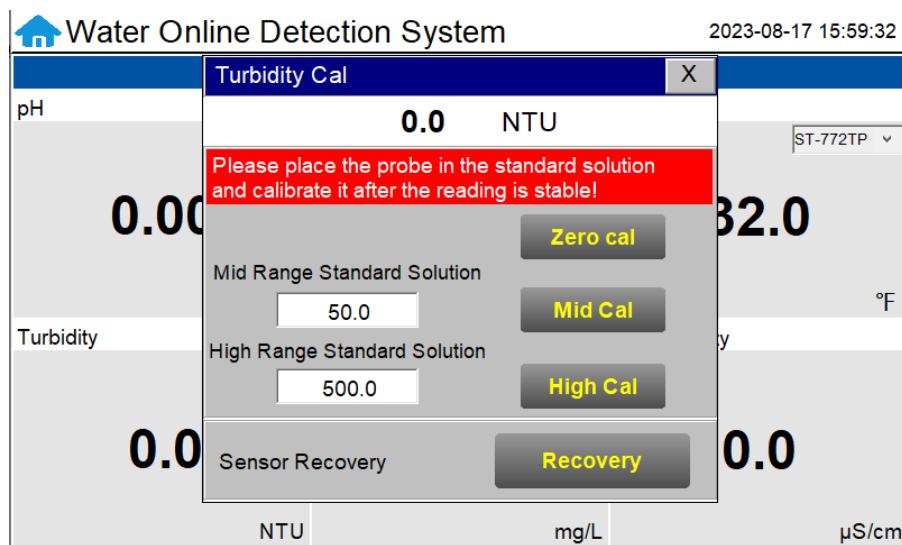
Figure. 18 - Turbidity Calibration Screen

Pyxis

Middle and high calibration can be individually calibrated, it is recommended to choose the appropriate range for calibration according to the site environment and application range commonly measured. *__NOTE * - If a zero calibration is done, please always complete the middle and high calibration in turn.__*

Zero Turbidity Calibration using L-CAL Portable Turbidity Calibration Kit:

Isolate the panel and drain the piping and inline Tee assemblies. Remove the ST-730B sensor from the flow tee. Rinse the sensor body and inner walls of the optical channel, then use a small pipe cleaner or Q-tip to clean the inner walls of the optical channel thoroughly. After physical cleaning, triple rinse the ST-730B optical channel and sensor body itself thoroughly with DI or clean tap water. Prepare and prerinse the L-CAL Portable Turbidity Calibration Kit (P/N 53247) vessel, as outlined on page 16 of this manual with DI or clean tap water. Insert the cleaned ST-730B turbidity sensor into the L-CAL calibration vessel and position 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 16 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, press "Zero" calibration button, 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".

Mid-Range Calibration using the L-CAL Portable Turbidity Calibration Kit:

After a successful Zero calibration, proceed by rinsing the L-CAL vessel with DI or clean tap water and refill with 500mL of known turbidity standard solution between 50NTU and 200NTU for mid-range calibration (see page 16). After the displayed data is stable, enter the medium range 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".

High-Range Calibration using the L-CAL Portable Turbidity Calibration Kit:

