Mobrey ultrasonic liquid level detection systems

Description
Ultrasonic liquid level switches are for use in industrial process, nuclear and marine cargo applications to detect high or low liquid levels.

Operation is achieved using the time proven principle of ultrasonic transmission between two crystals. Liquid presence is detected by virtue of its bulk, with liquid droplets, condensation or foaming being ignored.

Mobrey Hi-sens sensors are designed for fail-safe high level duty. Mobrey gap sensors are designed for fail-safe low level duty.

Control electronics are available standard or self-checking, with options including lamps to indicate sensor status, time delays and circuits to detect wiring faults.

Mobrey has been manufacturing and selling high quality ultrasonic level equipment for many years, and have built up considerable expertise in the supply of non-catalogue equipment, custom designing system if the standard product will not meet the exact application requirements.

Features
- No moving parts
- Simple installation
- ATEX Hazardous area approval
- Ignores foams
- Unaffected by:
  - RF Interference
  - Conductivity
  - Droplets
  - Most coatings
  - Liquid colour/opacity

Typical applications
- Petroleum processing
  - Fuels, lubricating oils, hydraulic fluids, liquid petroleum derivatives, crude oil, fuel - water interfaces.
- Chemical processing
  - Acids, alkalis, ammonia, paints, lacquer, waxes, peroxides, alcohols, slurries, printing inks, freon.
- Food processing
  - Beverages, fruit juices, cooking oils, molasses, liquids with entrained solids.
- Pharmaceutical and cosmetic
  - Liquids, emulsions, lotions, solutions.
- Marine operation
  - Fuel oil, hydraulic fluid, bilge level alarms, sea water, coolant, condensate levels, cargo levels.
- Reactor operation
  - Level control, alarm signalling.
- Cryogenic liquids
  - Liquid methane, nitrogen, oxygen, etc.
- Water industry
  - Flood control, reservoir levels, sludge blanket detection, sewage sump control.
- General
  - Leak detection, overflow alarm, low level alarm in evaporation.
System description

A Mobrey ultrasonic liquid level control comprises:
- A tank mounted sensor containing transmitter and receiver crystals
- An RF sensor drive and detector electronic circuit, which may be integral with the sensor or mounted adjacent to the sensor depending upon vessel conditions or access considerations.
- A control unit mounted remotely to monitor the sensor state and provide the required switching function.

Choice of sensor

Mobrey gap sensors
Mobrey gap sensors energise a relay output when there is a liquid present between the transmitter and receiver crystals of the sensor. In this way, absence of liquid, power failure or damage to plant cabling will result in an alarm condition. Gap sensors are fail-safe low level.

Typical applications
- Pump protection
- Vessel empty protection
- Foam/froth detection
- Pump control

Mobrey Hi-sens sensors
Mobrey Hi-sens sensors operate in a reverse manner. The transmitter and receiver crystals communicate around the wall of the sensor when it is dry. Presence of liquid around the sensor damps out the 'ringing' of the sensor and an alarm condition is then signalled.

Mobrey Hi-sens is therefore failsafe high level and will signal an alarm condition on presence of liquid, power failure or damage to plant cabling.

Typical applications
- High level alarm
- Overfill prevention
- Leak detection

Ultrasonic sensor operation can be adversely affected by the presence of excessive aeration, solids or foam in the liquid. If you have an application query contact Mobrey for expert advice on the selection of a suitable liquid level detection system. Sensors may be mounted in any position to signal liquid presence.
Choice of system & control unit

Select from the 3 systems below the one which meets your needs, then fold out page 16 and select a sensor to suit the liquid in the vessel.

**Standard industrial**

**Industrial control unit**

- Wall mounting IP65 polycarbonate enclosure
- Connection between sensor and control unit is by up to 50m of dual co-axial cable
- Failure of sensor or breakage of co-axial cable earth loop will cause an alarm condition and light the fault LED.

**Description**

The MCU200 control unit provides simple, economical control electronics for mounting on site near the tanks containing the appropriate ultrasonic sensor. The sensors provide liquid level detection and are available in various materials and mechanical designs. The control unit has a sensitivity potentiometer to adjust for sensor and liquid type.

