LSP-100 Level Sensor
Operation Manual

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Rev. A

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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 original shipment date.

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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 designate. 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 incorporation of a warranted repair component into an instrument extend the whole instrument's warranty beyond its original term.

Warranty Shipping

A Repair Authorization Number (RA) 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.

Pyxis Technical Support

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

Table of Contents

1. Introduction

The Pyxis LSP-100 is a pressure based submersible level sensor. It provides continuous level measurement up to 393-inch (32.8-ft. or 10-meter) with a 4-20 mA analog and Bluetooth digital output. It can be configured via the Pyxis **uPyxis®** app for mobile phones or PC. The sensor can be powered by 4 AA Li/SOCl2 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 submersible liquid level sensor is well suited for water, waste water, oil, and other non-corrosive liquid. Additional versions are available suited for corrosive liquids.

2. Specification

Item	Parameter
Power Supply	4 AA Li/SOCl2 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	32.8 ft. (10 m)
Range	0 – 393 inches H_2O (0 – 10 mH_2O)
Resolution	0.02 inches (0.5 cm)
Accuracy	±0.2% of the range
Stability	±0.2% URL / year
Measurement Log Interval	Continuously , 3 min, 10 min, 60 min, configurable
Installation	1-inch NPT
Weight	3.1 pound (1400 g)
Enclosure Material	Polycarbonate (PC)
Transducer Material	316L stainless steel
Cable Material	PTFE
Temperature	Working: 14 - 140°F (-10 - 60 °C) Storage: -4 - 158°F (-20 - 70 °C)
Enclosure Rating	IP66
Transducer Rating	IP68
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 as listed below. Inspect each item for any damage that may have occurred during shipping. Verify that all accessory items are included. LSP-100 Instrument Manual is available from http://www.pyxis-lab.com/support.html

3.1. Standard Accessories

- LSP-100 Sensor *(includes 7Pin Cable 6')* P/N: 54005

3.2. Optional Accessories, purchased separately

- Bluetooth to 4-20mA Transmitter BTA-100 P/N: 50729
- Bluetooth USB Adaptor for PC P/N: MA-NEB
- Replacement Li/SOCl2 AA Batteries (4 Each) P/N: 50731
- LSP-100 Mounting Bracket P/N: 50770

4. Installation

4.1. LSP-100 Battery Installation

The LSP-100 can be powered by ***four (4) AA Li/SOCl2 batteries*** if a 24 VDC is not available. These batteries are unique and available through Pyxis Lab under part #50731 as a Kit of 4 batteries. **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 LSP-100 battery compartment is shown in Figure 1.

Figure 1. Battery installation

The AA Li/SOCl2 batteries (P/N 50731 for Kit of 4 each) can be purchased at https://pyxis-lab.com/product/li-socl2-batteries-qt-4/

Battery Replacement Procedure

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 LSP-100 from accidently being turned on or off due to vibration, please firmly tighten the hex bolts.

In this battery powered setup, 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.

4.2. LSP-100 Wiring

The LSP-100 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 batteries should be removed from the compartment.

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.

Follow the wiring table below to connect the LSP-100 sensor to a controller.

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

4.3. Tank Top or Mounting Bracket Installation and Precautions

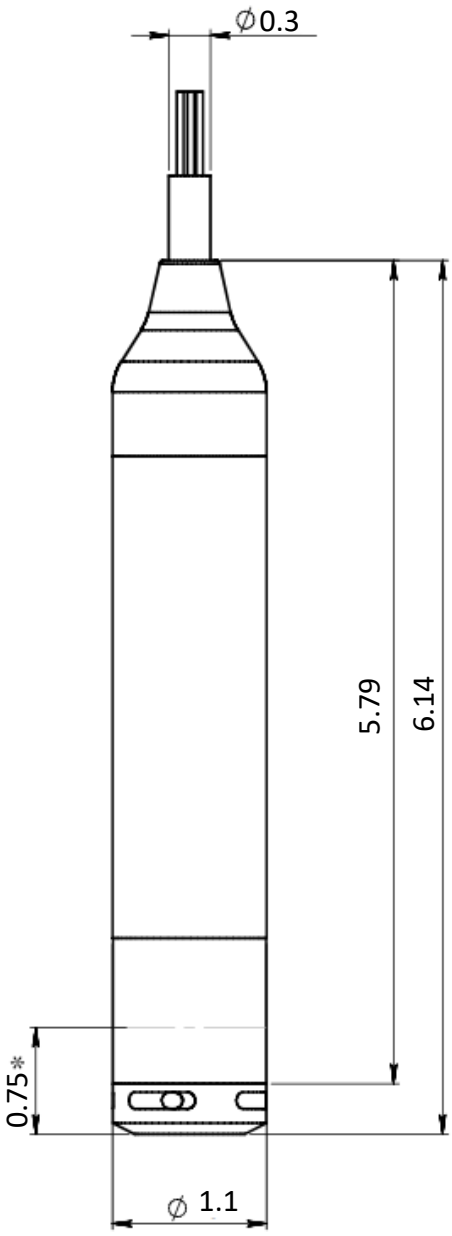
The LSP-100 sensor consists of a pressure transmitter module (figure 2) and a display/processor module (figure 3). The two modules are connected by a 32.8-foot cable. The cable provides electric connection between the two modules and serve air vent to the transducer. Please do not alter the cable.

