# MCU200 Installation, Operation & Maintenance Instructions


**WARNING:**
**If this equipment is used in a manner not specified by the manufacturer, the protection provided may be impaired. All installation and commissioning of this equipment must be carried out by electrically competent persons**

## Mobrey ultrasonic liquid level control or sludge blanket or interface detection systems using control unit type MCU200

Each Mobrey ultrasonic control system requires a sensor to suit the specific application, plus a control unit.

These installation instructions cover the Mobrey control units in the MCU200 series.

## Contents



## Specification

| | | |
|---|---|---|
| **Power supply** | **MCU 201** | 110/120 ±10% 220/240±10% 50-60 Hz |
| **Installation category** | **MCU 201** | II-IEC664 for 230V ac supply III-IEC664 for 115V ac supply |
| **Pollution degree** | **MCU 201** | 2-IEC664 |
| **Power consumption** | **MCU 201** | 6VA approx at 240 Vac |
| **Power supply** | **MCU 203** | 24V dc (20V Min, 30V Max) Supply must be floating or negative earth |
| **Current consumption** | **MCU 203** | 0.1A Max |
| **Relay output** | | 5A at 230V ac DPCO |
| **Relay state** | | Normal state selectable energised/de-energised |
| **Relay delay** | | 0.5,2,8,30 seconds selectable. Operates for change of relay state in one direction only. 50msecs in other direction. (Approx.) |
| **LED indicators** | | Red for alarm, Green for normal, Yellow for cable fault |
| **LED state** | | Green/Red indication selectable for either sensor state |
| **Sensors compatible** | | Any Mobrey ultrasonic gap, Hisens or Interface sensor |
| **Sensor frequency** | | Switch selects electronics operational at either I MHz or 3.7 MHz |
| **Cable check** | | Option selectable for certain sensors |
| **External input** | | Used to hold relay de-energised to provide pump control |
| **Box size** | | 200 x 120 x 75mm |
| **Fixing centres** | | 188 x 188 |
| **Box rating** | | IP65 Polycarbonate (clear lid) |
| **Temperature** | | -40°C to 55°C ambient |
| **Holes for glands** | | 3 off 16mmØ |
| **EMC** | | Emissions: EN50081-1 Immunity: EN50082-1 |
| **Safety** | | EN61010-1 |

# 1. Sensor Installation

## 1.1 General description

Each Mobrey ultrasonic sensor contains two piezoelectric crystals. A high frequency signal (1 MHz or 3.7 MHz) generated by the control unit is transmitted to one piezoelectric crystal by coaxial cable. This crystal converts the electrical signal into an ultrasonic oscillation.
The sensor design allows the ultrasonic oscillation to pass from the transmitter crystal to the receiver piezoelectric crystal.
Most Mobrey sensors (300 or 400 series) are "gap" type sensors, where the two piezoelectric crystals are separated by a gap. When the gap is in liquid the signal reaches the receiver, because of the low ultrasonic attenuation of the liquid. When the gap is filled with air, no ultrasonic signal can pass from transmitter to receiver.
See figure 1.

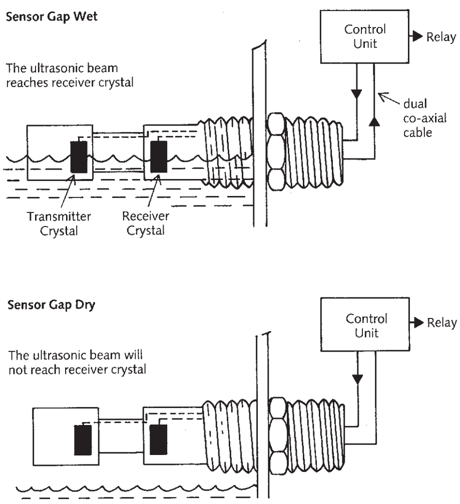



**Fig 1.**

When the gap is filled with liquid, the piezoelectric receiver crystal converts the ultrasonic wave into an electrical signal, which is transmitted back to the control unit using a second coaxial cable. Usually the two coaxial cables to the sensor are in one overall sheath. The control unit circuitry is a feedback amplifier, which oscillates when the sensor is wet, and is quiescent for the sensor dry. The "oscillating" or "non-oscillating" sensor states dictate the output relay states of the MCU200.
For sludge blanket or interface detection the sensor "oscillates" in a clear liquid, and is "non-oscillating" in the sludge or at the interface. The amplifier gain adjustment determines the sludge density for the change between these two states. See section 3.4.
For Mobrey Hisens sensors, (type numbers HL, HD etc) the metal body of the sensor provides the ultrasonic coupling between the piezoelectric crystals. This coupling is reduced when the sensor is under a liquid, so that for Hisens sensors "oscillating" state is dry, in air, and the "non oscillating" state is wet, submerged in a liquid.

