



Why use an ultrasonic switch over other level technologies? Depending upon your application, there may be three or four technologies equally suited for your application; however, only one will be the best choice when considering its features and benefits.

Ultrasonic switches are a cost-effective solution for your applications. Installation requires mounting the sensor (threaded or flanged) to the vessel, connecting the power and control wires, and applying power. There is no additional set-up or calibration required. Since it is an electronic instrument with no moving parts, preventive maintenance is limited to an annual visual inspection. The only recommended spare part is the "board" at a quantity of one board for every 10 units. A technician with basic electrical skills (wiring) can service the instrument.

Cost

- In addition to the price of the instrument, you must consider the cost of installation, set-up and calibration.

Maintenance

- You need to factor in the frequency of preventative maintenance. Also, consider the cost of keeping key "spare parts" on the shelf.

Skill

- What "skill" level is required of your maintenance personnel to service the instrument.

Ultrasonic switches are simple to apply and use. There are only a few limitations to their use:

- The media must be liquid
- Process temperature between -40 and 250°F (-40 to 121°C)
- The media must have less than 5% suspended solids
- No aeration in fluids with a viscosity of 100cP (30W motor oil) or greater

The following chart will assist you in selecting the right product for your application.

Single Point Sensing	Line Power		Loop Power
Integral Mount Electronics	701	711	701
Integral Mount Electronics with Sensor Monitor (Self-Test)		721	721
Remote Mount Electronics	701	711	701
Remote Mount Electronics with Sensor Monitor (Self-Test)		721	721
Dual Point Sensing	Line Power		Loop Power
Alarm or Pump Control		712	N/A
Alarm or Pump Control with Sensor Monitor (Self-Test)		722	N/A

Principle

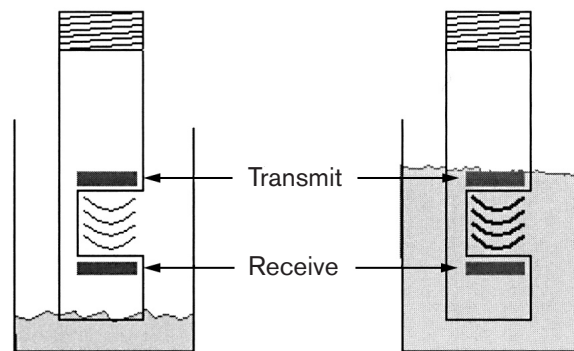
An ultrasonic switch is a device that uses inaudible high-frequency sound (ultrasound) to detect the presence or absence of a liquid at a designated point. The device consists of an electronic control unit and a sensor.

Ultrasonic level switches use the properties of sound transmission in vapor and liquids to detect liquid level. When sound travels in air, it loses a great deal of signal strength. When traveling in liquid, sound retains almost all of its signal strength.

To detect liquid level, we must determine if there is a liquid or gas (air) in the gap. Since liquids have a higher density than gasses, it is easier to transmit sound through them. One side of the sensor gap transmits sound, the other side detects it. When liquid is present, a high amount of sound is received at the detection side. When gas (air) is present, a small amount of sound is received. The electronics detect this difference and switch a relay accordingly.

Ultrasonic switch sensors contain two piezoelectric crystals, one transmits sound and one receives sound. Each crystal is mounted on one side of a gap in the metal sensor. The transmit crystal generates high frequency sound (1MHz to 3 MHz) that is directed across the gap to the receiver crystal. The receiver crystal converts the sound energy received into an electric signal, which is processed by the electronics to determine if the gap has liquid or air in it.

The drawing below shows the basic construction of an ultrasonic level switch sensor. An electrical signal is sent to the “transmit” crystal, which causes it to vibrate and produce high frequency sound. The “receive” crystal converts the high frequency sound that strikes it to another electrical signal, which is sent back to the electronics for processing. The sound energy that makes it across the sensor gap is very weak in air, and becomes very strong in liquid.



Application Conditions

Ultrasonic level switches can be used in a wide variety of applications without any calibration or setup. However, there are limitations to the types of process they will work in. The factors below must be taken into consideration before selecting an ultrasonic level switch for your application.

- Liquids only - the process media must be a liquid. The ultrasonic level switch cannot detect the difference between two gases or a gas and a solid. The even density of a liquid is required for proper detection.
- Clean liquids only - a liquid that has too high a percentage of solids will not transmit sound well enough to allow detection. Typically 5% suspended solids are the maximum amount allowed.
- The liquid must flow - an application where the liquid cannot drain out of the sensor gap will cause false alarms. If a liquid is too viscous to flow out of a 3/4" gap then the unit will not operate properly. Sometimes this can be solved by different mounting, but some liquids are just too viscous.
- No (or few) bubbles - especially in fluids with a viscosity higher than 100cP (30W motor oil). Large bubbles in thick fluids will block the sound signal from crossing the gap. Low viscosity fluids can have a fairly large amounts of bubbles as they tend to be very small (Alka-Seltzer in water).