The display/processor module of the LSP-100 sensor can be installed to a 1-inch bulkhead fitting on the top of the tank. The major dimensions of the sensor and display are shown in Figure 2 and Figure 3. Please pay close attention that installation not be too close large vibration locations.

- Lower the transmitter toward the bottom of the tank. The maximum depth is 1 inch away from the bottom of container
- Do not lay down the transmitter to the very bottom of the tank if the liquid in the tank could precipitate solids. Leave 1-inch space between the transmitter and the tank bottom surface.
- Do not remove the protective cap and expose the diaphragm directly to the liquid, which may cause the sensor damage.

Alternatively you may also use the LSP-100 Mounting Bracket (P/N – 50770) for installations where top tank mount may be to too high for visual display verification. In this format, the display/processor module is installed in a location away from the tank top to take the advantage of the 32.8-foot cable and have visibility to the display.

Figure 1.1 LSP-100 Mounting Bracket (P/N:50770)



* Show the distance from sensing diaphragm to the bottom of product

Unit: inch

Figure 2. LSP-100 pressure transducer dimensions

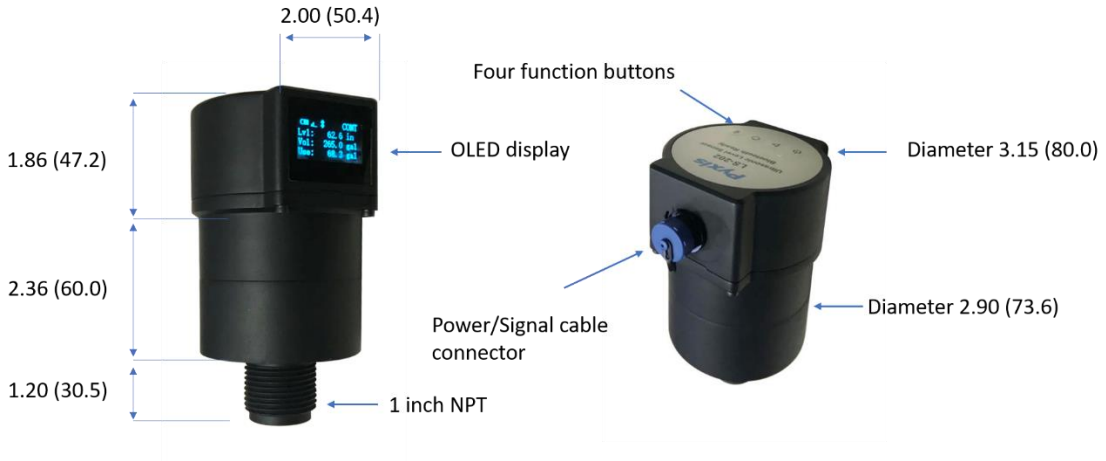


Figure 3. LSP-100 display module dimensions

5. Instrument Overview

5.1. Function Buttons

The buttons on the top of the LSP-100 (figure 4) 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: Push 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 log 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 LSP-100 is on the battery power.