## 1.2 Switching levels and orientation

Mobrey gap sensors should normally be mounted with the gap vertical, to avoid build up of solids on the sensor faces on either side of the gap. In this condition the switching level will be half way up the face: if the sensor is mounted from the side of the tank this is normally on the centreline of the cylindrical body.
Occasionally such sensors are mounted with the sensor faces horizontal, either to avoid air bubbles passing through the gap or for convenience of installation.
In this case the switching level will be at the sensor face at the top of the gap.

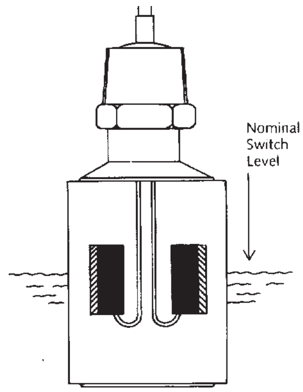



**Fig.2. Hi-Sens transducer**

The Hi-Sens sensor consists of two ultrasonic transducers mounted on the inside of a cylinder. When the sensor is not submerged in the liquid, the signal from one transducer resonates round the cylinder like a bell ringing. If the liquid rises up around the sensor, this ringing is damped and the signal received by the second transducer is significantly attenuated. The ringing or oscillation of the sensor is detected by the control unit. Switching occurs when the liquid is about half way up the cylinder of the Hi-Sens body.

**NOTE: For satisfactory operations the Hi-Sens must not be positioned in a vessel or tube less than 100mm internal diameter.**

## 1.3 Installation of sensor

The sensor must be handled with care - it is a measuring instrument. Before installation, check that sensor, cable and control unit have not been damaged in transit. Drill and tap a hole with a suitable thread. It is advisable to use a boss or similar on thin walls. The sensor has a tapered thread. Use PTFE tape or similar to seal the thread. Mark the sensor hexagon to identify the gap orientation of the sensor, if appropriate. Take care not to damage the sensor cable during tightening.
The cable should be laid on cable trays and separated from any high voltage or mains cables. The normal cable termination is a plastic gland (to fit the MCU200 control box drilled hole) and crimped terminal pins to suit the MCU200 terminals.

## 1.4 Extension cables

Extension Cables up to 50 metres long can be fitted to most Mobrey ultrasonic sensors in the factory to special order but a better site arrangement is to have a separate extension cable.

When double coaxial cable needs to be extended, two sets of coaxial plugs and sockets will be needed, one set for transmit and one receive.Care must be taken that the connectors are not earthed or shorted together in any way, to prevent cross-talk or pick-up. The coaxial connections must be made in a waterproof junction box. Terminal blocks should not be used.
The extension cable needs to be of 50ohm characteristic impedance. Suitable dual coaxial extension cables can be purchased from KDG Mobrey (Part No. K178).
For extensions over 50 metres it is recommended two runs of single coaxial low loss cable is used, with the transmit and return cable runs separated by 0.15 metres to minimise cross-talk.
If several sensor cables are being run together then all the transmit cables (those connected to E2) should be grouped together and all receive cables (those connected to 1E) grouped together maintaining the separation specified above.

# 2. Control Unit Installation

### 2.1 Mechanical

The control unit is supplied with three holes drilled in the bottom (longer) side of the box. Two glands are supplied for the power input cable and relay output cable. The sensor is normally supplied fitted with a suitable gland on the cable. Two further holes can be drilled in the bottom side of the box should these be needed: it is recommended that the circuit board is removed whilst drilling extra gland holes.

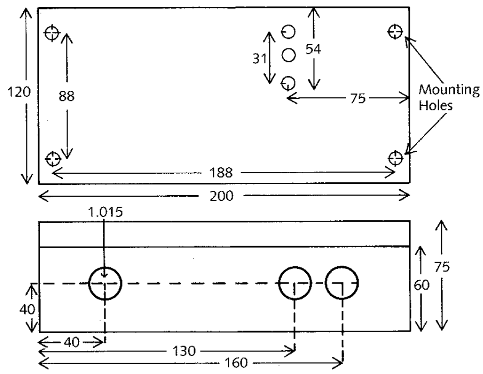



**Fig. 4 MCU200 housing dimensions**

All cable connections are made to the terminal blocks along the bottom edge of the pcb (see fig.5). Release the terminal screw before inserting the wire.

### 2.2 External Connections

**Protection for permanently installed equipment**

NOTE: This equipment is regarded as permanently installed equipment and must be wired up using suitable cable for the current and voltage specified. A suitable switch or circuit breaker must be included in the installation and this should be in close proximity to the equipment and marked as its disconnecting device. A suitable fuse rated at 3A must be fitted in the supply. Each relay circuit must be protected by a fuse not exceeding the maximum rated current for the relay as specified in the manual.