If these guidelines are observed properly the ultrasonic level switches will provide trouble-free operation without any calibration or periodic adjustment.

The Series 701 tip-sensitive ultrasonic switch is a single-point device designed for economical detection of clean liquids. There are no moving parts and no calibration. The 701 is available either integral or remote mounted. An optional time delay can be used to eliminate false alarms due to turbulence in the process. An optional field selectable fail-safe switch is also available. The standard unit is set to High-level Failsafe (HLFS).

Features

- No calibration required
- 10A DPDT relay output
- FM Approved or CSA Certified for hazardous locations
- Line and loop powered versions

701 Single Point

Product Specifications

Input Power			Maximum Current Draw (Line Power)	
Line	120 VAC, 50/60 Hz		24 VDC	100 mA
	240 VAC, 50/60 Hz		120 VAC	35 mA
			240 VAC	18 mA
Loop	11-36 VDC Intrinsically Safe			
Fuses	Field replaceable (line power only)		Response Time	
			On	0 second
			Off	1 second
Output Type			Enclosure Environmental Rating	NEMA 4X; IP65
Line	10A DPDT, 250 VAC		Conduit Connection	3/4" NPT
	10A DPDT, 30 VDC		Maximum Remote Distance from Sensor	50 feet (15.2 meters)
	DC rating shown for resistive loads		Ambient Temperature Range	-40 to 160°F (-40 to 71°C)
Loop	8mA (dry), 16mA (Wet)-Standard		Process Temperature Range	-40 to 250°F (-40 to 121°C)
Loop Resistance	765 ohms maximum @ 24 VDC		Maximum Process Pressure	2000 psig (138 bar)
Repeatability	0.078" (2mm)			
Failsafe	HLFS-Standard; field selectable is optional			

The Series 711 ultrasonic switch is a versatile single-point device designed for the detection of clean liquids. The 711 is available with a variety of sensor types to meet most process conditions. It is available integral or remote mounted and comes standard with field-selectable failsafe.

Features

- No calibration required
- Can be used with notch, epoxy and viscous type sensors
- FM Approved and CSA Certified, for hazardous locations
- Field-selectable failsafe

711 Single Point

Product Specifications

Input Power	120 VAC, 50/60 Hz	Response Time	On	250 mSec
	240 VAC, 50/60 Hz		Off	250 mSec
	24 VDC			
Output Type	10A DPDT, 250 VAC	Enclosure Environmental Rating	NEMA 4X; IP65	
	10A DPDT, 30 VDC		Conduit Connection	3/4" NPT
	DC rating shown for resistive loads			
Repeatability	0.078" (2mm)	Maximum Remote Distance from Sensor	50 ft. (15.2 m)	
Failsafe	Field-selectable	Ambient Temperature Range	-40 to 160°F (-40 to 71°C)	
Maximum Current Draw (Line Power)		Process Temperature Range	-40 to 250°F (-40 to 121°C)	
	24 VDC		140 mA	
	120 VAC		60 mA	
	240 VAC	30 mA		
		Maximum Process Pressure	2000 psig (138 bar)	

*See page 22 for sensor shipping weights.

The Series 721 ultrasonic

switch is an advanced single-point device designed to meet your needs for overflow protection. In addition to the features of the 711, the 721 includes a “Sensor Monitor.” This circuit continuously tests the functionality of the electronics and sensor. The “Sensor Monitor Relay” de-energizes if a fault is detected. The 721 is available with a variety of sensor types to meet most process conditions. It is available integral or remote mounted and comes standard with field-selectable failsafe.