After a successful Mid-Range calibration, proceed by rinsing the L-CAL vessel with DI or clean tap water and refill with 500mL of known turbidity standard solution between 500NTU and 1,000NTU for high-range calibration (see page 16). After the displayed data is stable, enter the high range 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) Ensure the turbidity sensor optical channel is not contaminated with debris or other substances.
4) Ensure the L-CAL reservoir is not contaminated by debris or other materials.
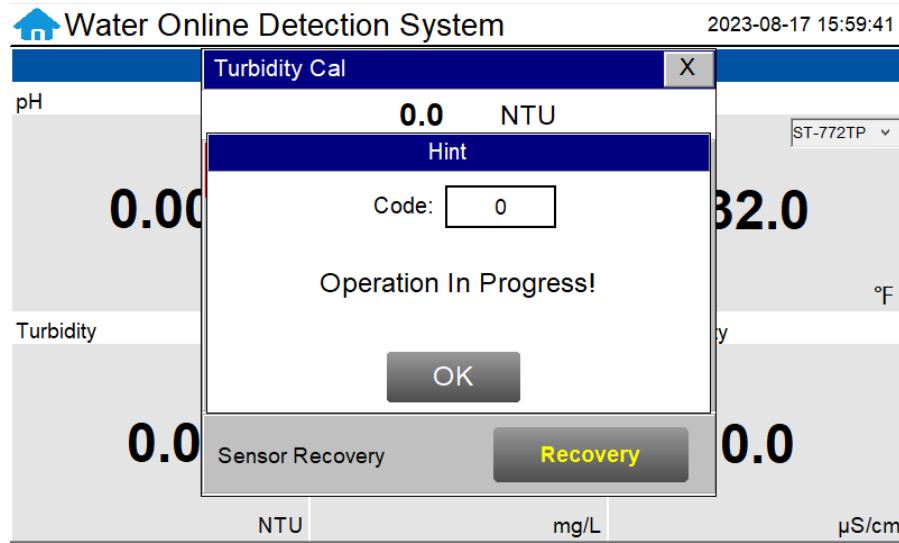
Figure. 19 - Awaiting Execution Screen of Turbidity Calibration

ST-730B Calibration using L-CAL Portable Turbidity Calibration Kit

Pyxis Lab has developed L-CAL as a portable and reusable liquid-state turbidity calibration kit for rapid calibration of all ST and LT Series inline turbidity sensors. The L-CAL calibration kit allows users to calibrate all Pyxis turbidity sensors using <u>smaller volumes of Formazin</u> 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 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

L-CAL Specifications

Item	L-CAL Portable Liquid Formazin Calibration Kit
P/N	53247
Sensor Name	ST-730B
Calibration	**Recommended Calibration Standard Solution Range**
Zero	Bubble Free DI Water
Mid-Range	50 – 200 NTU
High-Range	500 – 1,000 NTU

Pyxis Lab Turbidity Calibration Standard Solutions

Pyxis Turbidity Calibration Standard	Pyxis P/N
Pyxis 50 NTU Formazin Turbidity Calibration Std (500mL Bottle)	57009
Pyxis 100 NTU Formazin Turbidity Calibration Std (500mL Bottle)	57010
Pyxis 200 NTU Formazin Turbidity Calibration Std (500mL Bottle)	57010-1
Pyxis 500 NTU Formazin Turbidity Calibration Std (500mL Bottle)	57010-2
Pyxis 1,000 NTU Formazin Turbidity Calibration Std (500mL Bottle)	57010-3

Pyxis

L-CAL Portable Liquid Formazin Calibration Kit Use Method

After removing the Pyxis turbidity sensor, gently wipe off the body and rinse, brush and rinse again the internal optical channel walls of the sensor. The 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.

Insert Cleaned 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

PROCEED TO CALIBRATING SENSOR Via uPyxis APP

NOTE Sensor Brace Included with L-CAL Kit for Stability

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

DO Calibration

On the Calibration page, you can perform a calibration by clicking Zero Calibration and Air Calibration. Follow the on-screen instructions for each calibration step. *NOTE* *Before calibration, remove the DO sensor from the water and wipe with a damp cloth to remove surface debris and biological sludge. If there is water on the fluorescent membrane cap, wipe it dry with a soft cloth, taking special care not to damage the membrane.*

Zero Calibration
1. Place the probe in a 5% sodium sulfite solution (anaerobic water).
2. Allow the DO sensor to stand for at least 15 minutes and observe the values displayed on the calibration screen.
3. Once the displayed oxygen and temperature values have stabilized, press the Zero Calibration button to perform a zero calibration.
4. If the calibration is successful, the Calibration Succeeded message will pop up. If the calibration fails, press Zero Calibration again and repeat the procedure.

