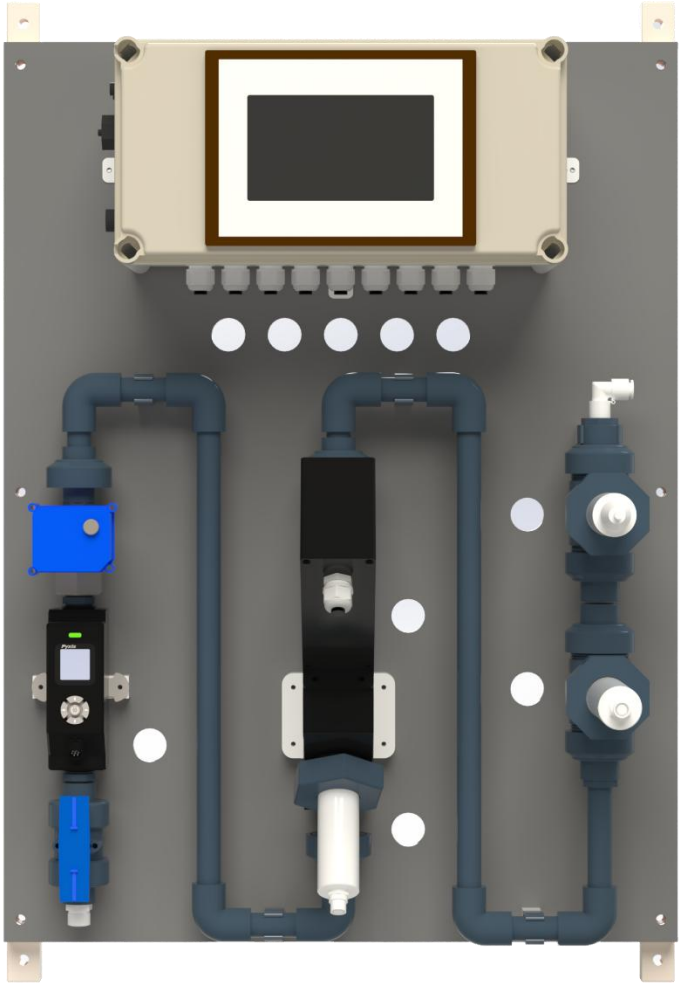
Pyxis

Integrated Water Analyzer

User Manual



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.

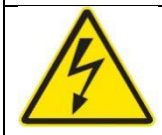
Warning
Indicates a potentially or very dangerous situation that, if not avoided, may cause serious personal injury or death.

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.

Pyxis

Table of Contents

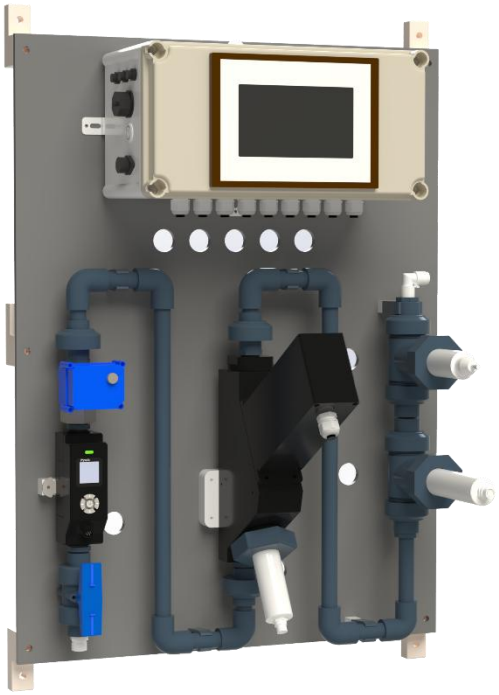
1. Specifications

Item	Integrated Water Analyzer
Turbidity Wavelength	Warm White
Light Source	LED
Turbidity Range	0-1000NTU
Turbidity Accuracy	±0.01 NTU or ±2%
Turbidity Resolution	+ 0.001 NTU or 0.5% <10NTU
pH Range	0.01-14.00 pH
pH Precision	±0.01 pH
ORP Range	±1,500mV
ORP Precision	±1.0mV Precision
Conductivity Measure Range	1-100,000 µS/cm
Conductivity Precision	± 1µS/cm or 1.5%
Display	7-inch LCD Color Industrial Capacitive Touch Screen
Storage Capacity	Built-In 4GB of Ram for Storing up to 1-Million Data/Event Record
Power Requirement	96-260VAC / 50-60 Hz; 10A Fuse; 200 W
Output	5 x Relays/ 5 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	40-113°F (4-45 °C)
Storage Temperature	Instrument: -4-131°F (-20-55°C) / Sensors 32-122°F (0-50°C)
Sample Water Temperature	40-104°F (4-40°C)
Sample Water Pressure	7.25-30 psi (0.05-0.2MPa)
Regulation	CE / RoHS
Relative Humidity	20% - 90% (No Condensation)
Altitude	<6,561 feet (<2,000 Meter)
Dimensions (HxWxD)	Panel 600H x 880W x 367D mm
Approximate Product Weight	20 kg

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

2. Product Description

The Integrated Water Analyzer offers highly accurate, real-time measurement, display and data-logging of Turbidity, ORP, pH and Conductivity utilizing proprietary Pyxis Lab smart sensor technology, coupled with a Pyxis touch screen display and data logging terminal. The Integrated Water Analyzer is offered in a convenient and easy to integrate panel mounted format for rapid installation and simple maintenance.



3. Features

- Pyxis Lab's advanced research and development sensor technologies to achieve highly accurate and stable measurement of Turbidity, Conductivity, pH and ORP.
- The Integrated Water Analyzer also offers the FS-100 ultrasonic flow sensor and motor valve control module providing precise measurement and control of the incoming water sample flow based on user defined setpoint without the challenges commonly associated with mechanical flow measurement in dirty water applications.
- Pyxis LT-736 (EPA) ultra-low resolution turbidity sensor offers a detection light source using warm white LED in 90-degree surface scatter format in accordance with USEPA 180.1 standards. The turbidity sensor offers a self-cleaning flat electrode design making them easy to maintain and clean. The LT-736 offers simple calibration using the Pyxis L-CAL Portable Turbidity Calibration Kit (uses 500mL Formazin per calibration).
- 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 as needed sold separately.

4. Part Numbers & Ordering Details

Please find a table below outlining ordering details and part numbers for The Integrated Water Analyzer of analyzers and replacement-spart parts.

Optional / Replacement Accessories Information	P/N
LT-736 *(Ultralow Turbidity 0-1000 NTU - Warm White Light - 3200K)*	53215
ST-712 *(Inline pH+ORP Analyzer)*	53003
ST-720 *(Inline Conductivity Water Sensor (1-100,000uS) + Temp)*	53101
FT-100-PLUS *(Auto-Brushing Flow Cell for LT-736)*	16005
FTP-100-1 *(Replacement Brush Kit for FT-100-PLUS)*	28698
UC-100A *(Replacement Display/Data Logging Terminal)*	43054
Pyxis pH Combo Calibration Pack *(pH 4-7-10 Calibration Solution 3-Pack - 500mL ea.)*	57007
Pyxis ORP Calibration Standard *(200mV ORP Calibration Solution – 500mL)*	57020
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

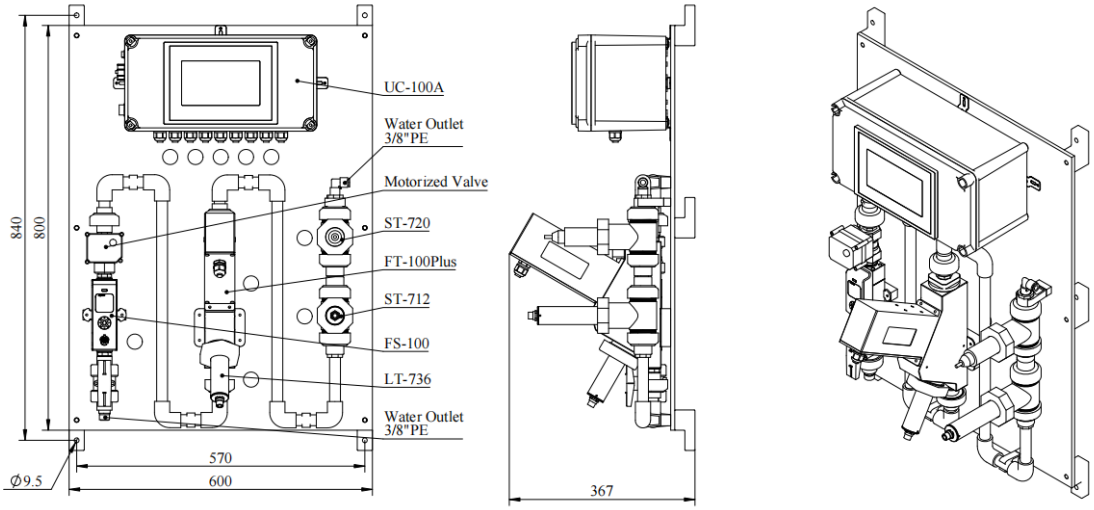


Figure. 1 - Integrated Water Analyzer

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. ***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.

Wall Mount Space: The Integrated Water Analyzer analyzer panel size is roughly 880H x 600W x 367D (mm) in dimension. Please leave at least 0.5m of installation space around the equipment for later maintenance.

Wall Mount Weight: Approximately 20kg. Please use appropriate mounting hardware.

6.2. Sample Water Connection

1. **Process Water Inlet:** Connect the inlet water to 1/2-inch NPT via 3/8 -inch O.D. quick connector.
2. **Water Outlet:** Connect the outlet water to 1/2-inch NPT via 3/8 -inch O.D. quick connector.

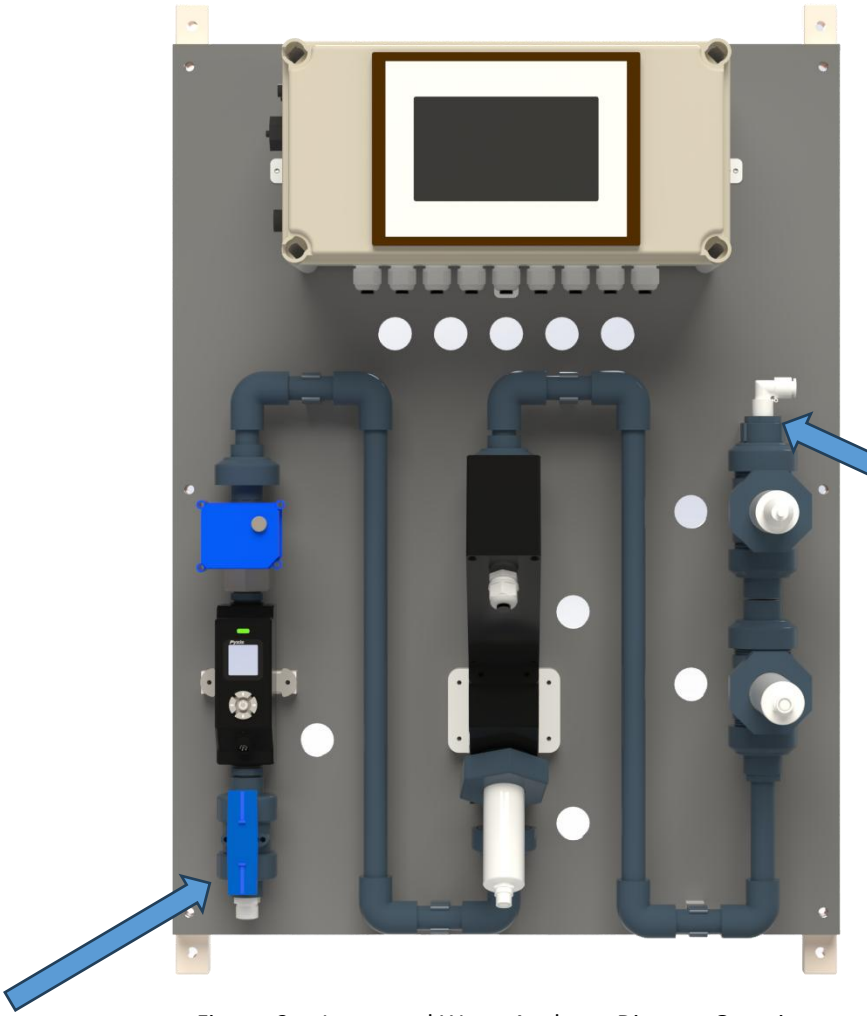
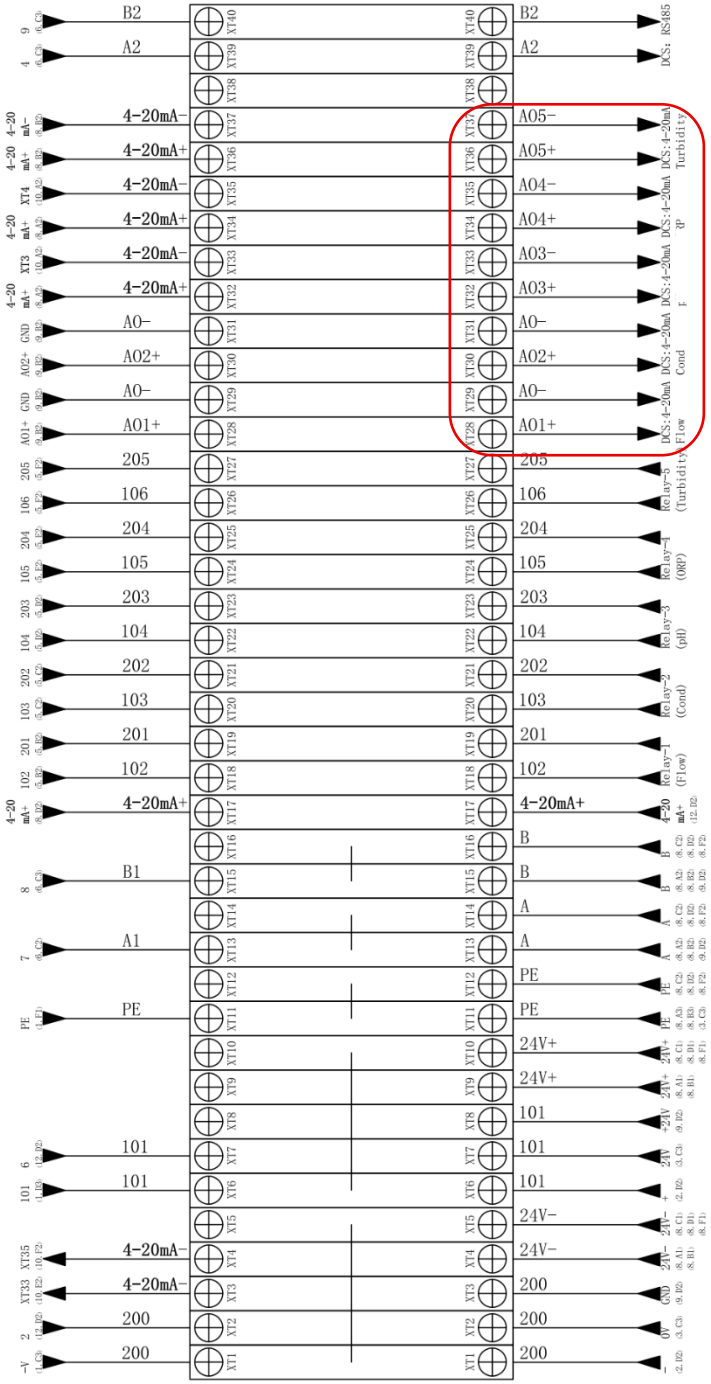