Features

- No calibration required
- Continuous self-test (sensor monitor) verifies operation
- FM or CSA Certified for hazardous locations
- Field-selectable failsafe
- On/Off time delay is standard

721 Single Point

Product Specifications

Input Power		Maximum Current Draw (Line Power)	
Line	120 VAC, 50/60 Hz	24 VDC	220 mA
	240 VAC, 50/60 Hz	120 VAC	60 mA
	24 VDC	240 VAC	30 mA
Loop		Response Time (Line Power)	
	11-36 VDC	On	250 mSec
	(Intrinsically safe)	Off	250 mSec
Output Type		Response Time (Loop Power)	
Line		On	0.5 seconds
Alarm	10A DPDT, 250 VAC	Off	5 seconds
	10A DPDT, 30 VDC		
	DC rating shown for resistive loads		
Sensor Monitor	10A DPDT, 250 VAC	Time Delay	0-30 seconds
	10A DPDT, 30 VDC		
	DC rating shown for resistive loads	Enclosure Environmental Rating	NEMA 4X; IP65
Loop		Conduit Connection	3/4" NPT
Alarm	8 mA (Dry), 16 mA (Wet)	Maximum Remote Distance from Sensor	50 ft. (15.2 m)
Sensor Monitor	5 mA or 19 mA; Field selectable	Ambient Temperature Range	-40 to 160°F (-40 to 71°C)
Loop Resistance	650 ohms maximum @ 24 VDC	Process Temperature Range	-40 to 250°F (-40 to 121°C)
Repeatability	0.078" (2mm)	Maximum Process Pressure	2000 psig (138 bar)
Failsafe	Field-selectable		

*See page 22 for sensor shipping weights.

The Series 712 ultrasonic

switch is a versatile dual-point designed for the detection of clean liquids. The dual-output can be used as independent alarm points or used in tandem to provide pump control. It is available integral or remote mounted and comes standard with field-selectable failsafe.

Features

- No calibration required
- Optional pump control logic available
- FM and CSA Certified for hazardous locations
- Field-selectable failsafe

721 Dual Point

Product Specifications

Input Power		Enclosure Environmental Rating	NEMA 4X; IP65
Line	120 VAC, 50/60 Hz	Conduit Connection	1" NPT
	240 VAC, 50/60 Hz	Maximum Remote Distance from Sensor	50 ft. (15.2 m)
	24 VDC	Ambient Temperature Range	-40 to 160°F (-40 to 71°C)
Output Type	(2) 10A DPDT, 250VAC	Process Temperature Range	-40 to 250°F (-40 to 121°C)
	(2) 10A DPDT, 30VDC	Maximum Process Pressure	2000 psig (138 bar)
	DC rating shown for resistive loads	Shipping Weight*	7 lbs. (3.2 kg) + 10.5 lbs. (4.8 kg) for cast iron housing + 2 lbs. (1 kg) for remote
Repeatability	0.078" (2mm)		
Failsafe	Field-selectable		
Maximum Current Draw			
24 VDC	280 mA		
120 VAC	120 mA		
240 VAC	60 mA		
Response Time (Line Power)			
On	250 mSec		
Off	250 mSec		

*See page 22 for sensor shipping weights.

The Series 722 ultrasonic switch is an advanced dual-point device designed to meet your needs for sump/pump control. In addition to the features of the 712, the 722 includes a "Sensor Monitor." This circuit continuously tests the functionality of the electronics and sensor (both gaps). The "Sensor Monitor Relay" de-energizes if a fault is detected. It is available integral or remote mounted and comes standard with field-selectable failsafe and time delay.

Features

- No calibration required
- Continuous self-test (sensor monitor) verifies operation of the unit
- FM and CSA Certified for hazardous locations
- Field-selectable failsafe
- On/Off time delay is standard

722 Dual Point

Product Specifications

Input Power		Response Time	
Line	120 VAC, 50/60 Hz	On	250 mSec
	240 VAC, 50/60 Hz	Off	250 mSec
	24 VDC		
Output Type		Time Delay	0-30 seconds
Alarm	(2) 10A DPDT, 250 VAC	Enclosure Environmental Rating	NEMA 4X; IP65
	(2) 10A DPDT, 30 VDC	Conduit Connection	1" NPT
	DC rating shown for resistive loads	Maximum Remote Distance from Sensor	50 ft. (15.2 m)
Sensor Monitor	(2) 10A DPDT, 250 VAC	Ambient Temperature Range	-40 to 160°F (-40 to 71°C)
	(2) 10A DPDT, 30 VDC	Process Temperature Range	-40 to 250°F (-40 to 121°C)
	DC rating shown for resistive loads	Maximum Process Pressure	2000 psig (138 bar)
Repeatability	0.078" (2mm)	Shipping Weight*	7 lbs. (3.2 kg) + 10.5 lbs. (4.8 kg) for cast iron housing + 2 lbs. (1 kg) for remote.
Failsafe	Field-selectable		
Maximum Current Draw (Line Power)			
24 VDC	440 mA		
120 VAC	120 mA		
240 VAC	60 mA		

*See page 22 for sensor shipping weights.