MCU 200 offers in addition a selectable time delay, earth continuity checking between sensor and control unit, and LED’s to indicate sensor state. MCU 200 has a DPCO relay output and is suitable for use with all Mobrey sensors.

Select sensor: Fold out page 16

Technical data: Pages 4-7

Control electronics: Page 8

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**High integrity**

**Electrosensor**

- Cabinet or DIN rail mounting control unit
- Simple twisted pair cable between sensor and control unit up to 1000m
- Safe or hazardous area use
- Failure of sensor or cabling will cause an alarm condition and light the fault LED
- Additional fault relay activated on fault condition

**Description**

Mobrey Electrosensor systems provide a cost effective method of level detection and control where high system integrity coupled with low cost installation is required.

Ultrasonic sensors are fitted with head-mounted or adjacent electronics which are then connected back to control room electronics using simple twisted pair wiring.

Sensors may be set to operate either when wet or dry and have a field adjustable sensitivity potentiometer and status LED.

All sensors are built to IS standards and may be used in safe or hazardous areas.

Select sensor: Fold out page 16

Technical data: Pages 4-7

Control electronics: Pages 9-11

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**Failsafe**

**Electropulse**

**Description**

Designed and developed to provide the ultimate fail safe system. Electropulse electronics can be used with most Mobrey sensors. Head mounted or adjacent electronics communicate with control room electronics by sending pulses down simple twisted pair wiring.

Electropulse systems are specified in applications where level is of critical importance, such as marine tanker overfilling, chemical plant and nuclear plant.

Sensors may be set to operate either when wet or dry and have a field adjustable sensitivity potentiometer and status LED.

All sensors are built to IS standards for use in safe or hazardous areas.

Select sensor: Fold out page 16

Technical data: Pages 4-7

Control electronics: Pages 12-15
Ultrasonic point level sensors: Dimensions

WH shows approximate switching level with sensor horizontal.

WV shows approximate switching level with sensor vertical.

Extended length versions: Max A = 000mm vertical, 915mm horizontal, where A is the measurement from the mounting thread run-out to the nominal switching point.

**General purpose**

- **Sensor type 332 SD**
  - General purpose stainless steel
  - Design or duty: Standard
  - Liquid type: Clean only
  - Temperature: \(-70^\circ C\) to \(+150^\circ C\)

- **Sensor type 302 SD**
  - General purpose stainless steel
  - Design or duty: Standard
  - Liquid type: Clean, minor aeration
  - Temperature: \(-70^\circ C\) to \(+150^\circ C\)

- **Sensor type 312 S**
  - High sensitivity plastic
  - Design or duty: Plastic
  - Liquid type: Aerated
  - Temperature: \(-70^\circ C\) to \(+65^\circ C\)

- **Sensor type 312 SY**
  - High sensitivity epoxy resin
  - Design or duty: Aerated liquids
  - Liquid type: Clean, aerated
  - Temperature: \(-70^\circ C\) to \(+130^\circ C\)

- **Sensor type 323 SY**
  - Wide gap epoxy resin & stainless steel
  - Design or duty: Dirty liquids
  - Liquid type: Clean, aerated, viscous with scale, with solids
  - Temperature: \(-70^\circ C\) to \(+130^\circ C\)

- **Sensor type 393 SD**
  - High sensitivity stainless steel
  - Design or duty: Dirty liquids
  - Liquid type: Clean, aerated, viscous with scale, with solids
  - Temperature: \(-70^\circ C\) to \(+150^\circ C\)

- **Sensor type HL**
  - General purpose stainless steel
  - Design or duty: High level
  - Liquid type: Clean, aerated, with solids
  - Temperature: \(-70^\circ C\) to \(+130^\circ C\)

**Multipoint sensors**

- **Model HD**
  - 2 Point maximum
- **Model 3525**
  - 2 Point maximum
- **Model 3735**
  - 6 Point maximum

Maximum length 3000mm typically used for two level pump control or combined high and low level alarms. Mounting flanges optional to order.
Ultrasonic point level sensors: Dimensions