Figure. 2 - Integrated Water Analyzer Diagram Overview

6.3. Terminal Wiring

The Integrated Water Analyzer 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.



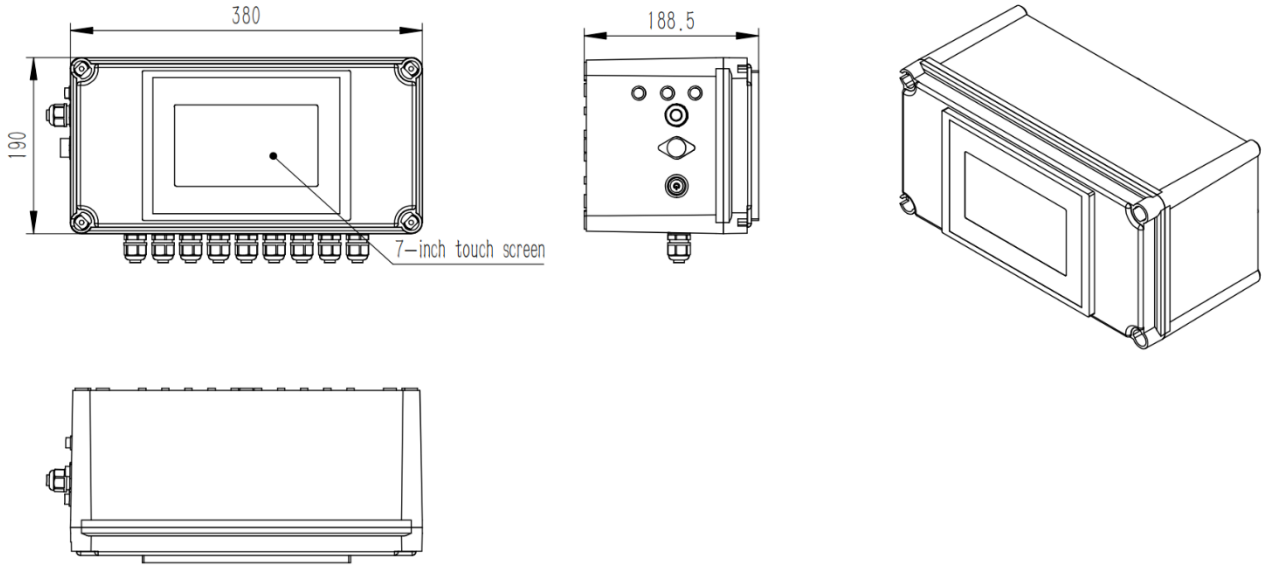
4-20 mA Outputs

Figure. 3 - Terminal Wiring Diagram

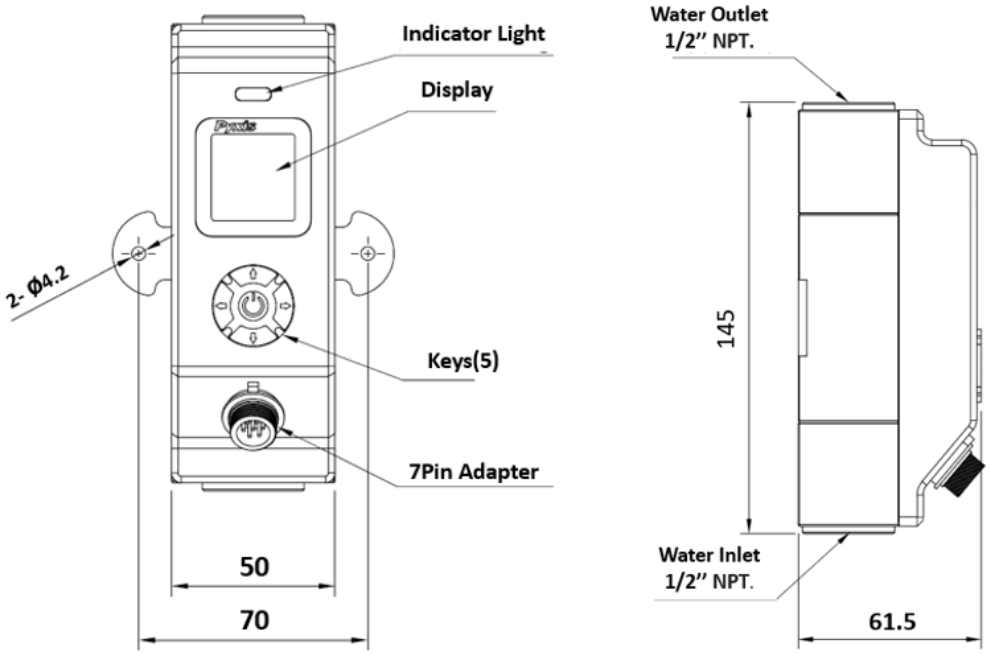
WARNING - The process of electrical connection to contact the 96-260VAC single-phase power supply, should be operated by personnel with an electrician's license. Failure to operate according to the electrical code of practice may result in electric shock injury or even death.

7. Analyzer Components & Dimensions

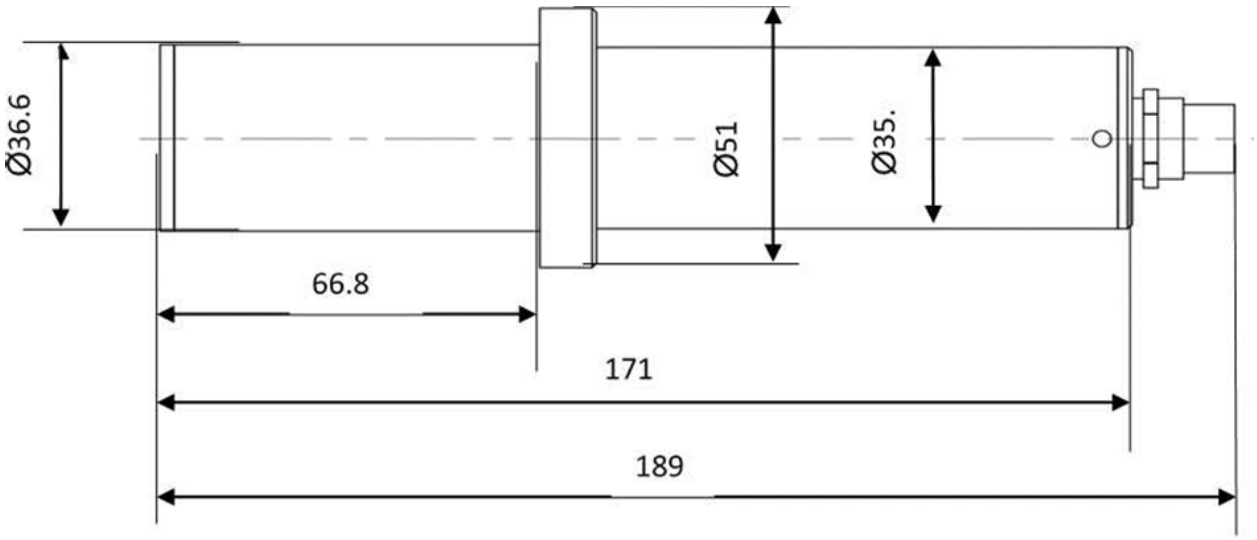
7.1. UC-100A Display & Data Logging Terminal (mm)



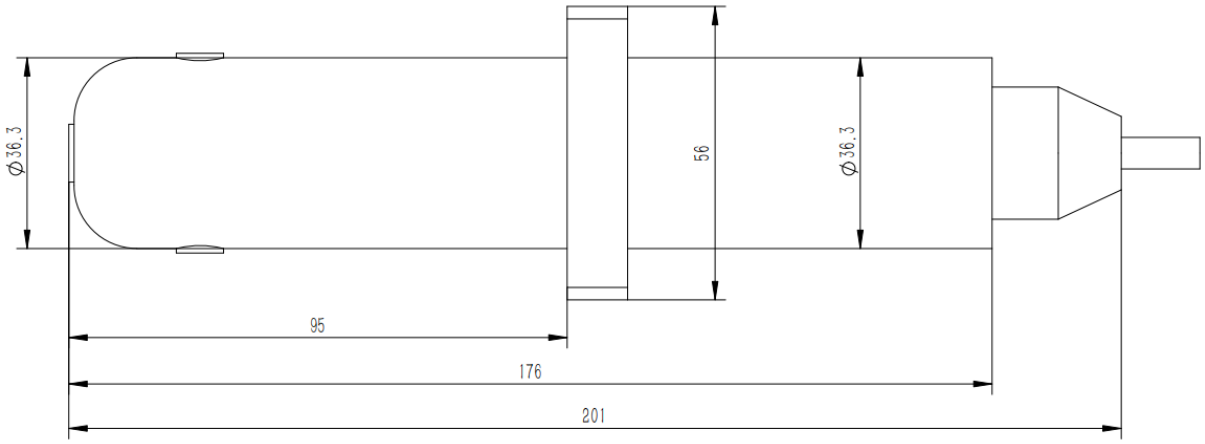
7.2. FS-100 Ultrasonic Flow Meter (mm)



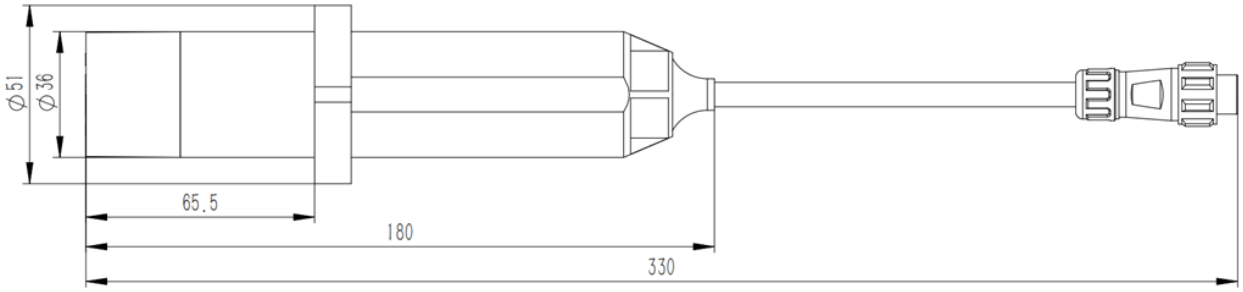
7.3. LT-736 Sensor (mm)



7.4. ST-712 Sensor (mm)



7.5. ST-720 Sensor (mm)



8. FS-100 Flow Control Module Overview & Use

The Flow Control Module is a stand-alone water flow measurement and control solution, a unique platform that provides accurate flow measurement and regulation. The Flow Control Module is equipped with the Pyxis FS-100 ultrasonic flow meter with display, which allows direct control of pre-installed regulating valves through a simple user programmable interface and a measurement range of 0 – 3,000mL/min.