Air (Slope) Calibration
1. Place the DO sensor in temperature stabilized air or saturated air and water.
2. Allow the DO sensor to stand for at least 6 minutes and observe the values displayed on the calibration page.
3. Once the displayed oxygen and temperature values have stabilized, press the Air Calibration button to perform an air calibration.
4. Enter the humidity value:
- If you are using air calibration, you will need to enter the current real-time humidity value.
- If you are calibrating with saturated air water, you will need to enter a humidity value of "1".
5. If the air (slope) calibration is successful, the screen will return a Calibration Succeeded message. If the calibration fails, press Air Calibration again and repeat the calibration.
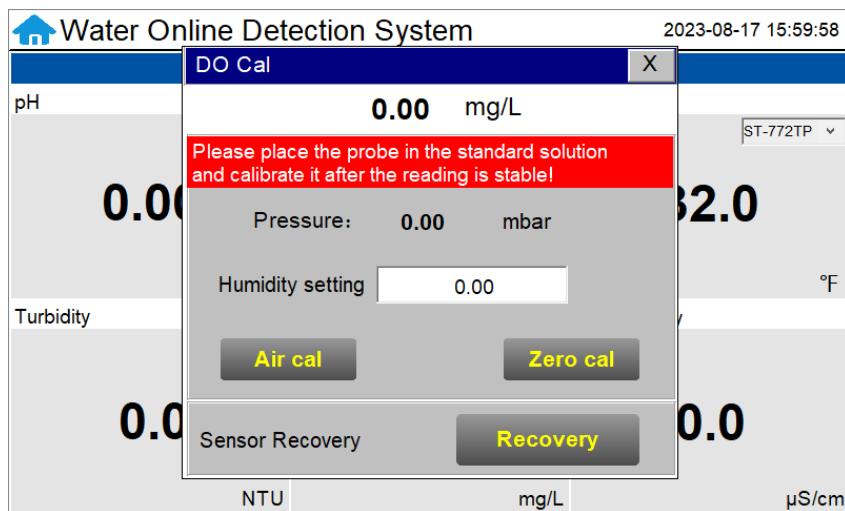

Figure. 20 - DO Calibration

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.
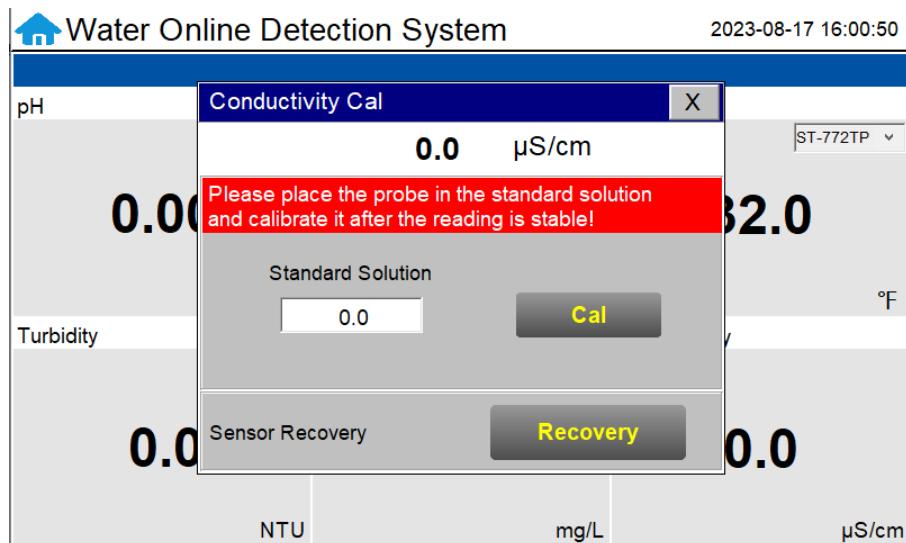

