



**LS-202
&
LS-202EX
Level Sensor Operation Manual**



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Rev. A

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Pyxis Technical Support

Contact Pyxis Technical Support at service@pyxis-lab.com.

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1. Introduction

The Pyxis LS-202 is a general purpose ultrasonic sensor. It provides continuous level measurement up to 78 inches (6.6 ft. or 2m) with a 4-20 mA signal, RS485, and Bluetooth digital output. It can be configured via the Pyxis **uPyxis**® app on mobile phones or computers. The sensor can be powered by 4 AA alkaline batteries or a 24 VDC external power supply. This battery-powered and Bluetooth-enabled level sensor is ideally suited for applications where signal/power wiring may be difficult or unavailable to install. A 1.3-inch OLED display and four push-buttons are also included in the sensor for display and setup. This non-contact liquid level sensor is well suited for corrosive liquids and can be used for cooling tower, boiler or multiple other chemical feed applications. LS-202EX is the Class I Div 2 certified version of this level sensor specifically designed & certified for use as Process Equipment Control in Hazardous Environments.

2. Specification

Items	Specification	
Device	LS-202	LS-202EX
P/N	54002	54008
Range	4 – 78 inches (0.1-2 M)	
Accuracy	±0.15% of range	
Resolution	0.2 inch (0.5mm)	
Dead band	4 inches (10mm)	
Configuration	uPyxis® APP in mobile phone	
Power supply	4x AA batteries / 24VDC, 1W Max	
Signal output	Bluetooth® Version 4.1 4-20mA, RS-485 MODBUS	
Enclosure Rating	IP65	
Process mount	1" NPT	
Storage temperature	-4 - 158°F (-20 °C - 70° C)	
Operational temperature	14 - 140°F (-10° C - 60° C)	
Enclosure material	Polycarbonate	
Transducer material	PVDF	
Dimension	6.8inch (172mm) long, 3.1inch (80mm) diameter	
Weight	550g (1.3 lbs)	
Regulation	CE	CE Class I&II / Div 2 Cass III / Div 1 & 2
*With Pyxis' continuous improvement policy, this specification is subject to change without notice.		

3. Unpackaging the Instrument

Remove the instrument and find the standard accessories from the shipping container as listed below. Inspect each item for any damage that may have occurred during shipping. Verify that all accessory items are included. If any item is missing or damaged, please contact Pyxis Lab Customer Service at service@pyxis-lab.com.

3.1. Standard Accessories

- LS-202 sensor P/N: 54002
- LS-202EX (Hazardous Environments) P/N: 54008
- Water Proof 7Pin LS-202 Cable 3Meter P/N: 50774



Scan QR code for
LS-202 Level Sensor
Operational Manual

Scan QR code for
LS-202 Video
Quick Start guide



3.2. Selection Guide & Optional Accessories

Pyxis		PYXIS LS SERIES PRODUCT LINE - SELECT*A*GUIDE					Pyxis
Functional Capability	LS-200	LS-202	LS-202EX	LSP-100	LSP-200	LSP-300	
Part #	54011	54002	54008	54005	54009	54010	
Ultrasonic Level Sensor (0-86" Capable)	X						
Ultrasonic Level Sensor w/Local Display (0-78" Capable)		X	X				
Pressure Based Level Sensor w/Local Display (0-32 Feet Capable)				X	X	X	
Bluetooth Configuration via uPyxis APP	X	X	X	X	X	X	
Bluetooth 6-Months Data Download via uPyxis APP		X	X	X	X	X	
4-AA Battery Powered Capable		X	X	X	X	X	
4-20mA/RS485 24V Powered Capable	X	X	X	X	X	X	
Class I & II Div 2 Certified / Class III Div 1 & 2 - Hazardous Environment			X				
316L Stainless Steel Pressure Transducer				X			
PVC Pressure Transducer					X		
PVDF Pressure Transducer						X	
Four Channel Receiver / Display - Bluetooth IN / 4-20mA-RS485 OUT							
<p>*NOTE* - LS-200 is 24VDC Power Supply only LS-202 / LSP Series Can Use AA Battery or 24VDC Power Supply LS-202 & LSP Series Sensors offer Bluetooth Connectivity for Configuration & Data Download via uPyxis APP LS-200 offers Bluetooth Connectivity for Configuration Only via uPyxis APP All LS / LSP Series Sensors offer 4-20mA & RS-485 Modbus Output</p>							

Pyxis		PYXIS LEVEL SENSOR ACCESSORIES		Pyxis
Accessory Name / Description	Part #	Photo		
10' LS/LSP Series Waterproof Cable - 7Pin Adapter w/Flying Leads	50774			
MA-L25 25' Waterproof Extension Cable (4-20mA/RS485)	50775			
MA-L50 50' Waterproof Extension Cable (4-20mA/RS485)	50776			
MA-L100 100' Waterproof Extension Cable (4-20mA/RS485)	50777			
LS-202 - Ultimate Lithium AA Battery (4 each)	57000			
LSP-Series Li/SOCI2 Battery Kit (4 each)	50731			
LSP-Series Wall Mounting Bracket	50770			

4. Installation

4.1. LS-202 Battery Installation

The LS-202 can be powered by four (4) AA alkaline batteries if a 24 VDC is not available. The measured level signal can be read by the uPyxis app via Bluetooth or transmitted to a controller via the Pyxis Bluetooth to 4-20mA Transmitter BTA-100. Do NOT use rechargeable nickel cadmium (NiCad) or rechargeable lithium batteries. Typical battery life after replacing a new battery set is about 6 months when the measurement interval is one hour. The LS-202 battery compartment is shown in Figure 1.



