Ultrasonic Level Switch

User Guide

Revision A.3
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Thank you for purchasing an ABM Ultrasonic Level Switch. Your Ultrasonic Level Switch is adaptable to your tank environment. This guide will help you understand the operation and setup of your Ultrasonic Level Switch. In this guide the Ultrasonic Level Switch will be referred as “Level Switch” or “Switch”.

**Ultrasonic Level Switch Wiring**

The Switch housing has 3 wiring cables as shown in Figure 1. The power and communication wire cable is #24 AWG. The relay cable is a three conductor #18 AWG capable of carrying higher currents. The wires are colour coded as shown in Figure 1. The Level Switch requires an input voltage between 12 and 30 volts DC. The third cable (#24 AWG) connects the ultrasonic controller to the transducer.

![Figure 1 The Ultrasonic Level Switch has 2 wiring cables, one for power and communication and a one for the relay.](attachment:image)

**Basic Switch Operation**

Your Ultrasonic Level Switch emits a short burst of ultrasonic energy. The energy is coupled through a rubber membrane to the tank causing the tank to vibrate. The tank vibrations are detected and analysed by the Switch. Based on the vibration patterns the Switch is able to detect the presence or absence of liquid inside the tank, and directly opposite the Level Switch.

When the liquid inside the tank is below the switch point of the Switch (see Figure 2) the Switch’s relay will be in the energized state referred to as the Normally Open (N.O) state (connecting the relay common to the relay normally open connector see Figure 1 for wiring). When the liquid inside the tank is above the detection zone of the Switch (see Figure 3) the relay will be in the non-energized state referred to as the Normally Closed (N.C) state (connecting the relay common to the relay normally close connector see Figure 1 for wiring).
When the Liquid level is below the Switch, the relay is energized and in the Normally Open (N.O) position.

Figure 2 The Switch’s relay will be in the Normally Open (N.O) position when the liquid in the tank is below the Switch.

When the Liquid level is above the Switch, the relay is not energized and in the Normally Close (N.C) position.

Figure 3 The Switch’s relay will be in the Normally Closed (N.C) position when the liquid in the tank is above the Switch.

**Hysteresis Zone – Preventing Relay Clatter.**

When the liquid in the tank crosses the switch point, the relay will change to energized or non-energized. To prevent the relay from changing state a small hysteresis zone is created around the switch point see Figure 4. The relay cannot change state until the liquid level in the tank increases or decreases beyond the hysteresis zone.

Figure 4 The hysteresis zone prevents the relay from toggling states when the liquid level is at the switch point.
Training Your Level Switch

After your Switch has been installed a simple 2 step training process must be performed using the training button on the Switch. Your Switch must learn the dynamics and characteristics of your tank when the liquid level is above and below the Switch. The liquid level requirements are different for thick walled tanks and thin walled tanks.

Level Switch Training Button

Your Switch is equipped with a training button that can be used to train your Switch to match your tanks characteristics. To access the calibration button on the Switch remove the Switch’s lid by unscrewing it. To activate the training mode using the button, power must be supplied to the Switch and the button must be pressed for time specified in Table 1. Press the button until the LED turns the desired color and then release the button.

Table 1 Training Button

<table>
<thead>
<tr>
<th>Seconds Pressed</th>
<th>LED Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>Off</td>
<td>If the button is pressed for less than 5 seconds it is ignored and no action is taken.</td>
</tr>
<tr>
<td>&gt; 5</td>
<td>Yellow</td>
<td>The tank liquid is below the Switch. Train the Switch for below Switch tank characteristics.</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>Red</td>
<td>The tank liquid is above the Switch. Train the Switch for above Switch tank characteristics.</td>
</tr>
<tr>
<td>&gt; 15</td>
<td>Off</td>
<td>If the button is pressed for greater than 15 seconds the sensor toggles between the Thick Walled Tank algorithm and the Thin Walled Tank Algorithm. The sensor LED indicates the sensor’s mode.</td>
</tr>
</tbody>
</table>

Where: < means less than and > means greater than.

Training the Level Switch - Liquid Level Below the Level Switch (Thin Walled Tank)

For this step the liquid level must be a minimum of 2 inches (5 centimeters) below the Switch as shown in Figure 5. With the Switch powered on the LED should be green. Press and hold the training button. The LED will turn off, 5 seconds later it will turn yellow. Release the button when the LED turns yellow. The LED will blink green for 10 seconds while it is training. When the Switch is finished its training cycle the LED will stop blinking and remain green.