### Low temperature

**Sensor type 362 SJ**  
Epoxy & stainless steel  
- **Design or duty:** Cryogenic small  
- **Liquid type:** Clean, aerated, with solids  
- **Temperature:** -210°C to +65°C

**Sensor type 366 SJ**  
Miniature  
- **Design or duty:** Small space  
- **Liquid type:** Clean  
- **Temperature:** -210°C to +65°C

**Sensor type 389 ST**  
PTFE for chemical applications  
- **Design or duty:** PTFE body  
- **Liquid type:** Clean, aerated  
- **Temperature:** -20°C to +130°C

**Sensor type 422 SD**  
Stainless steel  
- **Design or duty:** High pressure  
- **Liquid type:** Clean  
- **Temperature:** -70°C to +150°C

**Sensor type 433 SD**  
Stainless steel  
- **Design or duty:** Sludge or interface  
- **Liquid type:** Viscous or with solids in suspension  
- **Temperature:** -70°C to +50°C

**Sensor type 402 SD**  
Stainless steel  
- **Design or duty:** Chemical interface  
- **Liquid type:** Clean, viscous with solids  
- **Temperature:** -70°C to +150°C

### High temperature

**Sensor type 30 HS**  
High temperature stainless steel  
- **Design or duty:** High temp.  
- **Liquid type:** Clean, aerated, with solids  
- **Temperature:** +1°C to +250°C

**Sensor type 39 HS**  
High temperature stainless steel  
- **Design or duty:** High temp.  
- **Liquid type:** Aerated, viscous with solid scale  
- **Temperature:** +1°C to +250°C

**Sensor type 389 ST**  
PTFE for chemical applications  
- **Design or duty:** PTFE body  
- **Liquid type:** Clean, aerated  
- **Temperature:** -20°C to +130°C

**Sensor type 366 SJ**  
Miniature  
- **Design or duty:** Small space  
- **Liquid type:** Clean  
- **Temperature:** -210°C to +65°C

**Sensor type 389 ST**  
PTFE for chemical applications  
- **Design or duty:** PTFE body  
- **Liquid type:** Clean, aerated  
- **Temperature:** -20°C to +130°C

**Sensor type 422 SD**  
Stainless steel  
- **Design or duty:** High pressure  
- **Liquid type:** Clean  
- **Temperature:** -70°C to +150°C

**Sensor type 433 SD**  
Stainless steel  
- **Design or duty:** Sludge or interface  
- **Liquid type:** Viscous or with solids in suspension  
- **Temperature:** -70°C to +50°C

**Sensor type 402 SD**  
Stainless steel  
- **Design or duty:** Chemical interface  
- **Liquid type:** Clean, viscous with solids  
- **Temperature:** -70°C to +150°C

For non-penetration, interface & sludge sensors, see pages 6 & 7
Sensor technical data

<table>
<thead>
<tr>
<th>Standard sensors</th>
<th>302 (352)</th>
<th>30H</th>
<th>39H</th>
<th>312SU</th>
<th>312SY</th>
<th>332</th>
<th>362 (366)</th>
<th>389</th>
<th>393 (373)</th>
<th>402</th>
<th>422</th>
<th>433</th>
<th>442</th>
<th>621</th>
<th>HL3 (HD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatability (mm)</td>
<td>2</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Max. pressure (d) (bar)</td>
<td>105</td>
<td>50</td>
<td>3.5</td>
<td>21</td>
<td>21</td>
<td>70</td>
<td>3.5</td>
<td>See p.16</td>
<td>1500</td>
<td>300</td>
<td>350</td>
<td>350</td>
<td>850</td>
<td>350</td>
<td>600</td>
</tr>
<tr>
<td>Weight (gm)</td>
<td>350</td>
<td>500</td>
<td>150</td>
<td>350</td>
<td>250</td>
<td>400</td>
<td>250</td>
<td>1500</td>
<td>300</td>
<td>350</td>
<td>350</td>
<td>850</td>
<td>350</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>Standard frequency (MHz)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3.7</td>
<td>1</td>
<td>1</td>
<td>1.7</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>1</td>
</tr>
</tbody>
</table>

Technical data for all sensors
- Sensors are fitted with 3 meters cable and appropriate glands to fit control box.
- Power consumption is less than 10 milli-watts at sensor.
- Cable entry to sensor is IP65.
- MTBF of stainless sensors is found to be 0.15 x 10^-5/hr.
- Temperature shock range -70°C to +120°C if applicable.
- Mechanical shock - all transducers tested to withstand 20G min.
- Non-operational temperature limit 175°C typical.