Figure 1. Battery Installation

1. Separate the upper portion of the sensor by loosening the four hex bolts with the screw driver included in the package. Reach the battery holder by hand and pull it out carefully. Pay careful attention to the connection wire between the cover and main sensor body when separating them.
2. Follow the positive and negative signs and insert batteries firmly into the battery holder. Please note that 4 batteries need to be replaced, two on each side of the battery holder. Replace the 4 batteries together rather than partially.
3. Place the battery holder back to the main sensor body and secure it firmly.
4. Place the upper portion of the sensor back to the sensor main body. Make sure that the sealing O-ring is lying flat in the groove of the main sensor body. Failure to do so may result in water/moisture damage to the sensor. To prevent the LS-202 from accidentally being turned on or off due to vibration, please firmly tighten the hex bolts.

4.2. LS-202 Wiring

The LS-202 can also be powered by a 24V DC power supply and output the result with the 4-20mA output. When it is 24V powered, the battery set will stop powering the sensor.

If the power ground terminal and the negative 4-20 mA terminal in the controller are internally connected (non-isolated 4-20mA input), it is unnecessary to connect the 4-20 mA negative wire (green) to the 4-20 mA negative terminal in the controller. If a separate DC power supplier other than that from the controller is used, make sure that the output from the power supply is rated for 22-26 VDC @ 65mA.

The clear wire normally is not needed to be wired. In unusual cases, a low-quality power supply may cause the sensor reading to be unstable. Connecting the clear wire to the earth ground of the controller may solve the problem.

Follow the wiring table below to connect the LS-202 sensor to a controller.

Wire Color	Designation
Red	24 V +
Black	24 V Power ground
White	4-20 mA +
Green	4-20 mA -, internally connected to the power ground
Blue	RS-485 A
Yellow	RS-485 B
Clear	Shield, earth ground

4.3. Tank Top Installation and Precautions

The LS-202 sensor should be installed to a 1-inch bulkhead fitting on the top of the tank. The major dimensions of the sensor are shown in Figure 3. If a flat horizontal surface is not available on the top of the tank, please use a self-aligning bulkhead fitting so that the sensor can be adjusted to be perpendicular to the liquid surface.

- Install and adjust the sensor to be perpendicular to liquid surface
- Installation location shall not be too close to container wall to avoid interference.
- The sensor has a 3.94 inch (10cm) dead zone (DZ). Raise the probe to avoid the DZ if desired
- Do not install in a location which will cause the ultrasonic wave to be obstructed
- Do not install the sensor in a vacuum environment

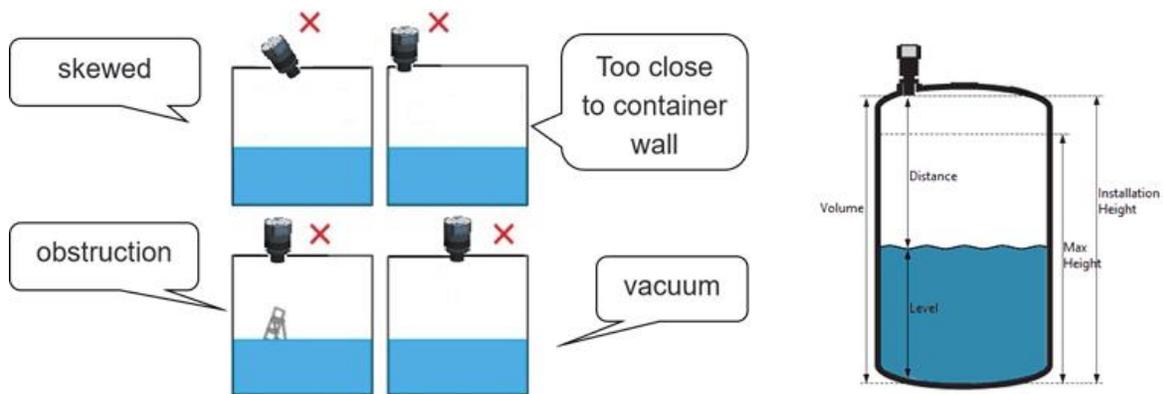


Figure 2. Installation illustration

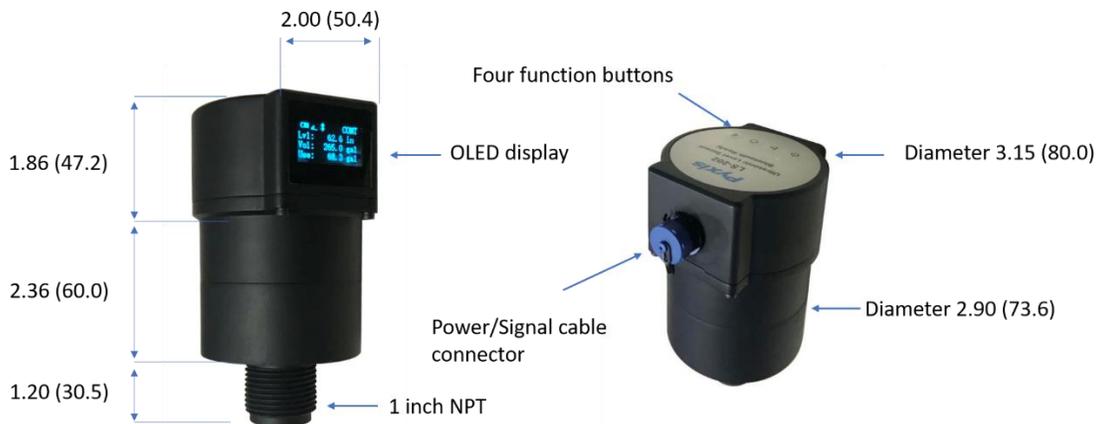


Figure 3. LS-202 Dimensions, inch (mm)

