Pyxis®

nanoFLOW™

Sample Water Flow Control Module

with FS-100 Ultrasonic Flow Meter + Regulating Valve

START-UP GUIDE

1   Product Description

The Pyxis Nano-Flow™ and Nano-Flow PLUS™ Control Module are stand-alone water flow measurement and control solutions 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 series module are offered in a convenient and easy to integrate micro-panel mounted format for rapid installation, setup and maintenance. Each micro-panel assembly integrates an ultrasonic flowmeter with display and a pre-mounted regulating valve controlled through a simple-to-program user interface: the Nano-Flow module is equipped with the Pyxis FS-100, while the Nano-Flow PLUS module is equipped with the Pyxis FS-200.

The new Pyxis FS-100/200 series are state-of-the-art ultrasonic flowmeters that operate on the principle of transit time difference. 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 provides a measurement range of 0–3,000 mL/min, while the FS-200 series extends the range to 0–10,000 mL/min; both offer a resolution of 1 mL for precise water flow measurement.   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.

Nano-Flow Series Control Module

The Nano-Flow™ series module also incorporates an electric box for panel power supply, internal regulating valve control and FS-100/200 output flow signal wiring with both 4-20mA and RS-485 Modbus for connection to any OEM controller, PLC or DCS.

1.1   Features

- Panel Mounted for Simple Installation and Startup
- Ultrasonic flowmeter with local display 0–3,000 mL/min (FS-100) & 0–10,000 mL/min (FS-200)
- Pre-wired regulating valve controlled via user programmed ultrasonic flow meter setpoint
- Dual Flow Meter Signal Outputs: isolated 4–20 mA and RS-485 Modbus
- Real - time flow rate trend chart
- Built-in temperature sensor automatically compensates the effect of temperature on flow-rate
- Monitor and display instantaneous flow rate and accumulated volume
- Large color LED indicator for operational state indication

2   Specifications

Table 1

Item	Nano-Flow™ Control Module	Nano-Flow PLUS™ Control Module
P/N	21329	20867
Supported Fluid	Liquids (water)	
Supported Fluid Temperature	4°C ~ 49°C (40°F ~120°F)	
Wet End Material of Construction	Regulating Valve: CPVC + PTEE + Fluorine rubber Flowmeter: UPVC + PPS Plastic + GF Polymer + Epoxy+ Fluorine rubber	
Sample Inlet Pressure	7.25 – 100 psi (0.01 – 0.690 MPa)	
Sample Inlet /Outlet	1/2 - inch NPT	
Flowmeter model	FS-100	FS-200
Flow Path Inner Diameter	5mm	12mm
Flowmeter Rated Flow Range	0 – 3,000 mL/min	0 – 10,000 mL/min
Minimum Flow Rate Detection	10mL/min	
Flowmeter Resolution	1mL/min	
Flowmeter Maximum Error	±10mL or ±1% of the value, whichever is greater	±40mL or ±1% of the value, whichever is greater
Flowmeter Display	1.44" Color 128 x128 Resolution	
Flowmeter Analog Output[1]	1# 4-20mA for flow rate 2# 4-20mA for regulating valve *(internally connected)*	
Flowmeter Digital Output	1 × Isolated RS485, Modbus RTU	
Regulating Valve Control Methodology	4-20mA from Flowmeter	
Panel Power Supply	24V DC, 6W	
Panel Operation Temperature	32 – 122 °F (-0 – 50 °C)	
Panel Storage Temperature	-4 – 158 °F (-20 – 70 °C)	
Panel Dimension (H x W x D)	300mm H x 180 mm W x 108mm D	
Panel Approximate Weight	~ 1.8 kg	
Humidity	5 – 95% No Condensation	
Protection	IP-65 Panel-Display / IP-67 Regulating valve	
Regulation	CE / RoHS	

(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.*

(2) *Specifications are subject to change without notice. Contact service@pyxis-lab.com for any questions.*

3 Unpackaging The Nano-Flow Series

The Nano-Flow Control Module package includes the following items:

- One Nano-Flow Control Module (P/N: 21329) or Nano-Flow PLUS Control Module (P/N: 20867)
- One CE-FE-4.9 Flying Lead Cable with Female 7-Pin Adapter – 1.5m/4.9 feet (P/N: 50762)
- One MA-AC-7US 110VAC-24VDC Cable w/Plug & Female 7-Pin Adapter – 1.5m/4.9 feet (P/N: 26398)

- *NOTE* – *Direct shipments to EU contain MA-AC-7EU and Shipments to UK contain MA-AC-7UK*