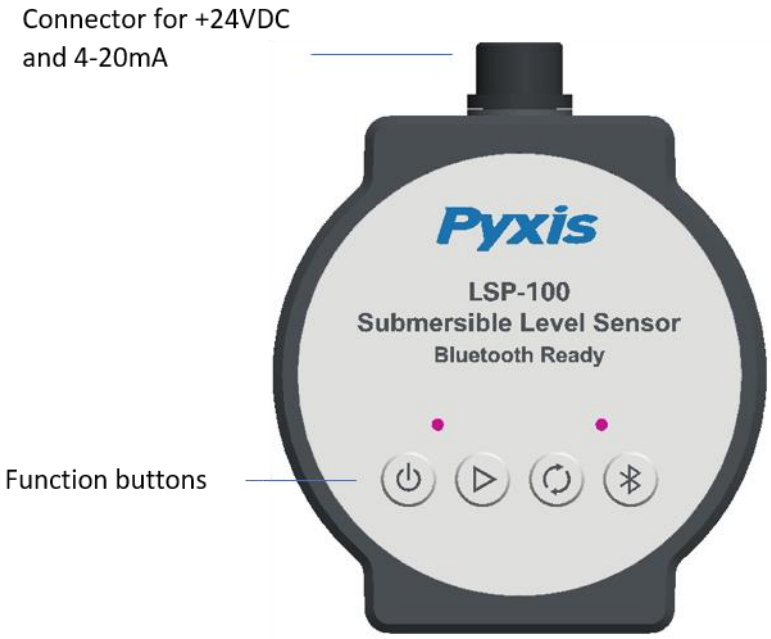


Figure 4. Power connector and function buttons

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.

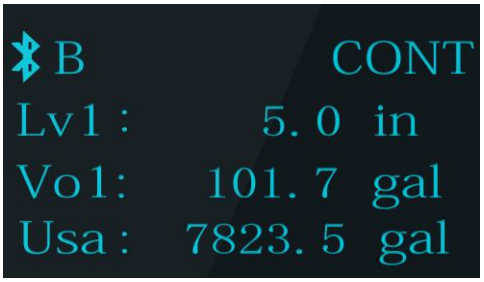


Figure 5. Mode 1, general information and also showing continous measurement and Bluetooth in B mode

Figure 6. Mode 2, level display

Figure 7. Mode 3, remaining volume

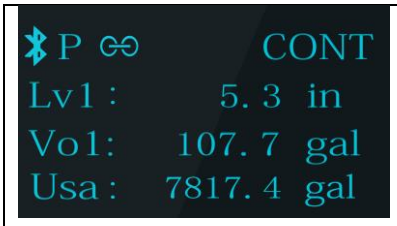
Figure 8. Mode 4, volume consumed

Figure 9. Device Mac address, FCC ID, and error code

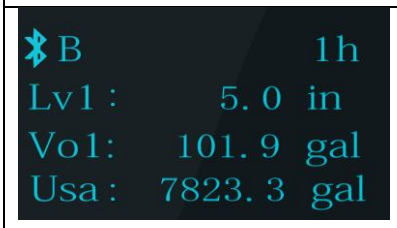
Figure 10. System time and date, and software version

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. 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 incorrect.

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



CONT	Continuous measurement mode
	Bluetooth is ready
P	Connectable Peripheral Mode
	Bluetooth connected
EMPTY	Liquid level reaches the lowest setting value
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

6. LSP-100 Setup with uPyxis

Pyxis LSP-100 has three Bluetooth modes: Peripheral mode, Beacon mode, and Shutdown mode.

Peripheral mode: Connected with another Bluetooth device via uPyxis app, such as a smart phone, computer with Bluetooth USB adapter (PN: MA-NEB), or the BTA-100/400.

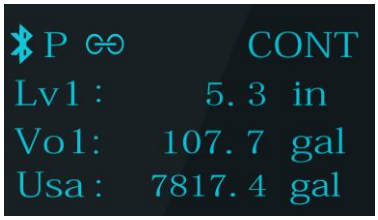


Figure 11. Bluetooth in peripheral mode

Beacon mode: The advantage of the beacon mode is that multiple Bluetooth enabled devices can read the LSP-100 broadcasting results at the same time.

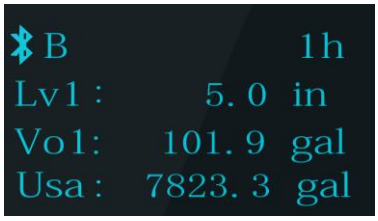
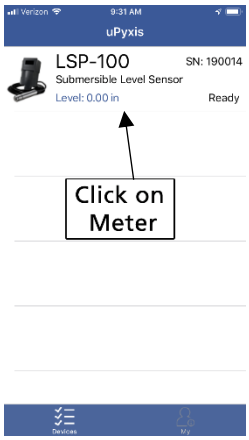


Figure 12. Bluetooth in beacon mode

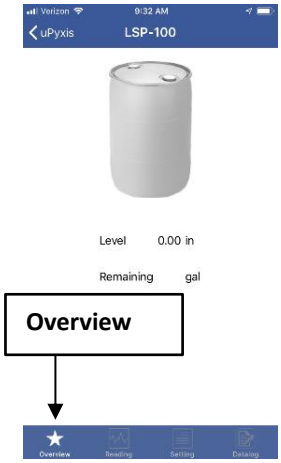
Shutdown mode: Bluetooth is deactivated. icon display is absent in OLED screen.