Figure. 21 - Conductivity Calibration

4.7. Recovering Data

Click the restore button in the calibration interface of each sensor to restore the data of sensor. If a user error is made during calibration and other operations, you may restore the factory settings of the sensor through the restore function.
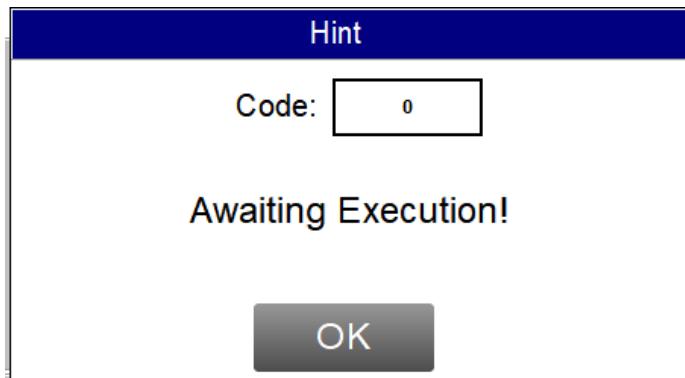

Figure. 22 - Data Recovery Screen

4.8. Alarm Browsing

Click the **Alarm Browsing** button on the main interface to enter the alarm browsing interface.
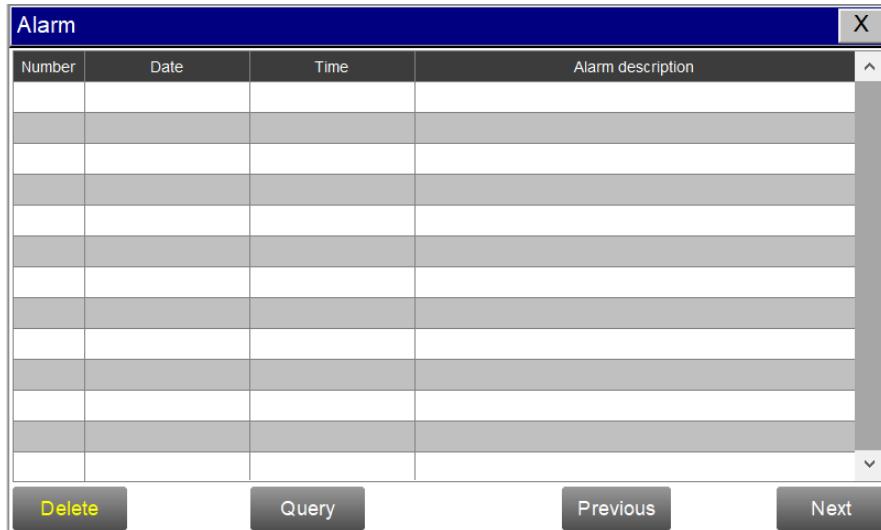

Figure. 23 Alarm Browsing

In this interface, the user can browse all alarm signals. Drag the right scroll bar to slide up and down to view historical alarm records. You can also click "Previous" and "Next" to turn pages quickly.

Click Query, enter the number in the pop-up box and query, you can quickly view the alarm problem of the corresponding number.
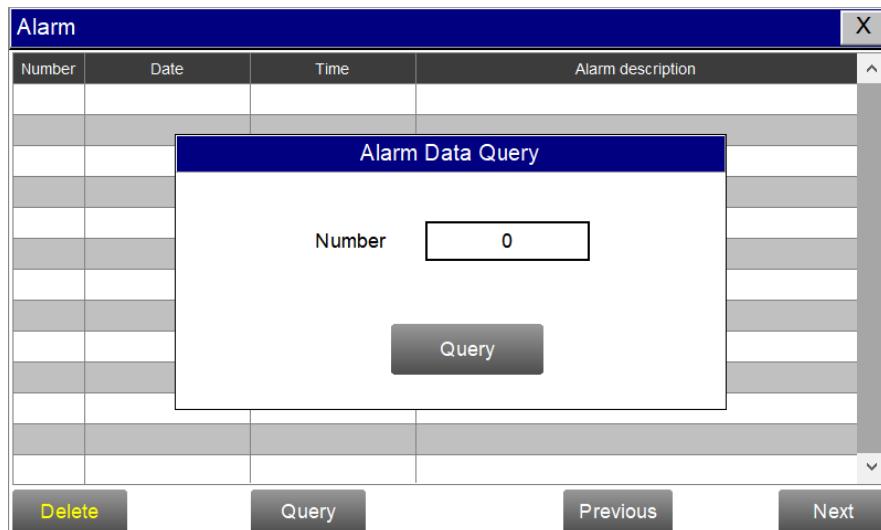

Figure. 24 Alarm data query interface

After clicking the delete button in the lower left corner, all alarm records will be deleted. After clicking delete, you need to exit the current interface and enter again, the historical data in the data report will be cleared.

