

Product Data Sheet

IP201, Rev BA
August 2011

Ultrasonic Liquid Level Switch

Mobrey Ultrasonic Liquid level Detection Systems For Niche Applications

- *Choice of Mobrey ultrasonic liquid point level switches for use in tanks and pipelines*
- *No moving parts*
- *Simple installation*
- *Ignores foams*
- *Unaffected by radio frequency interference, conductivity, droplets, most coatings, or liquid color/opacity*
- *Optional Mobrey MCU200 industrial control unit with alarm and fault output relays*



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Ultrasonic Liquid Level Switch

Ultrasonic Liquid Point Level Switch Overview



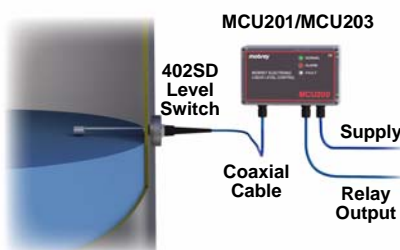
Mobrey 402SD Tank-Mounted
Ultrasonic Point Level Switch
(Gap Sensor)



Mobrey 433SD Tank-Mounted
Ultrasonic Point Level Switch
(Gap Sensor)



Mobrey MCU200 Series
Industrial Control Unit
(MCU201/MCU203)



See "Specifications" on page 5 for full technical details.

OVERVIEW

Ultrasonic liquid point level switches (sensors) are used in industrial processes to detect high or low liquid levels and liquid interface.

The liquid level switch operates using the time-proven principle of ultrasonic transmission between two piezo-electric crystals. The liquid presence is detected by virtue of its bulk. Liquid droplets, condensation, and foaming are ignored.

Control units are available for non-hazardous area operation only, with options including lamps to indicate sensor status and a circuit to detect wiring faults.

MOBREY ULTRASONIC LIQUID LEVEL CONTROL SYSTEM

A Mobrey ultrasonic liquid level control system contains:

- A **tank-mounted** Mobrey 402SD/433SD or **pipe-mounted** Mobrey 442SD ultrasonic point level switch containing transmitter and receiver piezo-electric crystals
- A Mobrey MCU200 Series industrial **control unit** mounted remotely in a *non-hazardous area* to monitor the level switch state and provide the required switching function

Typical applications include pump protection and control, tank empty protection, and interface detection duty.

Mobrey Ultrasonic Point Level Switches

Mobrey ultrasonic point level switches are activated when there is a liquid present between the sensor's *transmitter* and *receiver* crystals. In this way, the absence of liquid or cable damage results in a low level being indicated.

The level switches are normally fitted with dual coaxial cable for connection to the control unit. This cable can be extended with suitable coaxial extensions up to 164 ft. (50 m).

See "Specifications" on page 5 for technical details.

Mobrey MCU200 Series Industrial Control Unit

The **MCU201** and **MCU203** control units provide simple and economical control electronics for wall-mounting near a tank or pipeline containing a single ultrasonic level switch.

MCU200 Series features:

- Wall-mounting IP65 polycarbonate enclosure
- 115/230 Vac (*MCU201*) or 24 Vdc (*MCU203*)
- Suitable for use with all Mobrey ultrasonic liquid point level switches
- DPCO relay output relay for wet-to-dry or dry-to-wet changeover indication, external control, or alarm condition indication
- Accepts a voltage-free contact input e.g. to actuate a pump control function via the output DPCO relay
- Three LED indicators – Normal, Alarm, and Fault
- Selectable time delay
- Continuous cable check (between sensor and MCU200)

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INTERFACE DETECTION AND SLUDGE MEASUREMENT

Ultrasonic technology can be used to discriminate between immiscible liquids to indicate the interface and to detect and monitor suspended solids.

Interface detection

For interface detection between immiscible liquids, two techniques are available: *ultrasonic attenuation* and *ultrasonic reflection*.