**Fig 3 Suitable extension cables**

| 50mtr | 50-100m | over 100m |
|---|---|---|
| RG174<br>RG178 | URM76<br>RG58 | Consult<br>factory |

Two cables are required per sensor. The RG178 should be used where the cable itself is subject to temperatures exceeding 74°C.

(i) **AC Mains** is connected between the "N" terminal for neutral and one of the "115V" or "230V" terminals depending on the voltage supply available - BEWARE - the terminal not connected externally will be "live" once the transformer is powered via the other terminals.

(ii) **Protective earth**
NOTE: A protective earth should be used for all applications

(iii) **The DPCO relay** has two sets of contacts. These are labelled:

**Set 1:** NC1 - Normally closed
C1 - Common
NO1 - Normally open
**Set 2:** NC2 - Normally closed
C2 - Common
NO2 - Normally open

**Relay warning**
CAUTION: External circuits (such as signal circuits) with accessible parts or basic insulation only, MUST NOT be connected to the relay if the relay is also connected to external circuits which are hazardous live (mains circuits).

(iv) **The Sensor** connections are labelled "1", "E" for the receiver crystal and "2", "E" for the coax cable to the transmitter crystal. The screens of these coax cables are connected to the terminals marked "E".

(v) **The Auxiliary Input** is a terminal which can be connected to a "push to reset" button to achieve a latching alarm, or to another Mobrey control unit, to give a pump control from the MCU200 unit relay output. If a short circuit is connected between terminals 3 & 4, the MCU200 relay, once de-energised, is held de-energised. Even if the sensor attached to the MCU200 changes state, to that which should energise the output relay, this relay will not energise until the link between terminals 3 & 4 is broken in the circuit external to the MCU200. See section 3.3.

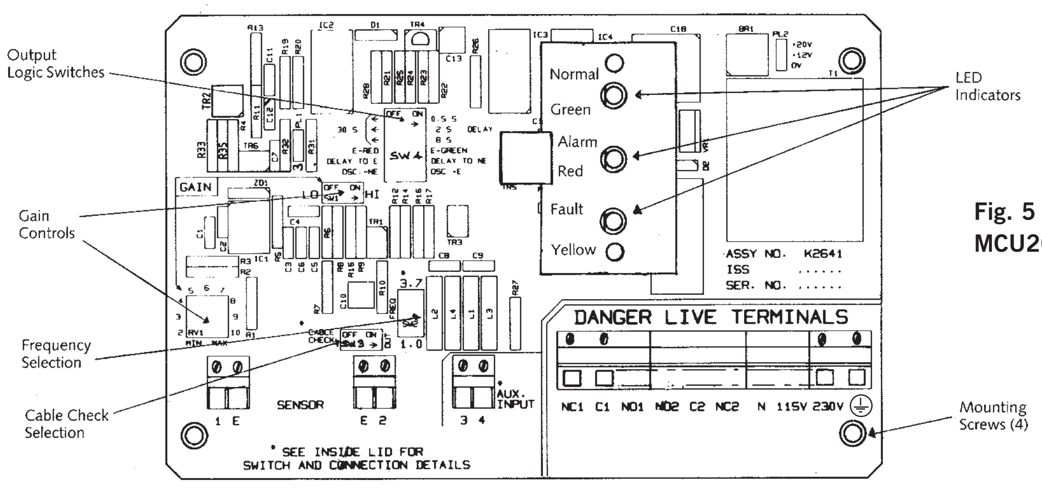



**Fig. 5**
**MCU201 PC Board**

## 2.3 Switch Settings in MCU200 Series

(i) **Gain switch**(and potentiometer): See section 3.

(ii) **Frequency selection**

This slide switch is labelled "FREQ" and is located between the sensor terminal block E2, and the Aux input terminals. This selects the operating frequency of the MCU200 oscillator, which is either 3.7MHz (switch in the 'up' position) or 1 MHz, (switch to the down position). The ex-factory setting is to 1 MHz. The setting required is dictated by the sensor type connected to the control unit. Usually these are:

| 1MHz sensors | 3.7 MHz sensors |
|---|---|
| 30*S, 31*S, 32*S, 33*S 35*S, 37*S, 38*S, 39*S, HL*S, HD*S. | 36*S, 40*S, 42*S, 43*S, 44*S 601S, 621S. |

**Fig. 6 Sensor frequencies**

Where any sensor is built to operate at non standard frequency, it will have the suffix M1 or M3 at the end of the type number.

