

## LS-200 Level Sensor User Manual



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## **Warranty Information**

### **Confidentiality**

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

### **Standard Limited Warranty**

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

### **Warranty Term**

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

### **Warranty Service**

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

Pyxis warrants that any labor services provided shall conform to the reasonable standards of technical competency and performance effective at the time of delivery. All service interventions are to be reviewed and authorized as correct and complete at the completion of the service by a customer representative, or 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 (RA) Number must be obtained from Pyxis Technical Support before any product can be returned to the factory. Pyxis will pay freight charges to ship replacement or repaired products to the customer. The customer shall pay freight charges for returning products to Pyxis. Any product returned to the factory without an RA number will be returned to the customer.

## 1 Introduction

The Pyxis LS-200 is a general-purpose ultrasonic sensor. It provides continuous level measurement up to 86 inches (7.2 ft or 2.2 m) with a 4-20mA output, RS-485, and Bluetooth digital outputs. It can be configured via the uPyxis® App on your mobile phones or computers. The sensor is powered by a 24 VDC external power supply. This non-contact liquid level sensor is well suited for corrosive liquids and can be used for industrial and municipal liquid storage and chemical feed applications.

## 2 Specifications

Item	Specification
Range	4–86 inch (0.01–2.2 m)
Resolution	0.02 inch (0.5 mm)
Accuracy	±0.15% of the range
Measurement Interval	Continuous, 10 or 30 seconds, 3 or 30 minutes, 1 or 4 or 6 hours, or stopped
Output	Bluetooth 4.1, 32 ft (10 m) Line of Sight, 4-20mA Analog Output, RS-485 Digital Output with Modbus protocol
Installation	1-inch male NPT
Cable Length	9.8 ft (3 m), extension cable available
Power Supply*	24 VDC, 2 W
Dead Zone	4 inch (10 cm)
Dimension	Height: 4.33 inch (110 mm); Diameter: 2.95 inch (75 mm)
Weight	0.45 lbs (210 g)
Enclosure Material	Polycarbonate (PC)
Transducer Material	Polyvinylidene Fluoride (PVDF)
Operational Temperature	5-122 °F (-15-50 °C)
Storage Temperature	-4-140 °F (-20-60 °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 Unpacking 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.

### 3.1 Standard Provided Accessories

- LS-200 Sensor P/N: 54011
- Waterproof Cable Adapter/Flying Leads (10 ft) P/N: 50774
- Bluetooth/USB adapter P/N: MA-NEB

## 4 Installation

### 4.1 Wiring

The LS-200 level sensor is powered by a 24V DC power supply from any standard controller, PLC or DCS. The unit offers both a 4-20mA output and an RS-485 Modbus output. If the power ground terminal and the negative 4-20mA terminal in the controller are internally connected (non-isolated 4-20mA input), it is unnecessary to connect the 4-20mA negative wire (green) to the 4-20mA negative terminal in the controller. If a separate DC power supply other than from a controller is used, make sure that the output from the power supply is rated for 22-26 VDC @ 80 mA. Under standard installations the clear wire is not landed and remains unused. 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 resolve this problem.

**\*NOTE\*** Pyxis recommends powering off the controller, landing wires to controller terminal board while the adapter to LS-200 is disconnected. Once the controller is powered on, re-connect the adapter end to the LS-200. Follow the wiring table below to connect the sensor to a controller or receiving device.

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

\* Internally connected to the power ground

### 4.2 Tank Top Installation and Precautions

The 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 2. 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



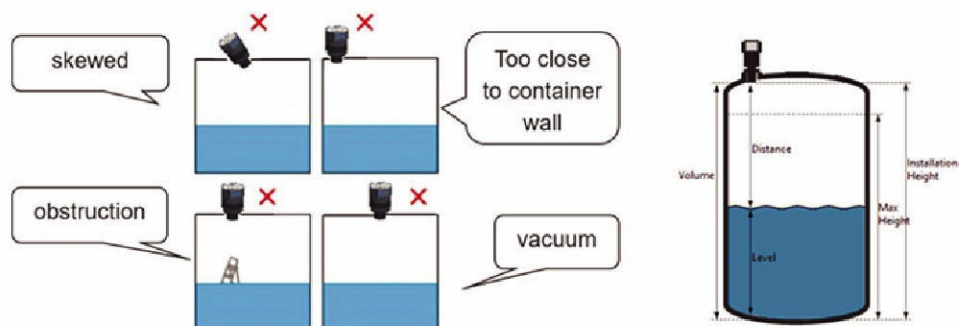


Figure 1. Installation illustration



Figure 2. Dimensions, inch (mm)

## 5 Instrument Indicator Overview

The indicators on the top of the sensor (Figure 3) are used to indicate power status and Bluetooth connection status.