Sensor cable
- Standard is P.T.F.E. insulated dual coaxial with PVC sheath.
- Minimum bend radius is 35mm.
- Radiation resistant cable, suitable for 100 Mega rads, may be supplied to order.

Non-catalogue sensors
Many of our customers have particular applications for which we custom engineer and build sensors. Whatever your requirement for a level control sensor, if you cannot find a suitable model in this catalogue, please do not hesitate to contact Mobrey for further discussion.

Non-penetration liquid level sensors

Type 621
- No contact with liquid
- No penetration of vessel
- For 18 to 75mm OD pipes

Description
The 621S ultrasonic liquid level sensor is mounted outside the sight glass or pipe to be monitored, at the required switch position. The two parts of the sensor are accurately aligned on site on either side of the pipe. Using epoxy resin or silicone grease, the ultrasonic signal is coupled into and through the pipe wall into the liquid or gas within the pipe. Liquid allows transmission to the opposite wall and through to the other part of the sensor. The sensors are connected to an adjacent head amplifier unit, to provide a liquid presence relay output.

Technical data
- Repeatability: Typically 2mm depends on application
- Housing: Epoxy resin
- Temperature: -20°C to +130°C
- Cable: 3m PTFE coaxial cable
- Adhesive bond: Epoxy resin pack supplied with every sensor pair
- Mounting: Horizontal preferred

Model numbers
Pipe size: Models are available to suit most pipe outside diameters within the range 18mm to 75mm. Accurate sizing is important to ensure reliable operation state with order the tube or pipe outside diameter for each application.

Typical installation
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, that is 150mm upwards.

Interface detection by attenuation

Ultrasonic attenuation is the reduction in energy of the beam 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 output relay can then be set to monitor which liquid is in the gap.

The ultrasonic attenuation of a liquid depends on many factors, the main ones being the complexity of the molecule, followed by the viscosity, assuming there is no aeration. Many liquids can be distinguished by this technique and for further information on previously tested liquid systems consult our technical sales. If samples of the liquids are available then a simple site test can often be done.

Interface detection by reflection

When two immiscible liquids have similar attenuations the above method cannot be used, however it is likely that the velocity of ultrasound will be different. In this case a beam of ultrasound passing through the interface will be 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 thus effectively attenuated. An angle of 10 degrees is chosen and often this results in total internal reflection of the transmitted beam. Thus when the interface is within the gap of the angled sensor, very little ultrasound reaches the receiver, but when the interface is above or below the sensor (ie in either liquid) then there is a large signal present. The control unit gain is set to actuate the relay when the interface is in the gap. Note this condition will also occur if the upper liquid drains away and air (gas) is in the gap. Note for further information on suitability of this application consult our technical sales.

Suspense solids 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. Leaflet IP250 gives details of Mobrey sludge measurement systems.

Interface and sludge monitoring

Typically sensors with gaps of 150mm or larger are used for interface and sludge measurement. These sensors are standard types 402, 433 and the 442 (a pair of sensors for mounting across or along a pipe section). Special flanged sensors with the 10 degree tilt built in are also available. Generally these sensors work at 3.7MHz and are compatible with Electropulse and Electrosensor electronics or plant mounted MCU200 electronics.

Special sensors

Special combinations of sensors are produced for specific applications - e.g. combined sludge blanket detectors, pump controls and very high level alarms. Such combinations are designed and engineered for each individual application, whether for shipboard high level alarms, waste processing plants or reservoir control systems. Contact the sales office for further information.

Multipoint sensors

Ultrasonic sensors are easily combined into multi-point transducers for two level pump control or combined high and low level alarms.

Typical standard sensors are:

Model HD - A two point dual high level sensor using two Hi-sens HL sensors. This is typically used for 95% and 98% high level alarm on marine cargo tankers, for outline dimensions see page 9.