4.9. Historical Data

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


Figure. 25 Historical data

In the data report, the user can view the stored data of all parameters. The system records sensor readings every 4 seconds by default. 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 100,000 pieces of data. After 100,000 data points saved, new data will overwrite the previous data.

The user can click the 'Periodicity' button to change the data saving time interval

Figure. 26 Data storage retrieving setting

Click Delete in the lower left corner. After entering the retention time, click the Delete button to clear all historical data except for those within the retention time period.
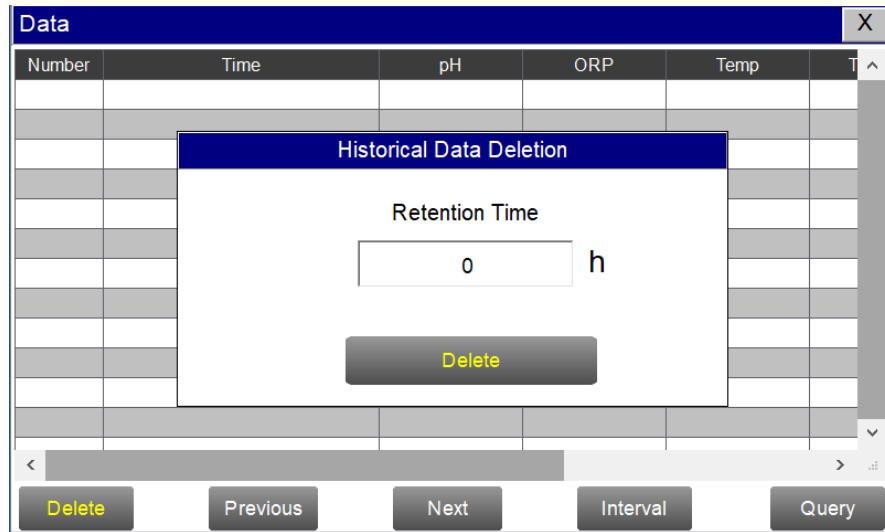
Figure. 27 Deleting historical data

Click the query 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 need to be filled in completely and exactly according to the system time format. Otherwise, it will not be recognized for the query.
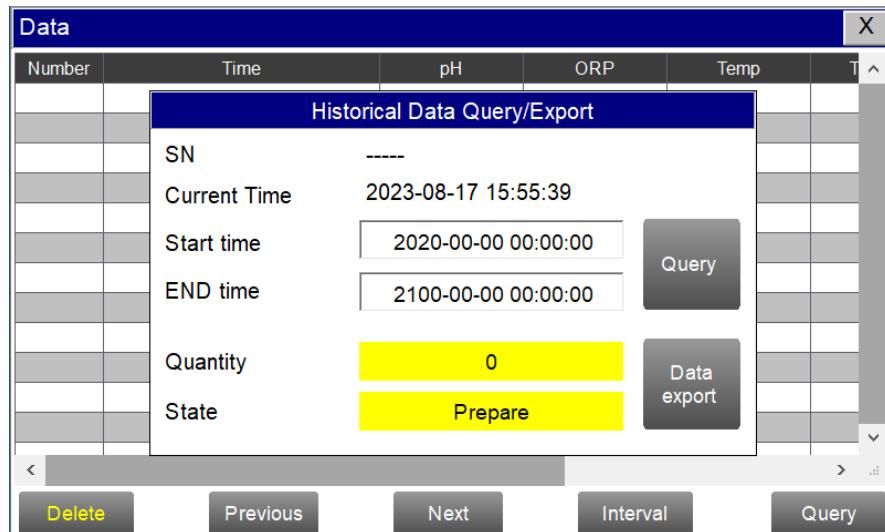
Figure. 28 Historical data query interface

Insert a USB disk behind the screen and enter the time range of the data to be exported in the query area, click on the data export, when the status is displayed as success, and the quantity is positive, the data export in the CSV format is successful. If the quantity is negative, the data was not successfully exported. Please check whether the time format is correct.