LED Status	On	Off
Green LED	Power Supply is on	Power Supply is off
Blue LED	Bluetooth is connected	Bluetooth is disconnected

**\*NOTE\*** The Bluetooth connected LED will illuminate within 30 seconds of powerup of the device. This feature is designed to minimize controller power draw during startup.

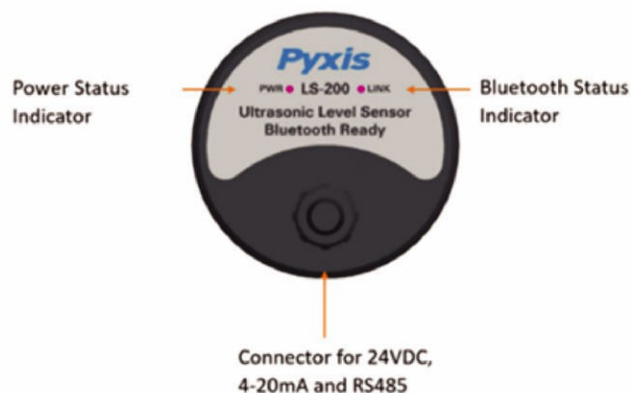


Figure 3. Sensor connection and indicators

## 6 Setup with uPyxis® Mobile App

### 6.1 Download uPyxis® Mobile App

Download uPyxis® Mobile App from [Apple App Store](#) or [Google Play](#).

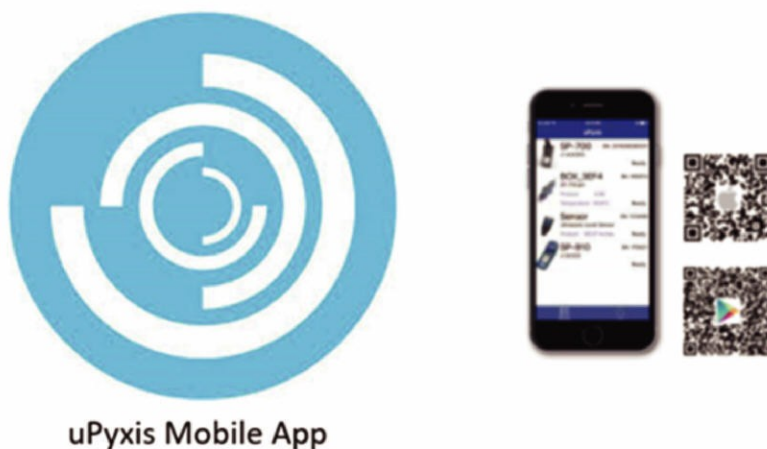


Figure 4.

### 6.2 Connecting to uPyxis® Mobile App

Turn on Bluetooth on your mobile phone (**Do not pair the phone Bluetooth to the LS-200**). Open uPyxis® Mobile App. Once the app is open the app will start to search for the sensor. When the uPyxis® Mobile App connects to the sensor then press on the **LS-200 Sensor Picture**.

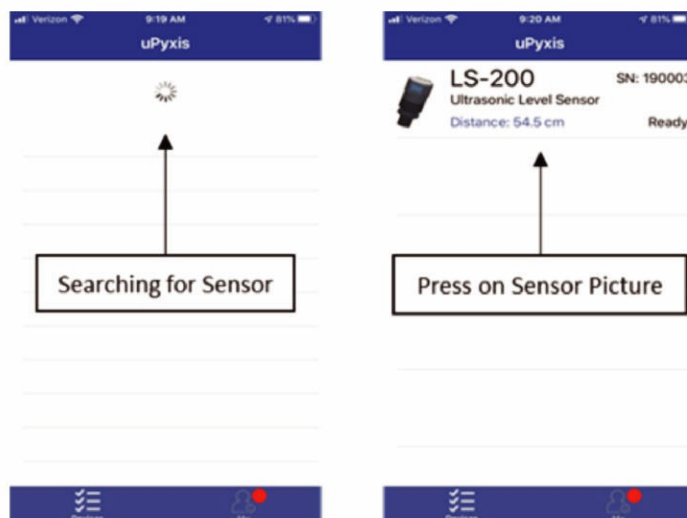


Figure 5.