6.1. Connecting to uPyxis Mobile App

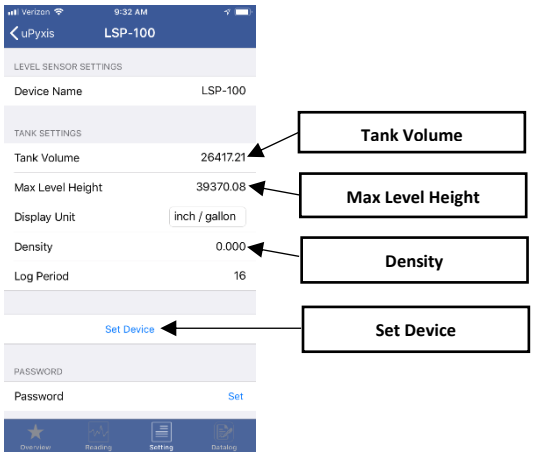
Turn on Bluetooth on your mobile phone. (Do not pair the phone Bluetooth to the LSP-100). Open the **uPyxis** Mobile App and connect to the meter by clicking on the LSP-100.



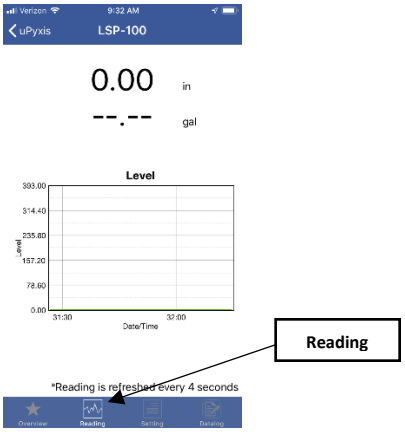
When connected, Mobile App will default to the Overview screen.



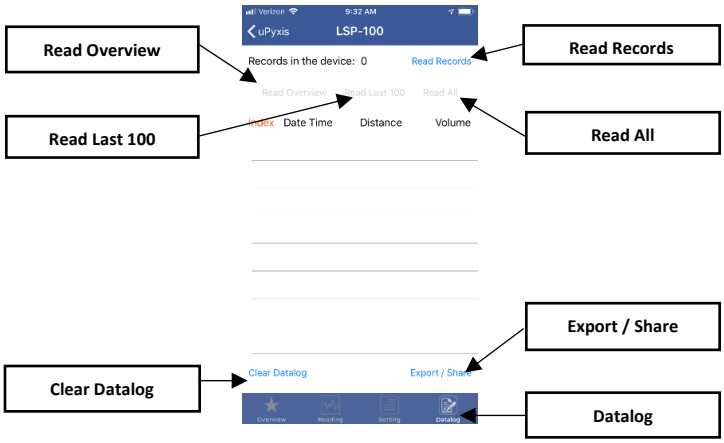
To set the Parameters, Click on Settings. Enter Tank Volume, Max Level Height (Max Liquid Height must be less than Installation Height) and Product Density (lb/gal), then press Set to save.



To verify your readings after setting your parameters click on Reading.



To download data history, Press Datalog tab. To get records, press Read Records, then Read last 100 (for only the last 100 readings) or Read Overview (Overview of all readings). To download records, Press Export/Share.



6.2 Install uPyxis Desktop Version

Download the latest version of **uPyxis** Desktop software package from: https://www.pyxis-lab.com/resource/software_driver/uPyxis.Setup.1.5.2.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 **uPyxis** Desktop application. Double click the **uPyxis.Setup.exe** file to install.

