



LS-202 Sensor Operation Manual



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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 2 m) 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

2. Specification

Item	Parameter
Power Supply	4 alkaline batteries or 24 VDC, 2W
Output	Bluetooth 4.1, 32 ft. (10 Meters) Line of Sight / RS-485 MODBUS and 4-20 mA
Data Storage	6 months (60 minutes per measurement)
Cable Length	5 ft. (1.5 m), extension cable available
Range	4 - 79 inch (0.01 - 2.0 meter)
Resolution	0.02 inch (0.5 cm)
Accuracy	±0.15% of the range
Dead Zone	4 inch (10 cm)
Measurement Interval	Continuously (5 readings per second), 3 min, 10 min, 60 min, configurable
Installation	1-inch NPT
Weight	1.1 pound (510 g)
Dimension	Height: 6.77 inch (172 mm) Diameter: 3.15 inch (80 mm)
Enclosure Material	Polycarbonate (PC)
Transducer Material	Polyvinylidene Fluoride (PVDF)
Temperature	Working: 5 - 140 °F (-15 - 60 °C) Storage: -4 - 158 °F (-20 - 70 °C)
Pressure	14 - 30 PSI (0.1 - 0.2 MPa)
Enclosure Rating	IP67
Regulation	CE

*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: 54001
- 5 ft. (1.5 m) sensor cable P/N: 02.08.01.0001
- Instruction manual. The Instrument Manual is also available from <https://www.pyxis-lab.com/support-2/>

3.2. Optional Accessories, purchased separately

- Bluetooth to 4-20mA Transmitter BTA-100 P/N: 50729
- Pyxis Display Panel UC-300 P/N: 51008
- Pyxis Display Panel UC-300B P/N: 51009

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.

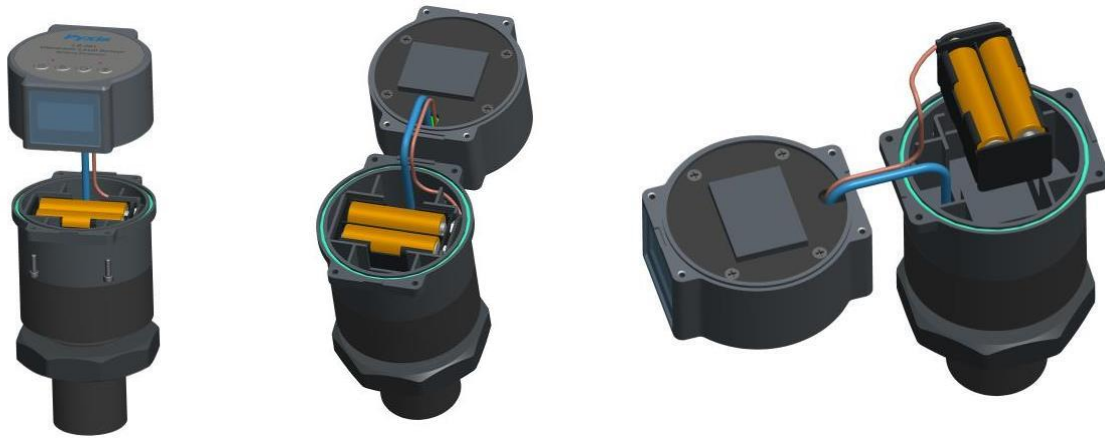


Figure 1. Battery Installation

Follow the steps below to install or replace batteries:

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 (10 cm) 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

