

# Mobrey Ultrasonic Liquid level Detection Systems for Interface Applications

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



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## Ultrasonic Liquid Level Detection System Overview



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



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



**Mobrey 442SD**  
Ultrasonic Point Level Switch for Pipe Section  
(Gap Type Sensor)



**Mobrey MCU200 Series**  
Industrial Control Unit  
(MCU201/MCU203)

Ultrasonic liquid point level switches (gap type sensors) are used in **non-hazardous area** industrial processes to detect high or low liquid levels and liquid interface.

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 results in a low level being indicated.

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

Typical applications include interface detection duty for immiscible liquids and sludge blanket level.

See "Specifications" on page 7 for technical details.

### MOBREY ULTRASONIC LIQUID LEVEL CONTROL SYSTEMS FOR INTERFACE APPLICATIONS CONTAIN

- A **wall-mountable** Mobrey MCU200 Series industrial **control unit** for monitoring the level switch state and provide the required switching function
- A **tank-mountable** Mobrey 402SD or 433SD ultrasonic point level switch containing transmitter and receiver piezo-electric crystals

### Mobrey MCU200 Series Industrial Control Units

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
- DPDT 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 DPDT relay
- Three LED indicators – Normal, Alarm, and Fault
- Selectable time delay
- Continuous cable check (between sensor and MCU200)

# Product Data Sheet

IP201, Rev CA  
January 2014

# Ultrasonic Liquid Level Detection System

## 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 (402SD)

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

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 refraction technique is used to detect the interface where two immiscible liquids have similar attenuations. When the sensor is oriented at an angle of 10 degrees from the horizontal, and the interface level is within the gap of the level switch, a small signal is received. The gain of the MCU200 Series control unit can be set to actuate the relay when little signal is received.

For further information on suitability of this application, consult your local Customer Care representative.

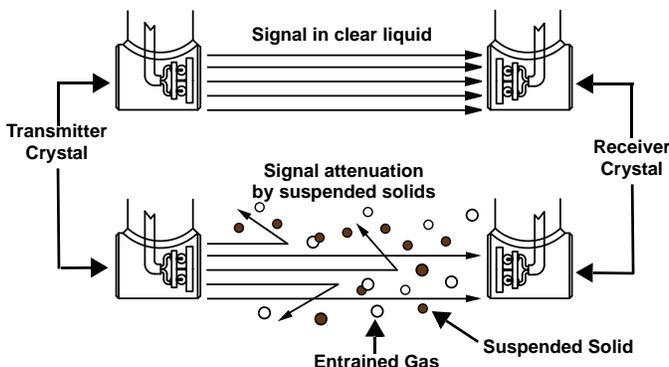
### Sludge Measurement (433SD and 442SD)

Solids suspended in a liquid will scatter ultrasonic beams, causing attenuation. This attenuation depends on the size and nature of the particles.

For typical sewage sludges, it is possible to use Mobrey ultrasonic systems to detect 1% to 15% suspended solids within a slurry. Industrial slurries such as fine pottery slips can often be measured up to 65% solids by weight.

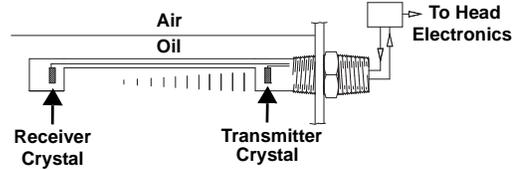
The 433SD sensor is normally suspended in a tank or separator. The 442SD sensors are typically installed as a pair in a section of pipe to detect sludge density.

