Pyxis®

FS-100 Series Flow Meters

Ultrasonic Flow Meters (0–3,000mL/min)

Pyxis Lab® Inc.
1729 Majestic Dr. (Suite 5)
Lafayette, CO 80026
www.pyxis-lab.com

USER MANUAL

Pyxis User Manual

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Warranty Information

Confidentiality

The information contained in this manual may be confidential and proprietary and is the property of Pyxis Lab, Inc. Information disclosed herein shall not be used to manufacture, construct, or otherwise reproduce the goods described. Information disclosed herein shall not be disclosed to others or made public in any manner without the express written consent of Pyxis Lab, Inc.

Standard Limited Warranty

Pyxis Lab warrants its products for defects in materials and workmanship. Pyxis Lab will, at its option, repair or replace instrument components that prove to be defective with new or remanufactured components (i.e., equivalent to new). The warranty set forth is exclusive and no other warranty, whether written or oral, is expressed or implied.

Warranty Term

The Pyxis warranty term is thirteen (13) months ex-works. In no event shall the standard limited warranty coverage extend beyond thirteen (13) months from the original shipment date.

Warranty Service

Damaged or dysfunctional instruments may be returned to Pyxis for repair or replacement. In some instances, replacement instruments may be available for short duration loan or lease.

Pyxis warrants that any labor services provided shall conform to the reasonable standards of technical competency and performance effective at the time of delivery. All service interventions are to be reviewed and authorized as correct and complete at the completion of the service by a customer representative or designer. Pyxis warrants these services for 30 days after the authorization and will correct any qualifying deficiency in labor provided that the labor service deficiency is exactly related to the originating event. No other remedy, other than the provision of labor services, may be applicable.

Repair components (parts and materials), but not consumables, provided during a repair, or purchased individually, are warranted for 90 days ex-works for materials and workmanship. In no event will the in-corporation of a warranted repair component into an instrument extend the whole instrument's warranty beyond its original term.

Warranty Shipping

A Repair Material Authorization (RMA) Number must be obtained from Pyxis Technical Support before any product can be returned to the factory. Pyxis will pay freight charges to ship replacement or repaired products to the customer. The customer shall pay freight charges for returning products to Pyxis. Any product returned to the factory without an RA number will be returned to the customer. To receive an RMA you can generate a request on our website at Request Return or Repair - Pyxis Lab, Inc. (pyxis-lab.com)

Pyxis Technical Support

Contact Pyxis Technical Support at +1 (866) 203-8397 ext. 2., or by emailing service@pyxis-lab.com

1. Introduction

The new Pyxis FS-100 series are state-of-the-art ultrasonic flowmeters that operate on the principle of transit time difference with a measurement range of 0 – 3,000 mL/min and resolution of 1mL. In this flow measurement method, the propagation speed of ultrasonic waves downstream is faster than upstream, and the transit time difference is directly proportional to the flow rate.

The FS-100 series flow meter is perfectly suited for the flow measurement and are offered in two liquid end materials of construction, for standard water and highly corrosive water applications. The sensors advanced PCB design offers built-in temperature compensation to eliminate the effect of temperature with instantaneous, accumulated, and controlled water flow based on user setpoint within the sensor itself.

The FS-100 series flow meter is powered by a 24 VDC/1 W power supply and provides both 4–20 mA and RS-485 Modbus output signals for connection to any OEM controller, PLC or DCS.

FS-100 Series Ultrasonic Flow Meter

1.1 Main Features

- Real -time flow rate trend chart
- Dual flow meter signal outputs for valve control and flowrate: Isolated 4–20 mA and RS-485 Modbus.
- Ultrasonic flow meter with local display capable of 0 – 3,000 mL/minute measurement.
- Built in temperature sensor automatically compensates the effect of temperature on flowrate.
- Monitor and display instantaneous flowrate and accumulated volume.
- Large color LED indicator for operational state indication.
- CPVC Liquid End for Common Water Flow Measurement Applications (FS-100)
- PPS Plastic / GF Polymer Liquid End for Highly Corrosive Water Flow Measurement Applications (FS-101)

2. Specifications

Table 1.