FS-100 Key Function

Enter Key

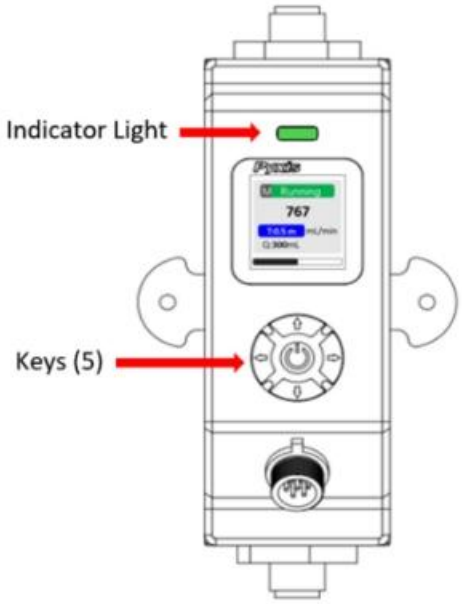
- Main screen → Setting Menu.
- Confirms and saves the input values.

◀ ▶ Left / Right Key

- Main screen → Trend Chart.
- Move the cursor to the left or right.
- Turn pages on the screen.

▲▼ Up / Down Key

- To increase or decrease a displayed number value.
- Jump up and down in the operating menu.

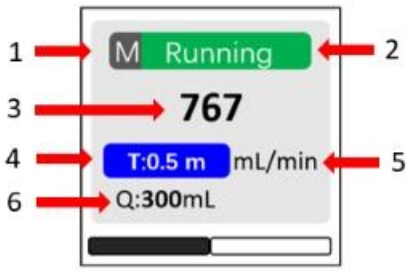


LED Status Indicator

The status LED is used for a quick visualization of the flowmeter status.

LED Behavior	Status
Green	Normal Running
Red	Alarm Information

8.1. FS-100 Main Screen



Main Screen Description

NO.	Description
1	Flow Detection Mode (1)
2	Working Status (same color as LED status indicator)
3	Flow Rate Value
4	Timer (2) (unit: auto range)
5	Unit of measured flow value
6	Accumulated Flow Value (unit: auto range)

(1) **R** = Average Flow Rate Mode

M = Instantaneous Flow Rate Mode

C = Flow Rate Control Mode ***NOTE*** *For C-Mode refer to Section 7.4 for programming details.*

(2) ▼The **Timer** feature is enabled when the FS-100 is powered on and can be set by pressing the key.

- **Pause or Restart the Timer:** Press ▼ key momentarily and release.
- **Reset the Timer:** Press and hold ▼ key for about two seconds

8.2. FS-100 Flow Trend Chart

From the main screen, Press ◀ or ▶ to the trend chart display. Flow values will be displayed as a line graph to show the real-time trend. Press ◀ or ▶ to return to the main screen.

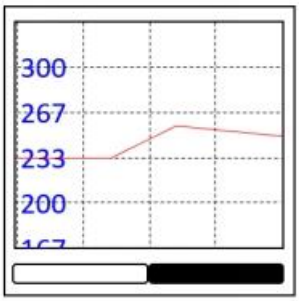


Figure. 4 - FS-100 Flow Trend Chart

8.3. FS-100 Setting the C-Mode for the Sample Flow Control

The Oxipanel PLUS series are programmed to use the Flow Rate Control (C) mode by default, which does not need to be changed by the customer. If a change to measure only is desired (with no control) users may follow the steps below to adjust the FS-100 functional settings.

Press ◀ or ▶ in the setting menu and select ***[Pattern]***. The following operating modes are available:

- **Flow Rate (R) =** Display the average flow rate
- **Flow Meter (M) =** Display the instantaneous flow rate
- **Flow Control (C) =** Set a desired constant flow rate

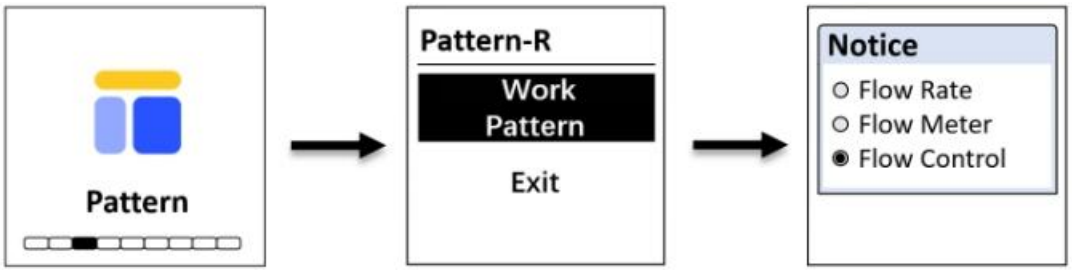


Figure. 5 - Operating Mode

When Flow Control Mode (C) is selected, a user defined flow rate setpoint must be entered (Figures 6 & 7). The FS-100 will automically control the regulating valve according to the preset flow rate with an internally calculated PID algorithm.

NOTE *The Oxipanel PLUS Series should be operated within the recommended flow rates of 200-800 mL/min. See Specifications Section 1.0*

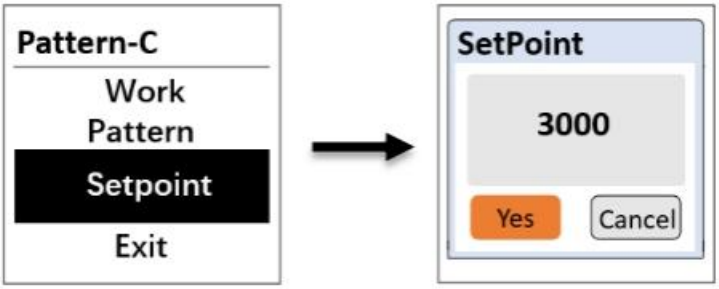


Figure. 6 - Flow Control (C) Operating Mode with User Defined Setpoint

NOTE *If the actual flow rate does not reach the preset flow rate for a duration time of longer than two minutes, the main screen and LED indicator will display* ***RED*** *alarm status .*

8.4. FS-100 Modbus Communication Settings

Press ◀ or ▶ in the setting menu and select ***[Com]*** to modify communication parameters (Figure 7).
The following communication settings are pre-programmed into the FS-100 for direct communication with the OxiPanel PLUS display interface. ***IMPORTANT NOTE*** *These values should NOT BE ALTERED, otherwise flow control failure will occur.*

- **Modbus Address** = *95*
- **Baud Rate** = *9600*
- **Parity =** *Even*

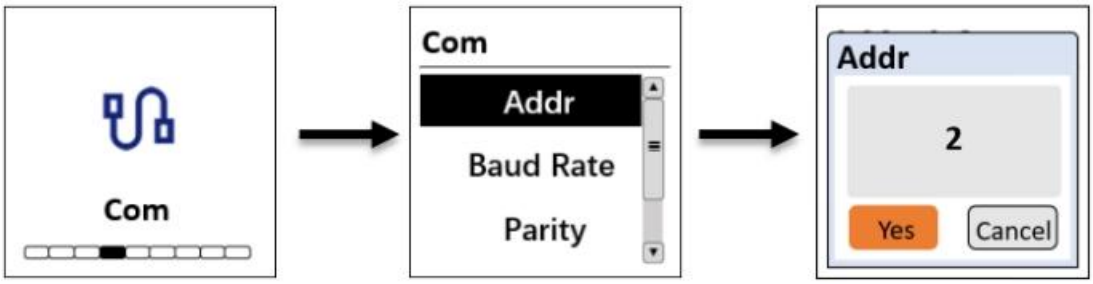


Figure. 7 - Communication Settings

8.5. FS-100 Factory Reset

If the user wants to restore all device settings to factory default parameters, Navigate to ***[Info]*** screen (Figure 10), press and hold ⏻ key for about two seconds, the FS-100 will reboot itself (Figure 12).

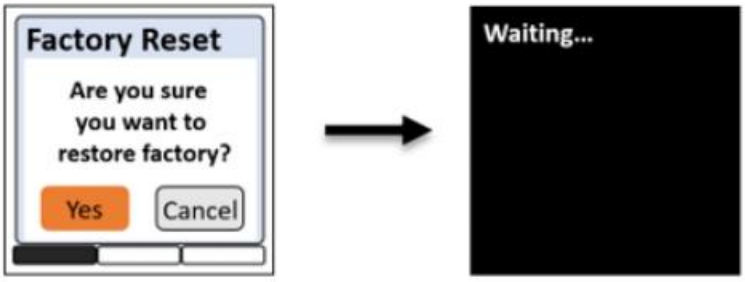


Figure. 8 - Factory Reset

8.6. FS-100 Device Information & Diagnosis

Press ◀ or ▶ in the setting menu and select ***[Info].*** This screen contains the device name, serial number, software version, and hardware version. Provide an image of both the **DEVICE INFORMATION** screen and the **DIAGNOSIS** screen when you contact Pyxis (service@pyxis-lab.com) for troubleshooting your device or call +1 (866) 203-8397 ext 2.

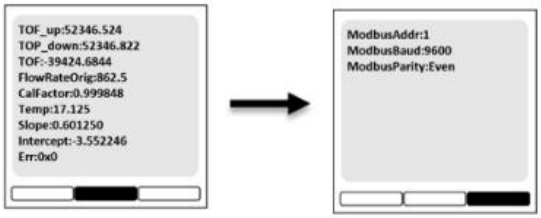


Figure. 9 - Device Information

Figure. 10 - Diagnosis

Press ◀ or ▶ to turn the page. This screen information has no use for normal operation, but instead is used for device troubleshooting. Provide an image of both the **DEVICE INFORMATION** screen and the **DIAGNOSIS** screen when you contact Pyxis (service@pyxis-lab.com) for troubleshooting your device or call +1 (866) 203-8397 ext 2.

9. UC-100A Display Touch Screen Operation

9.1. Main Screen

After the system is powered on an initial screen allows the user to log into the system.

Figure. 11 - Main Screen

9.2. 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.

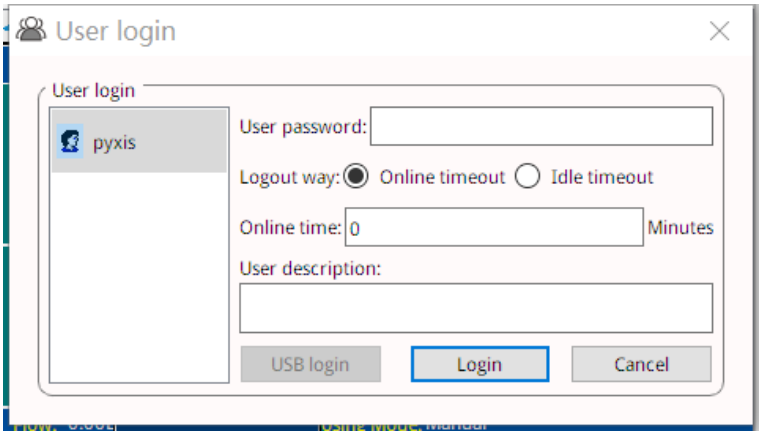


Figure. 12 - User Login Screen

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.

9.3. 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.

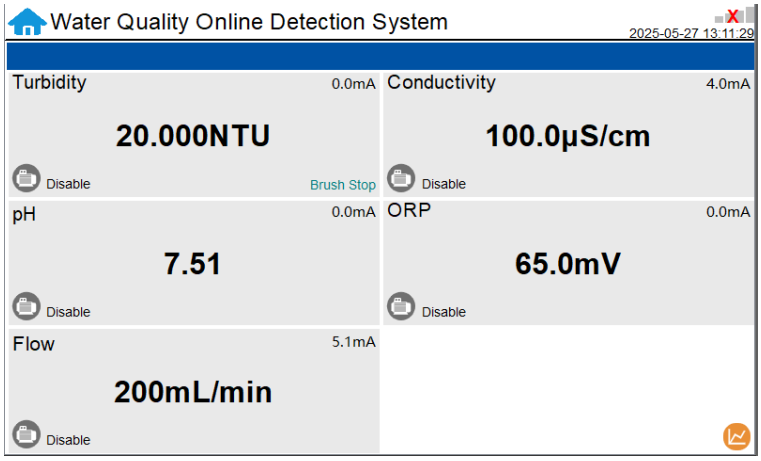


Figure. 13 - Real-time monitoring screen

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

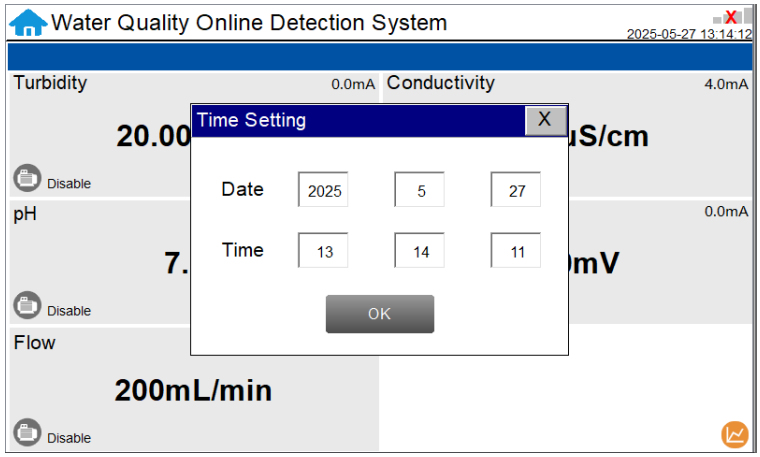


Figure. 14 - Time Setting

Click the orange icon located in the lower-right corner to access the real-time curve interface.