Model 373 - A multipoint version of the 393 sensors, with up to 6 switching levels.

Fitting: ¾” BSPT from inside the vessel. Option: flanged to customer specification

Model 352 - Two point version of the 302 type sensor, fitted from inside or outside of vessel
Mobrey standard industrial control unit MCU200

- Simple economical control unit
- IP65 enclosure
- 115v/230v AC or 24v DC

Features:
- Sensor status LED
- Time delay
- Cable check
- Pump control

Description
The MCU200 control unit provides simple, economical control electronics for mounting on site near the tanks containing the appropriate ultrasonic sensor. The sensors provide liquid level detection, and are available in various materials and mechanical designs. (See fold out page 16).

The control unit provides a relay output for external control or alarm functions according to whether the sensor is wet or dry. The MCU 200 has a dual pole relay output energised when the sensor is wet, LED indicators, time delays and cable check facilities preselectable. The MCU200 will operate with all Mobrey ultrasonic sensors and can accept a voltage free contact input from another level switch to give a pump control function on the output relay.

Installation
Mobrey ultrasonic sensors are normally fitted with 3 metres of dual coaxial cable. This cable can be extended with suitable coaxial extensions up to 50 metres. Suitable cable is part No. K178, or two lengths of coax type RG178 can be used.

The coaxial cables are terminated in the control unit. The output cabling from the control unit comes from the relay output terminals as a wet/dry changeover switch. This can be used to trigger an alarm or provide an input into a control system.

Technical data

**MCU200 Features**
- Suitable for all Mobrey ultrasonic point sensors
- Frequency selection by switch on PC board.
- Relay
  - Energised for sensor wet or dry selectable by switch.
- LED indicators
  - Visible through the box lid. Green for normal. Red for alarm. Selectable for wet/dry sensor as appropriate for the application.
  - Amber LED for fault condition.
- 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 wet to dry or dry to wet. 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 MCU 200 latches the output relay to achieve pump control.

<table>
<thead>
<tr>
<th>Power supply (Selector switch)</th>
<th>MCU201</th>
<th>MCU203</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>110/120V ac</td>
<td>24V ac</td>
</tr>
<tr>
<td>(Selector switch)</td>
<td>220/240V ac</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>TBA</td>
<td></td>
</tr>
<tr>
<td>Relay output</td>
<td>DPCO</td>
<td></td>
</tr>
<tr>
<td>Relay rating</td>
<td>5A at 230V</td>
<td></td>
</tr>
<tr>
<td>Box dimensions</td>
<td>200 x 120 x 75</td>
<td></td>
</tr>
<tr>
<td>Box rating</td>
<td>IP65 Polycarbonate</td>
<td></td>
</tr>
<tr>
<td>Holes for glands</td>
<td>3 off 16mm dia,</td>
<td></td>
</tr>
<tr>
<td>Fixing centres (WxH)</td>
<td>188 x 88</td>
<td></td>
</tr>
<tr>
<td>Fixing hole diameter</td>
<td>4mm</td>
<td></td>
</tr>
</tbody>
</table>

The MCU200 product range generally replaces control units types T396 & T496
Electrosensor systems

Description
An Electrosensor system comprises an ultrasonic sensor with associated ‘head’ electronics, are either mounted directly on the sensor or in an adjacent wall mounting.

Control room electronics
- Provides intrinsically safe power supply to sensor electronics and detects sensor state.
- Operates output relays and front panel LEDs
- Monitors plant wiring integrity

Principle of operation
The twisted pair supplies a DC voltage from the control electronics to the sensor. The current drawn by the sensor is used to signal the sensor state. This current signalling is detected by a trip amplifier in the control electronics. The control electronics include a fault monitoring circuit to detect if the current drawn is outside preset limits, such as would occur on cable breakage or short circuit.

Electrosensor can be used in all areas of the plant. Some users may prefer to provide their own supply and alarm circuits.

Electrosensors are fully system certified to accommodate this need, enabling connection to PLC or other control circuits via standard Zener safety barriers when the sensor is in a hazardous area.