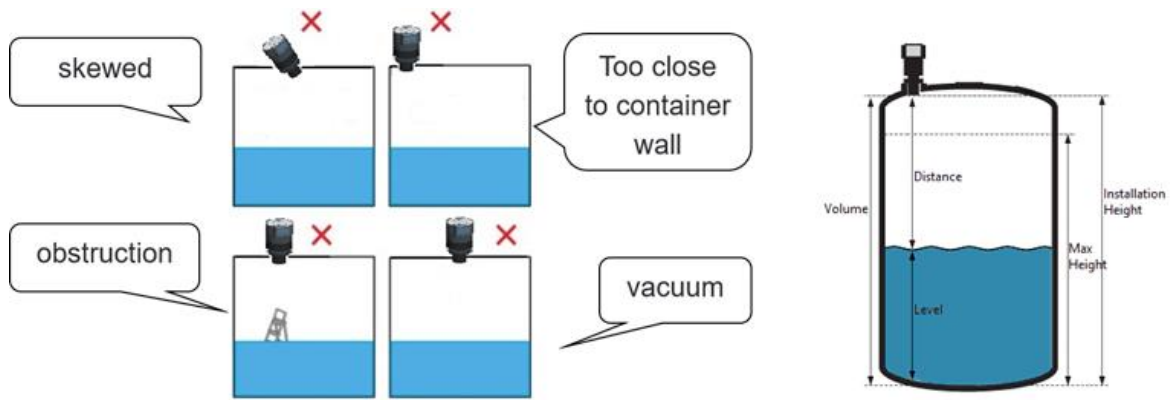


Figure 2. Installation illustration

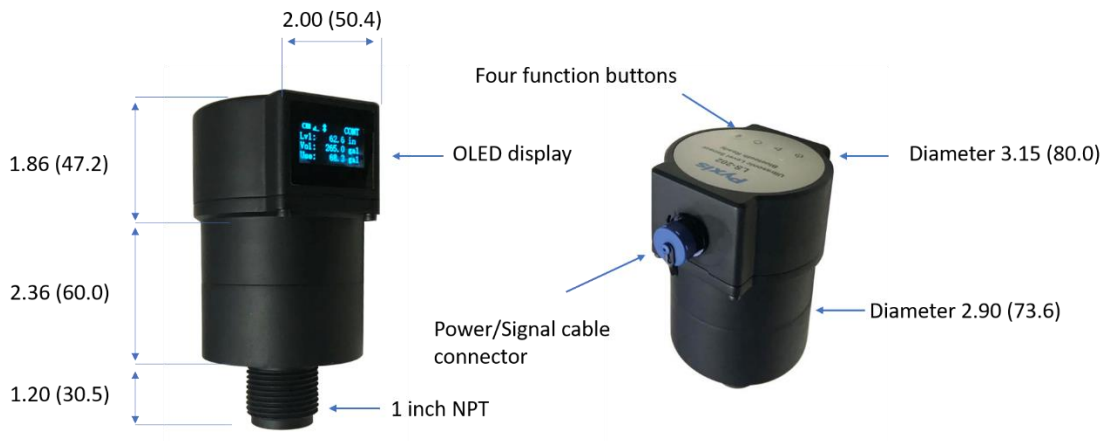


Figure 3. LS-202 Dimensions, inch (mm)

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 10 seconds, 30 seconds, 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 four display mode options. See details in Section 5.2

✳ **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.

Power consumption in the peripheral mode is much higher than the Beacon mode. Please use the beacon mode for a long-term Bluetooth connection if the LS-202 is on the battery power.

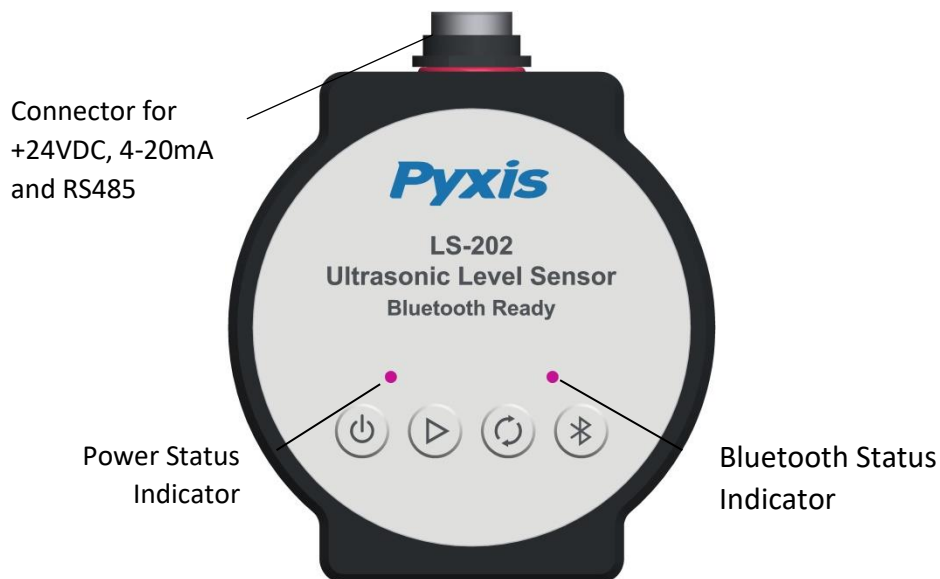



Figure 4. Sensor Connection and Indicators

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.

