

# Mobrey Ultrasonic Liquid Level Detection

## Systems for Interface Applications



CE

- 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

# 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 or 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 control 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 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)

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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 (402SD)

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

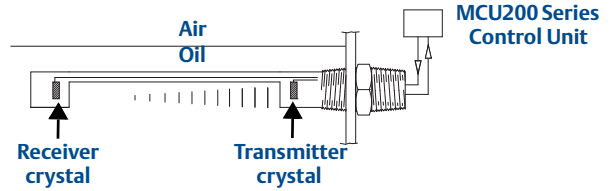
Ultrasonic attenuation is the reduction in beam energy as it is transmitted through the liquid. Viscous liquids, emulsions, and liquids with entrained solids generally have a higher ultrasonic attenuation than low viscosity clear liquids such as water. When the attenuation difference is sufficient, the amplifier gain can be adjusted so that the ultrasonic 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)

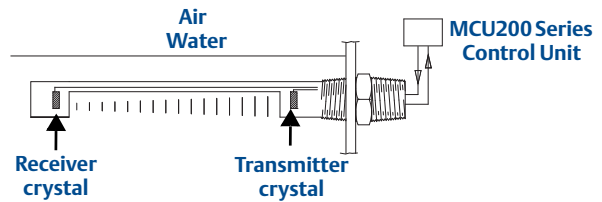
Solids suspended in a liquid will scatter ultrasonic beams, causing attenuation. This attenuation depends on the size and nature of the particles. For typical sewage sludges, it is possible to use Mobrey ultrasonic systems to detect 1% to 15% suspended solids within a slurry. Industrial slurries such 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.

### INTERFACE DETECTION BY ATTENUATION

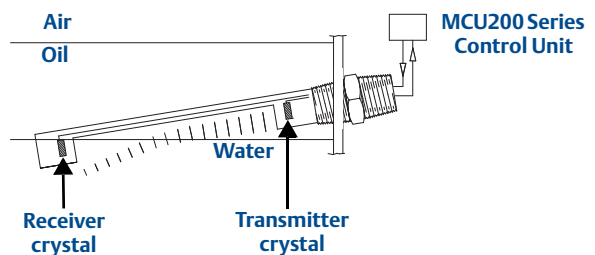
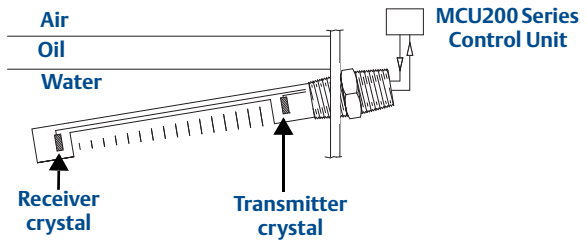
**Sensor in oil:**  
The ultrasonic beam is attenuated and will not reach the receiver crystal



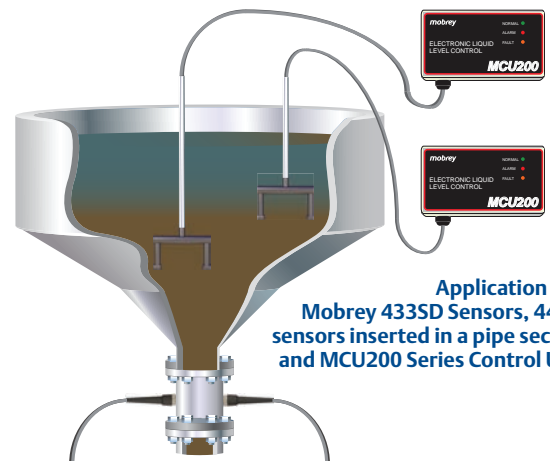
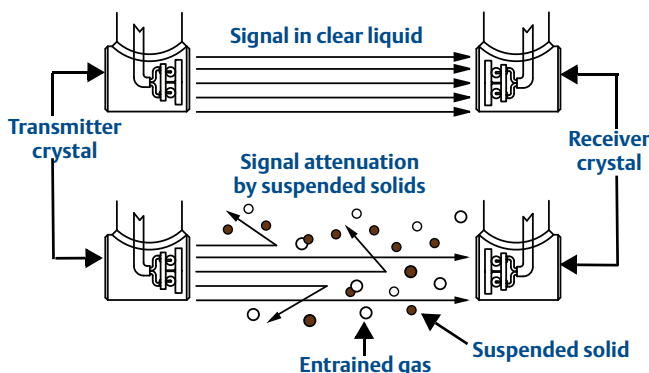
**Sensor in water:**  
The ultrasonic beam reaches the receiver crystal



### INTERFACE DETECTION BY REFRACTION



### ULTRASONIC ATTENUATION



Application with Mobrey 433SD Sensors, 442SD sensors inserted in a pipe section, and MCU200 Series Control Units

# 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 Customer Support for advice on the selection of a suitable liquid level detection system
- Supplied with 33 ft. (10 m) of cable as standard. Contact Rosemount Measurement for other cable lengths up to 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](#)

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**Table 1. 433SD ordering information**

| Model   | Product Description  |
|---|--|
| 433SD   | Tank-mountable sensor, 3/4-in. BSPT, non-hazardous area use only |
| <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 Rosemount Measurement.

