Overview

Introduction

Ultrasonic measurement is based on the speed of sound. Sound can be used as a measurement tool because there is a measurable time lapse between sound generation and the "hearing" of the sound. This time lapse is then converted into usable information. Ultrasonic sensing equipment generates a sound above 20000 Hz and then interprets the time lapse of the returned echo. The transducer creates the sound and senses the echo and then a transceiver interprets the sound and converts it into information.

Siemens ultrasonic units include Sonic Intelligence, a patented signal processing technology. Using unique algorithms, Sonic Intelligence differentiates between true echoes from the material and false echoes from obstructions or electrical noise, providing intelligent processing of echo profiles.

Typical System

Ultrasonic level measurement requires two components: one to generate the sound and catch the echo (transducer) and one to interpret the data and derive a measurement (transceiver). Even though some ultrasonic instruments combine the components in one unit, the individual functionality remains distinct. The measurement output is communicated to the unit, PLCs or PCs for process control.

Principle of Operation

A piezoelectric crystal inside the transducer converts an electrical signal into sound energy, firing a burst into the air which travels to the target and then is reflected back to the transducer. The transducer then acts as a receiving device and converts the sonic energy back into an electrical signal contained in the transceiver. An electronic signal processor analyzes the return echo and calculates the distance between the transducer and the target. The time lapse between firing the sound burst and receiving the return echo is directly proportional to the distance between the transducer and the material in the vessel. This basic principle lies at the heart of the ultrasonic measurement technology and is illustrated in the equation:
Distance = (Velocity of Sound x Time)/2.

Mode of operation

Common Terms

Attenuation

Denotes a decrease in signal magnitude in transmission from one point to another. Attenuation may be expressed as a scalar ratio of the input magnitude to the output magnitude or in decibels.

Beam angle

The diameter of a conical boundary centered around the axis of transmission when the power (radiating perpendicular to the transducer face on the axis of transmission) is reduced by half (-3 dB).

Blanking distance

Specified zone extending downward from the transducer face in which received echoes are ignored by the transceiver. Blanking distance ignores echoes from ringing.

Echo confidence

The recognition of the validity of the echo as material level.
A measure of echo reliability.

Ringing

The inherent nature of the transducer to continue vibrating after the transmit pulse has ceased; the decay of the transmit pulse.

Transducer/Transceiver

A transducer provides the initial ultrasonic pulse and receives its echo. An ultrasonic transducer amplifies the sound wave created by the piezoelectric crystal and transmits that sound wave to the face of the transducer while at the same time dampening the sound wave from the other sides of the crystal.

Transceivers analyze the echo from the transducer to determine the required measurement.

Technical specifications

Ultrasonics Transmitter/Controller Selection Guide

Criteria	SITRANS Probe LU	HydroRanger 200	MultiRanger 100/200	SITRANS LUC500	SITRANS LU	OCM III
Range	6 m (20 ft) or 12 m (40 ft)	15 m (50 ft) transducer and application dependent	15 m (50 ft) transducer and application dependent	15 m (50 ft) transducer and application dependent	60 m (200 ft) transducer and application dependent	3 m (10 ft)
Typical applications	Chemical storage vessels, filter beds, liquid storage vessels	Wet wells, flumes/weirs, bar screen control	Wet wells, flumes/weirs, bar screen control, hoppers, chemical storage, liquid storage, crusher bins, dry solids storage	Wet well/lift station control, weirs/flumes, open channels	Chemical storage, liquid storage, bulk solids storage (sugar, flour bins, grains, cereals), plastic pellets	Open channel measurement
Output	HART model: 4 to 20 mA/HART PROFIBUS PA model: PROFIBUS	6 relays standard, two 4 to 20 mA outputs (isolated)	1 relay (option on MultiRanger 100) 3 relays standard 6 relays (option) Two 4 to 20 mA outputs (isolated)	5 relays, 4 to 20 mA (option)	4 relays (LU01, LU02) Up to 40 relays (LU10) 4 to 20 mA isolated	3 relays, 4 to 20 mA
Communications	HART or PROFIBUS PA Options: • SIMATIC PDM for remote configuration and diagnostics	Built-in Modbus RTU/ASCII via RS-485 Options: • SIMATIC PDM • SmartLinx (PROFIBUS DP, Allen-Bradley Remote I/O, DeviceNet)	Built-in Modbus RTU or ASCII via RS-485 Options: • SIMATIC PDM • Smartlinx (PROFIBUS DP, Allen-Bradley Remote I/O, DeviceNet)	Telemetry capability with Modbus RTU/ASCII via RS-232/RS-485 Options: • SIMATIC PDM • SmartLinx (PROFIBUS DP, Allen-Bradley Remote I/O, DeviceNet) • ECT EnviroRanger Tool software	Dolphin, RS-232/RS-485 (LU01, LU02)) Dolphin via infrared (LU10) Options: • SmartLinx (PROFIBUS DP, Allen-Bradley Remote I/O, DeviceNet)	Via RS-232 Options: • Flow Reporter software
Power specifications	HART: 4 to 20 mA, 24 V DC nominal, max. 550 W, 30 V DC max. PROFIBUS PA: 12, 13, 15, or 20 mA, dependent on programming	AC version: 100 to 230 V AC ±15 %, 50/60 Hz, 36 VA/17 W DC version: 12 to 30 V DC, 20 W	AC version: 100 ... 230 V AC ±15 %, 50/60 Hz, 36 VA/17 W DC version: 12 to 30 V DC, 20 W	AC version: 100... 230 V AC ±15 %, 50/60 Hz, 30 VA/17 W DC version: 12 to 30 V DC, 20 W	LU01, LU02: AC version: 100/115/200/230 V AC DC version: 18 to 30 V DC, 25 W LU10: 100/115/200/230 V AC	100/115/200/230 V AC, ±15 %, 50/60 Hz, 15 VA and/or 9 to 30 V DC, 8 W
Approvals	CE, $CSA_{US/C}$, FM, C-TICK, ATEX, ANZEx, IECEx	CE, $CSA_{US/C}$, UL Listed, FM, C-TICK	CE, $CSA_{US/C}$, UL Listed, FM, C-TICK	CE, $CSA_{US/C}$, UL Listed	CE, $CSA_{US/C}$, FM, Lloyd's Register	CE, $CSA_{US/C}$, FM