### 6.3 Parameter Setting via uPyxis® Mobile App

The 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, or the consumed liquid, 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, it requires the user to enter three parameters. Figure 6 illustrates these parameters for the tank. When connected, uPyxis® Mobile App will default to the **Overview** screen. To enter the setting press on **Setting** tab.



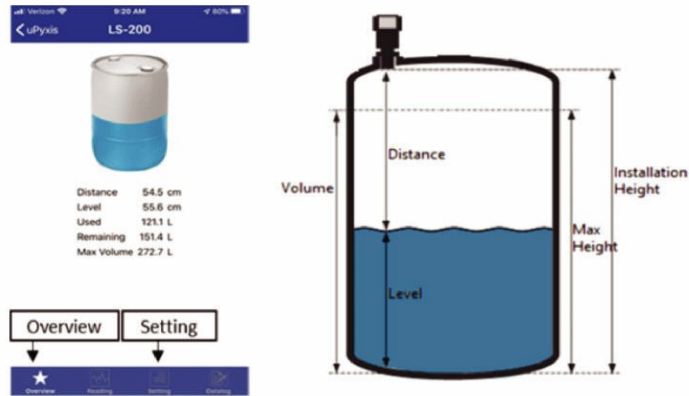


Figure 6.

In the **Setting** screen, you can set the Level Sensor Settings by renaming the **Device Name**. The **Sampling Mode** can be changed to your preference. To configure the tank, enter the settings by pressing on **Tank Volume**, **Installation Height**, **Max Level**, and **Display Units**. To save the settings, press **Apply Settings**.

**\*NOTE\*** Max Level Height must be at least 4 inches less than Installation Height

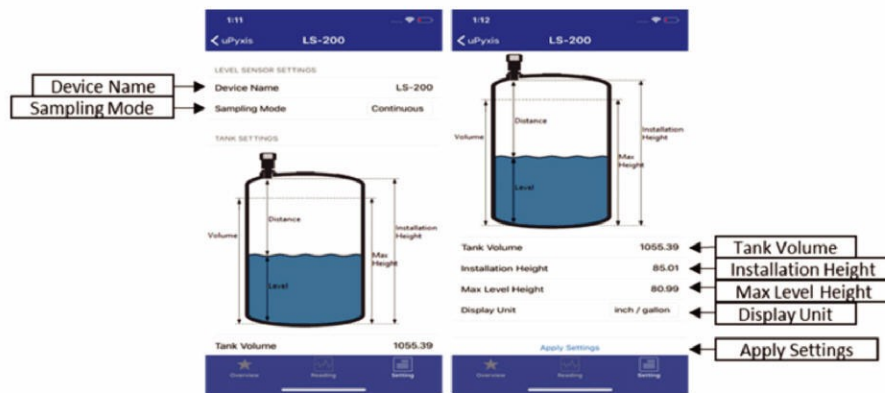


Figure 7.

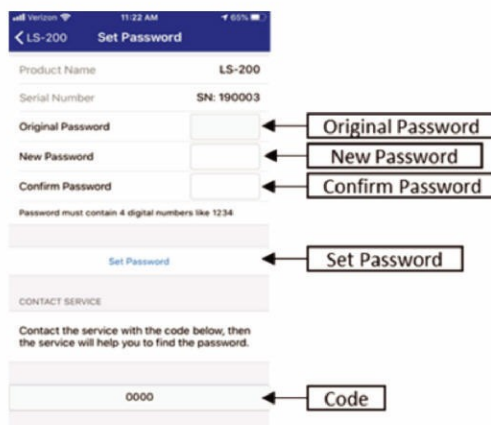
To verify your readings after setting your parameters click on **Reading**.