5. Instrument Overview

5.1. Function Buttons

The buttons on the top of the LS-202 (figure 3) are used to select one of four display modes, one of three Bluetooth modes, and one of four measurement modes. These buttons are not used to set up the sensor. The Pyxis **uPyxis** app is used to configure the sensor (Section 5)



Power Button:

- Power On: Hold the power button for 1 second
- Power Off: Hold the power button until OLED display is turned off
- Display wakeup: Hold the power button for 1 second to relight OLED display
(Only the power button has this function)



Working Mode Button: Hold the button to switch the probe working mode. Working modes include the continue measurement mode, the periodic measurement mode, and stop mode. In the periodic mode, the measurement interval can be selected from 3 minutes, 30 minutes, and 1 hour. Other measurement intervals can also be configured on the **uPyxis** app. The working mode is displayed on the right corner of the OLED screen.



Display Mode Button: Hold the button to cycle through the three display mode options. See details in Section 4.4



Bluetooth Mode Button: Hold the button to cycle through three Bluetooth mode options: These include connectable peripheral mode, beacon mode, and shutdown mode. The current working mode is display on the OLED.

B represents Beacon mode;

P represents Peripheral mode;

The absence of the Bluetooth sign represents the shutdown mode and that the Bluetooth communication is turned off.



Figure 4. Sensor Connection and Indicators

5.2. OLED Display

The OLED display supports four display modes as shown in the following figures. Press the display mode button  to switch modes.

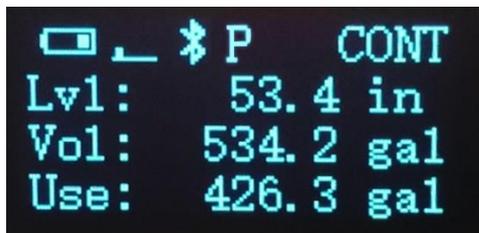


Figure 5. Mode 1, General Information

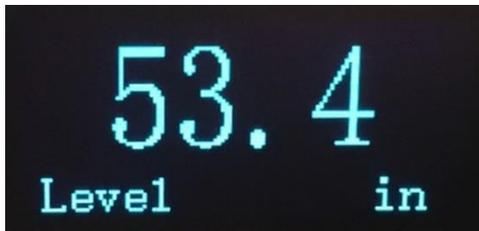


Figure 6. Mode 2, Level or Distance



Figure 7. Mode 3, Remaining Volume

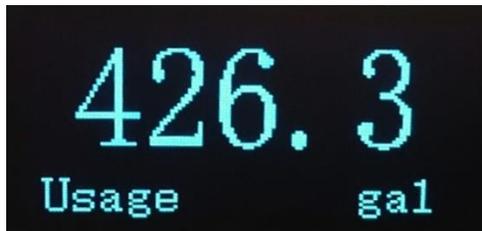


Figure 8. Mode 4, Volume Consumed

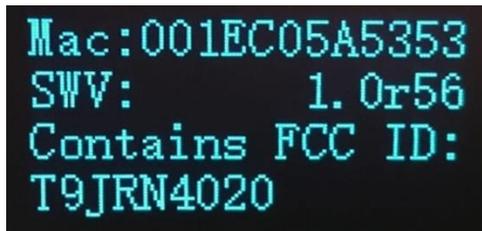


Figure 9. Device Mac Address, Software Version, and FCC ID

The definition of the abbreviated terms and symbols are listed below.

	Battery Status
	CONT Continuous measurement mode
	Bluetooth is ready
	P Connectable Peripheral Mode
	Bluetooth connected
	Dst Distance between the liquid surface and probe surface
	FULL Liquid level reaches the highest setting value
	In Inch
	B Beacon Mode
	Vol Liquid Volume
	gal Gallon
	Bluetooth Mode in switching
	Use Consumed liquid volume
	1.0 h Measurement interval, the interval is 1 hour
	Strength Indicator of the Received ultrasonic echo signal

6. LS-202 Setup with uPyxis

Pyxis LS-202 has three Bluetooth modes: Peripheral mode, Beacon mode, and Shutdown mode.

Peripheral mode: Connected with another Bluetooth devices via uPyxis app, such as a smart phone, computer with Bluetooth USB adapter (PN: MA-NEB), or the BTA-100.

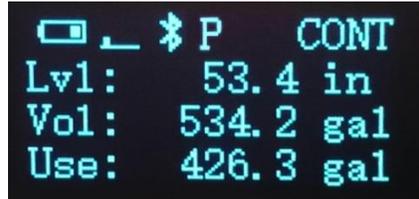


Figure 4. Bluetooth in Peripheral Mode

Beacon mode: The advantage of the beacon mode is that multiple Bluetooth enabled devices can read the LS-202 broadcasting results at the same time.

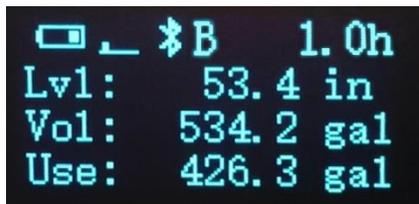


Figure 5. Bluetooth in Beacon Mode

Shutdown mode: Cannot be connected,  icon display is absent in OLED screen.

6.1. Install uPyxis Desktop Version

Download the latest version of **uPyxis** Desktop software package from: <http://www.pyxis-lab.com/support.html> This setup package will download and install the Microsoft .Net Framework 4.5 (if not installed on the PC before), the USB driver for the USB-Bluetooth adapter, the USB-RS485 adapter, and the main uPyxis Desktop application.