7ML1830-2AN

SITRANS Probe LU HART*
SITRANS LU

7ML5830-2AJ

SITRANS Probe LU PROFIBUS

7ML1830-2AA

OCM III

7ML1830-2AK

MultiRanger 100/200
HydroRanger 200
HydroRanger Plus
SITRANS LUC500

* **Note:** To order the IS version of this hand programmer, order 7ML5830-2AH.

Handheld programmer selection guide

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SIEMENS

Ultrasonic Level Application Questionnaire

Customer information

Contact: _____ Prepared By: _____

Company: _____ Date: _____

Address: _____ Notes on the Application: _____

City: _____ Country: _____

Zip/Postal Code: _____ Phone: ( )

E-mail: _____ Fax: ( )

Tanks/Vessel information

(Supply sketch where possible) Sketch attached ☐

Type:
☐ Storage
☐ Process
☐ Pump station
☐ Open channel

Dimensions:
Height: _____ m/ft
Width/Diameter: _____ m/ft

Critical Information
Nozzle Length: _____ cm/in
Nozzle Diameter: _____ cm/in

Tank top:
☐ Open
☐ Flat
☐ Conical
☐ Parabolic

Tank bottom:
☐ Sloped
☐ Flat
☐ Conical
☐ Parabolic

Internal equipment and/or obstructions: *(E.g. Agitator, Heating coils, Supports, Other)*
☐ No
☐ Yes *Please list* _____

Measurement type: ☐ Point Level ☐ Continuous Level ☐ Volume ☐ Flow

Area safety classification: *(specify code required)* _____

Material

Material being measured: _____ ☐ Slurry ☐ Liquid ☐ Solid

Material temperature: Norm: _____ °C/°F Max: _____ °C/°F

Atmosphere: ☐ Air ☐ Other _____ **Homogenous:** ☐ Yes ☐ No

Dust: ☐ None ☐ Light ☐ Heavy

Installation

(indicate all that apply)

Power available: _____

Inputs required:
☐ 4 to 20 mA
☐ Pump Interlocks (#): _____

Outputs required:
☐ 4 to 20 mA
☐ Relays (#): _____

Communications:
☐ HART ® /4 to 20 mA
☐ PROFIBUS DP
☐ PROFIBUS PA
☐ Modbus RTU/ASCII
☐ AB Remote I/O
☐ AB DeviceNet
☐ None

Products recommended:

www.siemens.com/processautomation
Form# 2-769R3

Overview

The Pointek ULS200 is an ultrasonic non-contacting switch with two switch points for level detection of bulk solids, liquids and slurries in a wide variety of industries; ideal for sticky materials.