Item	FS-100	FS-101
P/N	54200	58542
Supported Fluid	Liquids (water)	
Supported Fluid Temperature	4°C ~ 49°C (40°F ~120°F)	
Wet End Material of Construction	UPVC + PPS Plastic + GF Polymer + Epoxy+ Fluorine Rubber	PPS Plastic + GF Polymer + Epoxy + Fluorine Rubber
Sample Inlet Pressure	7.25 – 100 psi (0.05 – 0.689MPa)	
Sample Inlet /Outlet	1/2 - inch NPT	
Flow Path Inner Diameter	5mm	
FS-100 Rated Flow Range	0 – 3,000 mL/min	
FS-100 Minimum Flow Rate Detection	10mL/min	
FS-100 Resolution / Maximum Error	1mL/min or ±1% of the value	
FS-100 Display	1.44" Color 128 x128 Resolution	
FS-100 Analog Outputs (1)	1# 4-20mA for flow rate 2# 4-20mA for regulating valve	
FS-100 Digital Output	RS-485	
Power Supply	24V DC, 1W	
Panel Operation Temperature	32 – 122 °F (-0 – 50 °C)	
Panel Storage Temperature	-4 – 158 °F (-20 – 70 °C)	
Dimension (H x W x D)	145mm H x 50 mm W x 61.5mm D	
Weight	~ 600 g	
Humidity	5 – 95% No Condensation	
Protection	IP-65	
Regulation	CE / RoHS	

NOTE *(1) The flow control module supports only one 4-20mA (flow rate) output for connection to another device. A second 4-20mA output is internally connected and used to control the regulating valve. Specifications are subject to change without notice.*

3. Unpacking Instrument

Remove the instrument and accessories from the shipping container and inspect each item for any damage that may have occurred during shipping. Verify that all items listed on the packing slip are included. If any items are missing or damaged, please contact Pyxis Customer Service at service@pyxis-lab.com

3.1 Standard Accessories

- One **FS-100** ultrasonic flow meter (P/N: 54200) or One **FS-101** ultrasonic flow meter (P/N: 58542)
- Includes mounting materials.
- Includes one CE-FE-4.9 Flying Lead Cable with Female 7-Pin Adapter – 1.5m/4.9 feet (P/N: 50762)
- The full instrument manual is available for download at Support Documents - Pyxis Lab, Inc. (pyxis-lab.com)

3.2 Optional/ Replacement Accessories

The following optional accessories can be ordered from Pyxis Customer Service (order@pyxis-lab.com) or Pyxis E-Store at https://pyxis-lab.com/shop/

Table 2.

Accessory Name	Part Number
MA-AC-7US Power outlet adapter cable with USA/Type A plug 110VAC-24VDC	26398
MA-AC-7EU Power outlet adapter cable with EU/DIN plug 230VAC-24VDC	28787
CE-FE-4.9 Flying Lead Cable w/Female 7-Pin Adapter – 1.5m/4.9ft	50762
Nano-Flow Control Module FS-100 Ultrasonic Flow meter + Regulating valve	21329

4. Dimension & Installation

4.1 FS-100 Series Dimension(mm)

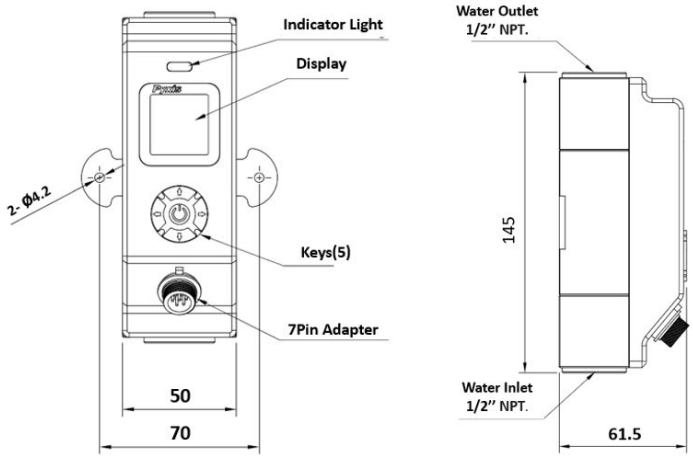


Figure 1.

4.2 Mounting Location

When measuring liquids, the flow meter should be installed in a vertical pipe that the fluid flows from the bottom up.

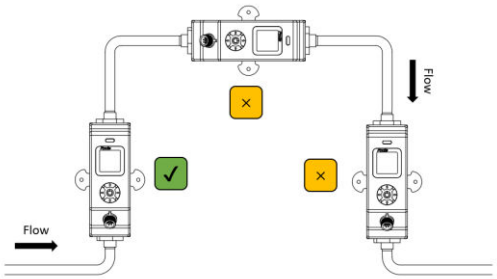


Figure 2.