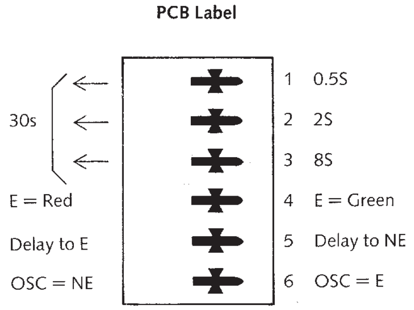
Mobrey sludge sensors type 433 and 448 with the suffix M1, built after S/No 9001, can operate at both 1MHz and 3.7 MHz. The MCU201 selection switch determines the operating frequency.

**(iii) Cable check option selection**

This slide switch is located directly above the sensor terminal block E2. It is labelled "Cable Check" and the ex factory setting is "OUT" with the slide switch to the right.

By sliding this switch to the left, the cable check circuitry is brought into action. This circuitry monitors the continuity of the screens of the two coaxial cables attached to the sensors: normally these are linked at the sensor to the metal body of the fitting (or to each other in the case of non metallic sensors). If this continuity is broken, the "FAULT" LED will illuminate giving an indication that the sensor cable is damaged, and the MCU200 will give the "ALARM" output relay state.

Note: OSC means sensor oscillating, E means relay energised, NE means de-energised




**Colour code:**

| | | | |
|---|---|---|---|
| Brown | 1 | Yellow | 4 |
| Red | 2 | Green | 5 |
| Orange | 3 | Blue | 6 |

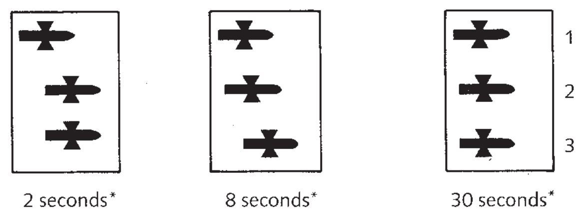
**Fig. 7 Relay output and LED logic switch**

NOTE: The construction of Hisens sensors type HL* and HD* and gap sensors types 601S, 621S prevents the use of this cable check system. The separated nature of the sensor pairs type 442S or 448S usually makes this cable check unreliable.

(iv) **Relay output and LED logic selection**

The bank of six slide switches towards the top of the pcb sets the relay output state logic relative to the sensor state, associated time delays and the LEDs. These are slide switches, best adjusted with a pencil, and the ex factory wetting is with all switches to the right.

Each switch is colour coded as shown in figure 7, and the pc board labels give brief function information.




**Colour code:** Brown 1
Red 2
Orange 3

**Fig 8 * Note that these times are approximate only**

Set the switches in the following order, starting at the bottom and working upwards.

**BLUE**: If the MCU200 relay is to be energised (E) when the sensor is oscillating (OSC) then set the No 6 blue switch to the right (OSC=E). This is the preferred setting, to give a de-energised relay in the ALARM state for a gap sensor as a low level alarm or for Hi-Sens as a high level alarm. The opposite setting might be used for a sludge blanket detector, when an oscillating sensor (OSC), which occurs in clear liquids, might preferably cause the relay to de-energise (OSC=NE)

**GREEN**: This selects the relay change which is subject to the time delay selected on the top switches. When the No.5 green switch is set to the right, the delay occurs between the sensor changing state and the relay de-energising or becoming "not energised" (NE). This time delay is a minimum of 0.5 seconds, (achieved by switching the top BROWN switch to the right) and is used to prevent relay chatter at the changeover point. Longer time delays are selected on the top three slide switches as follows:

The relay change in the opposite direction is immediate (within 50 milliseconds).

**YELLOW**: Only one of the GREEN or RED LEDs will be illuminated at any one time. These LEDs show the state of the MCU200 output relay. The RED LED is labelled "ALARM" and the GREEN LED is labelled "NORMAL". The yellow slide switch (Number 4) determines which LED will be illuminated when the relay is energised (E). It is usual to have the GREEN/NORMAL condition occur with the relay energised, ie with switch Number 4 to the right (E=GREEN).

## 3. Applications

### 3.1 Gain adjustment

Correct adjustment of the gain (HI/LO switch and potentiometer) is essential for proper operation of any ultrasonic sensor system. This adjusts the gain of the feedback amplifier in the control unit, which produces oscillation of the sensor when the coupling between the ultrasonic crystals is sufficient. Therefore the higher the gain setting, the lower the coupling needed to produce an oscillating sensor.
The universal control unit of the MCU200 operates with many sensors, so the correct setting for the particular sensor and application should be found on site by experiment, if possible. This will take account of particular site conditions like RF coupling between extension cables, which can affect the maximum allowed gain.
Other liquid characteristics, such as presence of suspended solids, or air bubbles, can mean that for reliable operation the MCU200 gain must be set as high as possible, to overcome future solids build up, but at least one potentiometer division below the maximum allowed level, to ensure temperature and component ageing stability. With Hisens sensors, condensation on the sensor may be overcome by increasing the gain as high as possible. With sludge blanket sensors, the gain adjustment changes the density of sludge at which the system will switch, increased gain giving increased solids levels.