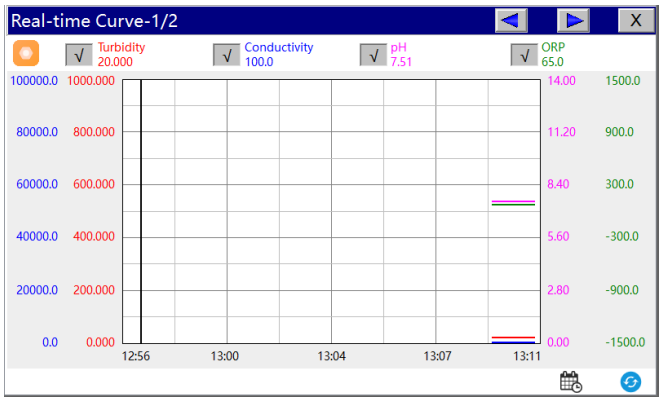


Figure. 15 - Real-time Curve

By clicking the calendar icon at the lower right corner, users can set the parameters of the X-axis.

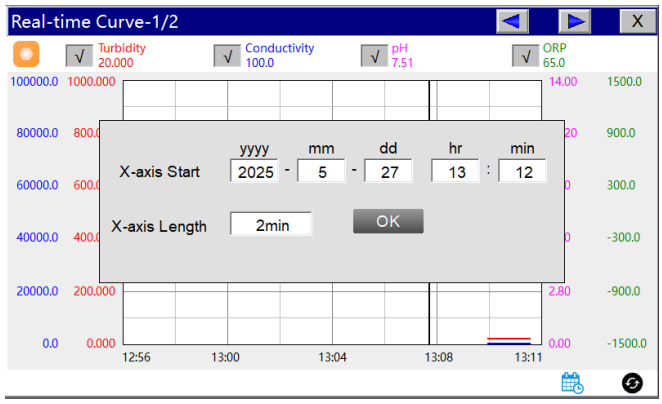


Figure. 16 - X-axis Range

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

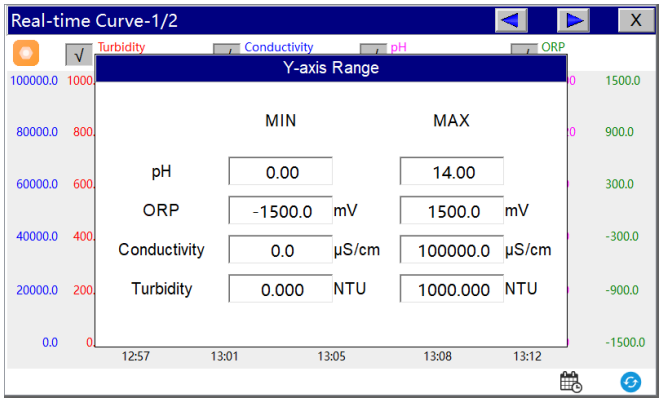


Figure. 17 - Y-axis Range

9.4. 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.

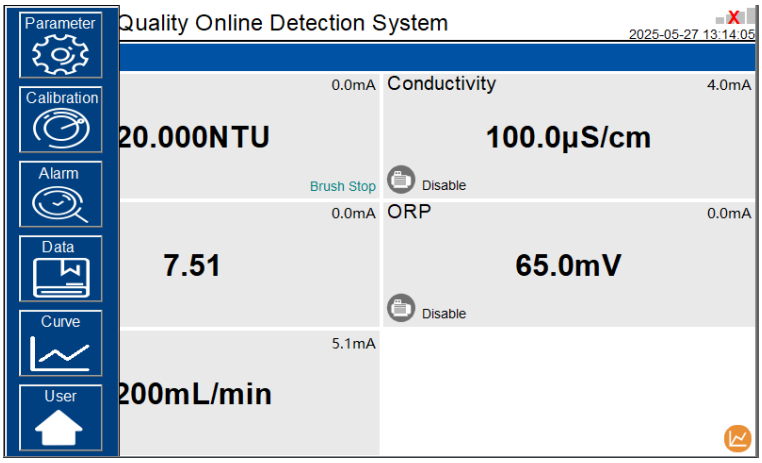


Figure. 18 - Menu Bar

9.5. Configurable Parameters

Click the **"Parameter"** button in the menu bar. Here you can select a list of options to include enter **Alarm Parameters** / **Control Parameters** / **TDS/Cond Setup** /**Cleaning Parameters**/ **User Defined** /**Information Service** and **DCS Output**.

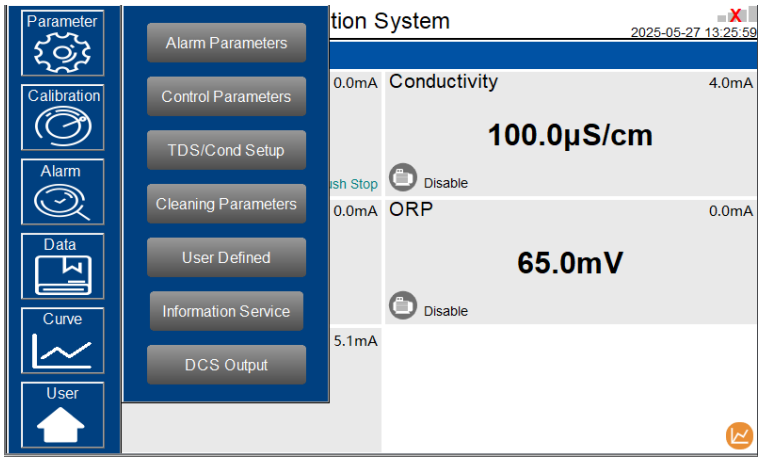


Figure. 19 - Parameter Settings Menu

9.5.1. 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.

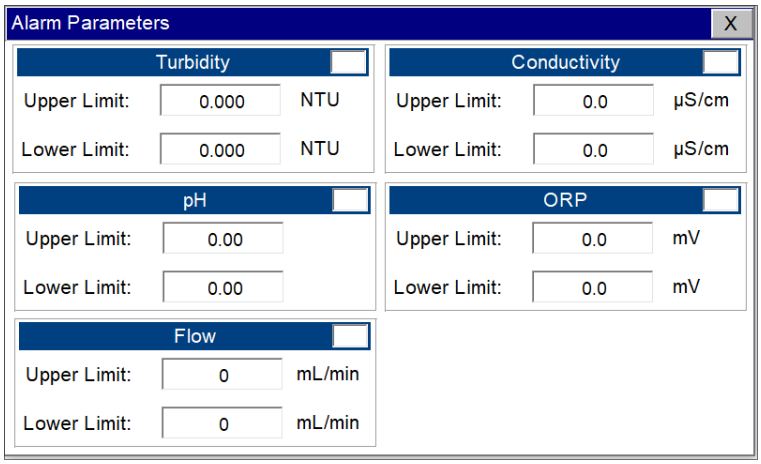


Figure. 20 - Alarm Parameter Setting

9.5.2. Control Parameters

The output control interface allows for the configuration of five parameters. Each parameter has four control modes including **Disable / Manual / Periodicity** and **Sensor Value**.

When the mode selection is set to **Disable**, there will be no relay output available.

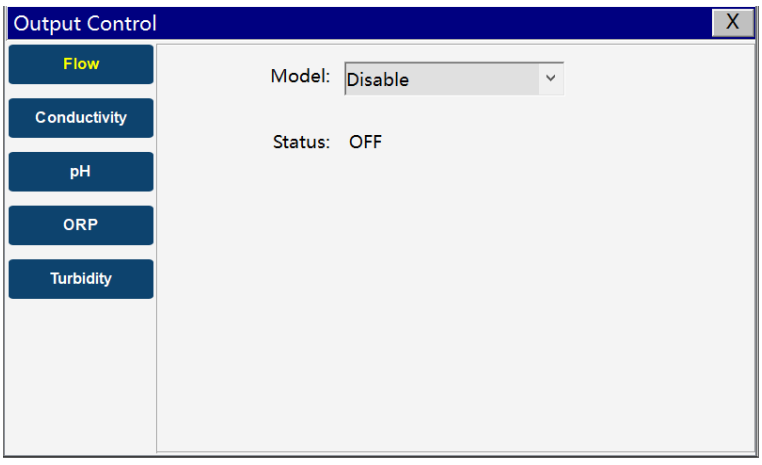


Figure. 21 - Disable

When the mode is selected as **Manual**, users can manually turn on the Output by clicking the "Turn On" button in the lower right corner and turn it off by clicking the "Turn On" button again.

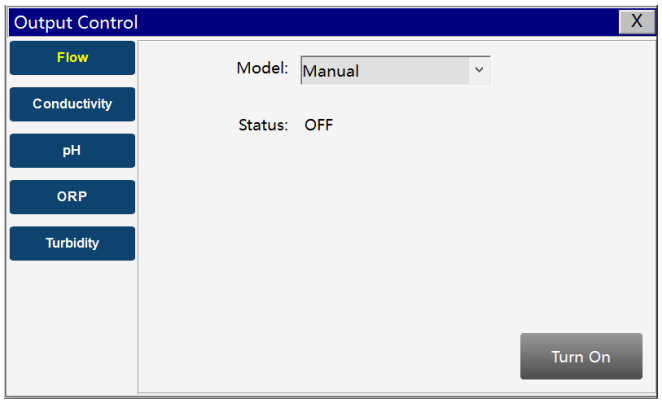


Figure. 22 - Manual

When the mode selection is **Periodicity**, it will periodically output according to the user programmed Interval Time and Running Time

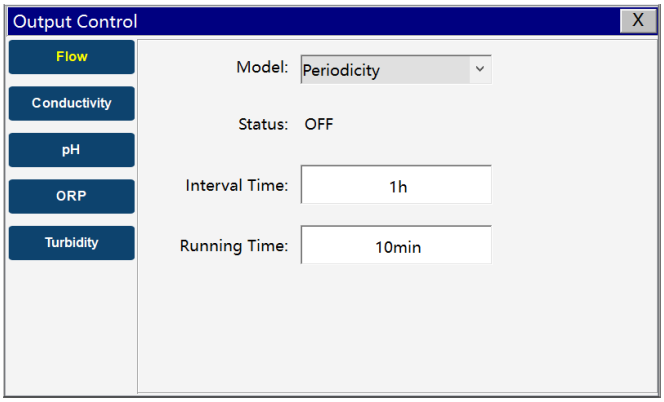


Figure. 23 - Periodicity

When the mode selection is **Sensor Value**, users can select which parameters they desire to control. See examples below.

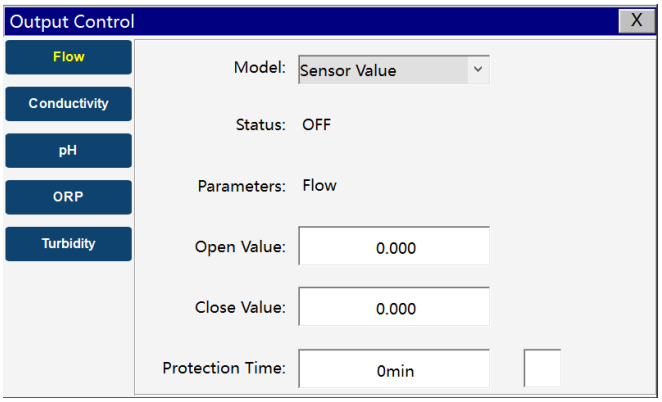


Figure. 24 - Sensor Value

Example 1: Open (ON) Value = 0.2

Close (OFF) Value = 0.5

Measured Value≤0.2 will Open the Relay

Measured Value≥0.5 will Close the Relay

Example 2: Open (ON) Value = 0.5

Close (OFF) Value = 0.2

Measured Value≤0.2 will Close the Relay

Measured Value≥0.5 will Open the Relay

Users can utilize the **Protection Time** to prevent over activation of the relay if the responding parameter does not come within desired range within a specified time. After relay opening, when the measured value continues to exceed the set shutdown value beyond the protection time, the relay will automatically shut down the output. This feature allows for overfeed prevention.