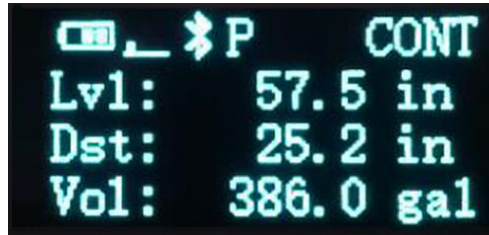


Figure 5. Mode 1, General Information

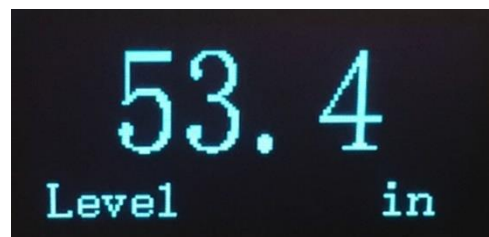


Figure 6. Mode 2, Level Display

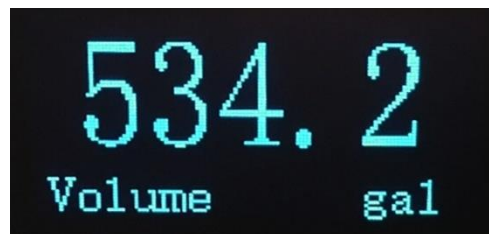


Figure 7. Mode 3, Remaining Volume

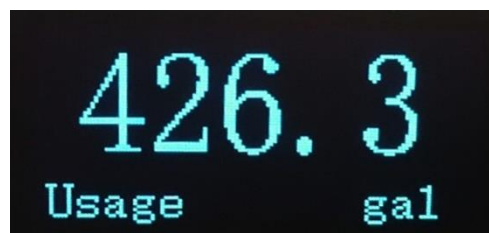


Figure 8. Mode 4, Volume Consumed



Figure 9. Device Mac Address, FCC ID, and Error Code

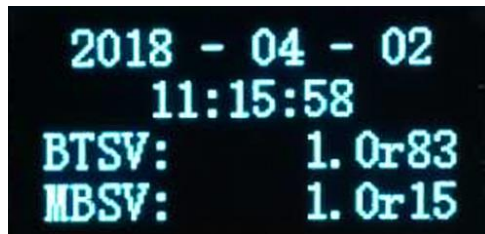


Figure 10. System Time and Software Version (Note 1)

Note 1: The system time will be reset to 2000-01-01 on every power-on operation. Please use uPyxis app to wireless connect the sensor to a phone or PC before the use. With the connection, the system time will be automatically set according to the phone or PC's clock. The wrong system time doesn't affect the sensor measurement function, but the time stamp in the data log will be wrong.

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
	Lvl Liquid level
	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.

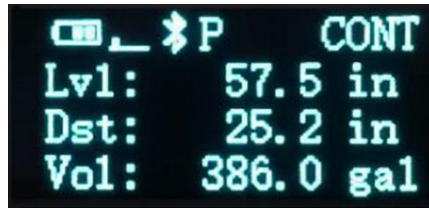


Figure 11. Bluetooth in Peripheral Mode

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.

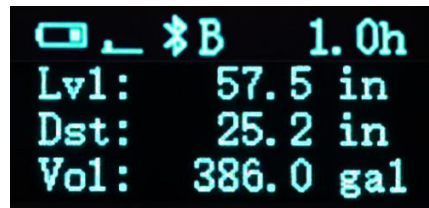


Figure 12. Bluetooth in Beacon Mode

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

6.1. Install uPyxis Desktop Version

Download the latest version of **uPyxis** Desktop software package from: https://www.pyxis-lab.com/resource/software_driver/uPyxis.Setup.1.3.8.zip 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.