4 Replacement / Order Information

| Order Information	P/N
Nano-Flow Control Module *(Ultrasonic Flow Regulating Module Panel)*	21329
Nano-Flow PLUS Control Module *(Ultrasonic Flow Regulating Module Panel)*	20867
Optional / Replacement Accessories Information	**P/N**
FS-100 *(Ultrasonic Flow Meter with Display 0-3,000mL/Minute)*	54200
FS-200 *(Ultrasonic Flow Meter with Display 0-10,000mL/Minute)*	54081
Nano-Flow Motorized Valve *(Replacement)*	21972
Nano-Flow Electric Control Box *(Replacement)*	22123
CE-FE-4.9 *(Flying Lead Cable with Female 7-Pin Adapter 1.5m-4.9ft)*	50762
MA-AC-7US *(Power outlet adapter cable with USA/Type B plug 110VAC-24VDC)*	26398
MA-AC-7EU *(Power outlet adapter cable with EU/DIN plug 230VAC-24VDC)*	28787
MA-AC-7UK *(Power outlet adapter cable with UK plug 230VAC-24VDC)*	25802

5   Dimensions
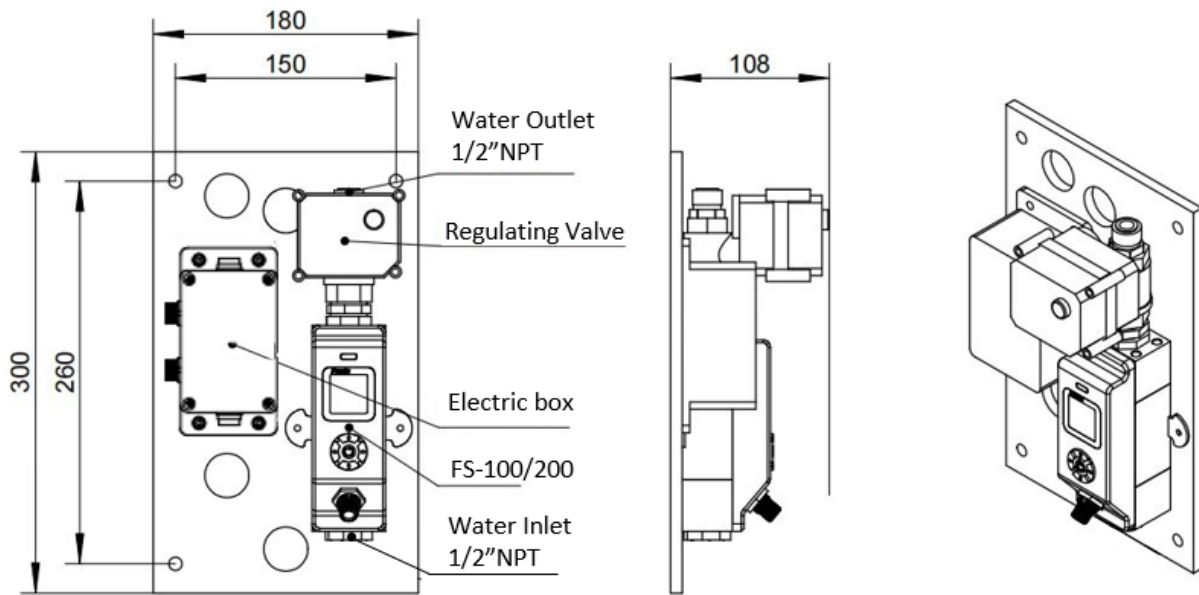
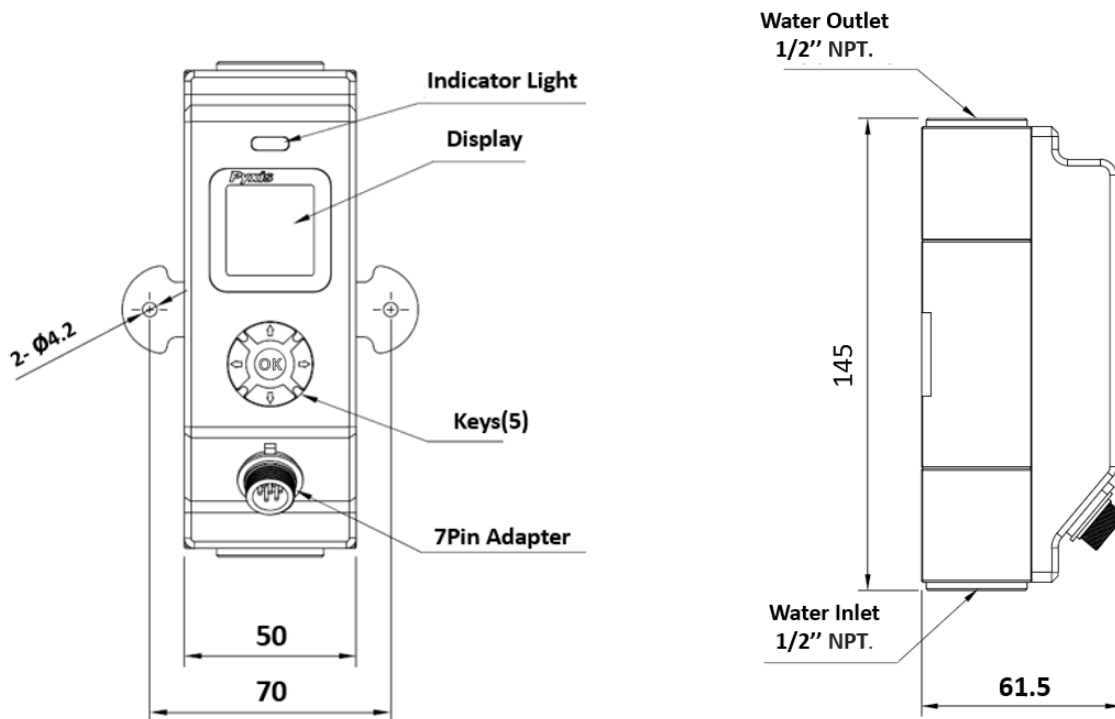*Figure 1 - Panel Dimensions(mm)*