Double click the **uPyxis.Setup.exe** file to install.

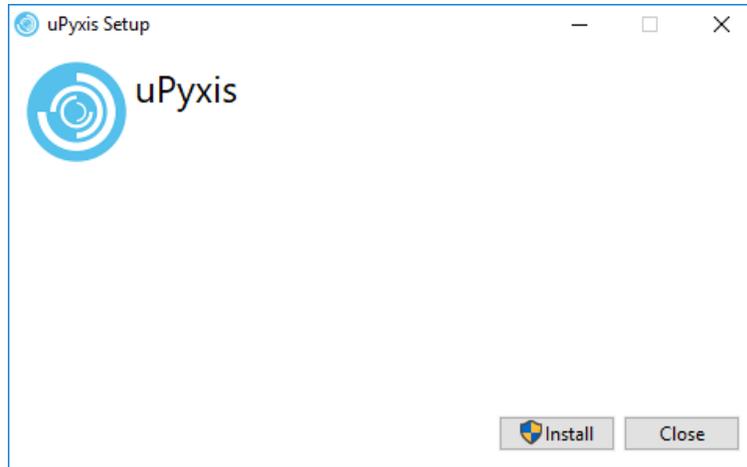


Figure 6. uPyxis Desktop App Installation

Click **Install** to start the installation process. Follow the screen instructions to complete the USB driver and uPyxis installation.

6.2. Connection to the uPyxis Desktop App

Connect the LS-202 to a Windows computer using a Bluetooth/USB adapter (PN: MA-NEB) according to the following steps:

1. Connect the Bluetooth/USB adapter to the computer USB.
2. Hold the  key on LS202 until the Bluetooth mode changes to the peripheral mode. Double click the uPyxis.exe icon  to launch the program on your Desktop.
3. On uPyxis Desktop, click menu Device -> **Connect via USB-Bluetooth** as shown in Figure 13. If the connection is successful, the LS-202 figure and its Serial Number will be displayed in the left pane of the uPyxis window as shown in Figure 14.
4. Figure 14. Successful Connection

Note: After the sensor and WiFi/Bluetooth is powered up, it may take up to 10 seconds for the adapter to establish the wireless signal for communication.