**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 402SD and 442SD



- Level switches may be mounted in any orientation to signal liquid presence
- Ultrasonic sensor operations can be adversely affected by high aeration, solids, or foam in the liquid. If you have an application query, contact Customer Support for advice on the selection of a suitable liquid level detection system
- Supplied with 10 ft. (3 m) of cable as standard. Contact Rosemount Measurement for other cable lengths up to 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](#)

Dimensions: [page 8](#)

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**Table 3. 402SD and 442SD ordering information**

| Model  | Product Description  |
|--|--|
| 402SD  | Interface sensor, 3/4-in. BSPT (internal or external thread), non-hazardous area use only              |
| 442SD <sup>(1)</sup>   | Pipe-mountable sensors (pair), 3/4-in. BSPT (internal or external thread), non-hazardous area use only |
| <b>Sensor Compatibility with Rosemount Measurement Systems</b> |  |
| 80 <sup>(2)</sup>  | MCU control unit   |
| <b>Cable Length<sup>(3)</sup></b>                              |  |
| / M03  | Supplied with 10 ft. (3 m) PTFE-insulated dual-coaxial cable   |
| <b>Typical Model Number: 402SD 80 / M03</b>                    |  |

(1) This is a pair of opposing sensors for installation horizontally across a customer's own pipe section.  
 (2) If the MCU control unit is required, add MCU201 (115/230 Vac) or MCU203 (24 Vdc) at the time of ordering a level switch.  
 (3) For other cable lengths, contact Rosemount Measurement.

## Ordering Information for 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)**

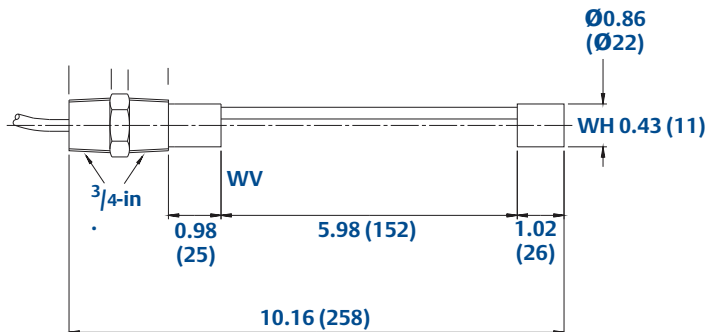
| Mobrey MCU200 Series   | MCU201  | MCU203                                |
|--|---|---------------------------------------|
| Number of Level Switch Inputs  | 1   | 1                                     |
| Power Supply (Selector Switch)   | 110/120 Vac or 220/240 Vac selectable   | 24 Vdc grounded (earthed) negative    |
| Power Consumption  | 6 VA  | 2.4 W                                 |
| 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