4.3 Panel Mounting

Mounting Materials (included)

- 2 × M4 screws
- 2 × M4 Spring pad
- 2 × M4 Flat pad
- 2 × M4 Nuts

Panel Mounting Procedure:

1. Use the mounting plate on the back of the FS-100 as a template to mark the positions of two holes.
2. Drill the holes: Ø 4.2mm

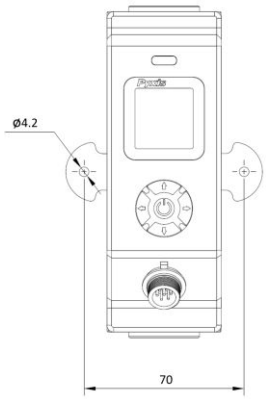


Figure 3.

3. Install the FS-100 using the mounting materials and tighten the screws snuggly.

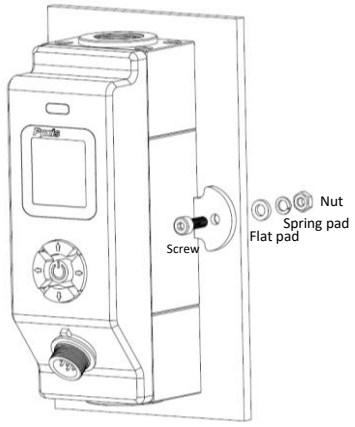


Figure 4.

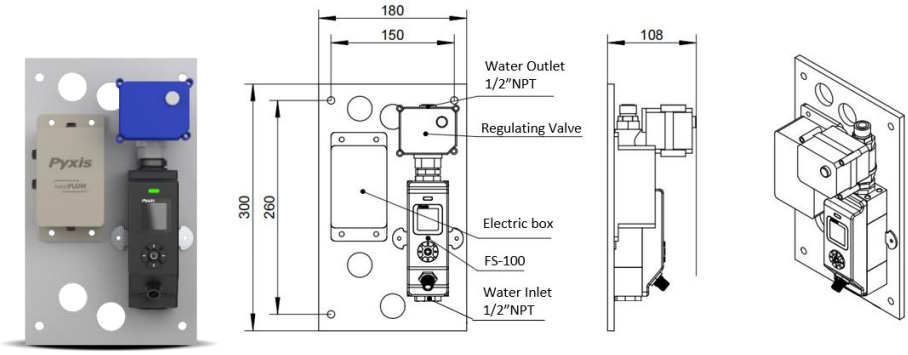
4.4 Nano-Flow™ Control Module

Sold separately, the Pyxis Nano-Flow Control Module is a stand-alone water flow measurement and control solution designed for use in critical cooling and process-water sample flow applications. This unique platform provides precise flow measurement and regulation and may be installed upstream of inline sensors in water systems that are subject to pressure and flow variation challenges.

The Nano-Flow module is offered in a convenient and easy to integrate micro-panel mounted format for rapid installation, setup and maintenance. The micro-panel design is equipped with the Pyxis FS-100 ultrasonic flowmeter with display, which directly controls a pre-mounted regulating valve through a simple to program user interface.

Table 3.

Item	P/N	Description
Nano-Flow™ Control Module	21329	FS-100 Ultrasonic Flow meter + Regulating valve



5. FS-100 Series Electrical Connection

The FS-100 series flowmeters provide 2x 4-20mA and 1x RS-485 output signals. The #1 4-20mA output (white wire) provides the sensor flow signal 0 – 3,000mL/minute to be connected to a receiving device. The #2 4-20mA output (green wire) provides the user defined flow control setpoint for operating a flow regulating valve capable of 4-20mA input. Users should connect the CE-FE-4.9 7-Pin Explosion-proof Female Adapter / Flying Lead Cable (P/N 50762) that is provided with each FS-100 flowmeter package and refer to the wiring table below for proper wiring. ***NOTE*** *Pyxis offers outlet plug in power supply adapter cables in both USA-Type A and EU-DIN formats for those desiring to power the FS-100 series via outlet. See Optional/Replacement Accessories Section 3.2 for details.*

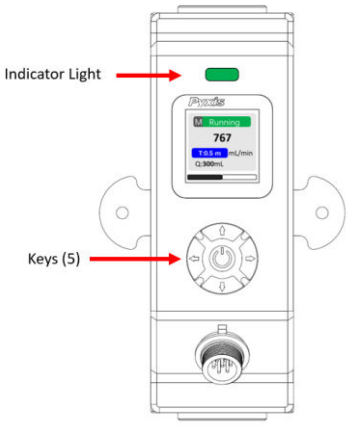
Table 4.