Both techniques use standard Mobrey liquid level control electronic systems. Suitable sensors for interface monitoring are typically the larger gap types i.e. 150 mm upwards.

Ultrasonic attenuation is the reduction in beam energy as it is transmitted through the liquid. Viscous liquids, emulsions, and liquids with entrained solids generally have a higher ultrasonic attenuation than low viscosity clear liquids such as water. When the attenuation difference is sufficient, the amplifier gain can be adjusted so that the ultrasound beam passes through the less attenuative liquid but is stopped by the more attenuative liquid. The relay output can then be set to monitor which liquid is in the gap.

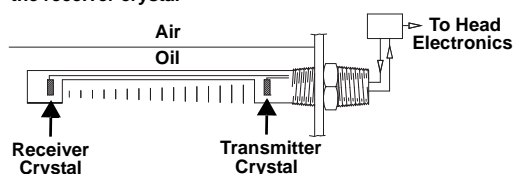
The above method cannot be used when two immiscible liquids have similar attenuations. However, it is likely that the ultrasound velocity will be different. In this case, a ultrasound beam passing through the interface is reflected and refracted and, if the sensor is arranged at a shallow angle, the effect is that the transmitted beam tends to miss the receiver and is effectively attenuated. An angle of 10 degrees is chosen and often this results in total internal reflection of the transmitted beam. Now when the *interface* is within the gap of the angled level switch, very little ultrasound reaches the receiver, but there is a large signal present when the interface is fully above or below the level switch. The MCU200 Series control unit gain can be set to actuate the relay when the interface is in the gap. This condition also occurs when the upper liquid drains away and air (gas) is in the gap. For further information on suitability of this application, consult our technical sales.

Sludge Measurement

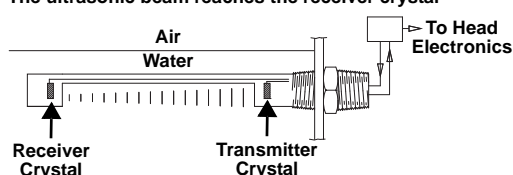
Solids suspended in a liquid will scatter ultrasonic beams, causing attenuation. This attenuation depends on the size and nature of the particles, and for typical sewage sludges it is possible to use Mobrey ultrasonic systems to detect 1% to 15% w/w. Industrial slurries such as fine pottery slips can often be measured to 65%, but coarse granular material is often very attenuative. See product data sheet IP250 for Mobrey sludge measurement systems.

INTERFACE DETECTION BY ATTENUATION

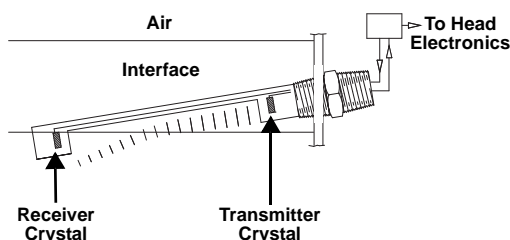
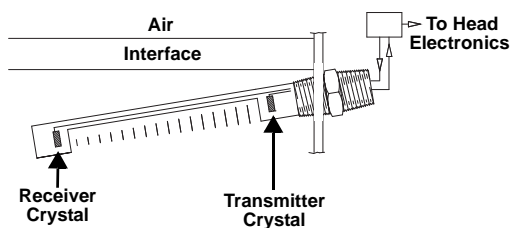
Sensor in oil:
The ultrasonic beam is attenuated and will not reach the receiver crystal



Sensor in water:
The ultrasonic beam reaches the receiver crystal



INTERFACE DETECTION BY REFLECTION



Ultrasonic Liquid Level Switch

Ordering Information



- Level switches may be mounted in any orientation to signal liquid presence
- Full details of Mobrey ultrasonic point level switches for *sludge blanket level monitoring* or *sludge density measurements* are in product data sheet IP250
- Ultrasonic sensor operations can be adversely affected by high aeration, solids, or foam in the liquid. If you have an application query, contact Mobrey Customer Support for advice on the selection of a suitable liquid level detection system
- To extend the cable, order Mobrey part number K178 or use two lengths of coax type RG178/U. The maximum allowed cable length is 164 ft. (50 m)