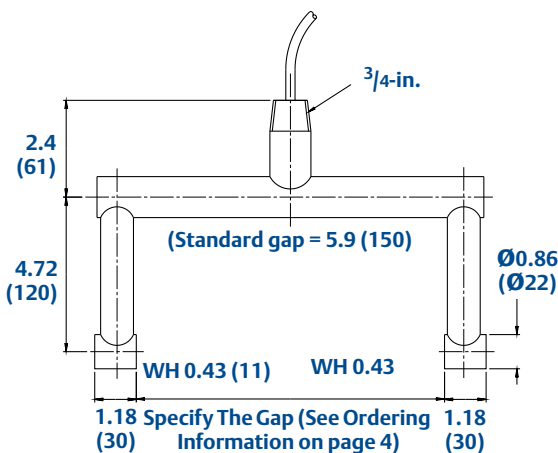
## Mobrey level switch dimensions

**Notes**

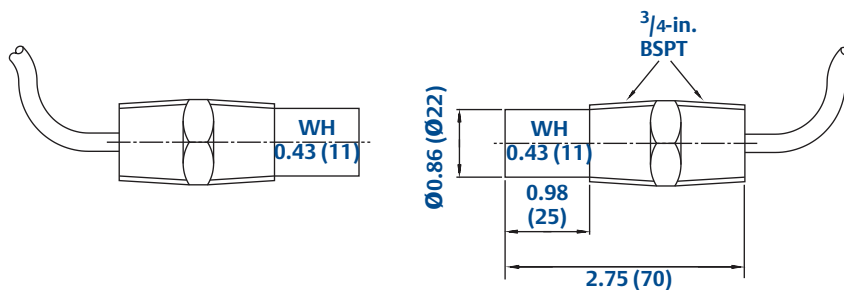
1. Dimensions are in inches (mm).
2. "WH" shows approximate switching level with the gap horizontal.
3. "WV" shows approximate switching level with the gap vertical.



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



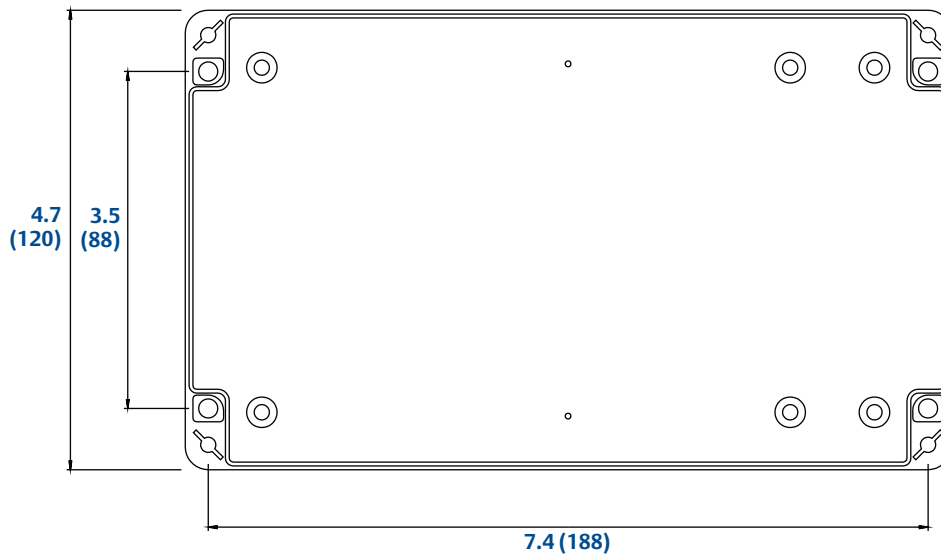
## Mobrey MCU201/MCU203 Dimensions

### Notes

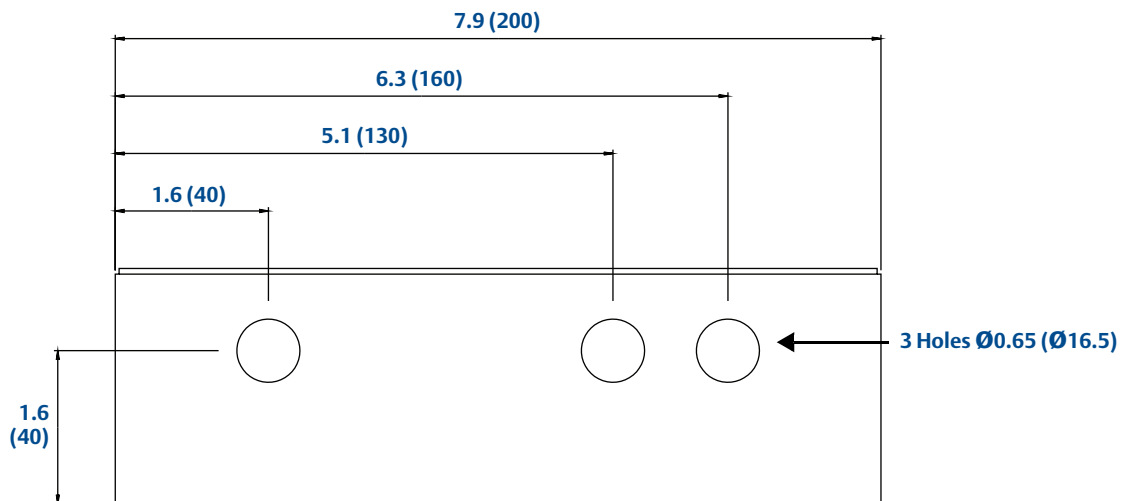
Dimensions are in inches (mm). See Table 6 on page 7 for the full specification.

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

#### TOP VIEW



#### BOTTOM VIEW



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