Wire Color	Designation
Red	24V +
Black	Power Ground / 4-20 mA-
White	1# 4-20 mA+ for flow rate
Green	2# 4-20 mA+ for flow control
Blue	RS-485 A
Yellow	RS-485 B
Silver	Earth Ground

FS-100 Flowmeter 4-20mA Scaling		
Unit of Measure	**4mA Value**	**20mA Value**
Flow Rate(mL/min)	0 mL/min	3000 mL/min

6. FS-100 Series Operation

6.1 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 Light

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

LED Behavior	Status
Green	Normal Running
Red	Alarm Information

6.2 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 (3) (unit: auto range)

(1) **R** = Average Flow Rate Mode / **M** = Instantaneous Flow Rate Mode / **C** = Flow Rate Control Mode
NOTE *For C-Mode please refer to Section 6.5 for programming details.*

(2) The **Timer** feature is enabled when the FS-100 is powered on. It can be set by pressing the ▼ key.
- **Pause or Resume the Timer Display:** Press ▼ key momentarily and release.
- **Reset the Timer:** Press and hold ▼ key for about two seconds.

(3) Calculation of the accumulated flow and **Timer** work synchronously, i.e., when the **Timer** is pause, pause display value; when the timer is resume, normally display the value; when the **Timer** is reset, clear the value.

6.3 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.

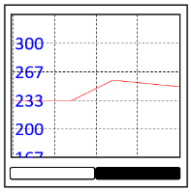


Figure 6.

6.4 Alarm Settings

Press ◀ or ▶ in the setting menu and select ***[Alarm]***. From Alarm settings screen, press ▲ or ▼ to adjust the displayed number, then press ◀ to move the cursor to "Yes". ***NOTE*** *To enable the alarm function, the Detection Time(s) must ≥ 1 second.*

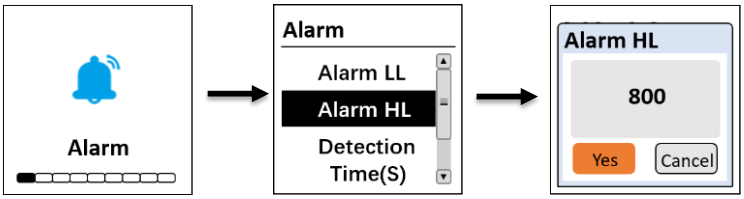


Figure 7.

The Upper Alarm (Alarm HL) and **Lower Alarm (Alarm LL) limit** are constantly compared with flow rate value. Once the flow rate value exceeds the alarm upper limit or falls below the alarm lower limit, and the duration time is longer than the user programmed detection time, the main screen and LED indicator will display a red alarm status as shown in Figure 8.

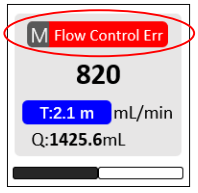


Figure 8.

6.5 Set the Operating Mode for the FS-100

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

- **Flow Rate =** Display the average flow rate.
- **Flow Meter** = Display the instantaneous flow rate.
- **Flow Control*** = Set a desired constant flow rate.

NOTE *The Flow Control mode should be used with a regulating valve. Pyxis offers a "Turn-Key" flow control solution called Nano-Flow™, please refer to Section 4.4 for more details.*

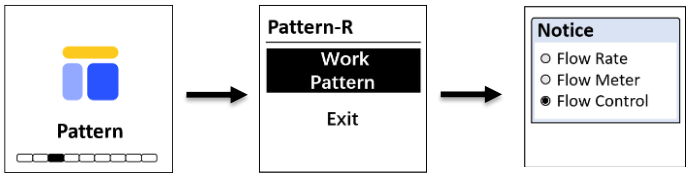


Figure 9.

If the user selects **Flow Control** mode, a preset flow rate must be entered (Figure 10). The FS-100 will control the regulating valve according to the preset flow rate.