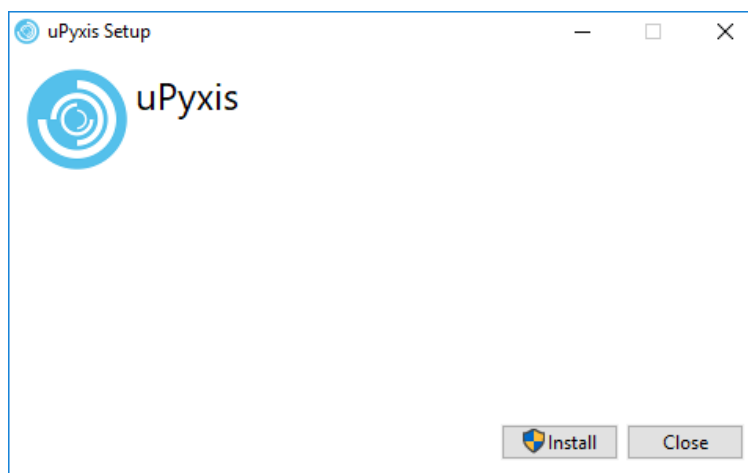




Figure 13. uPyxis Desktop App Installation

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 14. 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 15.

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.

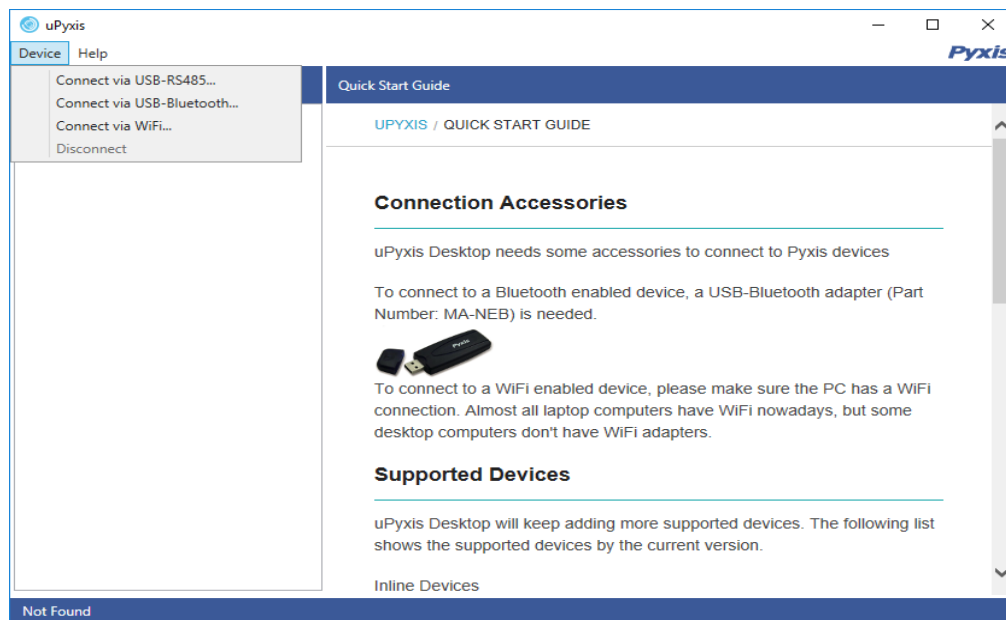


Figure 4. Connect uPyxis PC App to LS-202

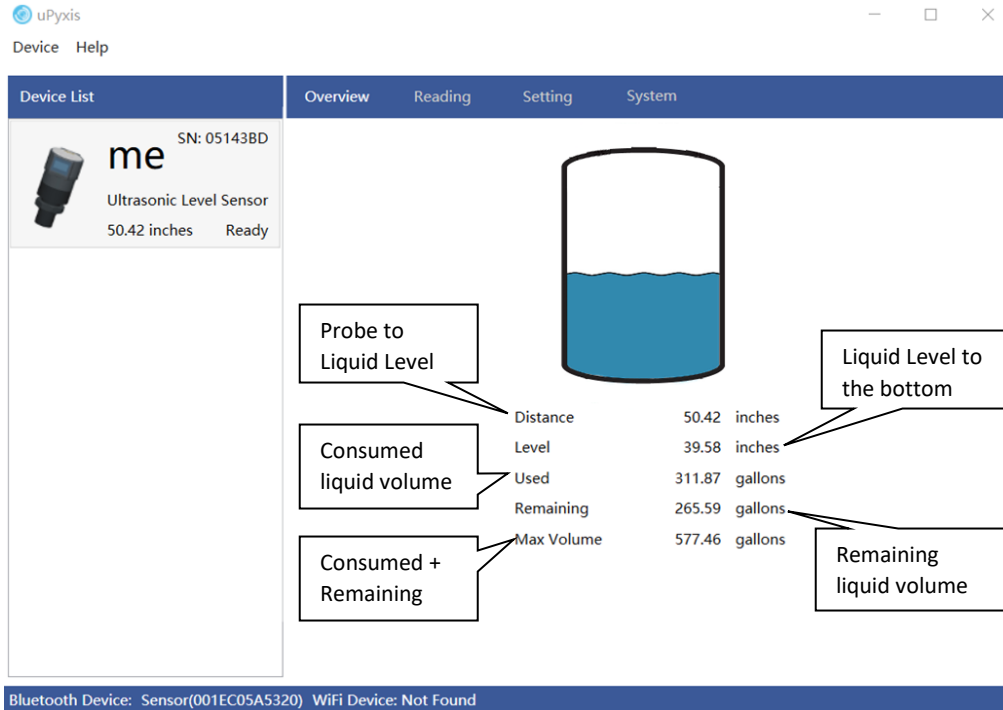


Figure 5. Definition of Terms

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

Click Setting to set the LS-202 parameters as show in Figures 16 - 18. 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 as shown in figure 16.

The **maximum height** (figure 16) 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.