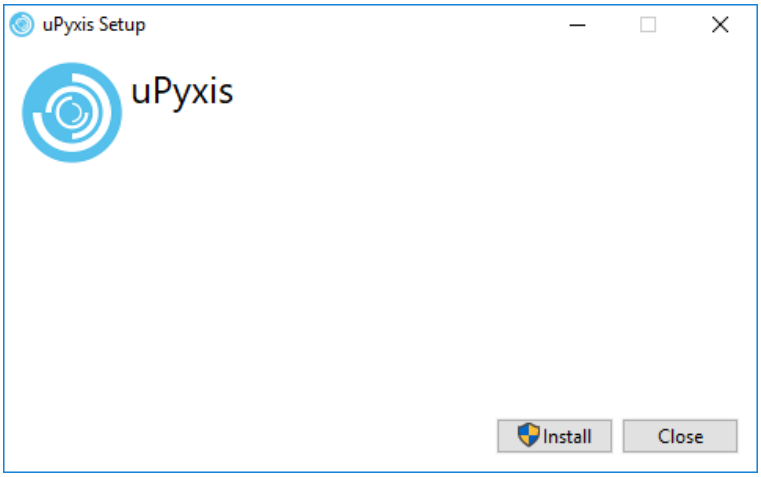


Figure 13. uPyxis desktop app installation

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

6.3 Connection to the uPyxis Desktop App

Connect the LSP-100 to a Windows computer using a Bluetooth/USB adapter (PN: MA-NEB) according to the following steps:

1. Plug the Bluetooth/USB adapter to a USB port in the computer.
2. Hold the key on LSP-100 until the Bluetooth mode changes to the *Peripheral mode, indicated by letter P on the upper left corner*. Double click the uPyxis.exe icon to launch the program.
3. On uPyxis Desktop, click menu Device -> **Connect via USB-Bluetooth** as shown in Figure 14. If the connection is successful, the LSP-100 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.