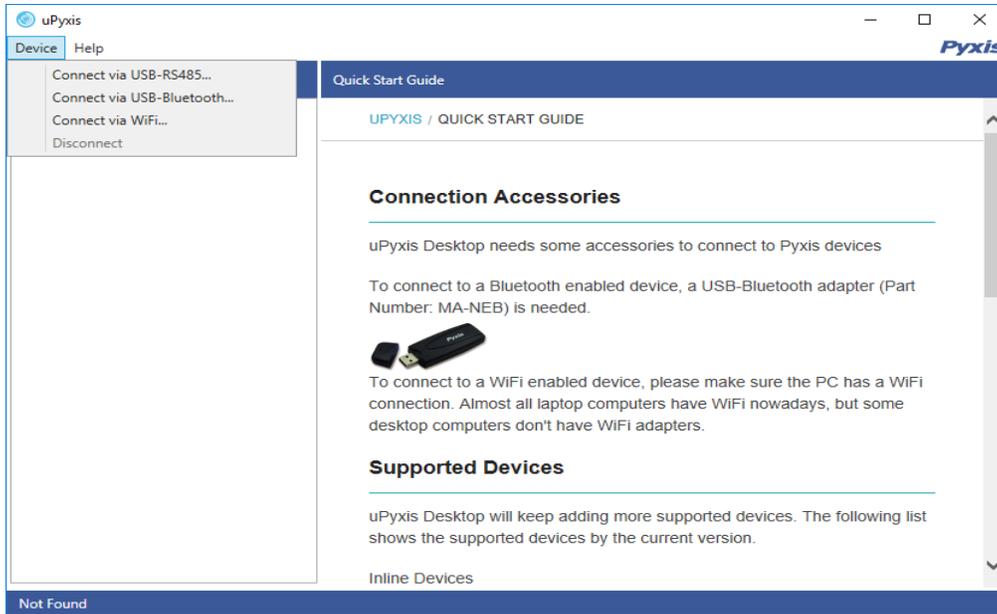


Figure 7. Connect uPyxis PC App to LS-202

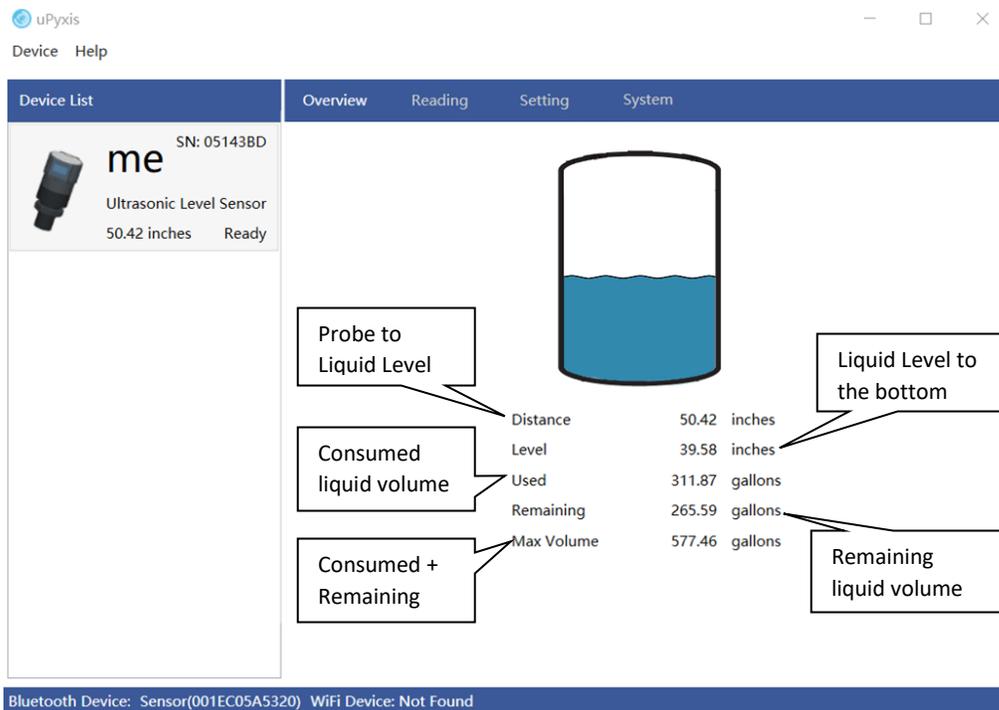


Figure 8. Definition of Terms

6.3. Parameter Setting via uPyxis (for Smartphone or Desktop)

Click Setting to set the LS-202 parameters as show in Figures 15 - 17. The LS-202 sensor measures the distance between the liquid surface in the tank and the bottom sensor surface. Converting this measured distance to other parameters such as the tank level, the remaining liquid volume in gallons, or the consumed liquid in gallons, requires the tank dimensional and volume capacity information. Common vertical tanks have a uniform horizontal cross section. As such, the liquid volume is proportional to the liquid level. To convert the measured distance to volumetric information, the LS-202 requires the user to enter three parameters via the uPyxis app for Smartphone or uPyxis Desktop. The maximum height (figure 15) is the liquid level measured from the tank bottom when the tank is filled to the rated volume capacity. The installation height is the distance between tank bottom and the sensor surface. Please make sure that the difference of the installation height and the maximum height is greater than 4 inches, the sensor dead zone.

For horizontal or other tanks that have a non-uniform cross section, please contact Pyxis Technical Support team (service@pyxis-lab.com) for assistance.