Benefits

- 2 switch outputs for high-high, high, low, and low-low level alarms or pump up/pump down control
- Integral temperature compensation
- AC or DC power supply
- Electronics provided with fail-safe function
- Threaded and sanitary fitting clamp process connections
- Polycarbonate or aluminum enclosures, Type 6/NEMA 6/IP67
- Easy, two-button programming

Application

The measuring range for bulk solids is max. 3 m (9.8 ft) and 5 m (16.4 ft) for liquids and slurries. Unlike invasive contacting devices, there is no material buildup on the sensor.

The level switch has a rugged design, combining the transducer and electronics in one durable device. It has no moving parts and is virtually maintenance-free.

The transducer, available in ETFE or PVDF copolymer, is inert to most chemicals. This means the device can be used in the chemical, petrochemical, water, and wastewater industries. A sanitary version of the ULS200, with an industry standard flange option, is easy to remove from the application for cleaning. It thus satisfies the prerequisites for use in the food, beverage, and pharmaceutical industries. The Pointek ULS200 delivers superior performance while reducing maintenance, downtime, and equipment replacement costs.

- Key Applications: liquids, slurries, fluid materials, plugged chute detection, chemical industry

Design

Installation

The Pointek ULS200 should be mounted in an area that is within the temperature range specified and that is suitable to the enclosure rating and materials of construction. The cover should be accessible to allow programming, wiring and display viewing.

It is advisable to keep the Pointek ULS200 away from high voltage or current runs, contactors and SCR control drives.

Locate the Pointek ULS200 so that it has a clear sound path perpendicular to the material surface. The sound path should not intersect the fill path, rough walls, seams, rungs etc.

Mounting and Interconnection

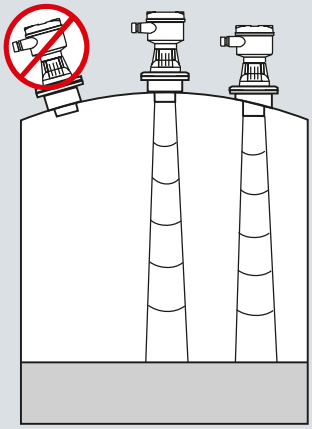
The Pointek ULS200 is available in three thread types: 2" NPT, R 2" (BSPT), EN 10226 or PF2 and can be fitted with the optional 75 mm (3 inch) flange adapter for mating to 3" ASME, DN 65, PN 10, and JIS 10K 3B sized flanges.

Separate cables and conduit may be required to conform to standard instrumentation wiring or electrical codes.