Specification

<table>
<thead>
<tr>
<th>Common specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design concept</td>
</tr>
<tr>
<td>LED indicators (3)</td>
</tr>
<tr>
<td>Approval</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stand alone electronics: MES3L/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm relay output</td>
</tr>
<tr>
<td>Fault relay output</td>
</tr>
<tr>
<td>Relays (2)</td>
</tr>
<tr>
<td>Cable entry</td>
</tr>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td>Output to sensor</td>
</tr>
<tr>
<td>Delay</td>
</tr>
<tr>
<td>Ambient temp</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Protection</td>
</tr>
<tr>
<td>Power supply tol.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIN rail electronics: MES2D/3S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm relay output</td>
</tr>
<tr>
<td>Rating</td>
</tr>
<tr>
<td>Time delay</td>
</tr>
<tr>
<td>Connections</td>
</tr>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td>Output to sensor</td>
</tr>
</tbody>
</table>

External zener barriers required when sensor in hazardous area (refer to system certificate)
**Electrosensor head electronics**

Most of the sensors on pages 4-5 can be specified with Electrosensor electronics. 1 MHz sensors with dual screwed fittings can be specified with head mounted electronics housed in a tough nylon enclosure integral with the sensor. A field adjustable gain potentiometer and an LED indicator, visible through the end cover to show sensor status are provided. A selector switch to set the 16mA signal to occur either with the sensor wet or dry is also provided. A terminal with PNP output allows direct connection to a PLC input via a third signal wire. Sensor head electronics are also available in an adjacent wall mounting enclosure, for use with any 1MHz or 3.7MHz sensor. These electronics are used where it is not possible or desirable to mount the electronics directly on the sensor. Connections between adjacent electronics and sensor is by dual coaxial cable (maximum length 10m).

**Head mounted (integral) electronics**

Mounted in a tough glass filled nylon enclosure weatherproof to IP66/IP67 the head electronics drive the sensor and detect its state; either wet or dry. Connection is via the M6 cable gland (supplied). Removal of the housing cover reveals:

- Adjustable gain potentiometer to set the sensor to suit application conditions.
- Mode selector switch.
- Connections for control electronics.
- LED to indicate sensor state (visible through window in end cover)

**Adjacent mounted electronics**

The sensor drive and detector electronics are enclosed in a wall mounted IP65 polycarbonate box which is wired to the sensor using dual co-axial cable (maximum length 10m). Connection is via 2 M16 cable glands (supplied). Removal of the box lid reveals:

- Sensor frequency selector switch (1Mhz or 3.7Mhz)
- Coarse and fine grain adjustment to set the sensor to suit application conditions.
- Mode selector switch.
- Connections for sensor and control electronics.
- Output selector switch for 8-16mA current loop operation. If PLC operation is selected, current drawn is set to approximately 8mA in both sensor states (wet or dry).
- LED to indicate sensor state (visible only when box lid removed).

**Specification**

<table>
<thead>
<tr>
<th>Hazardous area or approval</th>
<th>Electrosensors are approved intrinsically safe ATEX II 1 G EExia IIC T4 (-40°C ≤ Ta ≤ +85°C) T5 (-40°C ≤ Ta ≤ +40°C) and can be used with control room electronics (Page 9) or used in an intrinsically safe system.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power input:</td>
<td>12 -24V DC from associated MES control room electronics or other suitably protected source.</td>
</tr>
<tr>
<td>Sensing:</td>
<td>Draws either 8 or 16mA on a current loop dependent upon sensor state and mode switch setting.</td>
</tr>
<tr>
<td>Mode selector:</td>
<td>Gives choice of current level for sensor state. Would typically be set for 16mA with sensor switch oscillating (i.e gap sensor wet, Hi-sens dry)</td>
</tr>
<tr>
<td>Output selection:</td>
<td>Both types of head amplifier have a transistor output on a third terminal, suitable for signalling to a PLC or similar device. This transistor output switches upto 30mA at the supply line voltage onto the third wire.</td>
</tr>
<tr>
<td>Ambient temp.</td>
<td>- 40°C to + 60°C</td>
</tr>
<tr>
<td>Earthing</td>
<td>Head electronics are floating with respect to sensor body. Sensor body may be earthed through tank connection.</td>
</tr>
<tr>
<td>Plant cabling:</td>
<td>Standard twisted pair instrument cable recommended with screen (screen not connected at head electronics). Maximum loop resistance 30 ohms. Cable parameters must conform to ATEX requirements.</td>
</tr>
<tr>
<td>Users own electronics</td>
<td>Electrosensors on this page can be used in any intrinsically safe system. The user must ensure that suitable safety barriers are used.</td>
</tr>
</tbody>
</table>
Ordering information - control room electronics