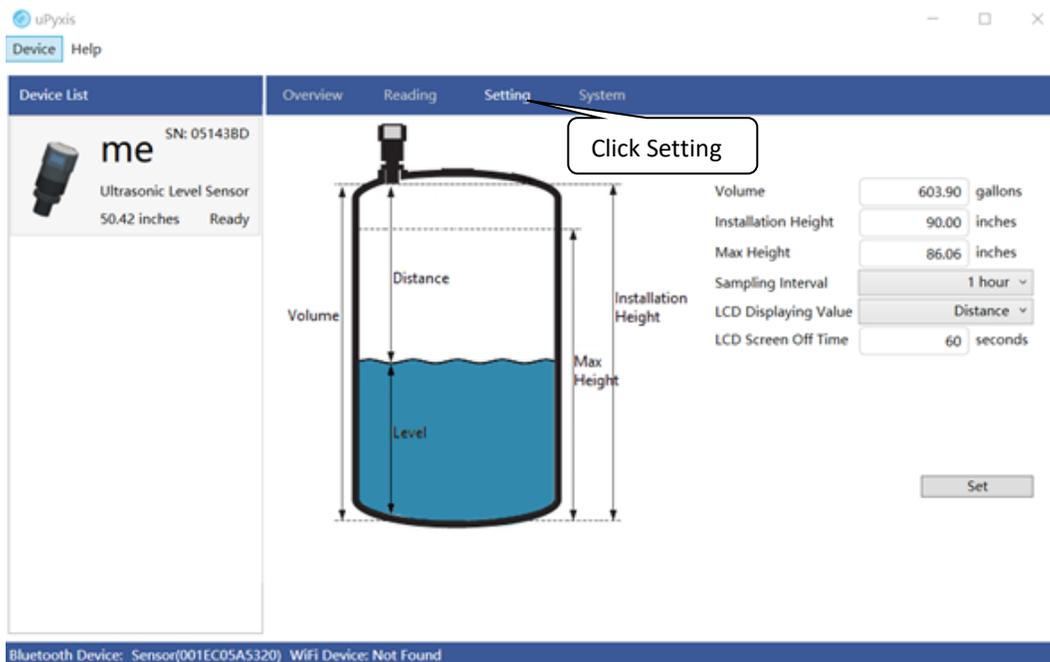


Figure 9. Illustration of Terms and Tank Capacity Setup

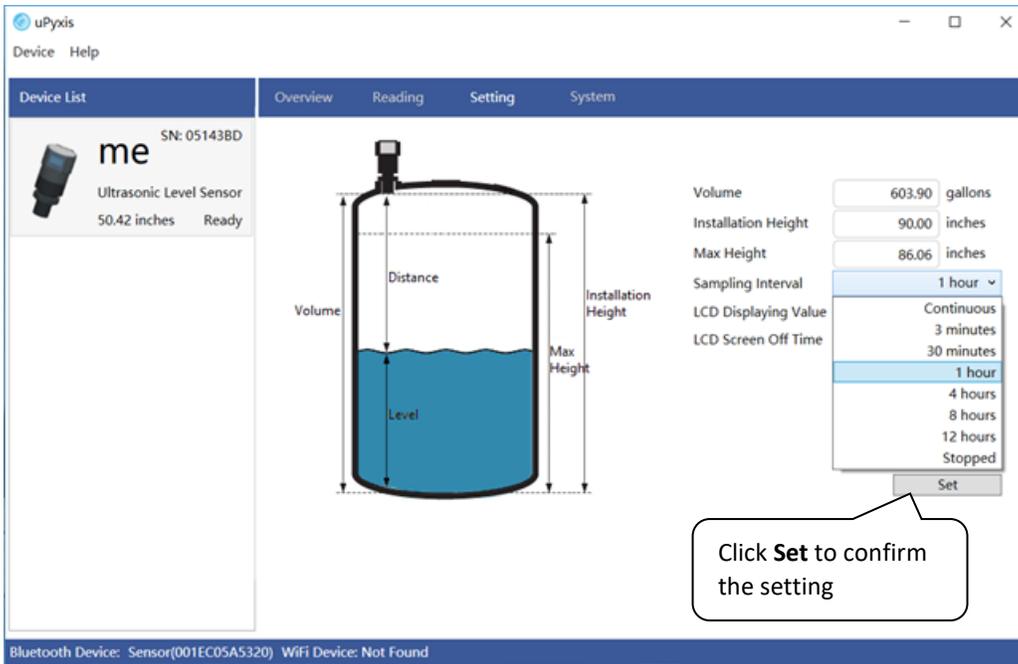


Figure 10. Measurement Mode Dropdown Selection

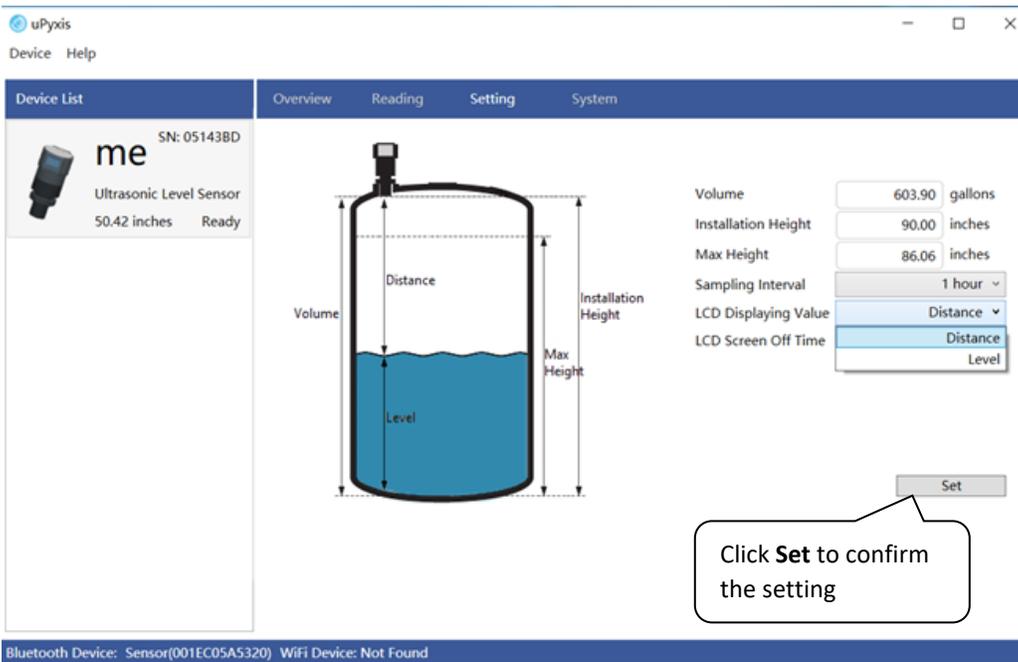


Figure 11. Select Distance or Level

Definitions figures 15 – 17. (After entering any setup parameter, click the Set button to confirm the setting.)

- **Volume:** Volume of the tank
- **Max Height:** Liquid level measured from the tank bottom as filled to rated capacity
- **Installation Height:** The distance between the tank bottom and the sensor surface.
- **Sampling Interval:** Continuous, 3, 30, 60 minutes, 1, 4, 8, 12 hours, or stopped
- **Value Displayed:** Display Distance or Level
- **LCD Screen Off Time:** 10 – 3600 seconds

Click **Reading** menu to display LS-202 real-time measurement data in a trend chart (figure 18).

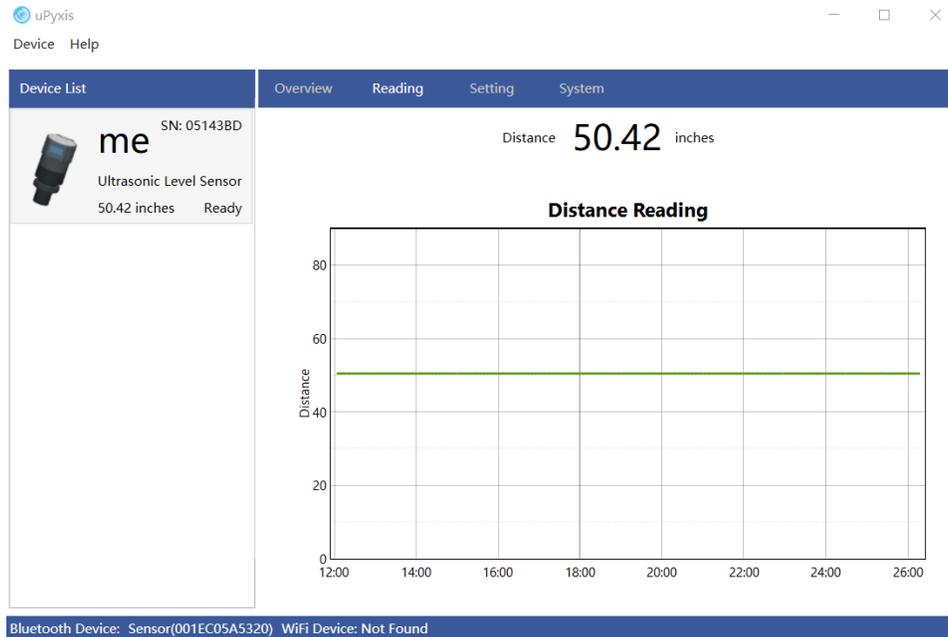


Figure 12. Level Trend Chart

Click **System** to upgrade firmware as shown in figure 19. The latest firmware can be downloaded from <http://www.pyxis-lab.com/support.html> .