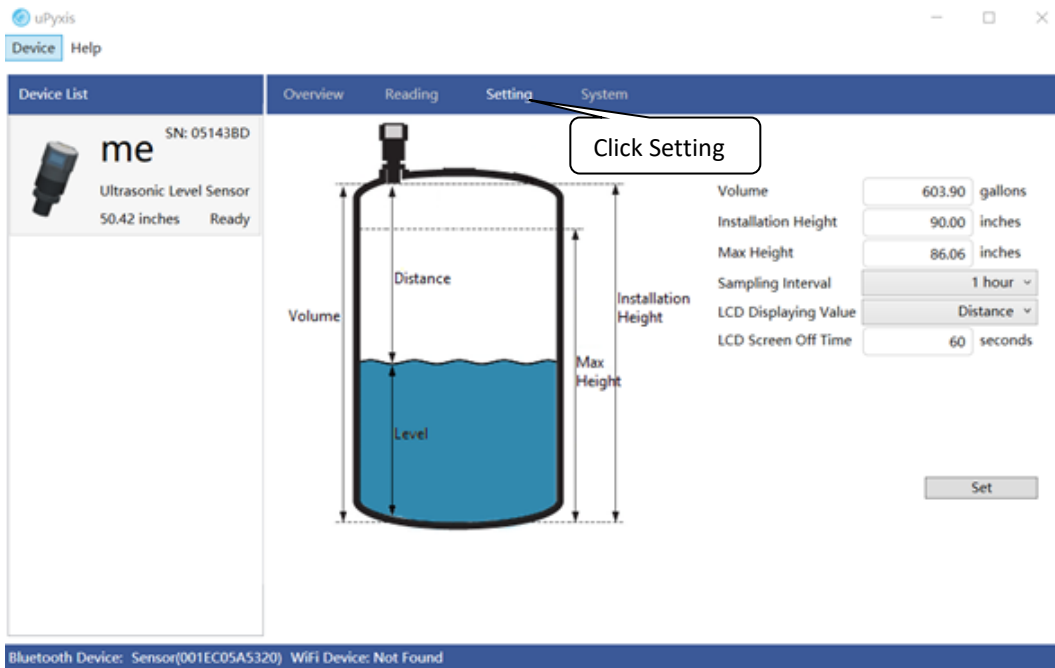


Figure 6. Illustration of Terms and Tank Capacity Setup

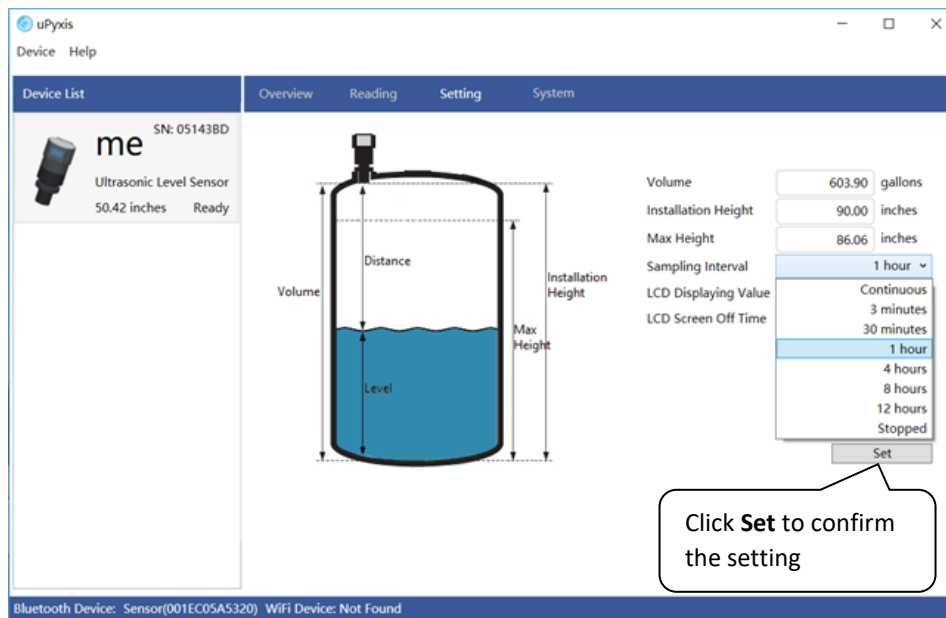


Figure 7. Measurement Mode Dropdown Selection

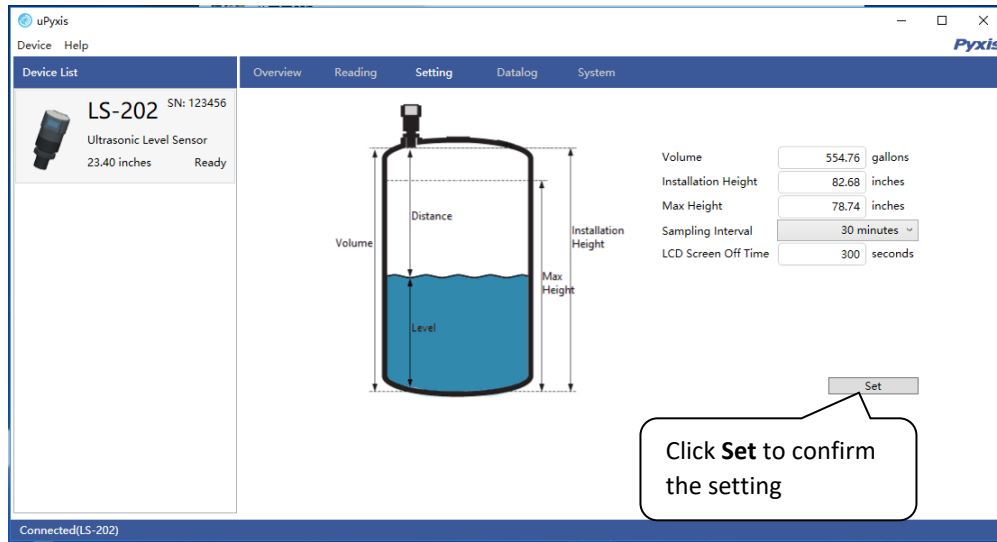


Figure 8. Set OLED Screen Off Time

Definitions figures 16 – 18. (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, 10 seconds, 30 seconds, 3 minutes, 30 minutes, 1, 4, 8, 12 hours, or stopped
- LCD Screen Off Time: 10 – 3600 seconds

Click **Reading** menu to display LS-202 real-time measurement data in a trend chart (figure 19).