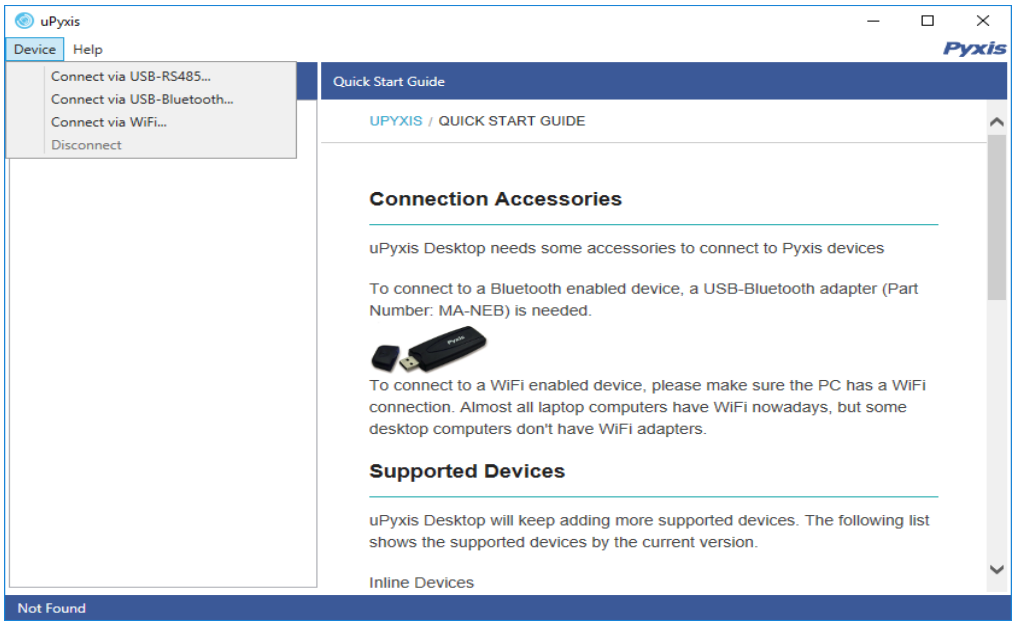


Figure 14. Connect uPyxis to LSP-100

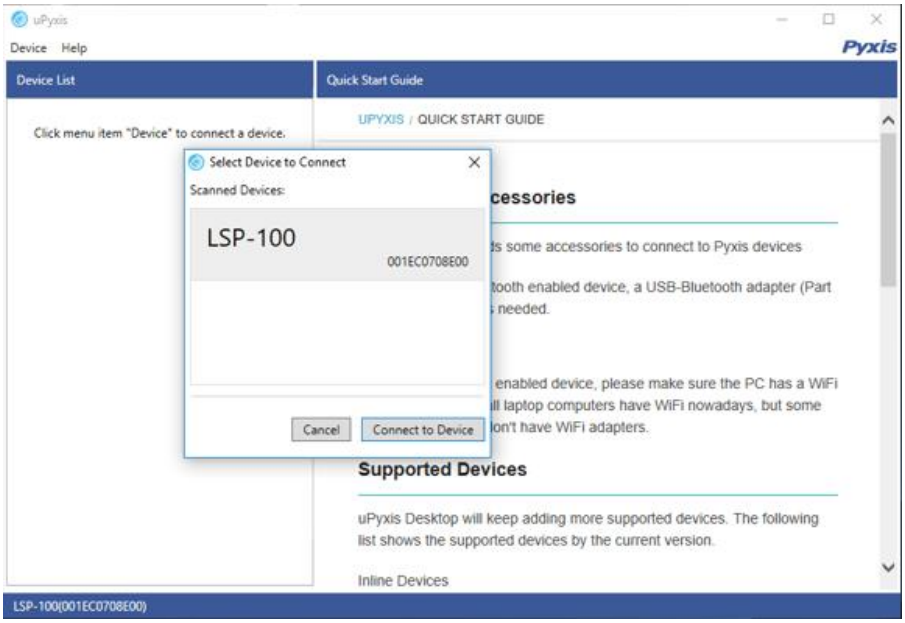


Figure 15. LSP-100 discovered

6.4 Parameter Setting via uPyxis

After connecting the LSP-100 sensor, uPyxis displays the overview page (figure 16). Click **Setting** to set the LSP-100 parameters as show in Figures 17. The LSP-100 sensor measures the hydrostatic pressure value created by the liquid level in the tank. Converting this measured pressure value to other parameters such as the tank level and the remaining liquid volume in gallons requires the tank dimensional and volume capacity information, and the specific gravity of the liquid as well. Common vertical tanks have a uniform horizontal cross section. As such, the liquid volume is proportional to the liquid level. To convert the measured pressure to volumetric information, the LSP-100 requires the user to enter three parameters via the uPyxis app for Smartphone or uPyxis Desktop as shown in figure 17.

The **maximum height** is the liquid level in inch measured from the tank bottom to the liquid surface when the tank is filled to the rated **Volume** capacity. **Density** is the specific gravity of the liquid. Please enter the specific gravity of the liquid in pound/gallon if the **Displayed unit** chosen is **inch/gallon**. The default value used by the sensor is 8.34 pound/gallon or 1.00 g/ml, which is the density of water at 77 °F (25 °C). **Log period** is the time in seconds between two level values measured being saved to the sensor storage. After entering all the parameters, please click **Set** to allow uPyxis to send data to the LSP-100 sensor.