Additional Information

Specifications: page 5
 Dimensions: page 6

TABLE 1. Ultrasonic Level Sensor Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model	Product Description							
	Fitting ⁽¹⁾	Wetside	Duty	Liquid Type ⁽²⁾	Temperature	Pressure ⁽³⁾	Sensor Active	
Standard								Standard
402SD	¾-in. BSPT dual	316 SST, cast	Interface	Clean	-70...150 °C	1523 psi (105 bar)	Wet or Clear	★
433SD	¾-in. BSPT inside	316 SST, cast	Interface		-70...50 °C			★
442SD ⁽⁴⁾	¾-in. BSPT dual	316 SST, cast	Across Pipe		-70...150 °C			★
Sensor Compatibility with Mobrey Systems								
Standard								Standard
80 ⁽⁵⁾	MCU Control Unit, standard with 10 ft. (3 m) cable, non-hazardous area							★

OPTIONS ⁽⁶⁾		
Sensor Gap Size (433SD Only)		
Standard		Standard
1	100 mm	★
2	200 mm	★
3	300 mm	★
4	450 mm	★
5	150 mm	★
Typical Model Number: 402SD 80		

- (1) Most sensors are available with flange mounting – contact Mobrey for details.
- (2) The sensor operation may be affected by highly aerated or heavily contaminated liquids – contact Mobrey Customer Support for advice, if in doubt.
- (3) For pressures above 725 psi (50 bar), always contact Mobrey before ordering.
- (4) This is a pair of opposing sensors for installation horizontally across a customer's own pipe section.
- (5) If the MCU control unit is required, add MCU201 (115/230 Vac) or MCU203 (24 Vdc) at the time of ordering a level switch.
- (6) Sensor Gaps Size codes only required for 433SD only e.g. 433SD 80 5.

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Ultrasonic Liquid Level Switch

Specifications

TABLE 2. Specification for the Mobrey Ultrasonic Point Level Switches

Ultrasonic Point Level Switches	Mobrey 402SD	Mobrey 433SD	Mobrey 442SD
Repeatability	2 mm	2 mm	2 mm
Operating Temperature	-94 to 302 °F (-70 to 150 °C)	-94 to 122 °F (-70 to 50 °C)	-94 to 302 °F (-70 to 150 °C)
Maximum Pressure	1523 psi (105 bar)	1523 psi (105 bar)	1523 psi (105 bar)
Weight	0.35 kg	0.5 kg	0.35 kg
Standard Frequency	3.7 MHz	3.7 MHz	1-3.3/3.7 MHz
Standard Cable Length	9.84 ft. (3 m)	9.84 ft. (3 m)	23 ft. (7 m)
Power Consumption	< 10 mW at sensor	< 10 mW at sensor	< 10 mW at sensor
Cable Entry	Cable entry to sensor is IP65	Cable entry to sensor is IP65	Cable entry to sensor is IP65
Mean Time Before Failure	MTBF of stainless sensors found to be 0.15 x 10.6/hr		
Temperature Shock Range	-94 to 248 °F (-70 to 120 °C) as applicable to sensor operating temperature range		
Mechanical Shock	Tested to withstand 20G minimum		
Non-operational Temperature Limit	347 °F (175 °C) typical		
Sensor Cable	Standard is PTFE-insulated dual coaxial with PVC sheath		
	Minimum bend radius is 1.4 in. (35 mm)		
	Radiation resistant cable, suitable for 100 Megarads, may be supplied to order		

TABLE 3. Specification for the Standard Industrial Control Unit (Mobrey MCU201 and MCU203)