The particular procedures outlined below for gain adjustments give the mid point gain settings, which may need to be adjusted to meet specific site/sensor future requirements as indicated above.

### 3.2 Level Alarm

#### 3.2.1. Low level alarm, gap type sensor

The normal gap sensor application. Relay de-energises for alarm immediately (after 50 milliseconds). Most sensors of this type operate at 1 MHz.

(i) Check that sensor is "dry", cables are connected correctly and "FAULT" LED is not illuminated. Put gain switch to "HI" and rotate the gain potentiometer to "MAX". In most cases the green LED will illuminate, this is known as the "false wet". Rotate the gain potentiometer until this LED extinguishes. Note the setting (X).
(ii) Reduce the gain potentiometer by 4 divisions from X, to X-4. If necessary switch to "LO" gain. If no "false wet" was possible set gain to "6" on the "HI" gain range.
(iii) Check that the green LED illuminates when the sensor gap is filled with the liquid to be monitored.

**Special cases**
(a) Sensors type 362, 366, normally used for cryogenic duties, operate at 3.7 MHz.
(b) Non penetration sensors type 601, 621 operate at 3.7 MHz and have a low wet to dry ratio compared to normal sensors. For 601, 621 the false wet setting X should be found and the operation point set to X-1.

#### 3.2.2. High level alarm, gap type sensor

This typical application has relay de-energising for alarm. Cable check here is important to provide a sensor check in the normal condition. The example uses 1 MHz sensors and 2 seconds delay before alarm, to prevent wave action produced by stirrers triggering the alarm.

**Fig. 9**

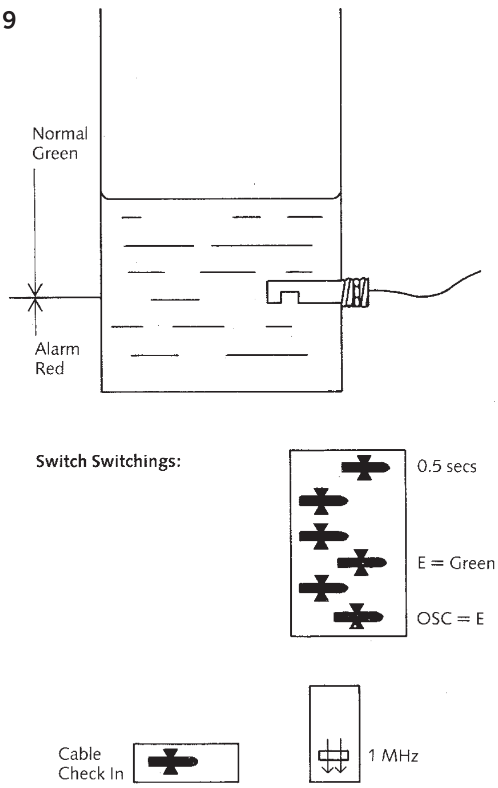
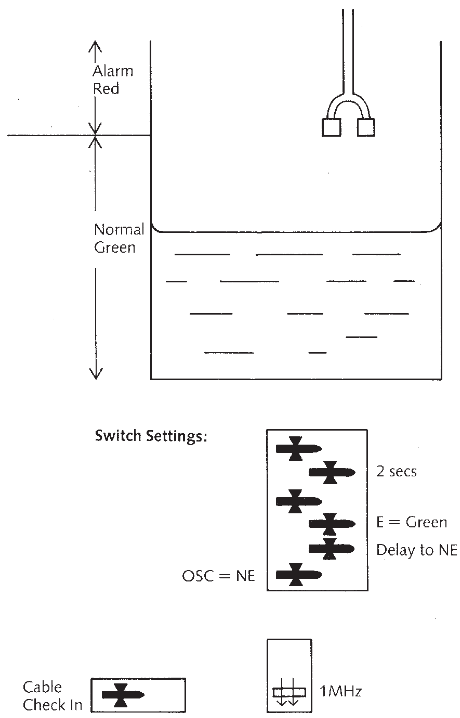



**Fig. 10**



### 3.2.3. High level alarm, Hisens sensor

The Hi-Sens sensor oscillates when the sensor is dry, so producing a fail safe high level alarm. Normally such systems have the relay de-energising for alarm. This example has time delay of 30 seconds to Normal to allow the operator to identify any tank giving an occasional alarm.

Note that all Hisens sensors are 1 MHz and that cable check circuit is out - firstly because it does not function with Hisens but secondly that a cable fault with Hisens will produce an alarm signal anyway.