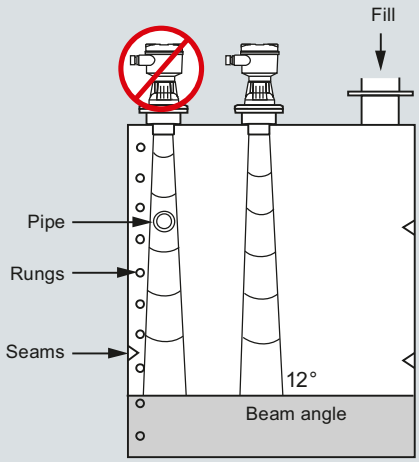
Pointek ULS200

Configuration

Parabolic mounting



Flat mounting and Beam angle



Pointek ULS200 Mounting

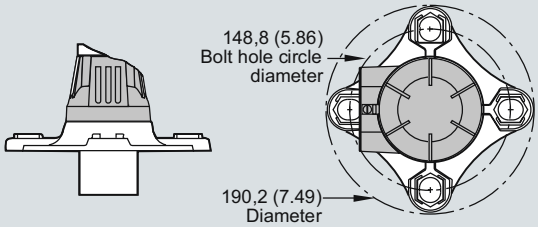
Technical specifications

Mode of operation	
Measuring principle	Ultrasonic level switch
Measuring range	
Measuring range in liquids	0.25... 5 m (0.8 ... 16.4 ft)
Measuring range in bulk solids	0.25 ... 3 m (0.8 ... 9.8 ft)
Output	
AC Version (relay)	2 SPDT Form C contacts rated 5 A at 250 V AC, resistive load
DC Version (relay)	2 SPDT Form C contacts rated 5 A at 48 V DC
DC Version (transistor)	2 switches, rated max. 100 mA, 48 V DC
Accuracy	
AC/DC version	
• Resolution	3 mm (0.1 inch)
• Repeatibility	0.25% of measuring range
Rated operation conditions	
Installation conditions	
• Location	Indoors/outdoors
• Beam angle	12°
Ambient conditions	
• Ambient temperature	-40 ... +60 °C (-40 ... +140 °F)
• If mounted in metal threads	-20 ... +60 °C (-5 t ... +140 °F)
Medium conditions	
• Process pressure	0.5 bar (7.25 psi) max.
Design	
Material	Polycarbonate or epoxy-coated aluminum with gasket
Weight	Approx. 1.5 kg (3.3 lb)
Transducer material	PVDF or ETFE copolymer
Threaded mounting	2" NPT [(Taper), ANSI/ASME B1.20.1] R 2" [(BSPT), EN 10226] or G 2" [(BSPP), EN ISO 228-1]
• Optional flange adapter	For 3" ASME, DN 65, PN 10 and JIS 10 K3B
Sanitary mounting	4" sanitary fitting clamp
Power supply	
AC version	100 ... 230 V AC, ± 15%, 50/60 Hz, max. 12 VA, 5 W
DC version	18 ... 30 V DC, 3 W
Displays and controls	
Display	LCD, three digits, 9 mm (0.35 inch) high, for display of distance between sensor face and material, multisegment graphic for operating state
Memory	EEPROM, non-volatile
Programming	2 keys

Electronics/enclosure	Connection: terminal block, max. 2.5 mm^2 (14 AWG) solid/ 1.5 mm^2 (16 AWG) stranded
Degree of protection	IP67/Type 6/NEMA 6
Cable inlet	2 x ½" NPT or 2 x PG 13.5
Certificates and approvals	• CE (EMC certificate available on request), CSA $_{US/C}$, FM • CSA/FM Class I, II, III, Div. 1, Gr A, B, C, D, E, F, G T4 • ATEX II 2G Ex d mb IIC T5 Gb • C-TICK, ANZEx Ex ds IIC T5, DIP A21 T5, IP65/IP67 • INMETRO Br-Ex d mb IIC T5

Options

Flange adapter for mating 2" NPT or 2" BSP process connections to 3" ASME, DN 65 PN10 and JIS 10K 3B flanges



Pointek ULS200 Optional Flange Adapter, dimensions in mm (inch)

Pointek ULS200

Selection and Ordering data		Order No.
Pointek ULS200 Ultrasonic non-contacting switch with two switch points for level detection of bulk solids, liquids and slurries in a wide variety of industries; ideal for sticky materials	C)	**7ML1510-** ■■■ **0** ■
Power supply		
24 V DC, relay output		**1**
24 V DC, transistor output		**2**
100 ... 230 V AC, relay output		**3**
Approvals		
CE, C-TICK, CSA Class I, II, III, Div. 1[1]		**F**
CE, C-TICK, FM Class I, II, III, Div. 1[1]		**G**
CE, C-TICK, CSA Class I, II, Div. 2[2]		**J**
CE, C-TICK, CSA us/c, FM		**K**
CE, C-TICK, ATEX II 2G Ex d mb IIC T5 Gb[3]		**L**
INMETRO Br-Ex d mb IIC T5[3]		**M**
C-TICK, ANZEx Ex ds IIC T5, DIP A21 T5, IP65/IP67[3]		**N**
Transducer/Process connection		
ETFE, 2" NPT [(Taper), ANSI/ASME B1.20.1]		**A**
EFTE, R 2" [(BSPT), EN 10226]		**B**
EFTE, G 2" [(BSPP), EN ISO 228-1]		**C**
PVDF copolymer, 2" NPT [(Taper), ANSI/ASME B1.20.1]		**E**
PVDF copolymer, R 2" [(BSPT), EN 10226]		**F**
PVDF copolymer, G [(BSPP), EN ISO 228-1]		**G**
PVDF copolymer, 4" sanitary mounting[4]		**J**
Enclosure/cable inlet		
Polycarbonate		
• Cable inlet PG 13.5		**1**
• Cable inlet ½" NPT		**2**
Aluminum		
• Cable inlet PG 13.5		**3**
• Cable inlet ½" NPT		**4**