When the quantity appears, you can refer to the following table to check the problem.

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

4.10. Historical Data Curve

Click the **Historical Curve** button in the menu bar to launch the trend curve interface. You can click the button below the time axis to browse and view the values in different time periods. Clicking the Y-axis range will pop up the Y-axis range setup as shown in figure 27. Enter the minimum and maximum values to reset the Y axis range.
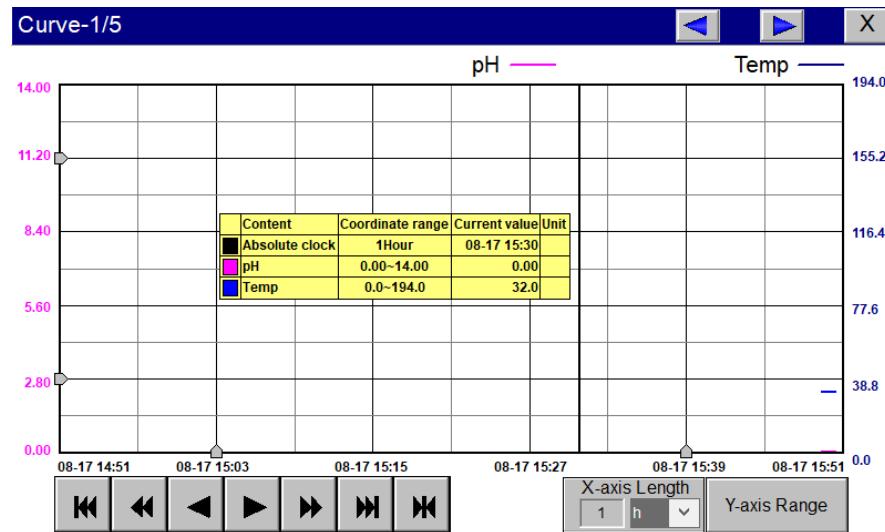

Figure. 29 Trend curve interface
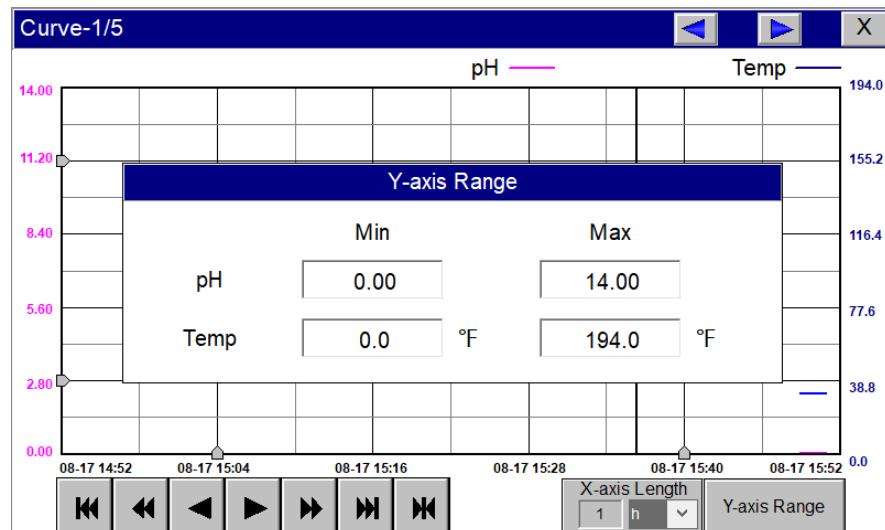
Figure. 30 Y-axis range setting