9.5.3. TDS/Conductivity Setup

Click "TDS/Cond Settings" to enter the setup interface, where TDS or conductivity can be selected according to the sensor, and the conversion factor can be set by the user below. ***NOTE*** The UC-100A will be preprogrammed with a default ratio of 0.67x Conductivity = TDS (ppm).

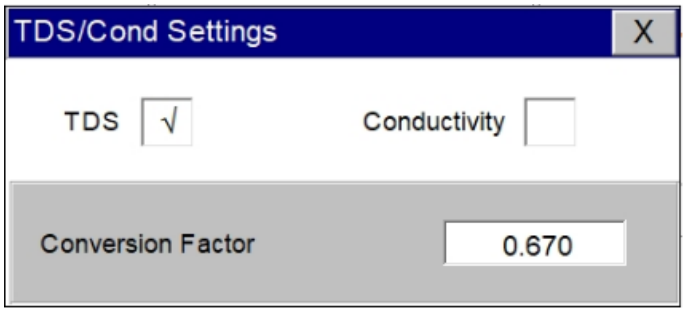


Figure. 25 - TDS/Cond Settings

9.5.4. Cleaning Parameters

The sensor brush cleaning operation be programmed to **AUTO** or **MANUAL** mode based on need. On the parameter setting interface, users can set the automatic cleaning cycle time frequency (minutes) and brush rotations per cleaning. ***IMPORTANT NOTE****A brush rotations per cleaning setting of 1 = 30 revolutions of the brush. Please keep this in mind when programming this section.*

When the brush is activated, the turbidity parameter will be locked. After configuring the corresponding time in the lock value recovery interface, upon the cessation of the brush operation, this value will remain locked and delayed by the specified duration before reverting to the real-time measurement value.

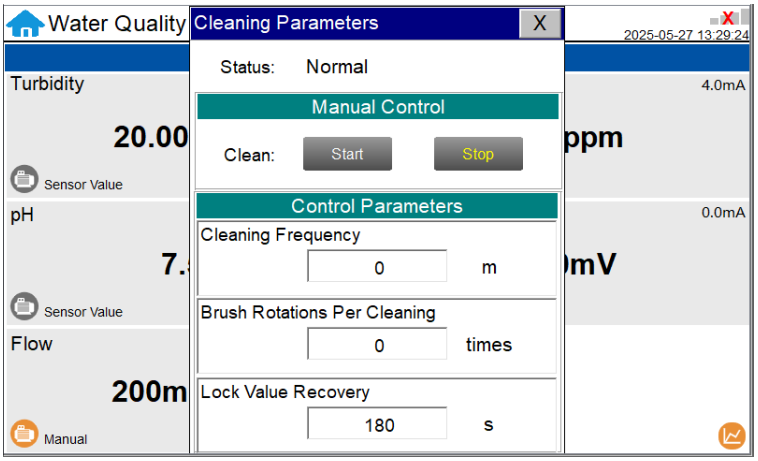


Figure. 26 - Cleaning Control

9.5.5. User Defined

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

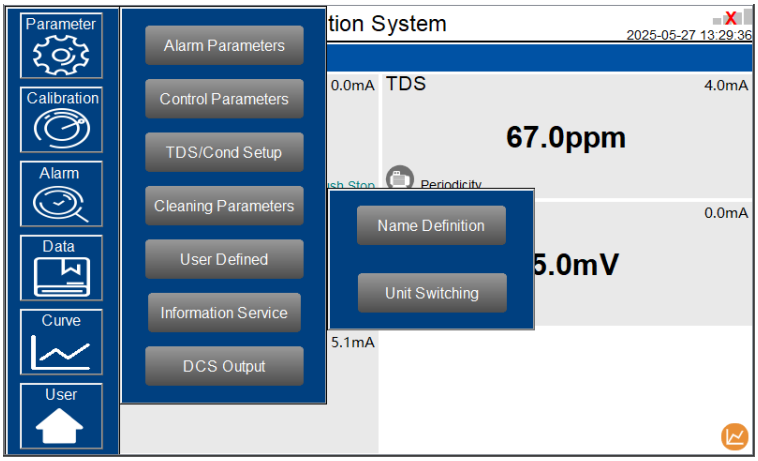


Figure. 27 - User Defined Settings

Parameter Name Definition

Click the orange dialog box to customize the sensor name.

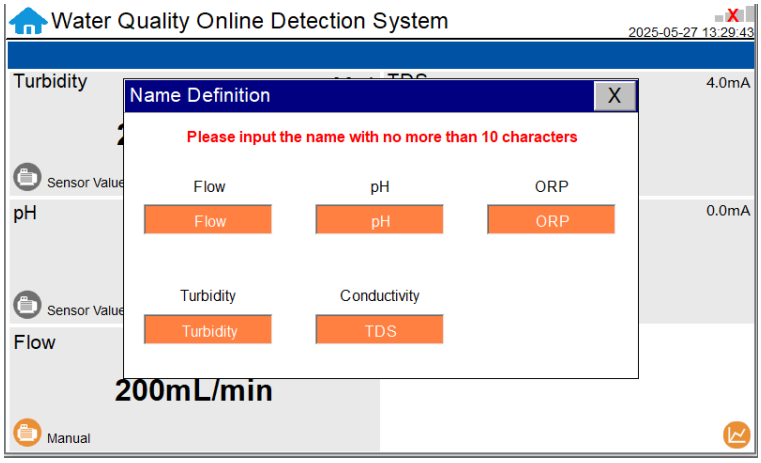


Figure. 28 - Name Definition

Unit of Measure Switching

Users can change the unit of flow in **"Unit Switching"**.

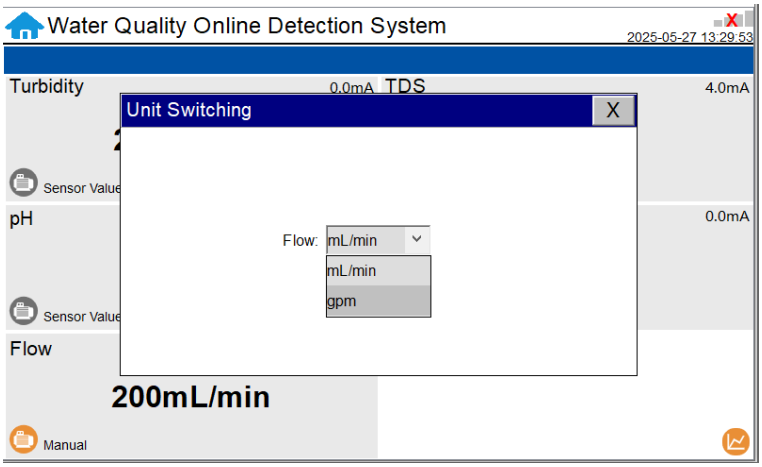


Figure. 29 - Unit Switching

9.5.6. Information Service

Clicking on **"Information Service "** opens a sub-menu for **Diagnostic Parameters** , **IO Monitoring** , **Terminal Definition Definition** and **Unit Switching**.

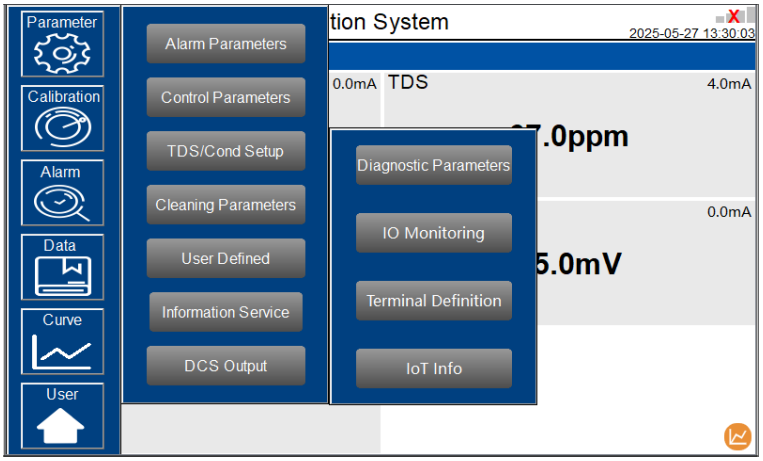


Figure. 30 - Information Service

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.

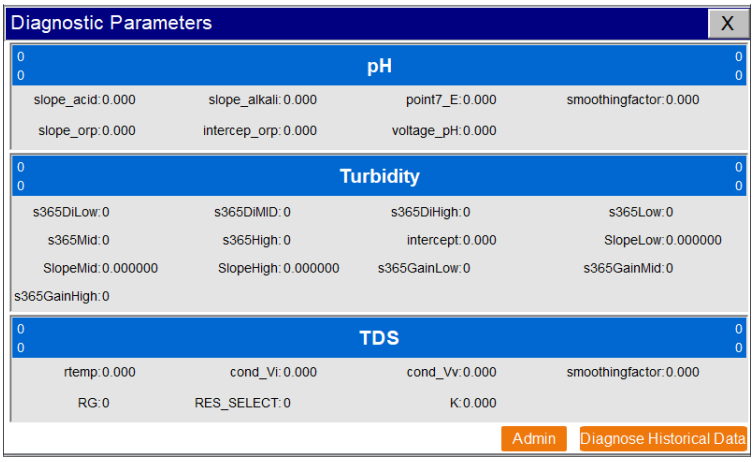


Figure. 31 - Diagnostic Parameters

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

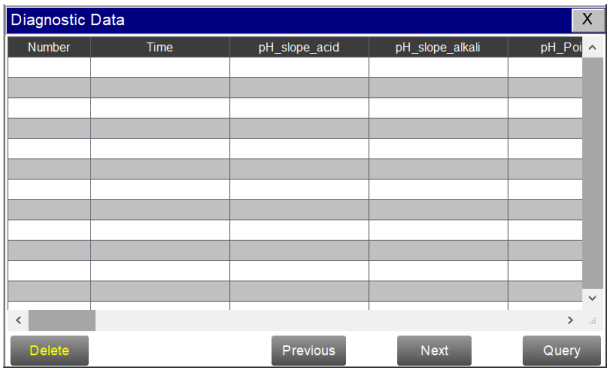


Figure. 32 - Diagnostic History Data

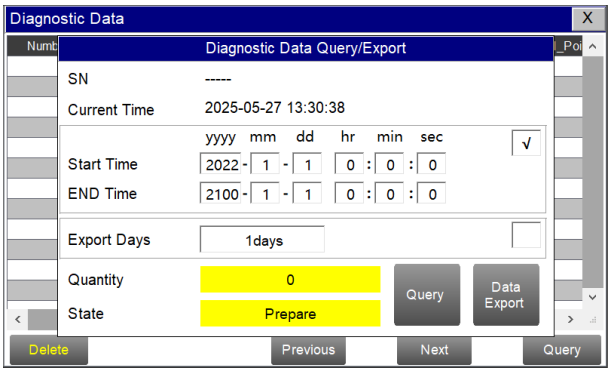


Figure. 33 - Diagnostic History Data Query

IO Monitoring

This interface enables users to monitor the operational status associated with the IO ports.

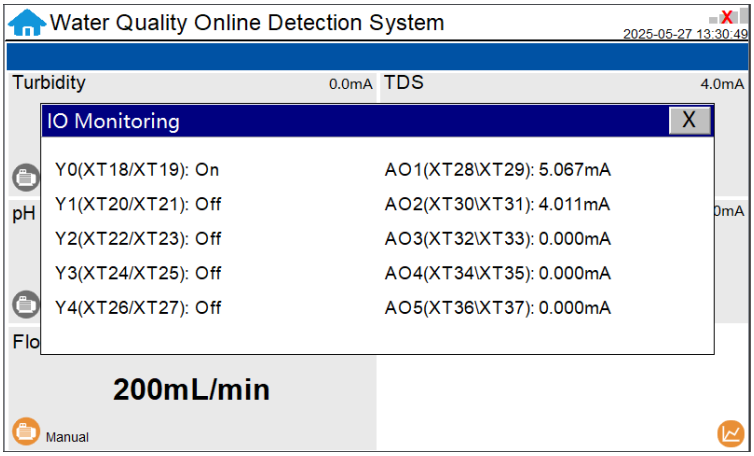


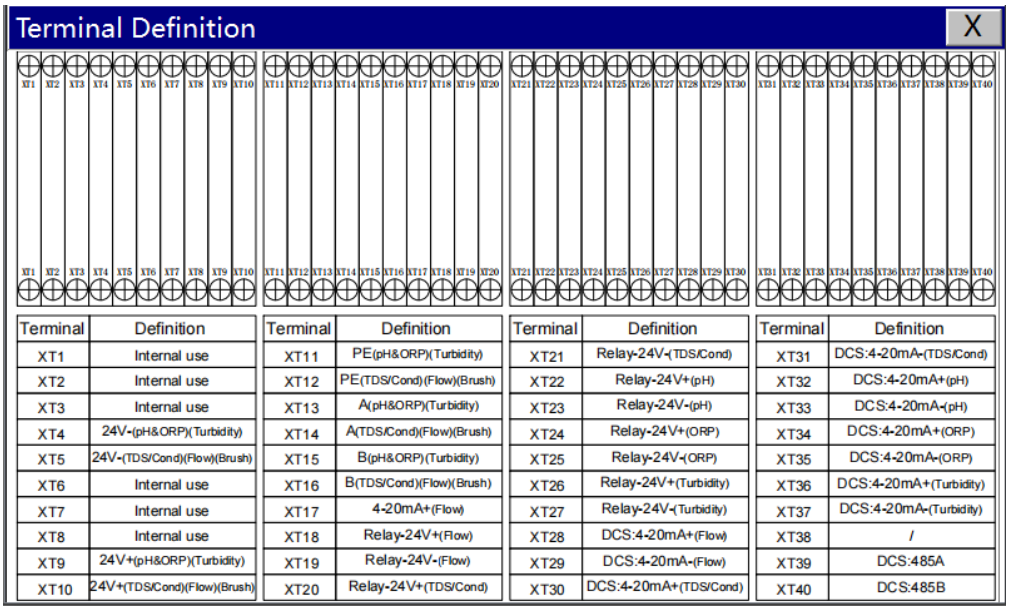
Figure. 34 - IO Monitoring

The corresponding table of names and parameters is presented below.