#### ULTRASONIC ATTENUATION

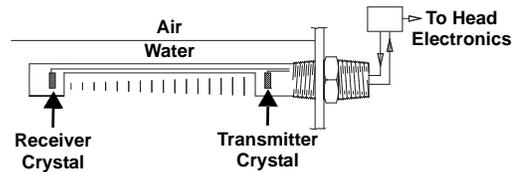


#### INTERFACE DETECTION BY ATTENUATION

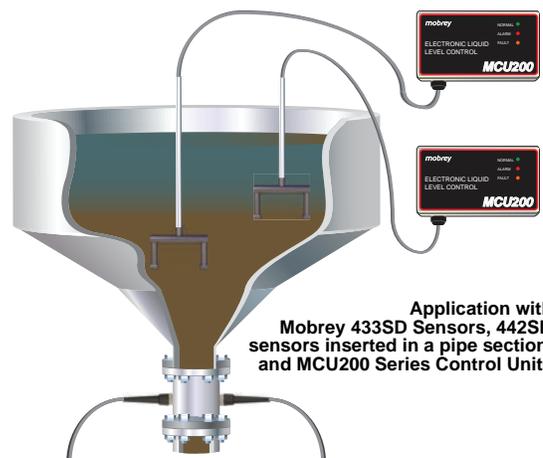
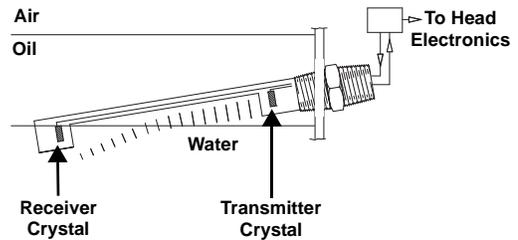
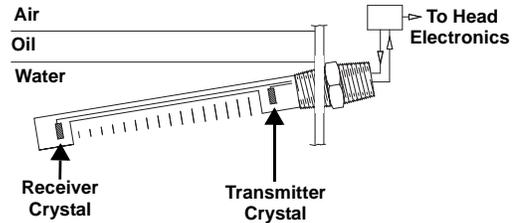
Sensor in oil:  
The ultrasonic beam is attenuated and will not reach the receiver crystal



Sensor in water:  
The ultrasonic beam reaches the receiver crystal



#### INTERFACE DETECTION BY REFRACTION



## Ordering Information for 433SD



- Level switches may be mounted in any orientation to signal liquid presence or at a 10 degree angle to detect the interface
- Ultrasonic sensor operation can be adversely affected by high aeration 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
- Supplied with 33 ft. (10 m) of cable as standard. For other cable lengths, contact Mobrey. The maximum allowed cable length is 164 ft. (50 m)
- If the MCU control unit is required, add **MCU201 (115/230 Vac)** or **MCU203 (24 Vdc)** at the time of ordering the 402SD, 433SD or 442SD

### Additional Information

MCU201/203 ordering: page 6  
Specifications: page 7

Dimensions: page 8

Table 1. 433SD Ordering Information

Model	Product Description
433SD	Tank-mountable sensor, 3/4-in. BSPT, <b>non-hazardous area use only</b>
<b>Gap Size – see Table 2 for measurement ranges in %solids</b>	
801M1 <sup>(1)</sup>	4-in. (100 mm) gap sensor for MCU200 Series
805M1 <sup>(1)</sup>	6-in. (150 mm) gap sensor for MCU200 Series
802M1 <sup>(1)</sup>	8-in. (200 mm) gap sensor for MCU200 Series
803M1 <sup>(1)</sup>	12-in. (300 mm) gap sensor for MCU200 Series
804M3 <sup>(1)</sup>	18-in. (450 mm) gap sensor for MCU200 Series
<b>Cable Length<sup>(2)</sup></b>	
/ M10	Supplied with 33 ft. (10 m) PTFE-insulated dual-coaxial cable
<b>Typical Model Number: 433SD 805M1 / M10</b>	

(1) If the MCU control unit is required, add MCU201 (115/230 Vac) or MCU203 (24 Vdc) at the time of ordering a level switch.

(2) For other cable lengths, contact Mobrey.

Table 2. Typical Measuring Ranges in %solids for Mobrey 433SD Sensors

Sensor Gap Size	PRIMARY SLUDGE (1 MHz)	PRIMARY SLUDGE (3.7 MHz)	SECONDARY SLUDGE (3.7 MHz)
4 in. (100 mm)	3 to 29%	1 to 6%	2 to 15%
6 in. (150 mm)	2 to 19%	1 to 4%	1 to 10%
8 in. (200 mm)	2 to 14.5%	0.5 to 3%	1 to 7.5%
12 in. (300 mm)	1 to 10%	0.5 to 2%	0.5 to 5%
18 in. (450 mm)	N/A	0.5 to 1.3%	0.5 to 3.3%
<b>Note:</b> These %solid ranges are based on typical attenuation factors for municipal wastewater sludge.			