Figure. 31 Button Function Review

Figure. 32 System Time Setting

4.11. User Management

Click the **User Management** button on the menu bar to Login, Logout, or carry out Administration operations.
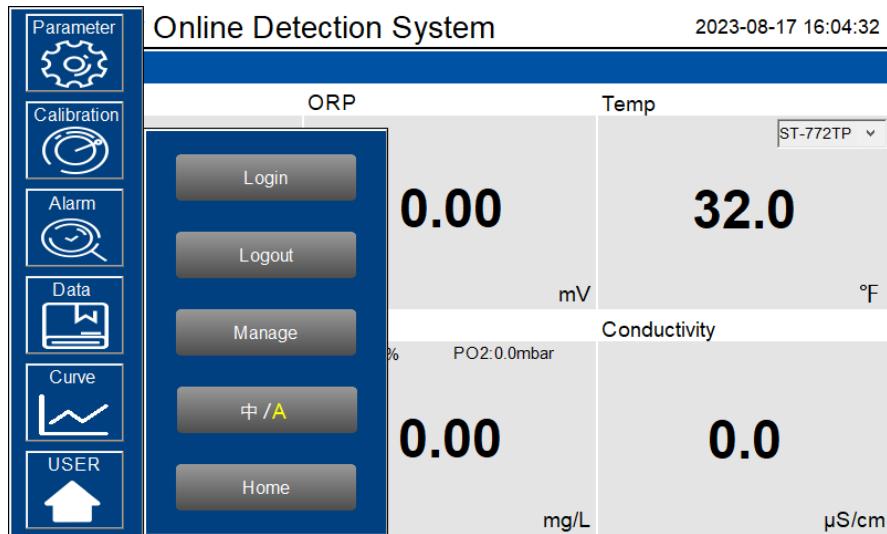
Figure. 33 User management

After Logout, the user can only view the measured values and cannot change any setup parameters.

Click Admin to launch the user management interface, where you can add users, modify passwords, and carry out other operations.
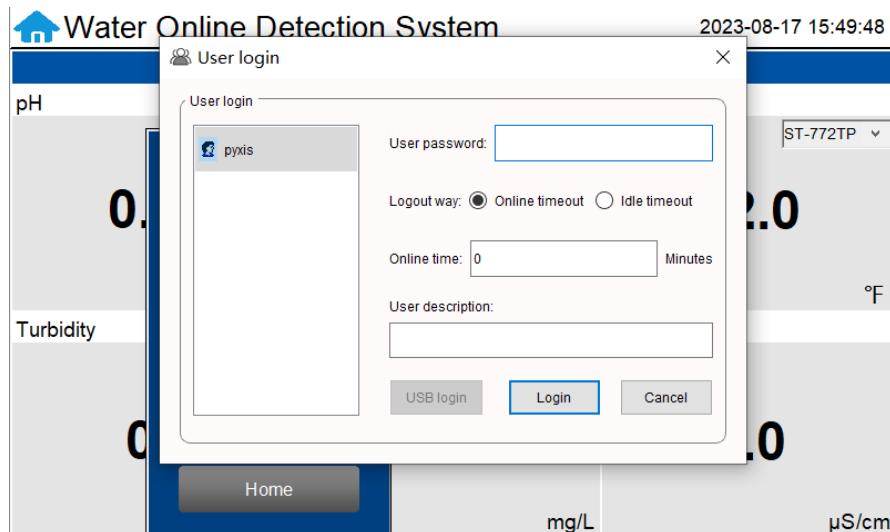
Figure. 34 User Management Interface

Change Password: Select the user to be changed. Then click the Change User button. Enter the user's own password in the User Password column and click Confirm to finish.