![Figure 5 Training the Switch when the liquid level is below the Switch. (Thin walled tank)](image-url)
Training the Level Switch - Liquid Level Above the Level Switch (Thin Walled Tank)

For this step the liquid level must be a minimum of 2 inches (5 centimeters) above the Switch as shown in Figure 6. With the Switch powered on the LED should be green. Press and hold the training button. The LED will turn off, after 5 seconds the LED will turn yellow, after another 5 seconds the LED will turn red. Release the button when the LED turns red. The LED will blink green for 10 seconds while it is training. When the Switch is finished its training cycle the LED will stop blinking and remain green.

Figure 6 Training the Switch when the liquid level is above the Switch. (Thin walled tank)

Training the Level Switch - Liquid Level Below the Level Switch (Thick Walled Tank)

For this step the liquid level must be at the bottom of the Sensor’s transducer as shown in Figure 7. With the Switch powered on the LED should be green. Press and hold the training button. The LED will turn off, 5 seconds later it will turn yellow. Release the button when the LED turns yellow. The LED will blink green for 10 seconds while it is training. When the Switch is finished its training cycle the LED will blink green.

Figure 7 Training the Switch when the liquid level is below the Switch. (Thick walled tank)
Training the Level Switch - Liquid Level Above the Level Switch (Thick Walled Tank)

For this step the liquid level must be at the top of the sensor’s transducer as shown in Figure 8. With the Switch powered on the LED should be green. Press and hold the training button. The LED will turn off, after 5 seconds the LED will turn yellow, after another 5 seconds the LED will turn red. Release the button when the LED turns red. The LED will blink green for 10 seconds while it is training. When the Switch is finished its training cycle the LED will blink green.

![Figure 8 Training the Switch when the liquid level is above the Switch. (Thick walled tank)](image)

Switch Point

When the Switch has been correctly trained the switch point will be located at the center of the transducer face as shown in Figure 9.
Easy Mounting Option for Round Tanks
The Ultrasonic Level Switch can be installed quickly and easily on round tanks using the ABM Level Switch mounting flange system (see Figure 10 and Figure 11). For other tank shapes please contact ABM Sensor Technology for different mounting options. A 1 inch (2.5 cm) ratchet strap is wrapped around the tank and connected to the either side of the mounting flange. Once the mounting flag is in place the strap is tightened using the ratched. The strap must be tightened enough to ensure that transducer face is pressed tightly against the tank wall and cannot move. Ratchet strap comes in lengths up to 100 feet or 30 meters. Watch our quick install video.

Figure 10 The transducer nozzle screws through the mounting flange allowing the nozzle to extend 1/4” (6.35mm) beyond the flange.

Figure 11 A UV resistant ratchet strap is attached to the mounting flange and wraps around the tank.
**Level Switch Installation Procedure**

The Switch is installed against an outside vertical tank wall. Refer to Figure 12 and Figure 13 during the installation process. As described in step 6 below, when installing the Level Switch a generous amount of High Vacuum Grease should be applied to the rubber spacer as shown in Figure 12. The grease should cover the entire rubber spacer. The grease provides an “air free” connection between the rubber spacer and the tank wall. For proper operation it is important that enough grease be used and carefully spread to prevent air bubbles being trapped between the rubber spacer and the tank wall. Watch our quick install video.

1. Identify and mark the location where the sensor is to be installed on the tank.
2. Hold the ratchet in place and run the 1” strap around the tank to each side of the mounting flange.
3. Thread the 1” strap through each side of the mounting flange.
4. Hold the flange in place and tighten the 1” strap, so that the flange pressure on tank is at least 1 bar or higher.
5. Use the provided buckles to prevent the straps from loosening.
6. Spread the high vacuum grease on the transducer’s rubber spacer. This is a critical step. The grease must cover the entire rubber spacer. There should be no air bubbles in or under the grease. Air bubbles will strongly reduce coupling between the sensor and the tank. The grease provides a medium that matches the transducer to the tank. **Without the grease the Level Switch will not work.**
7. Insert the transducer into the flange and thread it all the way into the flange while holding the flange away from the tank.
8. Once the transducer has been threaded all the way into the flange, unscrew the transducer one complete turn.
9. Gently let the transducer move towards and rest against the tank.
10. Tighten the transducer the remaining one turn.
11. The transducer should now be completely threaded into the flange and the transducer’s rubber spacer with grease should be pressed firmly against the tank. If there is a space between transducer’s rubber spacer and the tank or if the transducer’s rubber spacer is not firmly pressed against the tank, the transducer has not been completely threaded through the flange or the rubber straps have not been tightened sufficiently. In this case, remove the transducer from the flange and repeat steps 4 to 10.

![Figure 12 The transducer rubber spacer must be coated with grease before the transducer is inserted into the mounting flange.](image)

The Switch must be securely pressed against the tank wall to prevent the Switch from tilting or moving. Figure 13 shows a correctly mounted Switch.
No gaps or air pockets between rubber spacer and tank wall.

Figure 13 A correctly installed Level Switch with no gaps or air pockets between the rubber spacer and the tank wall.