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

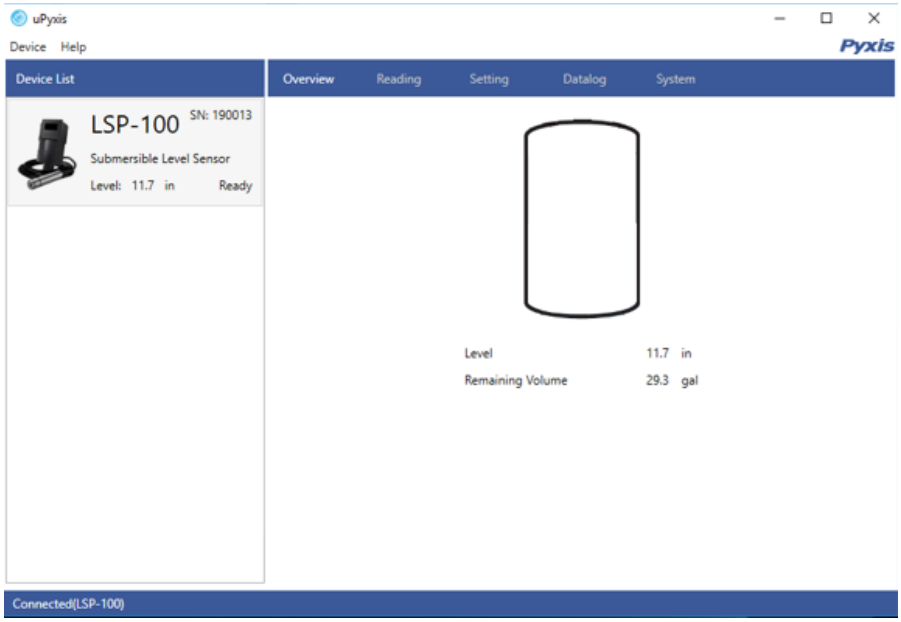


Figure 16. LSP-100 connected and the overview page

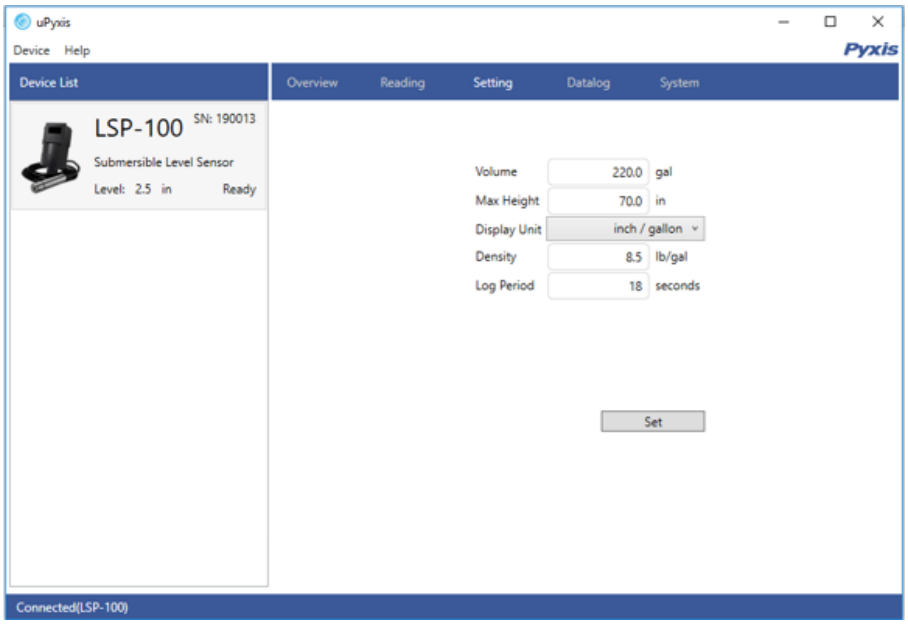


Figure 17. Parameter setup

6.5 Real Time Reading Chart

Click **Reading** menu to display LSP-100 real-time measurement data in a trend chart (figure 18).

Figure 18. Level trend chart

6.6 Data Log

Click **Datalog** to upload the historical measurement data as shown in figure 20. Please first click **Read Datalog Info** to enable functional buttons. The LSP-100 has the ability to have save large amounts of data (up to 8000 log readings). Dependent on the configuration of log data time period, **Read All Datalog** may take a long time to completely upload to uPyxis. Please use **Read Recent 100** datalog to read the most recent 100 data points.