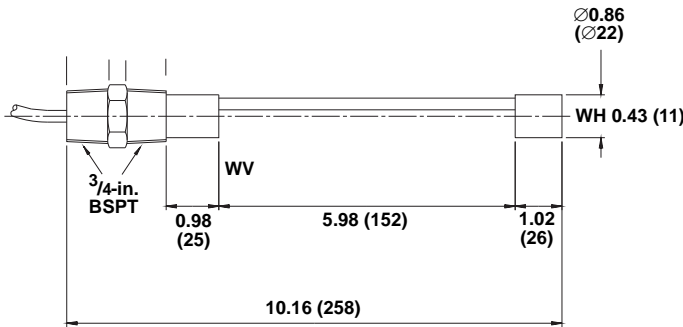
Mobrey MCU200 Series	MCU201	MCU203
Number of Level Switch Inputs	1	1
Power Supply (Selector Switch)	110/120 Vac or 220/240 Vac selectable	24 Vdc grounded (earthed) negative
Power Consumption	6 VA	0.1 A
Relay Output	Double-Pole Changeover (DPCO)	
	Energized when sensor is wet or dry (selectable by switch)	
Relay Rating	5A at 230V	5A at 230V
Box Dimensions	7.9 x 4.7 x 3 in. (200 x 120 x 75 mm)	7.9 x 4.7 x 3 in. (200 x 120 x 75 mm)
Box Rating	IP65 Polycarbonate	IP65 Polycarbonate
Holes for glands	3 off 0.63 in. (16 mm) diameter	3 off 0.63 in. (16 mm) diameter
Fixing centres (WxH) for Wall Mount	7.4 x 3.4 in. (188 x 88 mm)	7.4 x 3.4 in. (188 x 88 mm)
Fixing Hole Diameter	0.16 in. (4 mm)	0.16 in. (4 mm)
Frequency Selection	By switch on PC board	By switch on PC board
LED Indicators	Visible through the box lid	
	Green for normal. Red for alarm condition. Amber LED for fault condition	
	Selectable for wet/dry sensor, as appropriate for the application	
Gain Potentiometer	Fitted with scale and separate range switch to adjust for sensor type and site conditions	
Response Time	Selectable delay of 0.5, 2, 8 or 30 seconds	
	Delay selectable for wet-to-dry or dry-to-wet changeover	
	50 ms response in opposite direction	
Sensor Cable Check	Selectable to monitor coax screen to sensor for continuity	
	Fault lights fault LED and sets relay to alarm state	
Auxiliary Input	External closed circuit input to MCU200 latches the output relay to achieve pump control	

Dimensional Drawings

MOBREY LEVEL SWITCH DIMENSIONS

Notes:

1. Dimensions are in inches (mm).
2. "WH" shows approximate switching level with the gap horizontal.
3. "WV" shows approximate switching level with the gap vertical.