Figure 2- FS-100/200 Dimensions(mm)

6   Electrical Connection

The flow control module contains an electrical box for panel power supply (top left adapter), internal regulating valve control (top center adapter) and FS-100/200 output flow signal wiring (bottom left adapter). The electrical box provides 1x 4-20mA output signal and 1x RS-485 signal of the FS-100/200 flowmeter to be PASSED-THROUGH to another receiving device. Users should use the CE-FE-4.9 which is a 7-Pin Explosion-proof Female Adapter / Flying Lead Cable (1) provided with each Nano-Flow series Control Module. Refer to the wiring table below for proper wiring of flow signal and 24VDC power (if desired) to receiving device.

NOTE Each USA Shipped Nano-Flow comes with one **MA-AC-7US** (110VAC to 24VDC) power supply cable with USA-Plug Type A for direct power from outlet, eliminating the need to power via 24VDC flying lead wires in bottom adapter. For EU and UK shipped Nano-Flow units, Pyxis offers **MA-AC-7EU** (P/N 28787) with EU-DIN plug and **MA-AC-7UK** (P/N 25802) with UK plug as accessories. See Replacement / Order Information section for details.
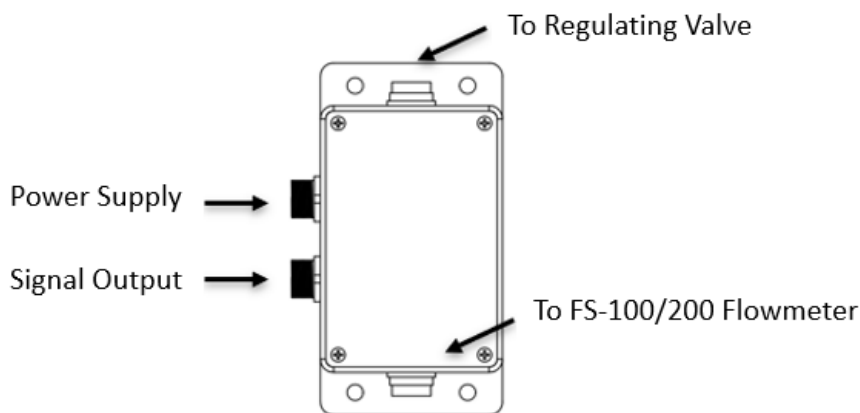

Figure 3

Power Supply from An Outlet (TOP LEFT 7-PIN ADAPTER)

Table 2

Power Cable Provided	Description
MA-AC-7US (P/N 26398)	110VAC-24VDC Type A Plug / 7Pin Female

NOTE Only use MA-AC-7US if you are not powering via 24VDC flying lead wires from bottom adapter.