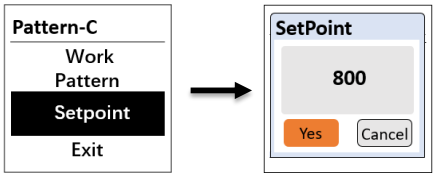


Figure 10.

NOTE *If the actual flow rate does not reach the preset flow rate, and duration time is longer than two minutes, the main screen and LED indicator will display red alarm status* Flow Control Err.

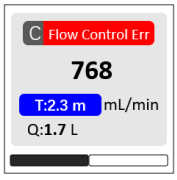


Figure 11.

6.6 Flow Regulating Valve Output - 4-20 mA Span

The FS-100 series flow meter controls the valve position of the regulating ball valve by outputting the 4-20 mA signal. After the user assigns a desired flow set point in **Flow Control (C)** mode, the FS-100 series will automatically calculate the error between the actual flow rate and the setpoint flow rate and adjust the appropriate 4-20mA output value through the preprogrammed PID algorithm to regulate the valve. This advanced capability and feature provides turn-key and real-time application use resulting in the sample flow rate infinitely close to the user programmed setpoint value. See process diagram below.

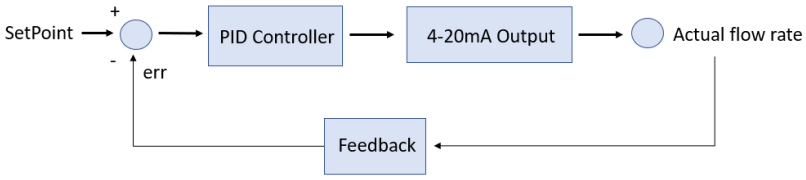


Figure 12.

6.7 Flow Measurement Output - 4-20 mA Span

Press ◀ or ▶ in the setting menu and select ***[4-20mA Out]*** to change the 4-20mA output corresponding to the flow rate. See Figure 13 for details. ***NOTE*** *The default 4–20mA output of the FS-100 flowmeter is scaled as: 4mA = 0 mL/min, 20 mA = 3000 mL/min.*

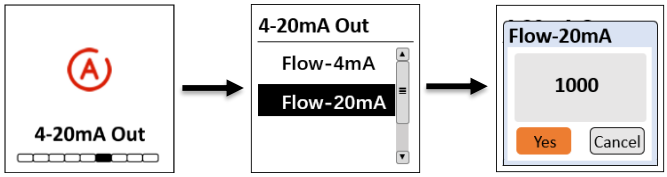


Figure 13.

6.8 Modbus Communication Settings

Press ◀ or ▶ in the setting menu and select ***[Com]*** to modify communication parameters (Figure 14).

The following communication settings are available:

- **Modbus Address** *(Range: 1~247)*
- **Baud Rate** *(Options: 9600 / 38400 / 57600 / 115200)*
- **Parity** *(Options: None / Odd / Even)*

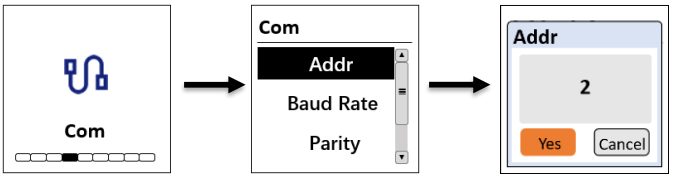


Figure 14.

6.9 Calibration

During flow meter ZERO & SLOPE calibration, the FS-100 must be set to instantaneous flow mode. ***NOTE*** *Please refer to Section 6.5 to set the operating mode for FS-100).*

6.9.1 Two-Point Calibration

Zero Calibration: This function is used to correct the instantaneous flow rate to "ZERO". ***NOTE*** *To perform zero calibration the pipe must be filled with fluid and the fluid should not be moving.*

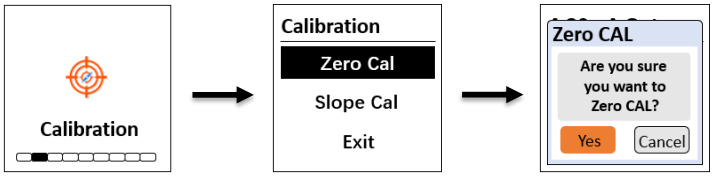


Figure 15.

Slope Calibration: This function is used to calibrate the accumulated flow value. Determine the accumulated flow value of the sample water over a period of time by using the electronic balance. The user can customize the sampling time to their preference.