Figure 8.

#### 6.4 Setting a Password via uPyxis® Mobile App

The LS-200 also has password protect capabilities. To password protect the setting on **Password**, press **Set**. After pressing **Set**, the screen will change over to the **Set Password** screen. Before setting a new password, contact Pyxis Service Department and give them the code at the bottom of the screen. The service representative will provide you with a password enabling you to reset a new password. Enter the password that was given in the **Original Password** box. Then enter the **New Password**, **Confirm Password**, and press **Set Password**.



The screenshot shows the 'Set Password' screen in the uPyxis mobile app. The header shows a back arrow, 'LS-200', and 'Set Password'. The screen displays the following information: Product Name: LS-200, Serial Number: SN: 190003. There are three input fields: 'Original Password', 'New Password', and 'Confirm Password'. Below these fields is a note: 'Password must contain 4 digital numbers like 1234'. There is a 'Set Password' button. Below the button is a 'CONTACT SERVICE' section with the text: 'Contact the service with the code below, then the service will help you to find the password.' There is a 'Code' input field with the value '0000'.

Figure 9.

## 7 Setup with uPyxis® Desktop App

### 7.1 Install uPyxis® Desktop App

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.

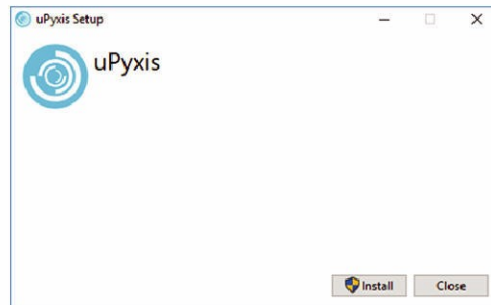



Figure 10. uPyxis® desktop app installation

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

### 7.2 Connecting to uPyxis® Desktop App

Connect the to a Windows computer using a Bluetooth/USB adapter (PN: MA-NEB, included in the package) according to the following steps:

1. Connect the Bluetooth/USB adapter (PN: MA-NEB) to the computer USB.
2. Double click the **uPyxis.exe** icon  to launch the program on your Desktop.
3. On uPyxis® Desktop App, click menu Device -> **Connect via USB-Bluetooth** as shown in Figure 11. If the connection is successful, the LS-200 image and its Serial Number will be displayed in the left pane of the uPyxis® window as shown in Figure 12.

**\*NOTE\*** After the LS-200 and the Bluetooth/USB adapter are powered up, it may take up to 10 seconds for the adapter to establish the wireless communication with the LS-200.