Signal Output and Power Supply via 24VDC Flying Lead (BOTTOM LEFT 7-PIN ADAPTER)

Table 3

Wire Color	Designation
Red	24VDC+ (6watts)
Black	24VDC- & 4-20mA – (Common Ground)
White	4-20 mA+ for Flow Rate
Green	Not Used
Blue	RS-485 A
Yellow	RS-485 B
Silver	Earth Ground

NOTE the CE-FE-4.9 Flying Lead Wire Offers 24VDC Power if user doesn't desire to use MA-AC-7US outlet power cable.

Table 4

Default 4-20mA Signal Pass-Through From FS-100/FS-200 Flowmeter		
Panel Model	Flowmeter Model	Flow Rate Scaling
Nano-Flow^{TM}	FS-100	4mA = 0 mL/min, 20mA = 3,000 mL/min
Nano-Flow PLUS^{TM}	FS-200	4mA = 0 mL/min, 20mA = 10,000 mL/min

7   FS-100/200 Series Operation

7.1   Key Functions

OK - Enter Key
- Turn on the Setting Menu from the home screen.
- In the Setting Menu: enter the **selected submenu**.
- In option lists: confirm the **selected option**.
- In value adjustment screens: execute the **cursor-selected action** (e.g., *Yes* to save, *Cancel* to discard).
- **Special case**: In the Device Information screen, press OK to return to the previous screen or press and hold OK to restore factory settings.

◀▶ - Left / Right Key
- In the Setting Menu: turn pages.
- In value adjustment screens: move the cursor to the left or right.
- **Special case**: In home screens: turn on/off the Trend Chart display

▲▼ - Up / Down Key
- To increase or decrease the displayed value. Long press for coarse adjustment, short press for fine adjustment
- In submenus: select items.
- In option lists: move between available options.
- **Special case**: In Home screen, press ▼ to pause/resume the timer, or press and hold ▼ to reset the timer.
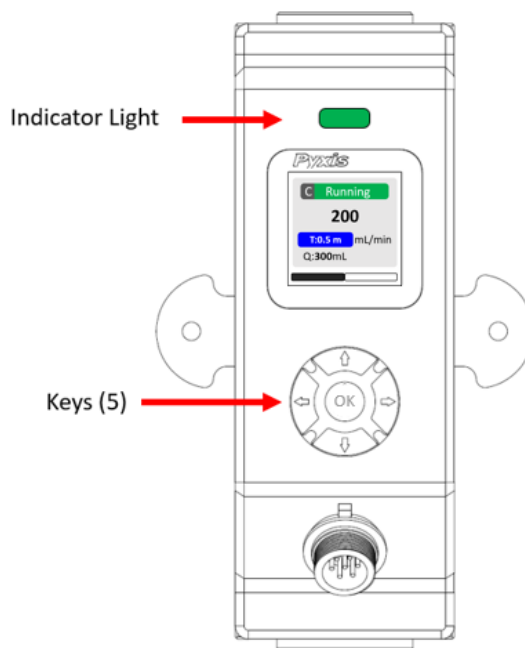
7.2   LED Status Indicator Light

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

Table 5

LED Behavior	Status
Green	Normal Running
Red [1]	Alarm Information

(1)   This indicator light will turn RED under the following conditions:

- Flow rate exceeds the maximum range of
  - 3,000 mL/min for FS-100
  - 10,000 mL/min for FS-200
- In flow rate control (C) mode, the flow fails to reach the setpoint for over 2 minutes
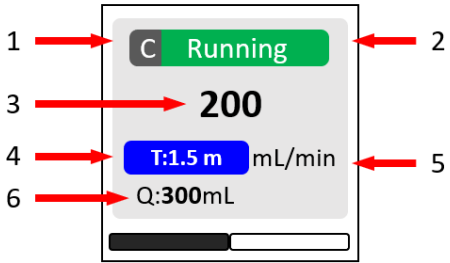- Flow rate exceeds user-defined upper or lower alarm limits

7.3   Home Screen

Upon power-up, the flowmeter automatically begins monitoring real-time flow rate (3) and calculating sample accumulated flow(6). A built-in timer(4) is also activated simultaneously and is used as the time base for sample flow accumulation.

NOTE *When leaving the Pyxis factory, the FS-100/200 is preset to operate in Flow Control (C) mode, with the flow setpoint configured at* **400 mL/min**.