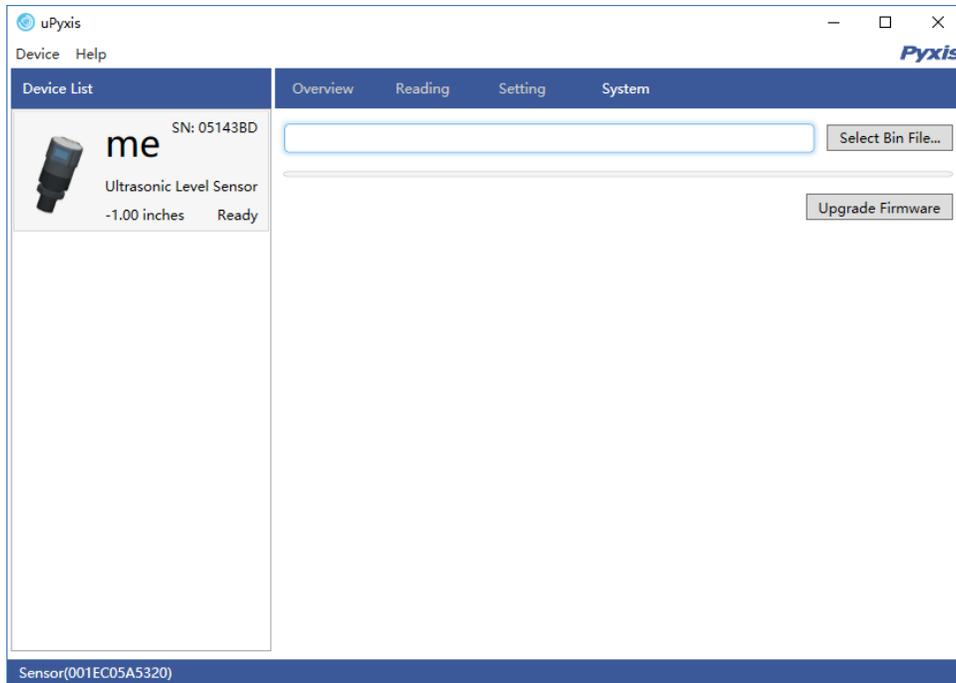


Figure 19. Firmware Upgrade

6.4. 4-20 mA Output Setup

The 4-20 mA output of the LS-202 is scaled as:

4 mA = (Tank is Empty) = (Level is 0) = (Distance is Installation Height),

20 mA = (Tank is Full) = (Level is maximum height) = (Distance is Installation – Maximum Height).

The 4-20 mA analog signal can be converted to one of four values (Level, Distance, Volume Remaining, or Volume Consumed) in the controller receiving the output according to the above scale. For example, a nominal 100-gallon vertical tank, the maximum height is 36 inches. The tank volume is 100 gallons when it is filled up to the maximum height 36 inches. The controller should be set up to convert 20 mA to 100 gallons.

Note: The nominal capacity provided by the tank manufacturer may be greater than the maximum safe (net or effective) capacity that can be practically filled. Please keep this in mind as you configure your LS202 for practical purposes.

7. Output 4-20 mA via BTA-100 adapter

The **BTA-100** adapter (BTA-100, figure 20) (P/N: 50729) can be switched among three modes, connectable peripheral (pairing), observer (beacon reader), or central. Reference the BTA-100 manual for details. The LS-202 sensor can be wirelessly connected to the BTA-100 in two ways as listed in the following table. The 4-20 mA output from the **BTA-100** adapter can be wired to a controller per manual.

LS-202 to BTA-100	LS-202 Mode	BTA-100	Comment
Peripheral to Central	Peripheral	Central	LS-202 can be only read by BTA-100 and cannot be discovered by other Bluetooth devices. The Bluetooth mode indicator “P” on LS-202’s OLED screen and “C” on BTA-100.
Beacon to Observer	Beacon	Observer	LS-202 can be read by other Bluetooth devices while being read by BTA-100. Bluetooth mode indicator “B” are displayed on LS-202’s OLED screen and “O” on BTA-100.

The user does not need to do any configuration before using the BTA-100. The BTA-100 can read the related parameters from the level sensor and automatically outputs a 4-20 mA signal accordingly.

7.1. Peripheral to Central Mode (LS-202 Connection to BTA-100)



Figure 20. Connect with LS202 in central mode

Follow the following steps to pair the LS-202 sensor with the BTA-100 adapter.

- Turn on the LS-202 and switch to the peripheral mode (Bluetooth mode indicator “P” on the LS-202 screen)
- Use the Bluetooth button  to switch the BTA-100 to the central mode (Bluetooth mode indicator “C” on the BTA-100 screen)
- The BTA-100 will search Pyxis Bluetooth devices that are in the peripheral mode and display the Mac addresses of the discovered devices (figure 20).
- Use the selection button  to scroll to the MAC address that belongs to the LS-202 sensor and press the enter button  to establish the peripheral-to-central connection.