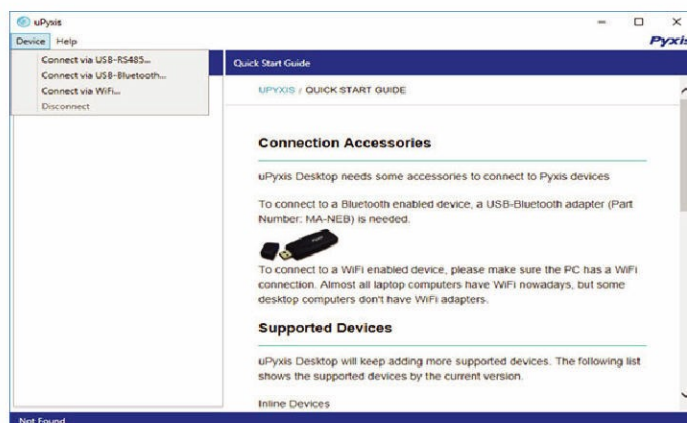


Figure 11. Connect uPyxis® desktop app to LS-200

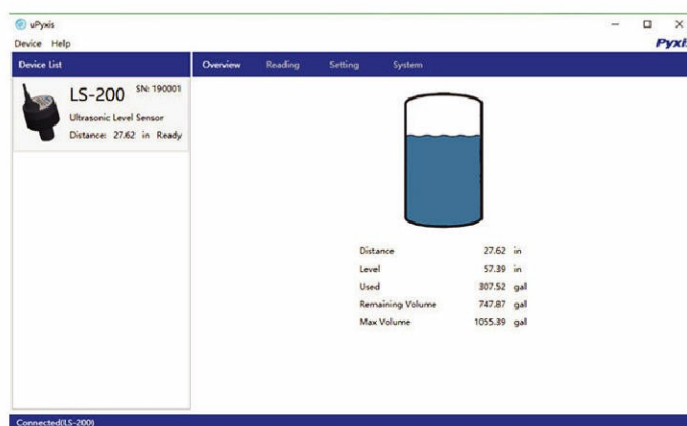


Figure 12. Definitions of terms

### 7.3 Parameter Setting via uPyxis® Desktop App

Click **Setting** to set the parameters as show in Figures 13-15. The 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, or the consumed liquid, 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, it requires the user to enter three parameters as shown in Figure 13.

The maximum height 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 bottom surface.

**\*NOTE\*** Max Level Height must be at least 4 inches less than Installation Height

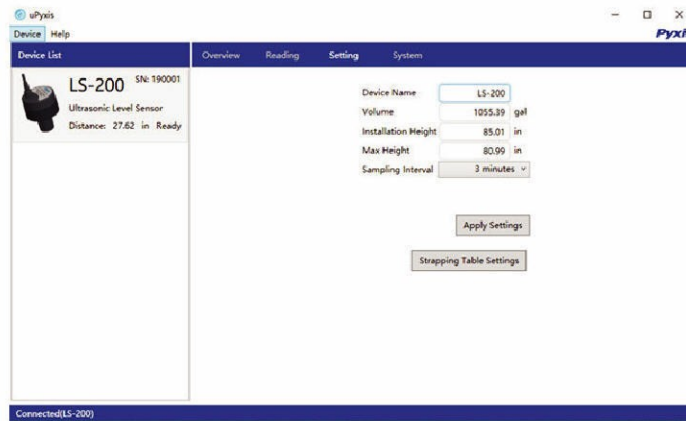


Figure 13. Illustration of terms and tank capacity setup

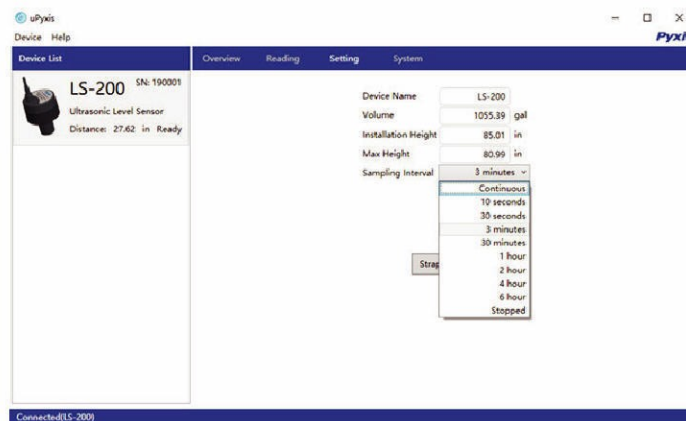


Figure 14. Measurement mode drop-down selection

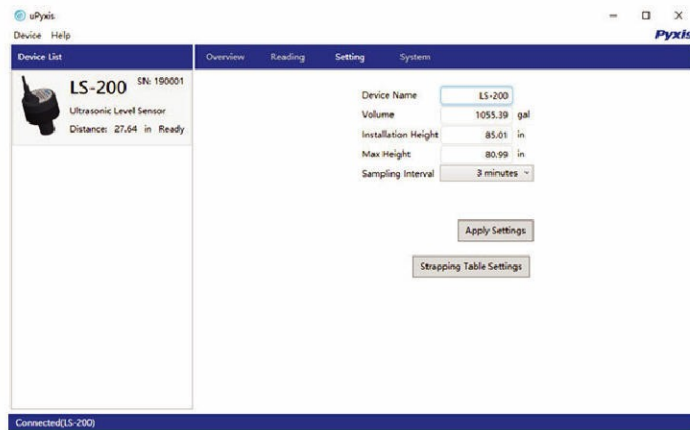


Figure 15. Click **Apply Settings** to save the settings

Definitions of terms in Figures 13–15.

- **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 bottom surface.
- **Sampling Interval:** Continuous, 10 seconds, 30 seconds, 3 minutes, 30 minutes, 1, 4, 6 hours, or stopped

Click **Reading** menu to display real-time measurement data in a trend chart (Figure 16).