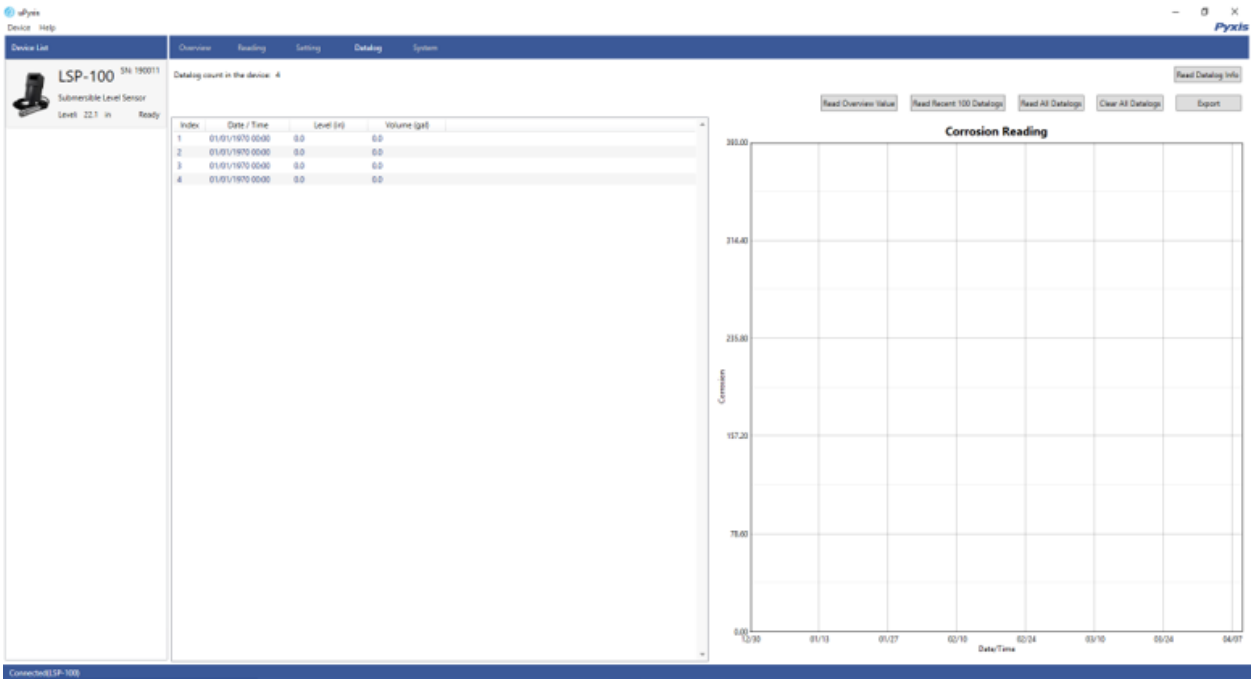


Figure 19. Datalop view and upload

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

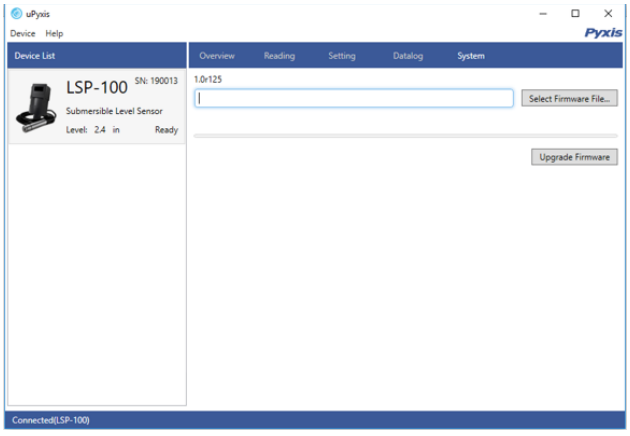


Figure 20. Firmware upgrade

6.7 4-20 mA Output Setup

The 4-20 mA output of the LSP-100 is scaled as:

4 mA = (Tank is Empty) = (Level is 0)
20 mA = (Tank is Full) = (Level is maximum height or volume)

The 4-20 mA analog signal can be converted to one of four values (Level, 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, at which the tank is full and the tank level is 36 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 LSP-100 for practical purposes.

6. Output 4-20 mA via BTA-100 Adapter

The **BTA-100** adapter (BTA-100, figure 22) (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 LSP-100 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 the manual.

LSP-100 to BTA-100	LSP-100 Mode	BTA-100	Comment
Peripheral to Central	Peripheral	Central	LSP-100 can be only read by BTA-100 and cannot be discovered by other Bluetooth devices. The Bluetooth mode indicator “P” on LSP-100’s OLED screen and “C” on BTA-100. LSP-100 power consumption on this mode is high. It is not recommended for a long-term connection
Beacon to Observer	Beacon	Observer	LSP-100 can be read by other Bluetooth devices while being read by BTA-100. Bluetooth mode indicator “B” are displayed on LSP-100’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.

6.1. Peripheral to Central Mode (LSP-100 Connection to BTA-100)

Figure 21. Connect BTA-100 to LSP-100 in central mode

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

- Turn on the LSP-100 and switch to the peripheral mode (Bluetooth mode indicator “P” on the LSP-100 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 LSP-100 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 LSP-100 is on the battery power.

6.2. Beacon to Observer Mode (LSP-100 Connection to BTA-100)

Figure 22. Connect BTA-100 to LSP-100 in observer mode

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

- Switch LSP-100 to the beacon mode (Bluetooth mode indicator “B” on the LSP-100 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 LSP-100 sensor and press the enter button  to establish the beacon-to-observer connection.

7. Sensor Cleaning and Maintenance

For best performance, following the steps below to clean the submersible transmitter if necessary:

STEP 1: Holding the body of the transmitter with one hand and carefully remove the protective nose cap by simply unscrewing it from the transmitter body. Do not touch the sensor diaphragm with your finger or any other object. Also, do not try to dry the inside portion of the transmitter, as you risk damaging the pressure sensor.

STEP 2: Place the transmitter in a vertical position with the sensing end facing downward in the bowl containing **Pyxis All-Purpose Cleaner** for approximately 1 minute. Rinse in the bowl containing clean water and wipe dry the external casing only. Place the protective nose cap in the same solution for approximately 1 minute, rinse and wipe dry.

STEP 3: Screw the protective nose cap back into place.

8. Regulatory Approval

United States

The LSP-100 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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