## Ordering Information for Mobrey MCU200 Series Control Units



- Wall-mounting IP65 polycarbonate enclosure
- If the MCU control unit is required, add **MCU201 (115/230 Vac)** or **MCU203 (24 Vdc)** at the time of ordering the 402SD, 433SD or 442SD
- The 402SD, 433SD, and 442SD sensors and MCU200 Series control units are for use in **non-hazardous areas only**

### Additional Information

Specifications: page 7  
Dimensions: page 8

Table 4. Mobrey MCU200 Series Ordering Information

Model	Product Description
MCU201	230/115 Vac version (50/60 Hz) MCU200 Series control unit, <b>non-hazardous area use only</b>
MCU203	24 Vdc version (grounded negative) MCU200 Series control unit, <b>non-hazardous area use only</b>
<b>Typical Model Number: MCU201</b>	

## Specifications

Table 5. Specification for the Mobrey Ultrasonic Point Level Switches (Gap Sensors)

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)	-40 to 158 °F (-40 to 70 °C)	-94 to 302 °F (-70 to 150 °C)
Maximum Pressure	1523 psi (105 bar)	1523 psi (105 bar)	1523 psi (105 bar)
Power Consumption	< 10 mW at sensor	< 10 mW at sensor	< 10 mW at sensor
Standard Frequency	3.7 MHz	1 MHz / 3.7 MHz	1 MHz / 3.7 MHz
Standard Cable Length	10 ft. (3 m)	33 ft. (10 m)	10 ft. (3 m) per sensor
Cable Entry	Cable entry to sensor is IP65	Cable entry to sensor is IP68	Cable entry to sensor is IP65
Sensor Cable	Standard is PTFE-insulated dual-coaxial with PVC sheath. Minimum bend radius is 1.4 in. (35 mm)		
<b>Note: The 402SD, 433SD, and 442SD are for non-hazardous area use only</b>			

Table 6. Specification for the Standard Industrial Control Unit (Mobrey MCU201 and MCU203)

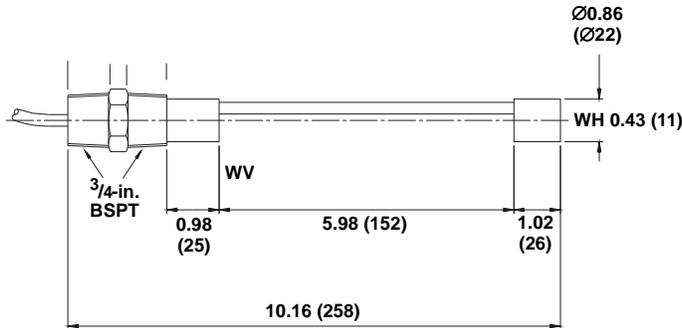
Mobrey MCU200 Series	MCU201	MCU203
Number of Level Switch Inputs	1	1
Power Supply (Selector Switch)	110/120 Vac or 220/240 Vac selectable	24 Vdc grounded (earthed) negative
Power Consumption	6 VA	0.1 A
Relay Output	Double-Pole Changeover (DPDT)	
	Energized when sensor is wet or dry (selectable by switch)	
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	
<b>Note: MCU200 Series control units are for non-hazardous area use only</b>		