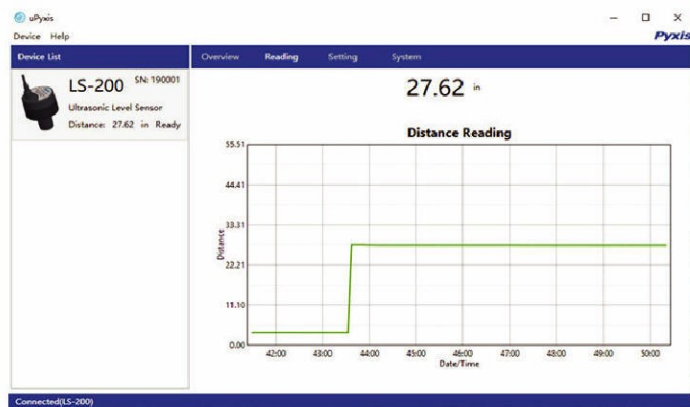


Figure 16. Level trend chart

To upgrade firmware, click **System** as shown in Figure 17.



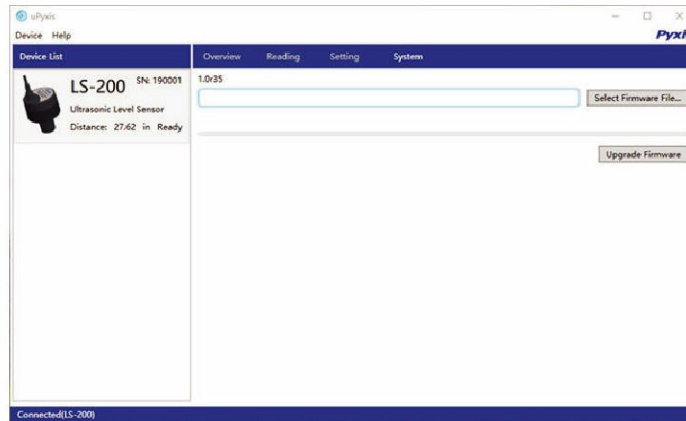


Figure 17. Firmware upgrade

## 8 Outputs

### 8.1 4-20mA Output Setup

The 4-20mA output of the sensor 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 Height – Maximum Height).

The 4-20mA 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 LS-200 for practical purposes.

### 8.2 Communication Using Modbus RTU

The sensor 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.

## 9 Sensor Maintenance and Precaution

For best performance, keep the sensor ultrasonic surface clean using a soft cloth or towel. Notice that sometimes the maximum sound pressure level inside the beam area is up to 165dB, which exceeds the

standard safe limit of 110dB. Never point the probe at the eye. The directivity pattern of the probe is shown in Figure 18.

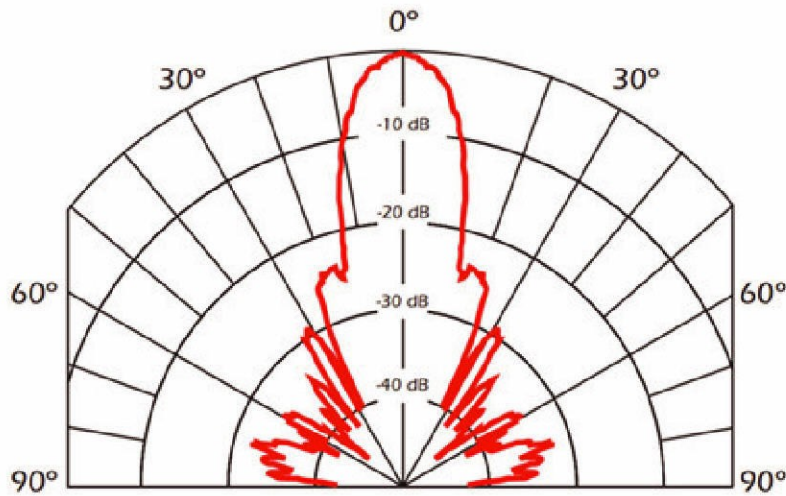


Figure 18. Directivity pattern of the LS-200

## 10 Regulatory Approval

### United States

The LS-200 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