<table>
<thead>
<tr>
<th>MES</th>
<th>Mobrey Electrosensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Approvals</td>
</tr>
<tr>
<td>3</td>
<td>Intrinsically safe (type L enclosure only)</td>
</tr>
<tr>
<td>2</td>
<td>Non I S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>DIN rail enclosure (requires external safety barriers for IS use)</td>
</tr>
<tr>
<td>L</td>
<td>Stand alone enclosure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Voltage input</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>230V ac MES3L only</td>
</tr>
<tr>
<td>2</td>
<td>115V ac MES3L only</td>
</tr>
<tr>
<td>3</td>
<td>24V dc (non I S)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Relay output</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>SPCO</td>
</tr>
</tbody>
</table>

**MES 3 L / 1 S** Typical model number

Ordering information - control room electronics

Sensor
Head amplifier

Fold out page 16
Select type ***SDU8H***

MES3AI

Ordering information - control room electronics

Sensor/amplifier

Fold out page 16
Select type ***SDSSH***
Section 5  -  Electropulse systems

Electropulse systems provide the ultimate in fail safe liquid level alarm. Standard sensors are fitted with a head amplifier which communicates with a control room unit using standard twisted pair instrument wire. Using a gap sensor for low level and a Hi-Sens for high level, a system is constructed such that any failure: mechanical, electronic or in the communication line, causes the system to fail safe.

Electropulse control room mounted electronics provide front panel LED indication of the level sensor status, plus a change-over relay output, rated at over 500VA, to control pumps, alarms or signal to the controller. The green LED labelled "NORMAL" indicates that the sensor is in its oscillating condition. For all gap sensors the oscillating condition is the wet condition, for Hi-Sens sensors this is dry (see over). The red LED indicates that the sensor is not oscillating, which is defined as "Alarm". A further LED, yellow, indicates a "Fault" condition, resulting from plant cabling faults or head amplifier damage to either of these causes the current in the control loop to deviate from normal value. The fault condition automatically triggers the alarm relay and the red alarm LED. The Electropulse MEP3R units are cards suitable for mounting in the standard 19" MEP3B rack, up to 14 units per rack. These MEP3R cards are available with either SPCO or DPCO alarm relay and a separate SPCO fault relay. The Electropulse MEP3L units are single units housed in a plastic case, suitable for wall, panel or DIN rail mounting.

These units are only available with one combined DPCO alarm/fault relay. For hazardous area operation the MEP3R and MEP3L units have intrinsically safe sensor output connections. When used with the appropriate sensor, the system is approved intrinsically safe to ATEX standards.

Plant cabling
The Electropulse control room readout units are connected by a twisted pair instrument cable, preferably screened, to the Electropulse head amplifier. This twisted pair provides approximately 12 Volt DC at 15mA to power the head amplifier and sensor: current pulses of 2mA at approximately 240Hz signal that the sensor is in the oscillating or NORMAL state. The ALARM state is indicated by constant current drain. Loop resistant of the two wire cable must be less than 35 ohms. The audio current signalling provides a noise and RF interference resistant transmission over long distances.