Functional Areas

Table 6

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, **s** = seconds, **m** = minutes, **h** = hours, **d** = days).	
5	Unit of measured flow value	
6	Accumulated Flow Value [3] (unit: auto range, ml, L,)	

(1)   **R** = Average Flow Rate Mode / **M** = Instantaneous Flow Rate Mode / **C** = Flow Rate Control Mode
NOTE *For C-Mode please refer to Section 7.6 for programming details.*

(2)   This timer serves as the time base for calculating total accumulated flow. The timer can be set by pressing the ▼ key.

- **Pause or Resume the Timer Display:** Press ▼ key momentarily and release.
When the timer is paused, the accumulation of sample flow is also paused. Flow will not be added to the totalizer until the timer is resumed.
- **Reset the Timer:** Press and hold ▼ key for about two seconds.
Resetting the timer will also clear the accumulated flow and restart both time and flow accumulation from zero.

(3)   The timer and the accumulated flow totalizer are functionally linked. Any operation that pauses or resets the timer will directly affect the accumulated flow calculation.

7.4   Trend Chart

From the main screen, Press ◄ or ► to open the trend chart display. The flow values are shown as a line graph, indicating the real-time trend. Press ◄ or ► again to return to the home screen.
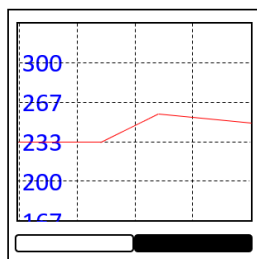
Figure 4

7.5   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".
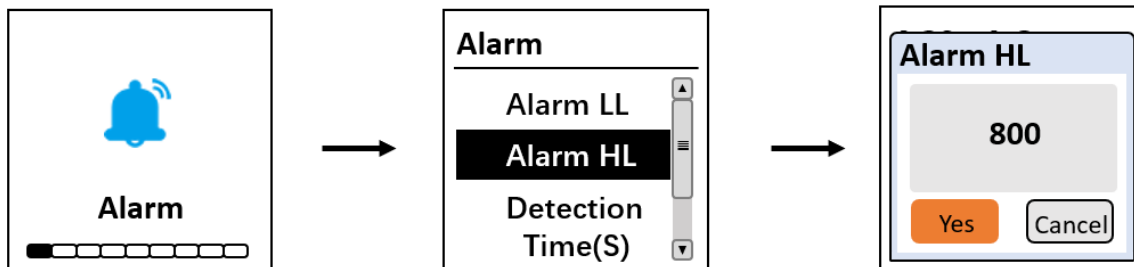

Figure 5

After the limits are defined, select **Detection Time (s)** and adjust the value in the same way.
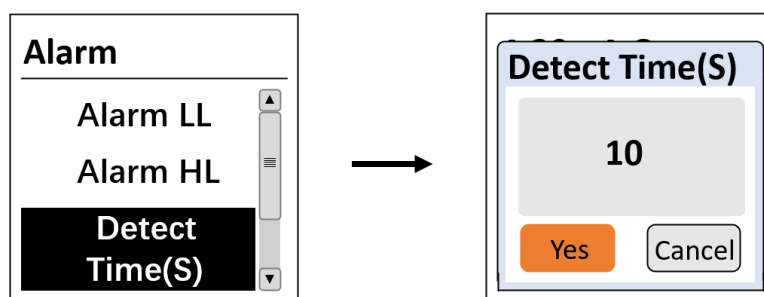*NOTE* *To enable the alarm function, the Detection Time(s) must ≥ 1 second.*

Figure 6

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 lower alarm limit, and the duration time is longer than the detection time, the main screen and LED indicator will display a red alarm status as shown in Figure 7.
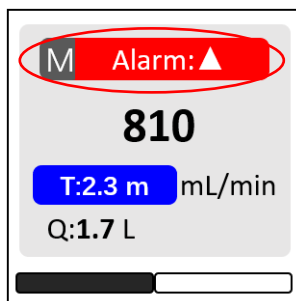

Figure 7

7.6   Set the Operating Mode for the FS-100/FS-200

In the Nano-Flow™ and Nano Flow Plus™ system, the FS-100/FS-200 defaults to **Flow Control (C)** mode, which maintains a **stable and regulated flow rate and pressure** to downstream sensor. This mode should remain unless a calibration is required.