**Gain adjustment:**

(i) With sensor dry, reduce time delays to 2 seconds for simpler adjustment. Set gain switch to "LO" and reduce pot to "MIN". Red LED will illuminate - this is the "false wet". Rotate the gain potentiometer clockwise slowly until the green LED illuminates: note the setting (X).

(ii) Increase the gain setting X + 3 if it is necessary to switch to the "HI" gain range, re-check for a "false wet" position on the "HI" range, or assume an overlap between "LO" and "HI" of 2 divisions of gain.

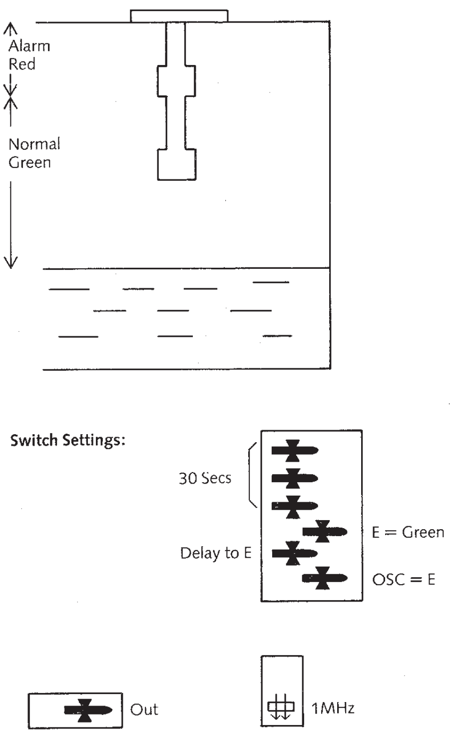
(iii) Check that the sensor when immersed in water gives an alarm output. Recheck in the liquid to be monitored.

(iv) Reset the time delays as needed.

**Special site conditions:**

In the above application the time delay can be used to prevent high level alarms caused by splashing of the sensor, by setting the green switch to "Delay to NE". Avoiding severe splashing or condensation effects may require a slight increase in the gain setting to X + 4. To detect splashing or for use on light oils the gain can be reduced to X + 2.

**Fig. 11**




### 3.3 Pump control and latching alarms

The output relay of the MCU200 can be latched into the de-energised state. This latch is achieved by short circuiting the two terminals of the Auxiliary input, labelled as terminals 3 & 4 on the pc board (see figure 5). The relay will remain de-energised while the latching short circuit is applied. Only after this circuit is broken can the relay re-energise under the control of the sensor.

A latching alarm can therefore be achieved by connecting one pole of the output relay into the auxiliary input, through a push to break "reset" button. NC1 and C1 should be used to create this latch, with NC2, C2 and NO2 being used for the external alarm circuit.

For a pump control application, switching a pump to control a liquid between two sensors in a tank, this auxiliary input can be used to monitor the second sensor. The control system must be designed as follows:

(i) The pump to be latched "on" must be driven by the MCU200 output relay.

(ii) The sensor attached directly to the MCU200 must initiate the pump action to be latched.

(iii) The latched pump action occurs when the MCU200 relay is de-energised.

(iv) The separate sensor must be used to detect the liquid presence at the switch off point.

(v) The signal from the separate sensor to switch off the pump must be an open circuit, and is connected to the auxiliary input in the MCU200.

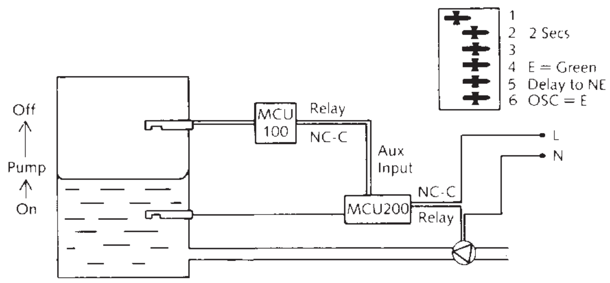



**Fig. 12 Tank filling pump control**

In this example the number 6 switch (blue) on the MCU200 would be set to OSC = E, so that when the lower gap sensor sees air it de-energises the relay to bring on the pump. With switch number 4 (yellow) set to E = GREEN, the red LED illuminates when the pump is running. With "Delay to NE" set at 2 seconds, the sensor will ignore occasional bubbles or surface turbulence which could trigger a pump start.

The high level sensor, illustrated as a Mobrey MCU200 plus sensor, could alternatively be a Mobrey 005, or another MCU200 or a float operated level switch: all will give a volt free contact output suitable for the auxiliary input on the lower MCU200.