Figure 9. Level Trend Chart

Click **DataLog** to upload the historical measurement data as shown in figure 20

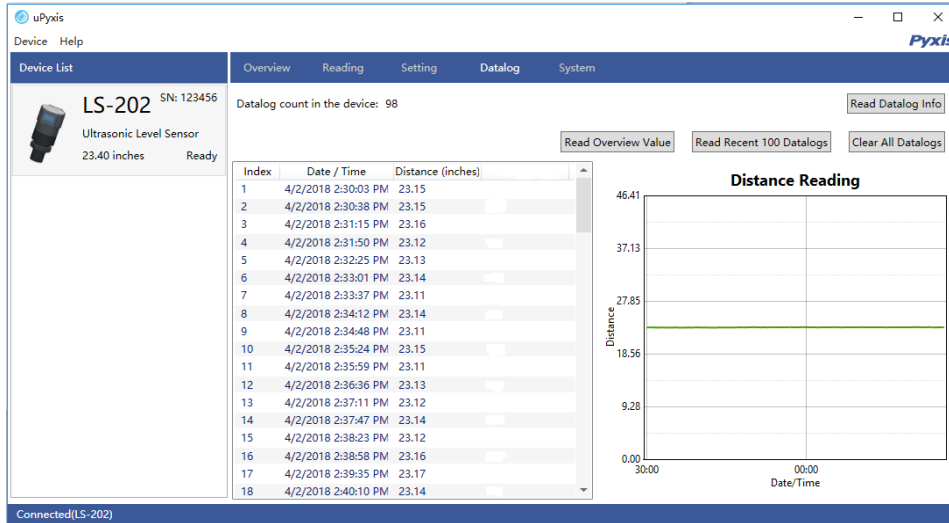


Figure 20. Datalog Upload

Click **System** to upgrade firmware as shown in figure 21. The latest firmware can be downloaded from <https://www.pyxis-lab.com/support-2/>

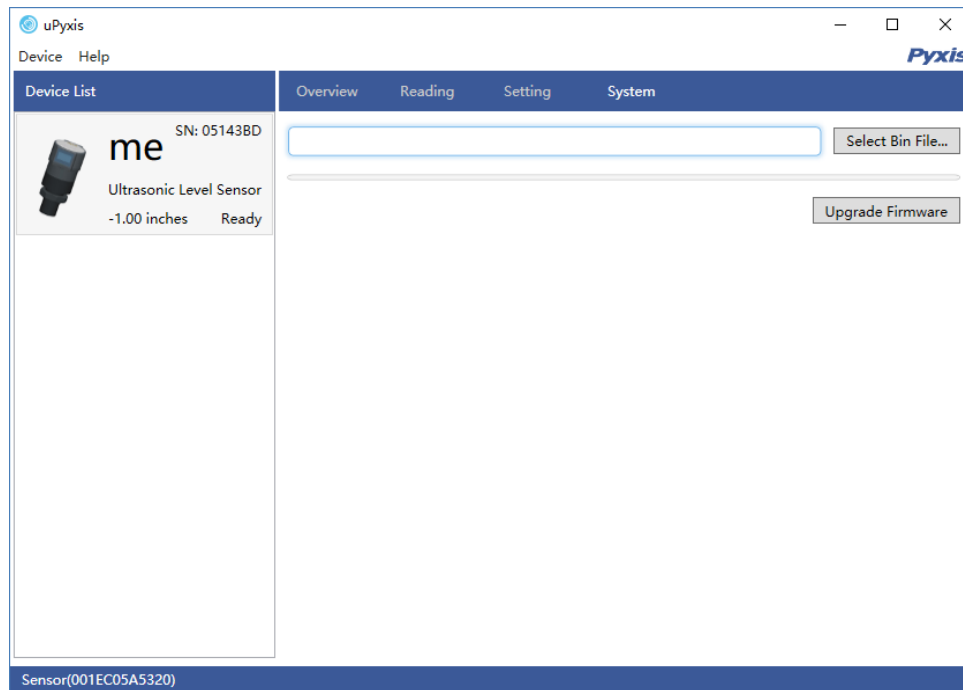


Figure 21. Firmware Upgrade

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 and installation height is 42 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, at which the tank is full and the tank level is 36 inches and the distance measured is 6 inches.