To set the operating mode of the flowmeter, select *[Pattern]* from the Setting Menu. In the submenu, choose **Work Pattern** to open the option list. The following operating modes are available:

- **Flow Rate =** Display the <u>average</u> flow rate
- **Flow Meter =** Display the <u>instantaneous</u> flow rate
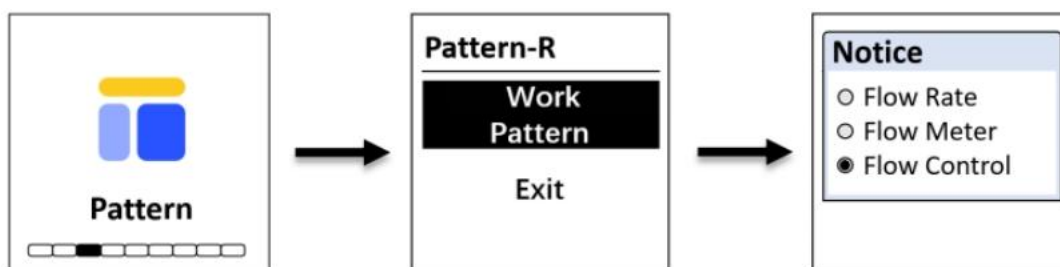- **Flow Control =** Set a desired constant flow rate

Figure 8

If the user selects **Flow Control** mode, a preset flow rate must be entered *(Figure 9)*. The FS-100/200 will control the regulating valve according to the preset flow rate.

Figure 9

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**
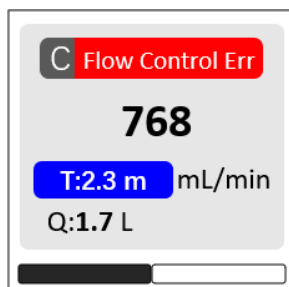

Figure 10

7.7 Regulating Valve Output - 4-20mA Span

The FS-100/200 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-100/200 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.
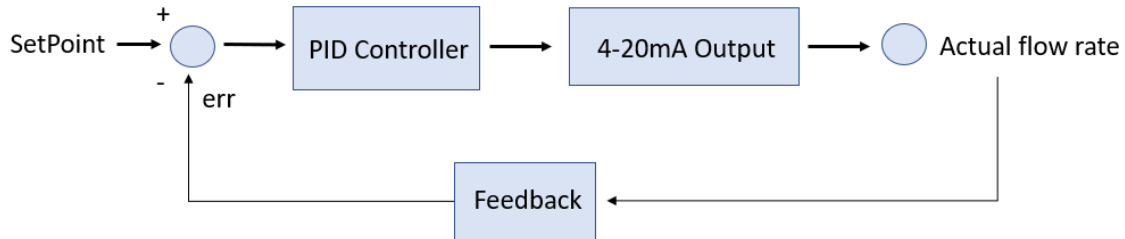

Figure 11

7.8 Flow Measurement Output - 4-20mA Span

To change the 4–20 mA output corresponding to the flow rate, select *[4–20mA Out]* from the Setting Menu. In the submenu, adjust the output assignment as required, see Figure 12. *Refer to Table 4 for the default 4–20 mA output scaling of the FS-100/200 series flowmeters.*
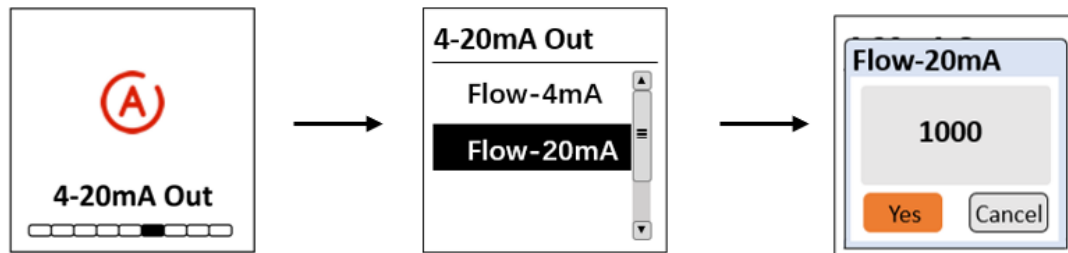

Figure 12

7.9 Modbus Communication Settings

To adjust the Modbus communication parameter, select *[Com]* from the setting menu.
The following communication settings are available:

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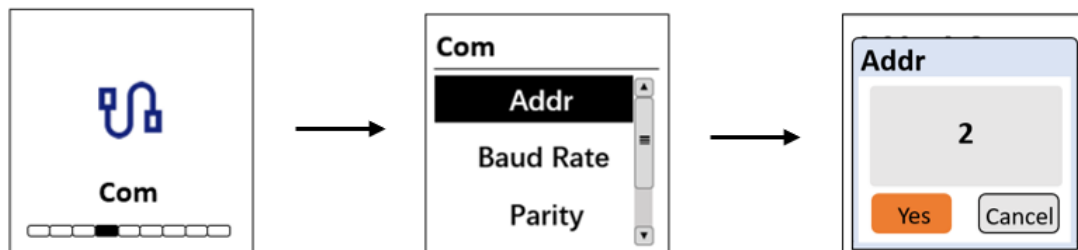- **Parity** *(Options: None / Odd / Even)*

Figure 13

7.10   Calibration

During ZERO & SLOPE calibration, the FS-100/FS-200 must be set to instantaneous flow mode.
NOTE Please refer to section7.6 to set the operating mode for FS-100/FS-200).