### 3.4 Interface Detection

#### 3.4.1. Suspended Solids blanket sludge discharge detection

The Mobrey MCU200 control unit can be used in conjunction with a 433S sensor to provide sludge blanket level detection in a settling tank, facilitating the control of automatic desludging. Similarly, in conjunction with a Mobrey sludge pipe using a pair of 488S sensors, the MCU200 can control the end of desludge cycle when thin solids are discharged. Figure 13 shows the operation of the sensor. In a clear liquid the ultrasonic signal is carried across the gap and the sensor "oscillates". In a dirty liquid - one containing high levels of suspended solids - the signal cannot cross the gap and the oscillation ceases. (Note that this is the same condition that occurs when the sensor is in air.) The Mobrey 433 sensor is normally suspended in the settling tank itself.

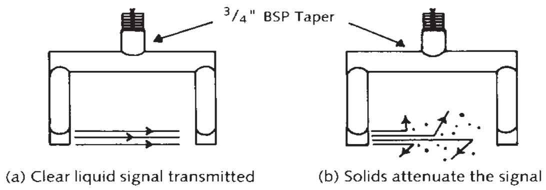



**Fig. 13 Type 433 sensor for suspended solids blanket alarm**

An alternative sensor type is Mobrey sludge pipe, installed on the sludge discharge line from the tank. In this application it is essential to install the pipe section close to the tank discharge, below the bottom of the tank. This maintains the hydraulic pressure on the sludge to prevent release of dissolved gases. Any such air entrained will give a false "thick sludge" indication.

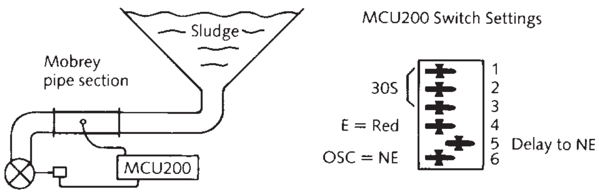



**Fig. 14 Sludge discharge control**

The application of fig 14 shows a control valve opening on a timed basis to discharge the sludge. Once sludge is flowing along the line, the control valve can be closed by the MCU200 when sludge of low density is detected. The gain pot gives adjustment of the % solids level at which the output relay trips, increasing sludge density for clockwise rotation.

**Settled sludge discharge control**

(i) Reduce time delays (see fig 8) to make adjustment easier. Set frequence of operation to 1 MHz (see fig 5) if the sensor will operate at this frequency.

(ii) With sensor or pipe in relatively clean water (supernatant) set gain switch to "LO" and reduce gain pot (see fig 5) until the LED changes. Note this point on the pot as the "zero suspended solids" switch point.

(iii) For a 1 MHz sensor on a 150mm or 200mm ID pipeline or sensor gap, working on primary sewage sludges, each division on the potentiometer increase above this zero switch point represents approximately 1% suspended solids.

Increase the pot to the desired level, remembering a 2 division overlap between "LO" and HI" gain ranges.

Check the setting in practice by taking a sludge sample at the switch point, and adjust as necessary. Increasing the gain pot makes the switch point occur at a higher suspended solids level.

(iv) For different diameter pipelines or sensor gaps, of dimensions Dmm, each division represents (180¸D) % solids approximately.

(v) In a 3.7 MHz system, on a 150mm gap sensor each division represents 0.25% solids: for sensor gaps Dmm the divisions are (38¸D) % solids typically.

**Overflow alarm or fine solids detection**

(i) Set frequency to 3.7 MHz if sensor is suitable.
This improves sensitivity.

(ii) Reduce time delays and locate "zero" position as above.

(iii) Assume gain pot adjustment is (90¸D) % solids per division increase to set initial switch point.

#### 3.4.2. Interface detection between two dissimilar liquids

Viscous liquids, emulsions and liquids containing solid particles have a greater ultrasonic attenuation than clear liquids. This technique is used to detect which liquid is present at the sensor, for example for the separation of oil and water. For this duty Mobrey 402 or 433 sensors are used, operating at 3.7 MHz to produce the maximum ultrasonic difference between two liquids monitored. An alternative technique for pipelines is the use of a Mobrey sludge pipe section with 448 type sensors.

The gain is adjusted so that the sensor oscillates only in the liquid with the lower ultrasonic attenuation: this is usually the clearer liquid (water in the example of fig 15). Note that the signal when oil is present in the sensor gap will be the same as that for air in the gap, and that emulsion layers give a very high attenuation.

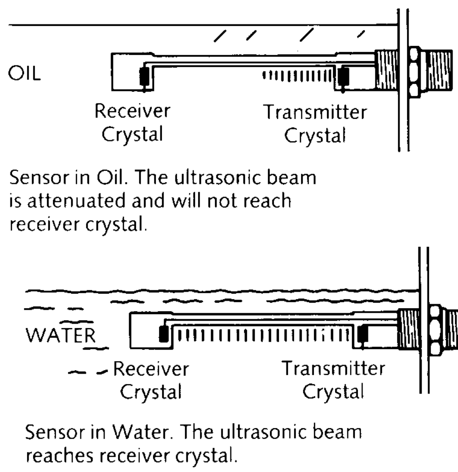



**Fig. 15 Mobrey 402 sensor as oil/water interface**

(i) Reduce the gain potentiometer with the sensor immersed in one of the liquids until a "false dry" indication is obtained. Note the position of the pot.