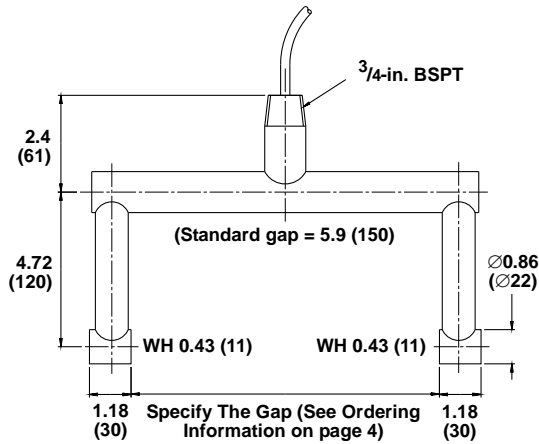
Sensor type 402SD

316 SST, cast

Duty: Chemical interface

Liquid type: Clean, viscous with solids

See Table 2 on page 5 for the full specification



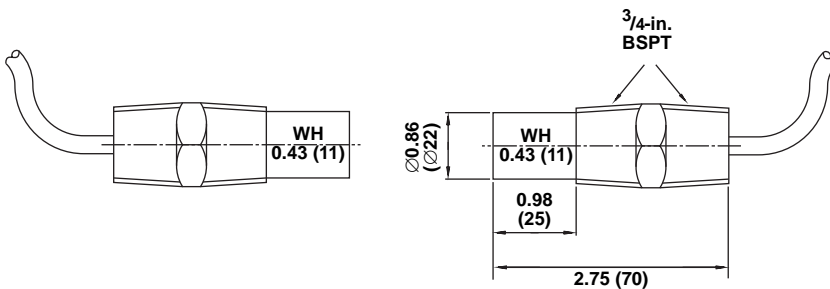
Sensor type 433SD

316 SST, cast

Duty: Sludge or interface

Liquid type: Viscous or with solids in suspension

See Table 2 on page 5 for the full specification



Sensor type 442SD

Across Pipe

Duty: Pipelines

Liquid type: Clean or sludge

See Table 2 on page 5 for the full specification

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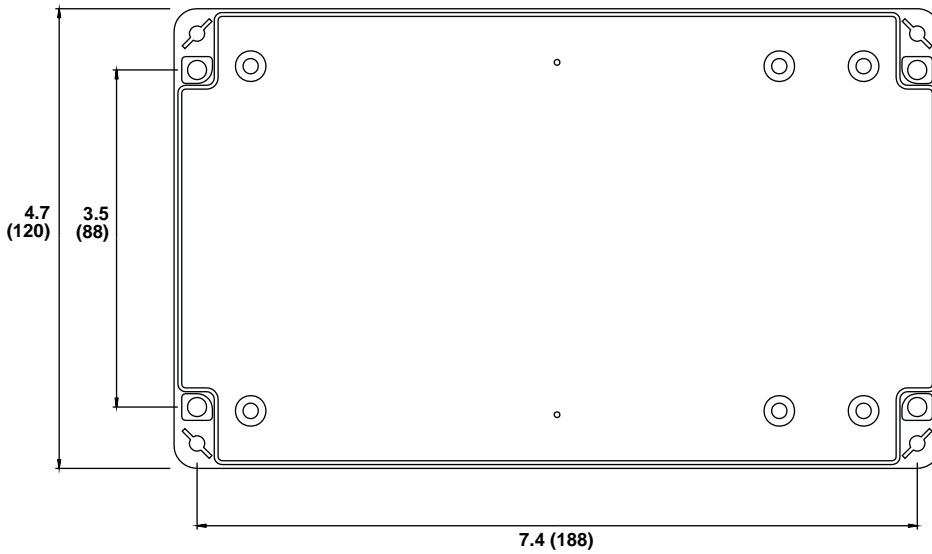
Ultrasonic Liquid Level Switch

MOBREY MCU201/MCU203 DIMENSIONS

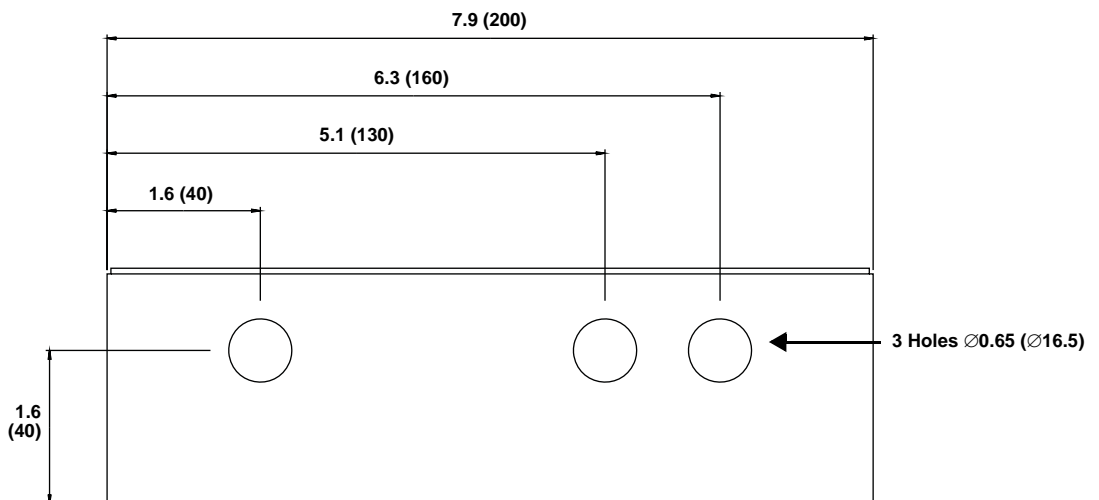
Notes: Dimensions are in inches (mm). See Table 2 on page 5 for the full specification.