7.10.1 Two-Point Calibration

Zero Calibration: This function is used to correct the instantaneous flow rate to "ZERO".

IMPORTANT NOTE To perform zero calibration the pipe must be filled with fluid and the fluid should not be moving.
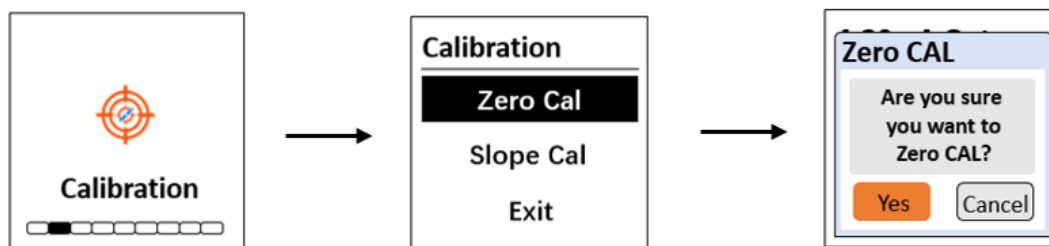

Figure 14

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.
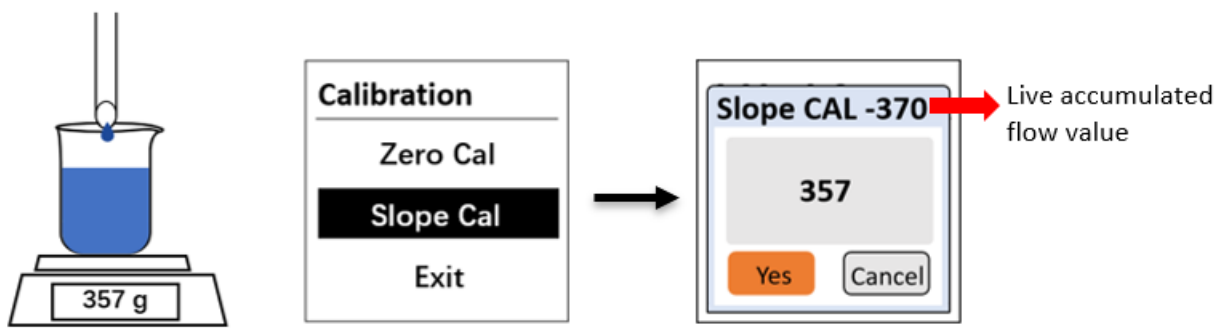

Figure 15

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

7.11 Display Screen Orientation Settings

To adjust the display orientation, select *[Screen]* from the setting menu. In the submenu, choose **Clockwise rotation** to open the option list, then use ▲/▼ to select the desired rotation angle and press **OK** to confirm.
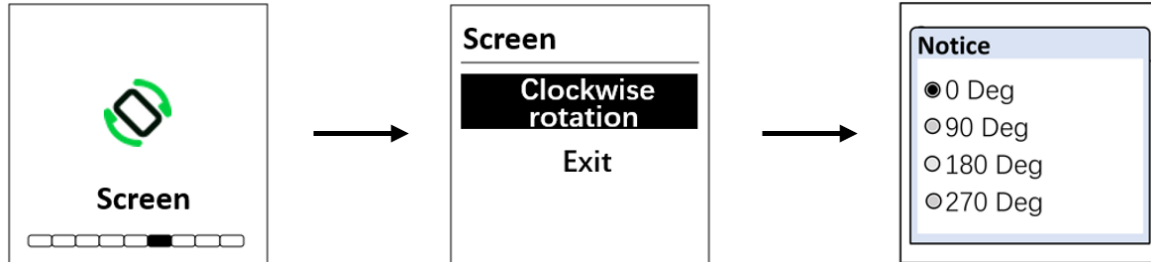
Figure 16