7.2. Beacon to Observer Mode (LS-202 Connection to BTA-100)



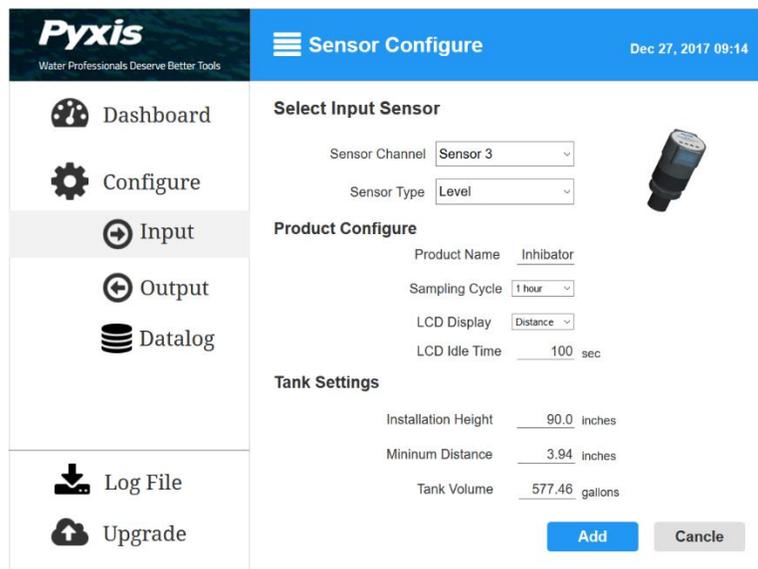
Figure 21. Connect with LS202 in the observer mode

The advantage of using the BTA-100 adapter reading the LS-202 in the beacon mode is that multiple Bluetooth enabled devices including a phone app can read the LS-202 beacon messages at the same time. Follow the steps to establish the LS-202 to the BTA-100 connection in the beacon-to-observer mode.

- Switch LS-202 to the beacon mode (Bluetooth mode indicator “B” on the LS-202 screen)
- Use the Bluetooth button  to switch the BTA-100 to the observer mode (Bluetooth mode indicator “O” on the BTA-100 screen).
- The BTA-100 will search Pyxis Bluetooth devices that are in the beacon mode and display the Mac addresses of the discovered devices (figure 21).
- Use the selection button  to scroll to the MAC address that belongs to the LS-202 sensor and press the enter button  to establish the beacon-to-observer connection.

8. LS-202 Connection to Pyxis display Panel UC-300

The Pyxis UC-300 can provide 24 VDC power to four LS-202 sensors. The panel connects to the sensor by Modbus and reads the sensor data every 4 seconds. The trends of the tank levels from the four connected sensors can be displayed and recorded (figure 22). The UC-300 panel passes the four (4) 4-20mA current signals to other controllers if desired. An alarm on the level for each sensor can be configured. The panel turns on a relay output if an alarm condition is met. Please reference the UC-300 manual for further information.



The screenshot shows the Pyxis Sensor Configure web interface. The top navigation bar includes the Pyxis logo, the title "Sensor Configure", and the date/time "Dec 27, 2017 09:14". A left sidebar contains menu items: Dashboard, Configure, Input (highlighted), Output, Datalog, Log File, and Upgrade. The main content area is titled "Select Input Sensor" and features a dropdown for "Sensor Channel" set to "Sensor 3" and a dropdown for "Sensor Type" set to "Level". To the right is an image of the LS-202 sensor. Below this is the "Product Configure" section with fields for "Product Name" (Inhibitor), "Sampling Cycle" (1 hour), "LCD Display" (Distance), and "LCD Idle Time" (100 sec). The "Tank Settings" section includes "Installation Height" (90.0 inches), "Minimum Distance" (3.94 inches), and "Tank Volume" (577.46 gallons). At the bottom right are "Add" and "Cancel" buttons.

Figure 22. Configure Level Sensor Parameters by UC-300

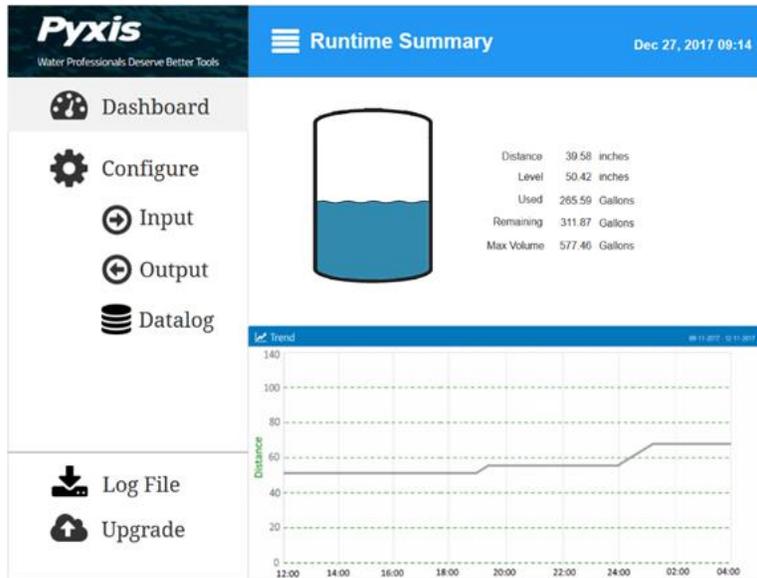


Figure 13. UC-300 dashboard showing measured level data and trend chart

9. Communicating using Modbus RTU (To be developed)

The LS-202 can be configured as a Modbus slave device via RS-485. In addition to the level, volume, and distance, many operational parameters, including warning and error messages, are available via a Modbus RTU connection. Contact Pyxis Lab Customer Service (service@pyxis-lab.com) for more information.

10. Sensor Cleaning and Maintenance

For best performance, keep the sensor ultrasonic surface clean. Remove

11. Regulatory Approval

United States

The LS-20x sensor has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in an installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

Canada

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible

Contact Us

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