MOBREY MCU200 SERIES INDUSTRIAL CONTROL UNIT (MCU201/MCU203)

TOP VIEW



BOTTOM VIEW



Ultrasonic Liquid Level Switch

Mobrey Level Solutions

Emerson provides a wide range of Mobrey products for level measurement applications.

POINT LEVEL DETECTION

Vibrating Fork Liquid Level Switches

For high and low alarms, overflow protection, pump control, including wide pressure and temperature requirements, and hygienic applications. Flexible mounting. Immune to changing process conditions and suitable for most liquids.

- Mobrey Mini-Squing (Compact)
- Mobrey Squing 2 (Full-featured)

Ultrasonic Gap Sensor Liquid Level Switches

For use in non-hazardous industrial processes to detect high or low liquid levels and liquid interface. Immune to changing density, and wide dielectric and pH variations. Suitable for use in most clean and non-aerated liquids, with options for sludges and slurries.

Float and Displacer Liquid Level Switches

Mobrey electromechanical float and displacer level switches are ideal for alarm and pump control duties, especially in critical applications or hazardous areas.

- Mobrey Horizontal Level Switches
- Mobrey Vertical Level Switches

Chambers are available for external mounting of these level switches on process vessels.

Dry Products Level Switches

For high and low level alarms. Including threaded mounting connections, extended lengths, high temperature capability, and multiple detection techniques. Suitable for a wide variety of powders, granules, and free flowing solids with wide variations in bulk densities.

- Mobrey VLS Series – Vibrating Rod Level Switch
- Mobrey PLS Series – Paddle Level Switch
- Mobrey CLS Series – Capacitance Level Switch

CONTINUOUS MEASUREMENT

Ultrasonic Continuous Level Transmitters and Controllers

Top mounted, non-contacting for simple tank and open-air process level measurements. Unaffected by fluid properties such as density, viscosity, dirty coating, and corrosiveness. Intrinsically Safe versions are available for operating in hazardous areas.

- Mobrey MSP Series Ultrasonic Level and Flow Transmitters
- Mobrey MCU900 Series Universal Controllers

Ultrasonic Sludge Density Blanket Monitoring and Control

Ultrasonic in-line pipe or tank mounted sensors for sludge density measurement and control, and top mounted ultrasonic sensors for continuous measurement of sludge blanket level in Industrial and Municipal effluent treatment processes.

- Mobrey MSM400 – Sludge Density Monitor
- Mobrey MSL600 – Sludge Blanket Level Monitor

Displacer Continuous Level Measurement

Top mounted in a vessel or externally mounted in a vertical chamber. For use in hazardous areas.

- Mobrey MLT100 – Displacer Level Transmitter

Hydrostatic Continuous Level Transmitter

For level measurements in non-pressurized tanks where in-tank problems such as foaming, vapor layers, and temperature gradients prohibit the use of other instrumentation.

- Mobrey 9700 Series hydrostatic electronic level transmitters

SPECIALIZED CONDUCTIVITY

Conductivity Water and Steam Interface Monitoring

Steam/water interface level gauges using specialized, high performance conductivity probes in external columns and manifolds, ideal for steam plants where reliable and redundant indication of boiler water level and turbine protection is critical.

- Hydratec 2462 – Water/Steam detection Systems
- Hydrastep 2468 – Water/Steam Monitoring Systems

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