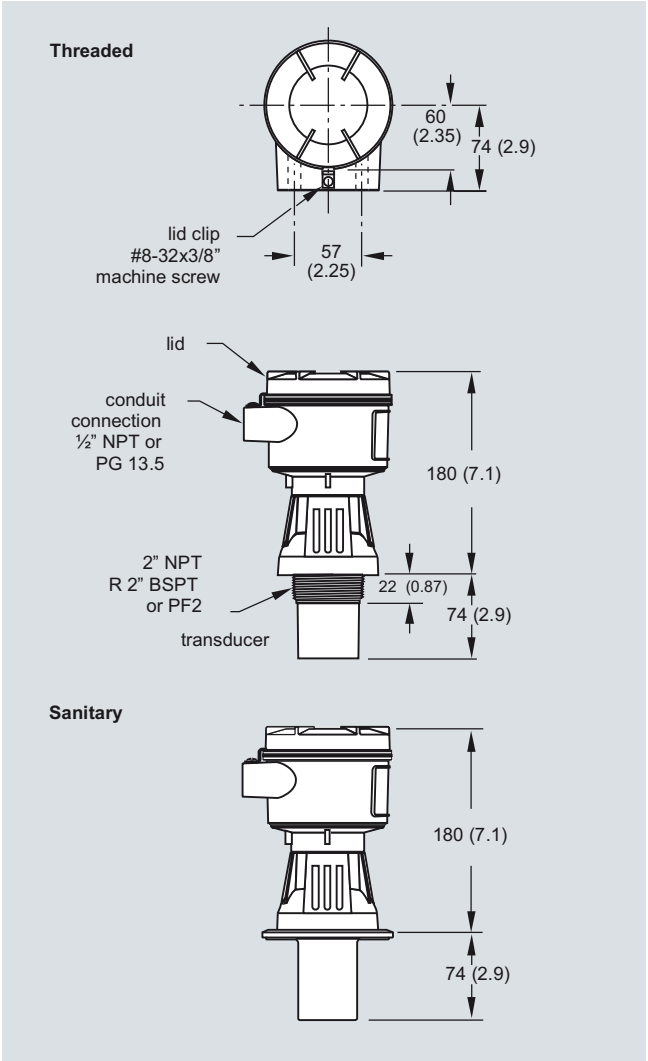
1) Available with Enclosure/cable inlet option 4 only and process connection options A and E only
2) Available with Enclosure/cable inlet options 2 and 4 only
3) Available with Enclosure/cable inlet option 4 only
4) Available with Approvals option K only

C) Subject to export regulations AL: N, ECCN: EAR99.

Selection and Ordering data		Order code
Further designs		
Please add "-Z" to Order No. and specify Order code(s)		
Stainless steel tag [69 x 50 mm (2.71 x 1.97 inch)]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Operating Instructions		Order No.
Quick Start manual, multi-language	C)	**7ML1998-1XB83**
This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.		
Accessories		
Tag, stainless steel, 12 x 45 mm (0.47 x 1.77 inch), one text line, suitable for enclosures		**7ML1930-1AC**
Universal Box Bracket Mounting Kit		**7ML1830-1BK**
3" ASME, DN 65, PN 10, JIS 10K 3B ETFE Flange adapter for 2" BSPT		**7ML1830-1BT**
3" ASME, DN 65, PN 10, JIS 10K 3B ETFE Flange adapter for 2" BSPT		**7ML1830-1BU**
2" BSPT Locknut, plastic		**7ML1830-1DQ**
2" NPT Locknut		**7ML1830-1DT**
4" sanitary mounting clamp		**7ML1830-1BR**
Spare Parts		
Polycarbonate Lid		**7ML1830-1LG**
Aluminum Lid		**7ML1830-1LH**

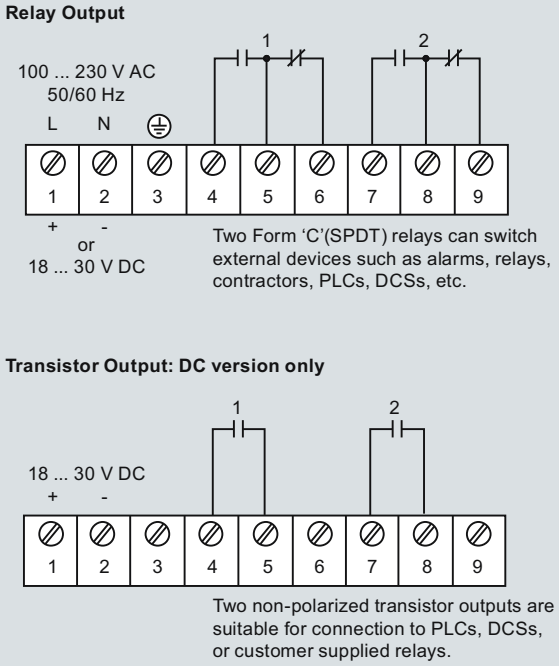
C) Subject to export regulations AL: N, ECCN: EAR99.

Dimensional drawings



Pointek ULS200, dimensions in mm (inch)

Schematics



Pointek ULS200 connections