## 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.



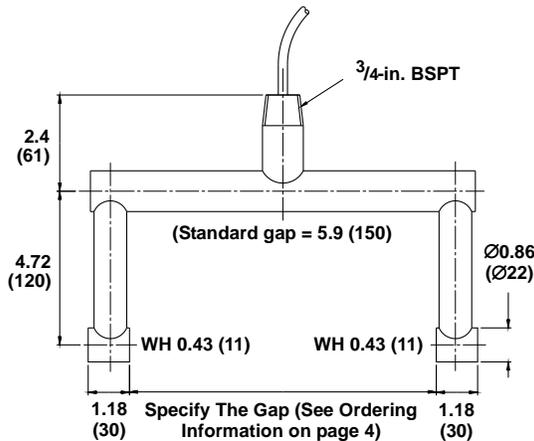
**Sensor type 402SD**

316 stainless steel

Duty: Interface, immiscible liquids

Liquid type: Clean, viscous with solids

See Table 5 on page 7 for the full specification



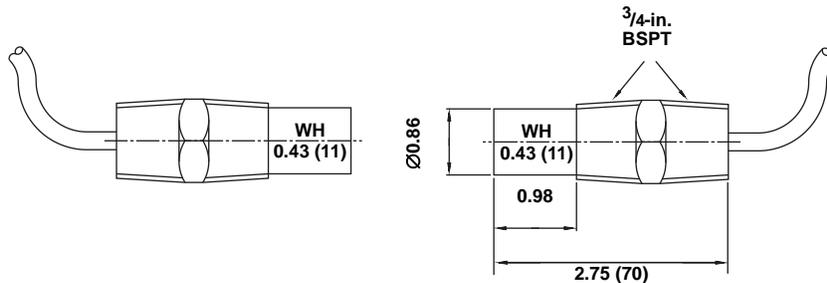
**Sensor type 433SD**

316 stainless steel

Duty: Sludge blanket or interface, immiscible liquids

Liquid type: Viscous or with solids in suspension

See Table 5 on page 7 for the full specification



**Sensor type 442SD**

Across Pipe

Duty: Pipelines

Liquid type: Clean or sludge density

See Table 5 on page 7 for the full specification

**Product Data Sheet**

IP201, Rev CA  
January 2014

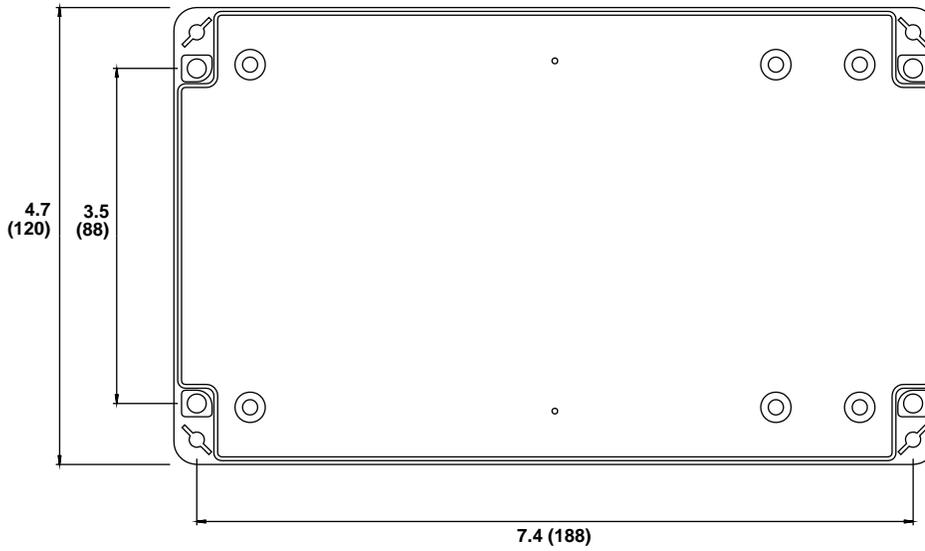
**Ultrasonic Liquid Level  
Detection System**

**MOBREY MCU201/MCU203 DIMENSIONS**

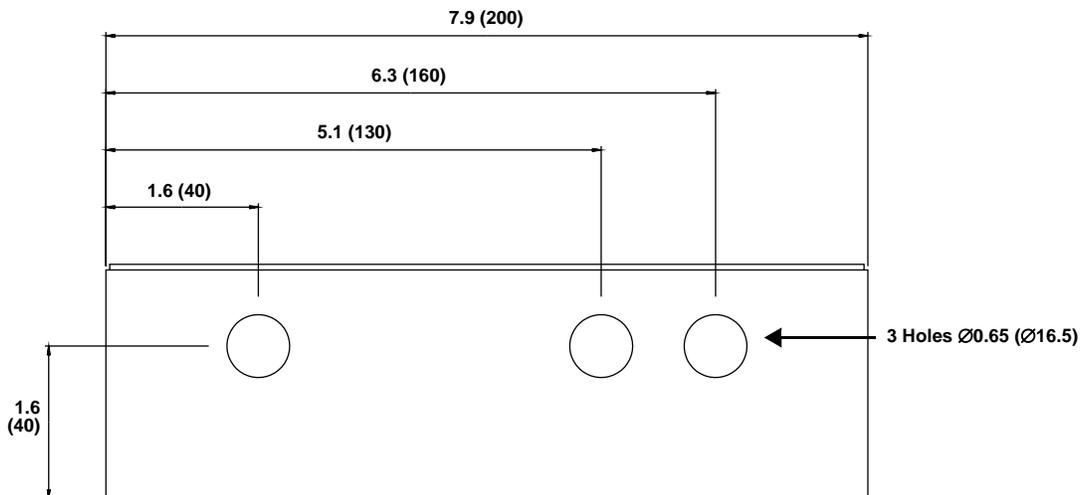
Notes: Dimensions are in inches (mm). See Table 6 on page 7 for the full specification.

**MOBREY MCU200 SERIES  
INDUSTRIAL CONTROL UNIT (MCU201/MCU203)**

**TOP VIEW**



**BOTTOM VIEW**



### 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

#### 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.

- Mobrey MSM400 – Sludge Density 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.

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

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