Name	Parameter
AO1	Flow
AO2	Conductivity
AO3	pH
AO4	ORP
AO5	Turbidity

Terminal Definition

This interface shows the terminal definitions of the terminal block.



Terminal	Definition	Terminal	Definition	Terminal	Definition	Terminal	Definition
XT1	Internal use	XT11	PE(pH&ORP)(Turbidity)	XT21	Relay-24V-(TDS/Cond)	XT31	DCS:4-20mA-(TDS/Cond)
XT2	Internal use	XT12	PE(TDS/Cond)(Flow)(Brush)	XT22	Relay-24V+(pH)	XT32	DCS:4-20mA+(pH)
XT3	Internal use	XT13	A(pH&ORP)(Turbidity)	XT23	Relay-24V-(pH)	XT33	DCS:4-20mA-(pH)
XT4	24V-(pH&ORP)(Turbidity)	XT14	A(TDS/Cond)(Flow)(Brush)	XT24	Relay-24V+(ORP)	XT34	DCS:4-20mA+(ORP)
XT5	24V-(TDS/Cond)(Flow)(Brush)	XT15	B(pH&ORP)(Turbidity)	XT25	Relay-24V-(ORP)	XT35	DCS:4-20mA-(ORP)
XT6	Internal use	XT16	B(TDS/Cond)(Flow)(Brush)	XT26	Relay-24V+(Turbidity)	XT36	DCS:4-20mA+(Turbidity)
XT7	Internal use	XT17	4-20mA+(Flow)	XT27	Relay-24V-(Turbidity)	XT37	DCS:4-20mA-(Turbidity)
XT8	Internal use	XT18	Relay-24V+(Flow)	XT28	DCS:4-20mA+(Flow)	XT38	/
XT9	24V+(pH&ORP)(Turbidity)	XT19	Relay-24V-(Flow)	XT29	DCS:4-20mA-(Flow)	XT39	DCS:485A
XT10	24V+(TDS/Cond)(Flow)(Brush)	XT20	Relay-24V+(TDS/Cond)	XT30	DCS:4-20mA+(TDS/Cond)	XT40	DCS:485B

Figure. 35 - Terminal Definition

IoT Info

This interface displays information related to the 4G gateway and the status of the connection.

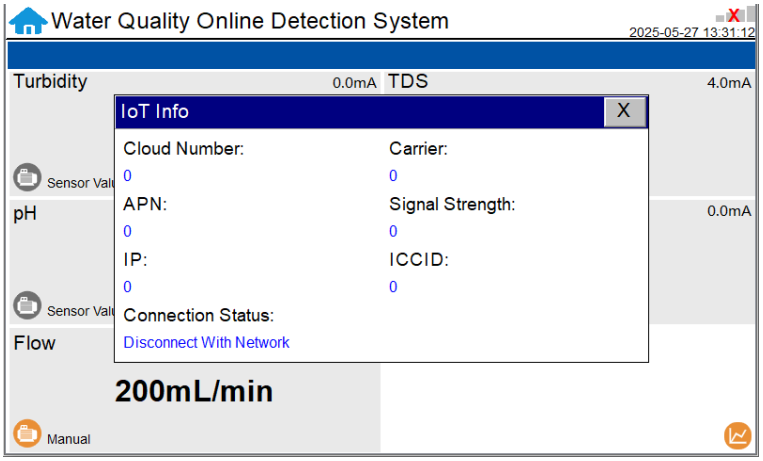


Figure. 36 - IoT Info

9.5.7. DCS Output

Clicking on **"DCS Output "** opens a sub-menu for **4-20mA Output** , **Modbus RTU** , **Modbus TCP**.

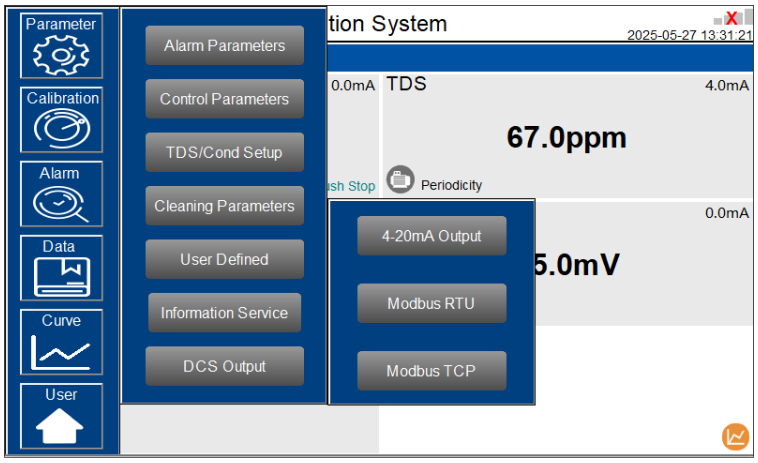


Figure. 37 - DCS Output

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.*

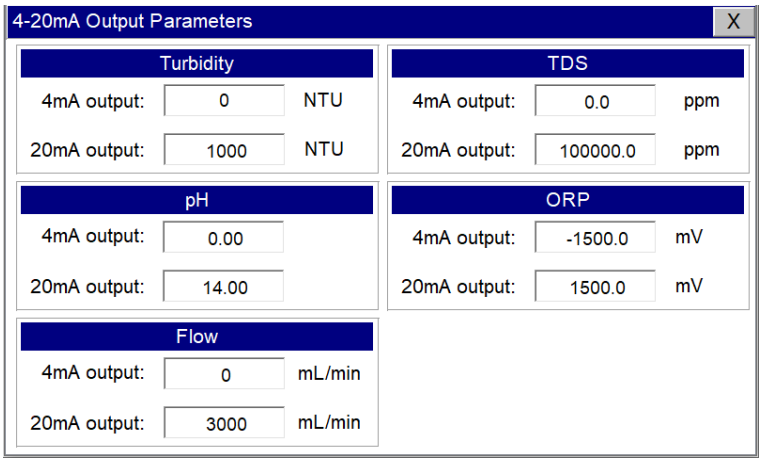


Figure. 38 - 4-20mA Output Setting

9.5.8. Comm Settings

Communication parameters generally do not need to be changed. If the communication station number and other parameters need to be changed on site, they can be changed on this interface.

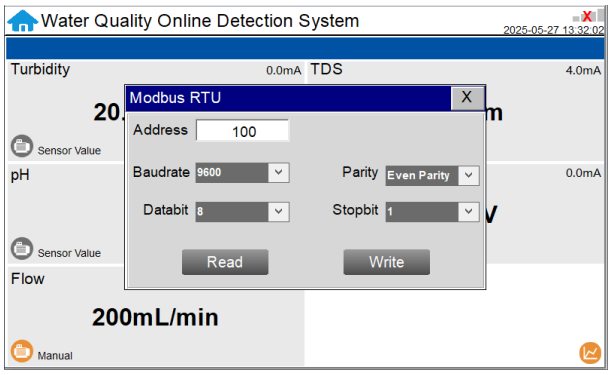


Figure. 39 - Modbus RTU

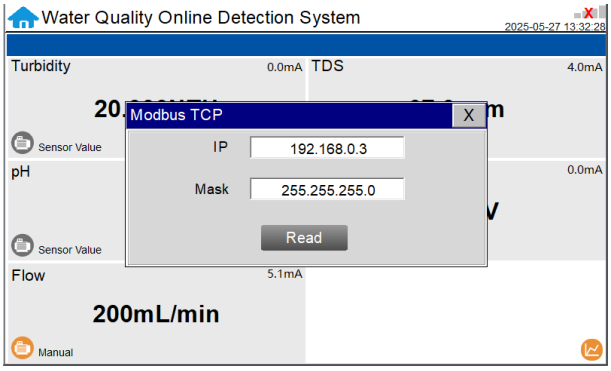


Figure. 40 - Modbus TCP

9.6. Sensor Calibration

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

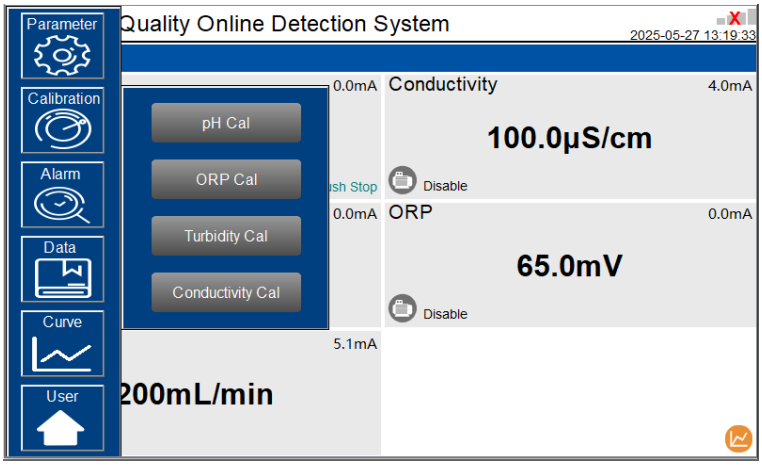


Figure. 41 - Sensor Calibration

9.6.1. 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-712 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.*

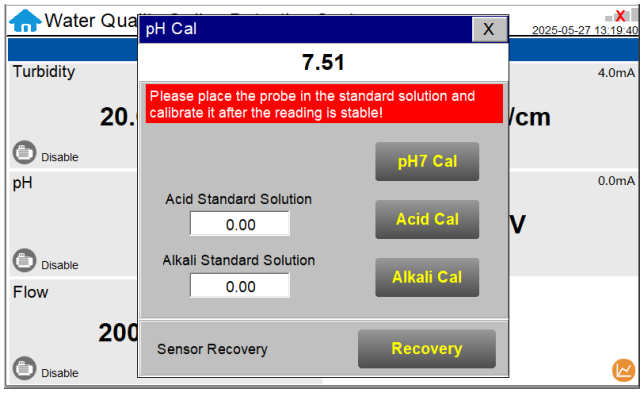


Figure. 42 - pH Calibration

Single Point pH Calibration

Remove the ST-712 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"**.

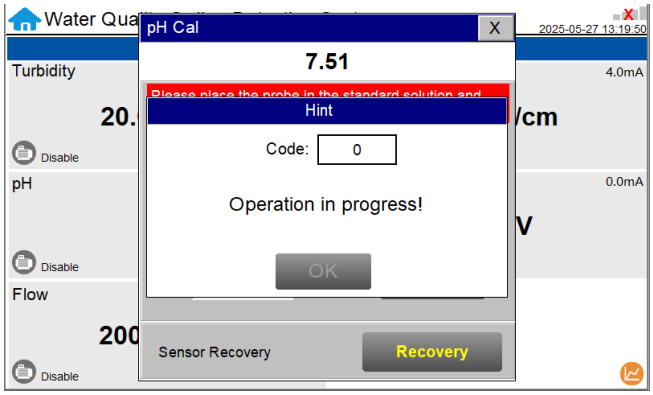


Figure. 43 - pH Calibration Prompt

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-712 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-712 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.

9.6.2. ORP Calibration

Close the water inlet valve and remove the 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 ORP-200 Calibration Standard Solution (P/N: 57020) or similar. Enter the known concentration of the ORP standard solution in the calibration screen and click **"Calibrate"**. A dialog box will pop up to confirm whether to perform this operation. If the calibration operation is confirmed, click **"OK"**. If the calibration is successful, the dialog box will display **"Calibration Successful"**.