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. LS-202 power consumption on this mode is high. It is not recommended for a long-term connection
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 22. 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 22).
- 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.




Power consumption on this mode is much higher than the Beacon mode. It is recommended that the Beacon is used for a long-term Bluetooth connection while the LS-202 is on the battery power.

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



Figure 23. 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 23).
- 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(B)

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 24). 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.

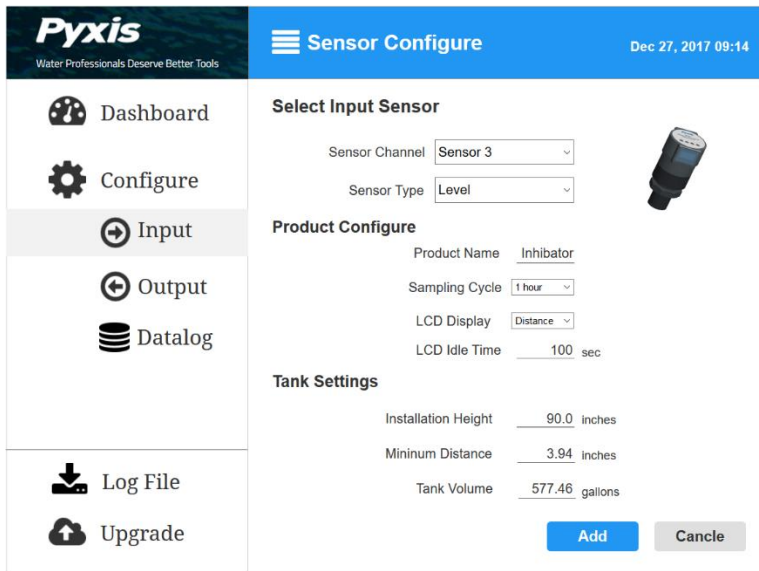


Figure 24. Configure Level Sensor Parameters by UC-300

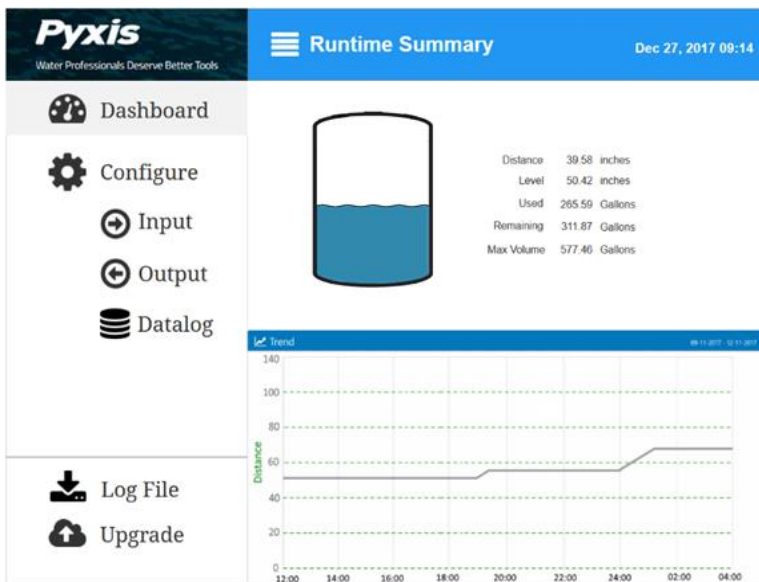


Figure 10. UC-300 dashboard showing measured level data and trend chart

The UC-300B can read tank levels from up to four LS-202 sensors operated in the Beacon mode and convert the tank level values to four 4-20 mA current outputs. Reference the UC-300B manual for details.

9. Communicating using Modbus RTU

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 using a soft cloth or towel.

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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