(ii) Repeat for the sensor immersed in the other liquid

(iii) Set the potentiometer half way between these two values. Correct performance requires a total difference between the two set points of at least 3 divisions.

### 3.4.3. Interface detection between two immiscible similar liquids

When liquids are ultrasonically very similar - as happens for example with paraffin and water - the procedure in section 3.4.2. produces very little difference between the two “false dry” points.  In this case the “reflection” method of interface detection is used.
If an ultrasonic beam is transmitted from one liquid to another at a suitable angle (10%) it is split at the interface into a reflected and a refracted beam, so that it does not reach the receiver crystal.  If there is no interference in the gap, but only one liquid, the beam is received and the sensor oscillates.
The gain adjustment is made so that the gain is 3 divisions higher than the highest false dry position obtained, as in section 3.4.2.  Performance at the interface should then be checked.
Note that the non oscillating state of the sensor, at the interface, also occurs throughout any emulsion layer at the interface, and also when the sensor is in air.

# 4. Maintenance

Safety maintenance:  This is limited to periodic inspection by a qualified person to ensure that the installation including wiring and equipment housing is safe.

# 5. Spares and fault finding

**5.1** The following parts are suitable for replacements on the MCU201.

| | |
|---|---|
| Main pcb complete | K2641 |
| LED indicator pcb | K2643 |
| LED pcb spacers | K2623 |
| LED pcb connector | K2624/50 |
| Box assembly | K2662 |
| Gland assembly | K746/K747/K748 |

There are no consumable items such as fuses.

### 5.2 Fault Finding

(i)  At least one LED should be illuminated.  If not check the power supply to the unit.
(ii)  If the “Fault” LED is on and the sensor is a standard Mobrey 300 series or a 402/422/433, check the coax cable to the sensor for incorrect wiring or damage. Particularly check continuity of extension cables, connection of crimped connectors on cable ends.  For other types of sensor switch the cable check circuit “OUT” - (see section 2).  The pcb board can be checked by linking the two terminals labelled E on the sensor terminals - this should cancel the fault indication LED.
(iii)  If the sensor is giving incorrect indications check the gain adjustment (see section 3).

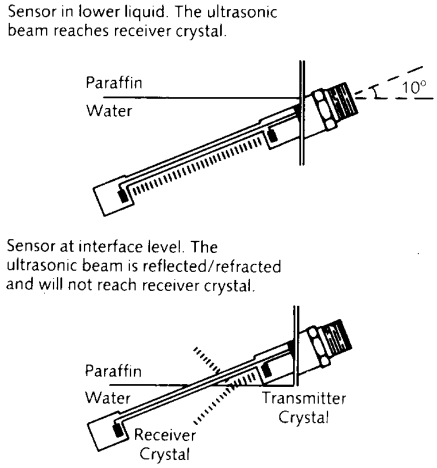



**Fig 16 Interface detector by reflection method**

a)  For a gap sensor giving false dry indication, this could possibly be due to aeration or solids in the liquid.  This can be overcome by increasing the gain slightly, to a maximum of X-2.  This increases the sensitivity and is appropriate for high level alarms.
b) For a gap sensor giving false indication, this could be due to cross talk between cables - check that all junctions use coax connectors with the outer casings isolated. Seperate the two coax cables for long cable runs. False wet can also be caused by viscous liquids clinging to the sensor: sensitivity can be decreased slightly by reducing the gain to X-6 minimum - check for reliable operation in the liquid.
c) For a Hisens sensor the gain adjustment is slightly more critical, as quoted in 3.2.3. Sensitivity is increased by reducing the gain to X+2. Decreasing sensitivity, sometimes necessary to avoid condensation, is achieved by increasing the gain to perhaps X+4.
The Hisens sensor can take 30 seconds or more to drain off surface coatings and re-instate a dry signal in viscous liquids.
d) Check for correct sensor operation whenever the gain is adjusted away from the normal set point. Assume an overlap of 2 divisions between the "LO" & "HI" gain ranges.
(iv) Check the incorrect operation has not been produced by incorrect setting of the frequency selection switch or an external short circuit on the auxiliary input terminals.
(v) The circuit board can be checked by linking the sensor terminals 1 and 2 with a wire, to simulate an oscillating sensor.



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Manual reference : IP227 Rev AA, July 2007