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.*

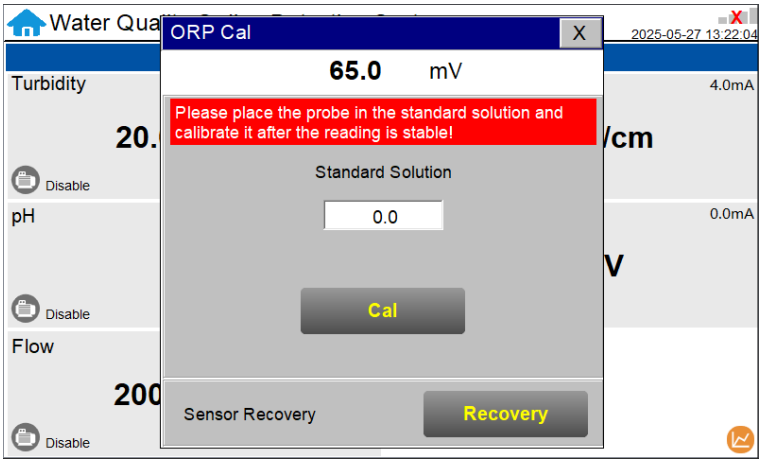


Figure. 44 - ORP Calibration

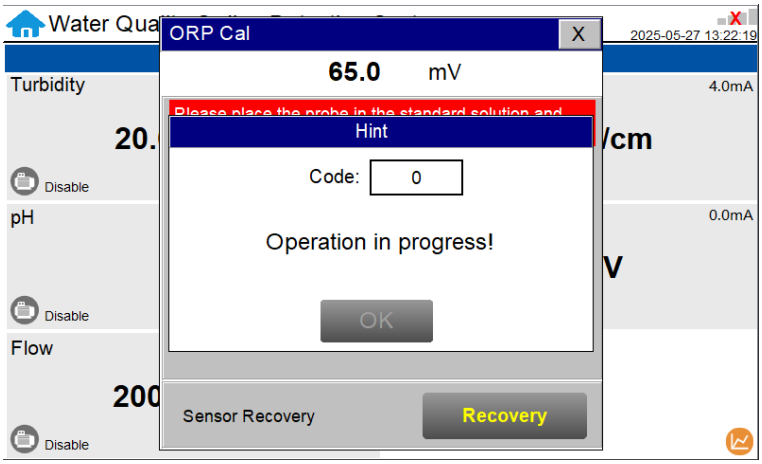


Figure. 45 - Awaiting Execution Screen

9.6.3. Turbidity Calibration

The LT-736 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.

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

Isolate the panel and drain the piping and inline Tee assemblies. Remove the LT-736 sensor from the FT-100 flow tee. Triple rinse the LT-736 sensor surface, the FT-100 flow tee internals and the L-CAL Portable Turbidity Calibration Kit (P/N 53247) vessel with Deionized water. Insert the cleaned LT-736 turbidity sensor into the L-CAL calibration vessel and positon the L-CAL vessel vertically . 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.*

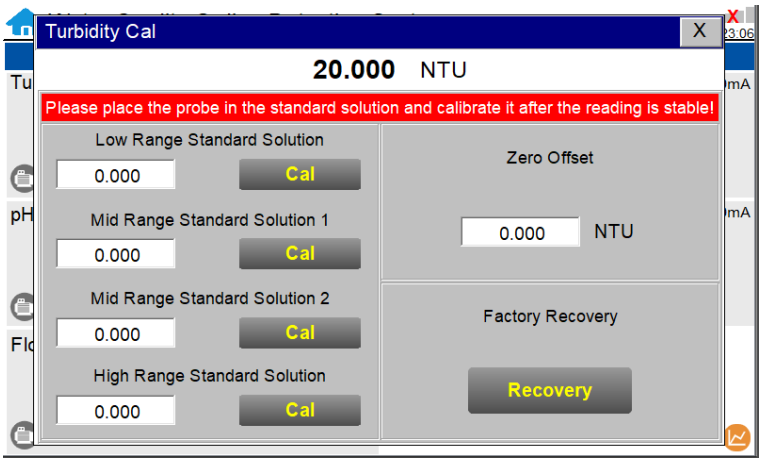


Figure. 46 - Turbidity Calibration Screen

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

The mid-range calibration of LT-736 is further divided into mid-low point calibration and mid-high point calibration. The turbidity standard solution concentration for mid-low point calibration is 1-10 NTU, and the calibration range for mid-high point is 10-100 NTU. If a mid calibration is required, proceed by rinsing the L-CAL vessel with Deionized water and refill with 500mL of a known turbidity standard solution for either mid-low point calibration or mid-high point calibration as required for intermediate calibration. After the displayed data is stable, enter the turbidity standard solution value and click on "Mid Range Standard Calibration 1" or "Mid Range Standard Calibration 2", 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:

If a high-range calibration is not required, the user does not need to perform a high-range calibration of the LT-736 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 540NTU and 660NTU for high-range calibration. 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-736 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.

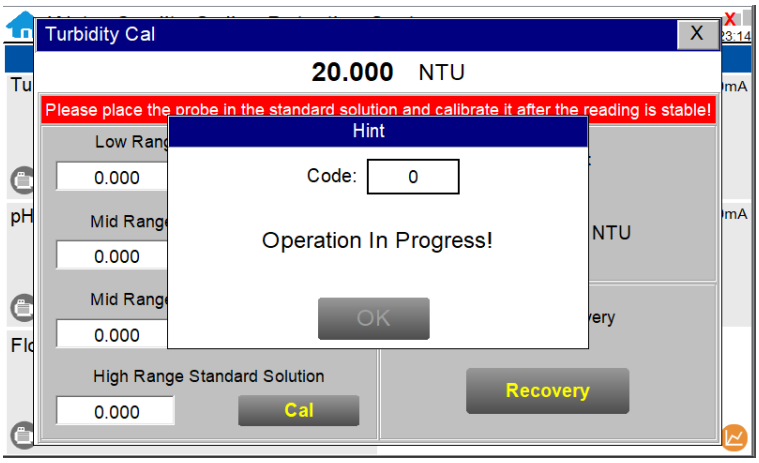


Figure. 47 - Awaiting execution Screen of Turbidity Calibration

LT-736 Calibration using L-CAL Portable Turbidity Calibration Kit

As an alternative to using the flow reservoir for LT-736 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-736
Calibration	**Recommended Calibration Standard Solution Range**
Low-Range (0.05NTU Recommended for Calibration)	Bubble Free DI Water or Sample <0.1 NTU
Mid-Low-Range	1 – 10 NTU
Mid-High-Range	10-100 NTU
High-Range	540– 660 NTU

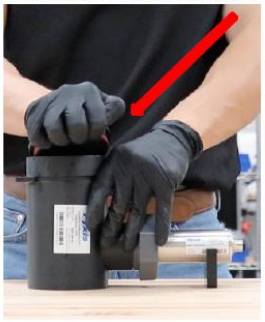
L-CAL Portable Liquid Formazin Calibration Kit Use Method

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*

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

9.6.4. 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.

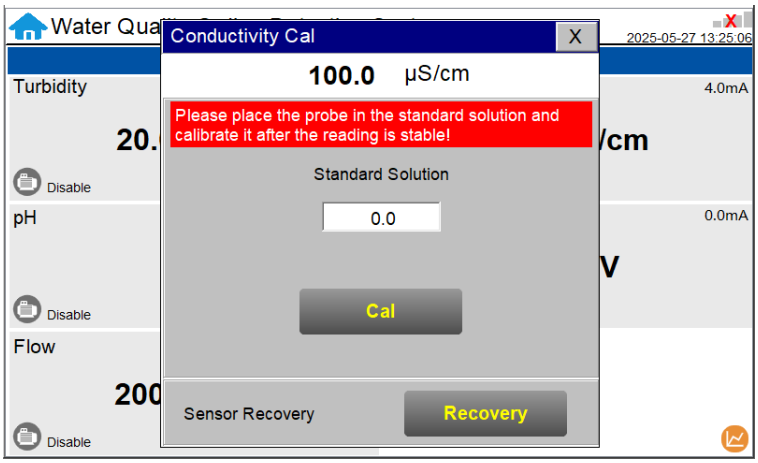


Figure. 48 - Conductivity Calibration

9.7. Alarm

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

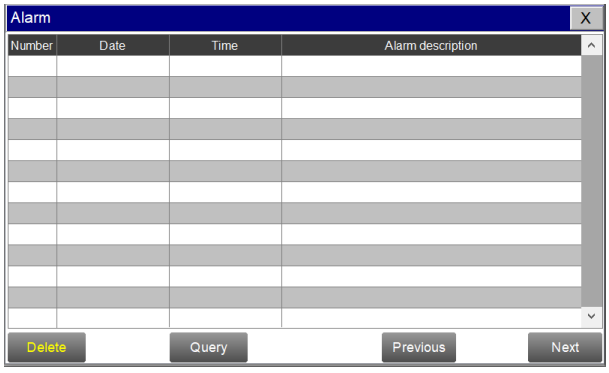


Figure. 49 - Alarm View

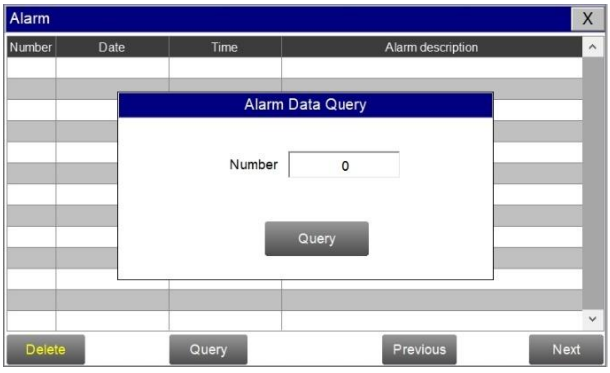


Figure. 50 - Alarm Data Query Screen

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.

9.8. Data

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

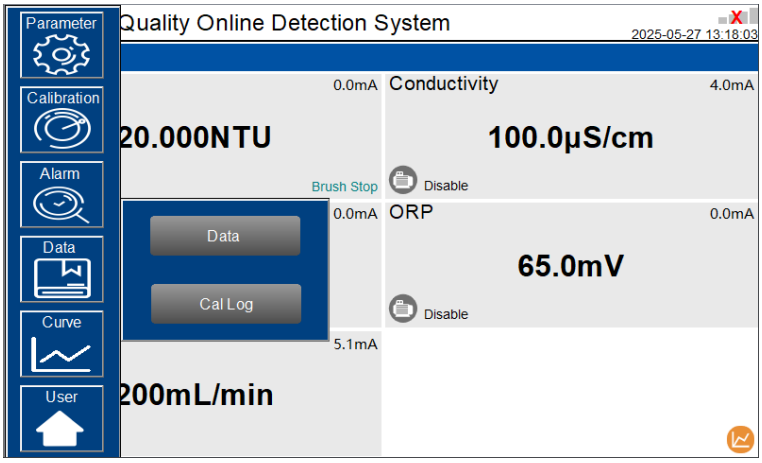


Figure. 51 - Data

9.8.1. Historical Data

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

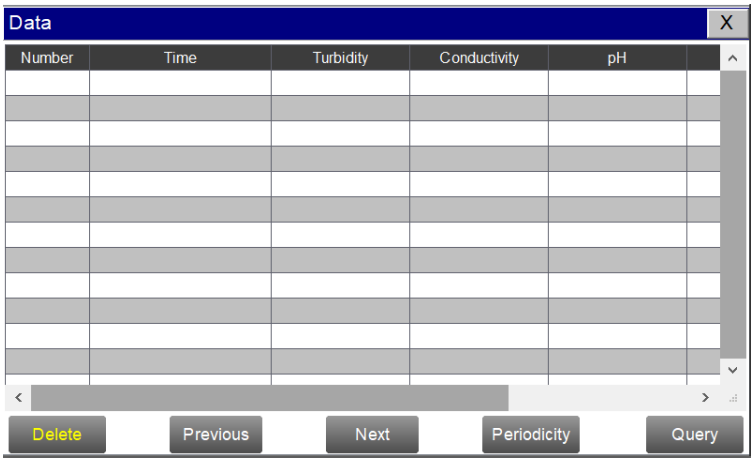


Figure. 52 - Historical Data Screen

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.

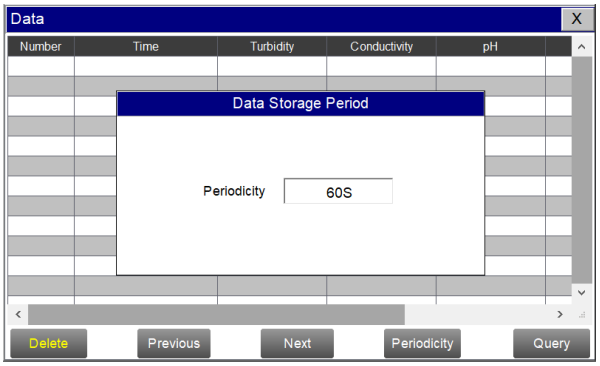


Figure. 53 - Data Storage Cycle Time Setting Figure.