1. Turn off the water valve and place the water outlet line in a beaker.
2. From the main screen, reset the Accumulated Flow Value (Q) to 0.00mL by pressing and holding the ▼ key for about two seconds.
3. Quick Press the ▼ key to restart the calculation of the accumulated flow value. Turn on the water valve and fill the beaker with water.
4. Navigate to Slope Calibration screen and enter the measured value of the shot amount as noted by the electronic balance (as grams). ***NOTE*** *1-mL of water weighs 1-gram.*

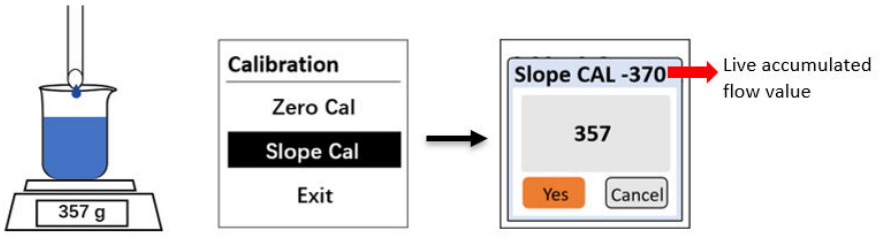


Figure 16.

5. If the calibration was successful, the interface will return a message "calibration succeed".

6.9 Display Screen Orientation Settings

Press ◀ or ▶ in the setting menu and select ***[Screen]*** to select the display orientation of the screen.

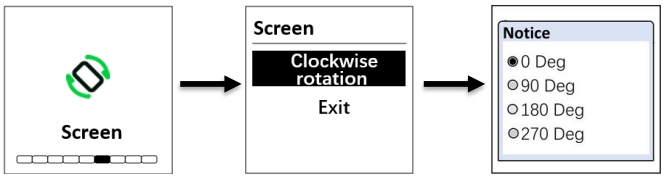


Figure 17.

6.10 Device Information

Press ◀ or ▶ in the setting menu and select ***[Info].*** This screen contains the device name, serial number, hardware version(HV), software version(SV), full scale value- mL/min (FS), Flow Path Inner length - cm (PipeL) and Flow Path Inner Diameter - cm (PipeD).

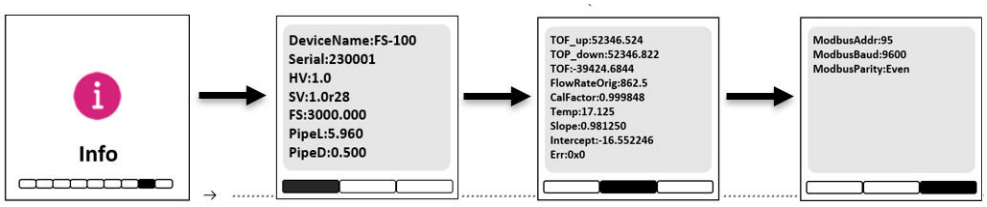


Figure 18. **Figure 19.** **Figure 20.**

Press ▶ to turn the page. This screen (Figure 19) 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.

Figure 20 page shows the current **Modbus** communication parameters. Please follow these settings when using **Modbus RTU** , *see Section 7*.

6.11 Restore to Factory

Commented [RG1]: Add restore to factory function

If the user wants to restore all device settings to factory default parameters, Navigate to ***[Info]*** screen (Figure 18), press and hold ⏻ key for about two seconds, the FS-100 will reboot itself.

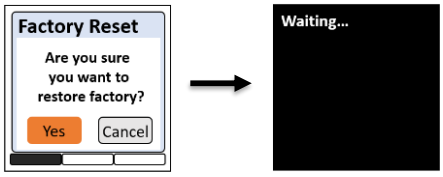


Figure 21.

7. Communication Using Modbus RTU

The FS-100 series ultrasonic flowmeter is configured as a Modbus slave device. In addition to flow rate mL/min and temperature ℃ values, many operational parameters, including warning and error messages, are available via Modbus RTU connection. Contact Pyxis Lab Customer Service (service@pyxis-lab.com) for more information.

8. Contact Us

Pyxis Lab, Inc
21242 Spell Circle
Tomball, TX. 77375 USA
www.pyxis-lab.com
Phone: +1 (866) 203-8397
Email: service@pyxis-lab.com