7.12 Language Settings

To change the display language, select *[Language]* from the setting menu. In the submenu, choose **Language** again to enter the option list, then use ▲/▼ to select the desired language and press **OK** to confirm.
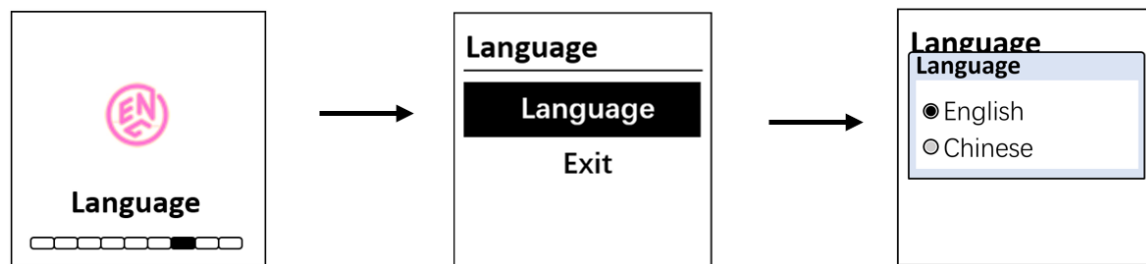
Figure 17

7.13 Device Information

To view the device information, select *[Info]* from the setting menu. The first screen, **DEVICE INFORMATION**, contains the device name, serial number, software version, and hardware version. The second screen is the **DIAGNOSIS** screen, which displays raw parameters related to the measurement. The third screen displays the current Modbus communication parameters. 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.
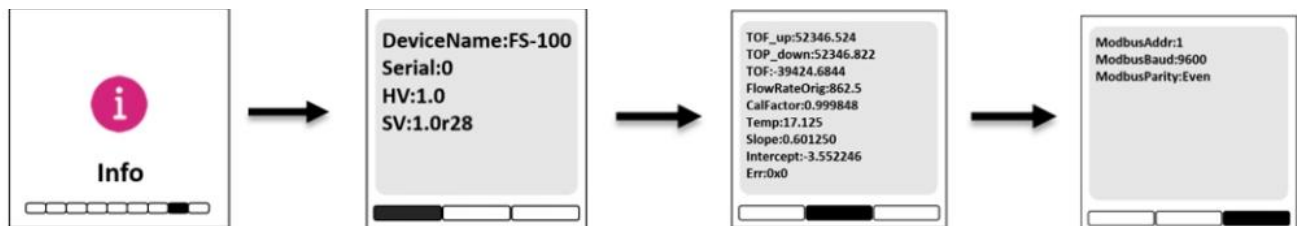
Figure 18 Device Information, Diagnosis and Modbus Parameters

7.14   Restore to Factory

If user wants to restore all device settings to factory default parameters, Navigate to *[Info]*screen (*Figure 19*). Press and hold the **OK** key for about two seconds. The device will automatically reboot, and all parameters will be reset to factory defaults.
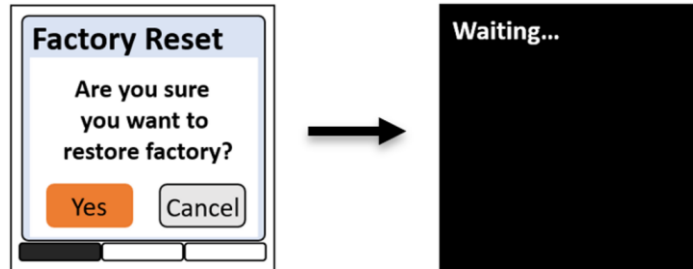

Figure 19

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8   Communication using Modbus RTU

The FS-100/200 series ultrasonic flowmeters are configured as a Modbus slave device. Users can view the measured values via a **Modbus RTU** connection. *Refer to Electrical Connection section for wiring.*

Default Modbus Communication Settings

Table 7

Slave Address	95
Baud Rate	9600 bps
Data Bit	8-bit
Stop Bit	1-bit
Parity Check	Even
Bus Type	RS-485

Modbus communication parameters can be configured directly from the setup menu, see Modbus Communication Settings section.

Modbus RTU Protocol

Register Address Model	Address Base 0

Note: Register addresses in this document are zero-based (base0). When communication with PLCs systems that use one-based addressing (base1), add 1 to the listed register address.

Supported Function Code

03	Read Holding Register

Register Map

Table 8

Register Address	Number of registers	Data Type & Byte Order	Register Definition
46002-46003	2	Float/CDAB	Flow Rate
46004-46005	2	Float/CDAB	Temperature Value
46022-46023	2	Float/CDAB	Flow Rate 4-20mA Output

9 Contact Pyxis Lab

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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