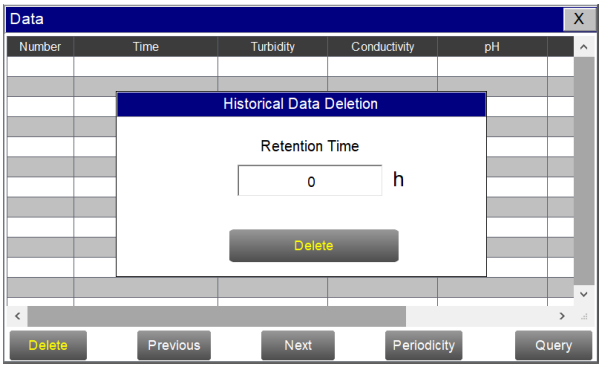


Figure. 54 - History Data Deletion Screen

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.*

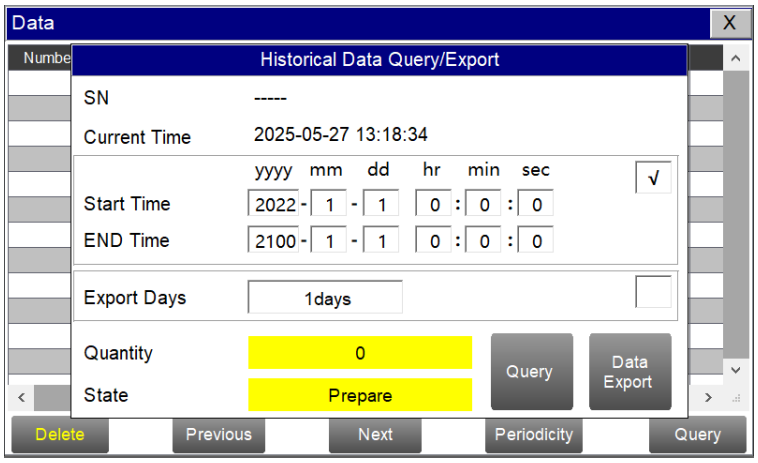


Figure. 55 - Historical Data Query and Export Screen

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

9.8.2. 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.

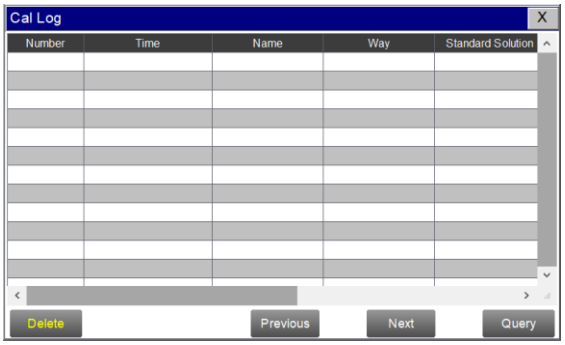


Figure. 56 - Calibration Log

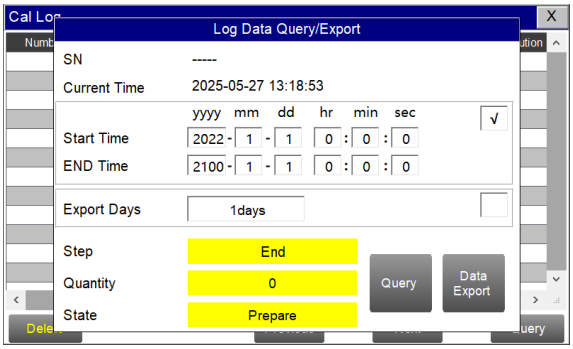
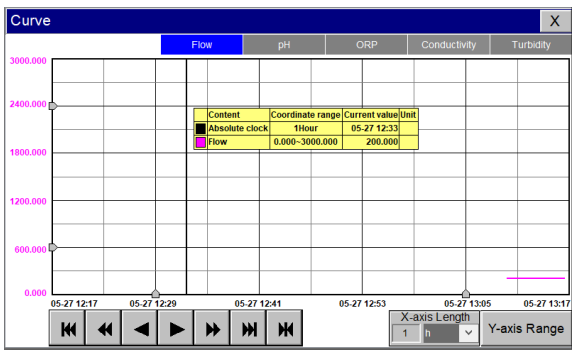


Figure. 57 - Calibration Log Query/Export

9.9. 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.



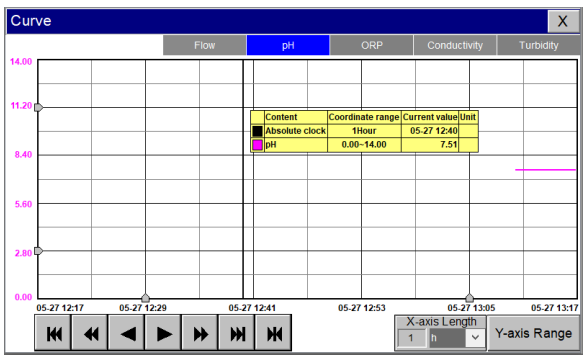
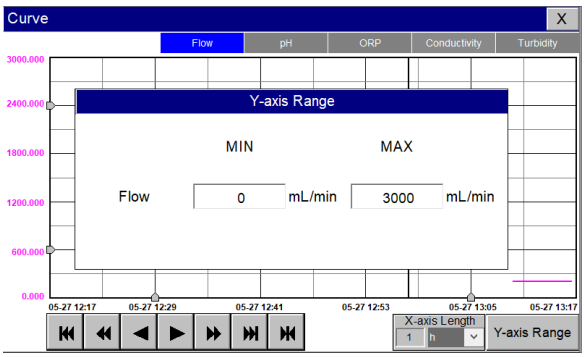


Figure. 58 - History Curve Screen 1-3

Figure. 59 - History Curve Screen 2-3



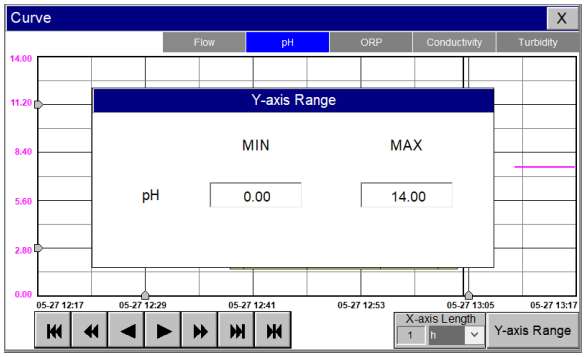


Figure. 60 - Y-axis Range Setting 1-2

Figure. 61 - 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. 62 - Button Function Review

9.10. User

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

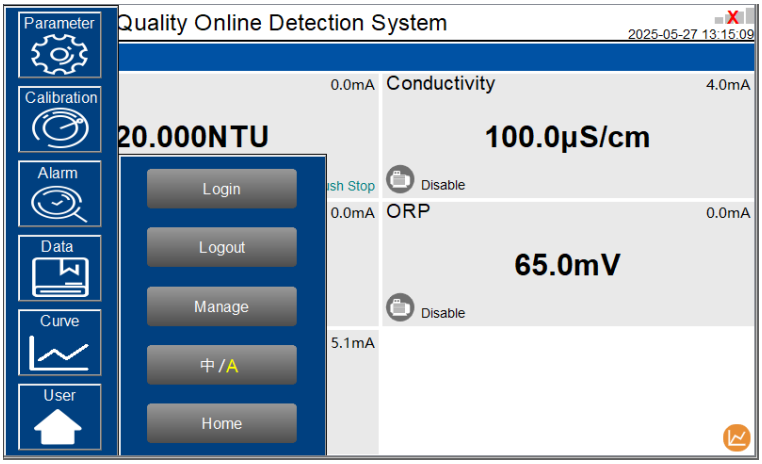


Figure. 63 - User Management

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.

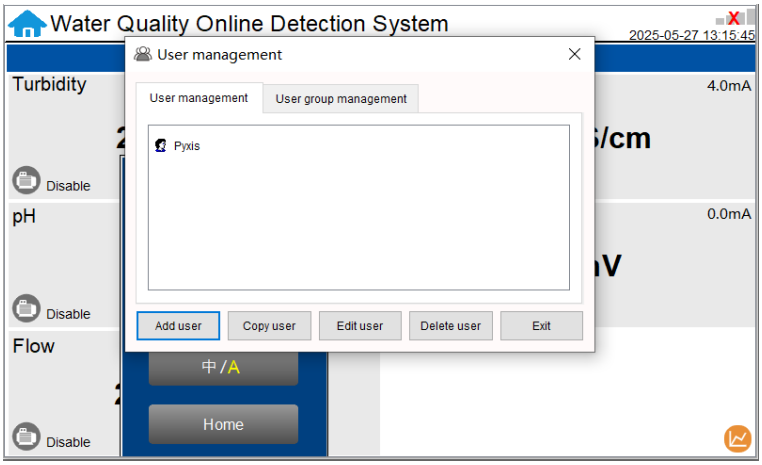


Figure. 64 - Modifying the User Screen

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.*

10. Modbus Register Table & Analyzer Maintenance

10.1. Modbus Correspondence Address

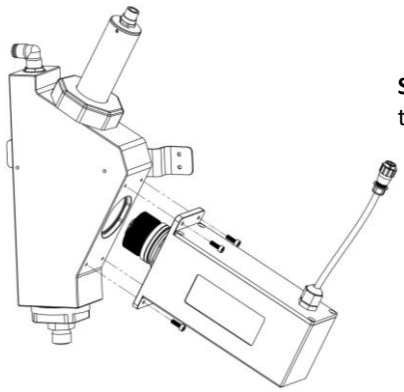
Number	Definition	Address	Format	Mode	Unit	Note
1	Turbidity	1	float	read-only	NTU	
2	TDS_Cond	3	float	read-only	ppm/µS/cm	Data
3	pH	5	float	read-only		Format
4	ORP	7	float	read-only	mV	ABCD
5	Flow	9	float	read-only	gpm/mL/min	
6	Turbidity Lower Limit Alarm	11	uint	read-only		
7	Turbidity Upper Limit Alarm	12	uint	read-only		
8	Conductivity Lower Limit Alarm	13	uint	read-only		
9	Conductivity Upper Limit Alarm	14	uint	read-only		
10	pH Lower Limit Alarm	15	uint	read-only		
11	pH Upper Limit Alarm	16	uint	read-only		
12	ORP Lower Limit Alarm	17	uint	read-only		
13	ORP Upper Limit Alarm	18	uint	read-only		
14	Flow Lower Limit Alarm	19	uint	read-only		0:Normal
15	Flow Upper Limit Alarm	20	uint	read-only		1: Alarm
16	Turbidity Sensor Communication Abnormal	21	uint	read-only		
17	Conductivity Sensor Communication Abnormal	22	uint	read-only		
18	pH_ORP Sensor Communication Abnormal	23	uint	read-only		
19	Flow Sensor Communication Abnormal	24	uint	read-only		
20	PLC Communication Abnormal	25	uint	read-only		
21	Analog Module Communication Abnormal	26	uint	read-only		
22	Cleaning module Communication Abnormal	27	uint	read-only		
23	Brush Abnormal	28	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

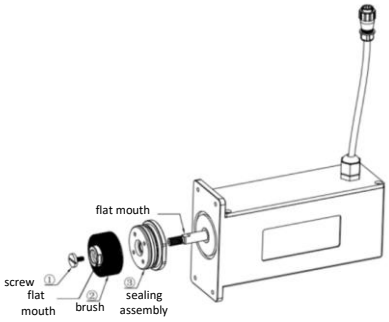
11. Replacement Maintenance

11.1. Replacing the FT-100-PLUS Brush & Seal Assembly

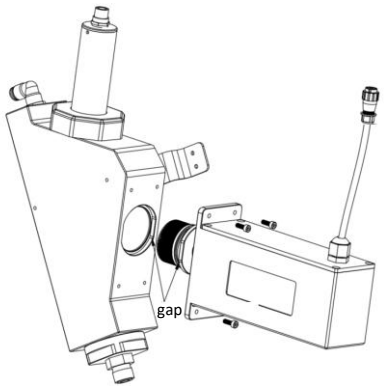
The Integrated Water Analyzer comes equipped with FT-100-PLUS automatic brush assembly for inline sensor cleaning and air bubble removal. Replacement of the brush and seal assembly should be conducted annually or as needed by following the process steps below.



STEP 1: Remove the 4 screws(M4), separate the flow-reservoir from the motor box.



STEP 2: Remove the shaft tip screw then rotate the brush head and remove the sealing assembly. Then replace with a new sealing assembly and brush head kit then reinstall and tighten the shaft screw.



STEP 3: Reinstall the motor-box parts shown and tighten the screws snuggly.

Figure. 65 - *Replacing FT-100-PLUS Brush & Seal Asse*

12. Contact Pyxis Lab

21242 Spell Circle
Tomball, TX. 77375
service@pyxis-lab.com for technical service and support
order@pyxis-lab.com for order and pricing inquires
1-866-203-8397 Phone USA for all needs
Office Hours 7AM – 5PM Central Time USA