4.12. Setting the DATE & TIME

In the main interface, click the time in the upper right corner, the time setting box will pop up, you can change the date and time here
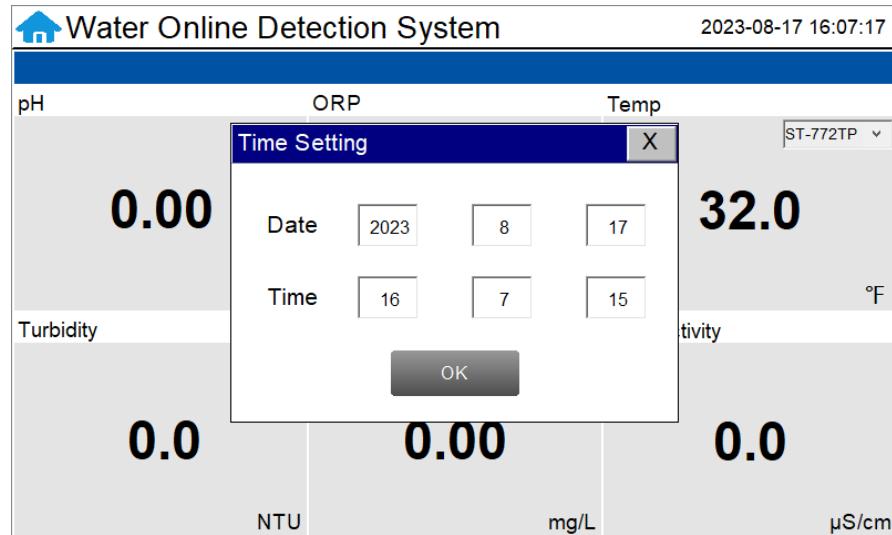
Figure. 35 Time Setting

5. Modbus RTU Register Table

| No.	Format	Model	Unit	Note	No.	Format
1	pH	1	float	read-only		
2	ORP	3	float	read-only	mV	
3	Temp	5	float	read-only	ºC/ºF	
4	Turbidity	7	float	read-only	NTU	Data format: ABCD
5	DO	9	float	read-only	mg/L	
6	Conductivity	11	float	read-only	µS/cm	
7	PLC communication exception	13	uint	read-only		
8	The communication of the pH_ORP	14	uint	read-only		
9	The communication of the turbidity	15	uint	read-only		
10	The communication of the dissolved	16	uint	read-only		
11	The communication of the	17	uint	read-only		
12	pH lower limit alarm	18	uint	read-only		
13	Upper pH alarm	19	uint	read-only		
14	ORP lower limit alarm	20	uint	read-only		
15	ORP upper alarm	21	uint	read-only		0: Normal
16	Lower temperature alarm	22	uint	read-only		1: Alarm
17	Upper temperature alarm	23	uint	read-only		
18	Turbidity lower limit alarm	24	uint	read-only		
19	Turbidity limit alarm	25	uint	read-only		
20	Dissolved oxygen lower limit alarm	26	uint	read-only		
21	Dissolved oxygen upper limit alarm	27	uint	read-only		
22	Lower conductance alarm	28	uint	read-only		
23	Upper conductance alarm	29	uint	read-only		
Communication protocol: Standard Modbus-RTU						
Communication parameters: Baud rate - 9600, data bit - 8, stop bit - 1, parity bit - Even						Communication parameters and station numbers can be modified via **PARAMETERS**
Station number: 100						
Communication protocol: standard Modbus-TCP						
Communication parameters: IP: 192.168.0.3 (can be set); Port: 502						
Station number: 1						
NOTE - Address has been reduced by 1						

6. Replacing the DCC-1 Membrane Cartridge on ST-772 Series

On an annual basis, Pyxis Lab recommends the replacement of the optical dissolved oxygen membrane cartridge assembly (DCC-1) on the ST-772 series dissolved oxgen sensor. This replacement consumable can be purchased from Pyxis Lab under part # 53712 and is available by contacting order@pyxis-lab.com

Remove the sensor guard by loosening the Allen screws. Once guard is removed, slowly unscrew the DCC-1 Membrane Cap from the ST-772 sensor. Gently clean the sensor eye and install the new replacement DCC-1 Membrane Cap onto the ST-772 sensor. Reinstall the sensor guard and tighten the Allen screws snugly. Your sensor is now ready for service for another year of operation.

7. Contact Us

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