Head amplifier
Electropulse head amplifiers provide the necessary interface between the ultrasonic liquid level sensor and the control room electronics. The head amplifier is either mounted directly onto the sensor or is mounted on the plant close to the sensor. The head amplifier is a tuned RF amplifier at either 1 MHz or 3.7 MHz to suit the sensor. When the attenuation between transmitter and receiver piezoelectric crystals is low enough, the amplifier oscillates. This is the NORMAL or oscillating condition of the sensor. The oscillation frequency is divided down by normal digital circuitry until a square wave at around 240 Hz is obtained. This is used to switch the 2mA current drain on and off across the supply line from the control unit. Head amplifiers are available in IP66/IP67 aluminium housings and IP68 gunmetal housings when mounted on the sensor and in an IP65 polycarbonate box for plant mounting adjacent to the sensor. Optionally available, a push to test switch on the head amplifier allows an operator to simulate alarm conditions, for shutdown testing. Other options include two separate head amplifiers in one IP68 housing, and stainless steel housing material.

"Normal" sensor state
For gap sensors, the NORMAL condition occurs when the sensor is immersed in liquid. Hi-Sens sensors oscillate and give NORMAL indications when the sensor is in air, dry. The NORMAL condition with an active oscillating sensor is the best state for a level alarm system, since all components are energised and active. Such a system is ‘fail safe’.
An Electrosensor system comprises three modules:-

<table>
<thead>
<tr>
<th>Liquid sensor:</th>
<th>Fold out page 16 and select the most appropriate sensor for your application. (For adjacent mount electronics see Page 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control room electronics:</td>
<td>Descriptions are given on page 15 - choose wall/DIN rail mounting or rack mounting. Ordering information is given on page 17</td>
</tr>
</tbody>
</table>

Typical system (Direct mounting head amplifier):

<table>
<thead>
<tr>
<th>Liquid sensor:</th>
<th>302SDPHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control room electronics:</td>
<td>MEP3R/1S</td>
</tr>
</tbody>
</table>

Typical system (Adjacent mounting amplifier):

<table>
<thead>
<tr>
<th>Liquid sensor:</th>
<th>312SU U8H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjacent amplifier:</td>
<td>MEP3A/3CPN</td>
</tr>
<tr>
<td>Control room electronics:</td>
<td>MEP3R/1S</td>
</tr>
</tbody>
</table>
Elecropulse sensor head amplifier units

1. Industrial sensor head mounted amplifier unit
The head amplifier is mounted on the sensor in an IP65 (IP66/IP67 when suitably glanded) aluminium die cast box. Cable connection via one or two PG16 gland holes. Sensor gain potentiometer adjustable and gain switch accessible with lid removed.

2. Marine sensor head mounted amplifier unit
The head amplifier housing in either gunmetal or stainless steel is permanently mounted on the sensor flange. Cable connection is via one of the M20 gland holes, into cable clamp and corrosion resistant terminals. Amplifier board is coated with polyurethane varnish and is optionally resin potted. Lid is ‘O’ ring sealed. Gain control adjustment potentiometer is factory preset, but site adjustable.
For use with two point sensor two totally separated head amplifiers can be housed in one MARINE housing. The general design concept of the marine sensor head amplifier is based on the worst case of deck mounting on a chemical tanker. Typical application involves two Hi-Sens sensors positioned for 95% and 98% high level alarms.

3. Adjacent sensor head amplifier
Housing polycarbonate box designed for mounting adjacent to the sensor. Sensor coaxial cables are attached to terminals in the housing, and the twisted pair plant cable fits through an M16 plastic gland. Gain switch and adjustment potentiometer are accessible with the lid removed.

Reverse action unit
With standard head amplifiers as above, the "NORMAL" condition on control room readout unit occurs when the liquid sensor is in its active/oscillating condition. (Gap sensor dry, Hi-Sens sensor wet).

 MEP3L or MEP3R when the sensor is not oscillating (Gap sensor dry, Hi-Sens sensor wet).

Common specifications
Function
The head amplifier provides the RF drive circuitry for the liquid level sensors (gap type or Hi-Sens) or for interface detection sensors. These sensors are physically attached to the head amplifier, or mounted very close to the adjacent amplifier. Signals are transmitted along the two wire plant cabling to Elecropulse control room units to provide readout.

Design concept - fail safety
The head amplifier electronic design features fail to safety (no pulse output) for any anticipated electronic, mechanical or wiring failure.

Hazardous area approval
Units are available approved intrinsically safe to ATEX, EN5004, EN50020. Certified II1G EExia IIC T4. (-40°C<+85°C).

Specification
Power input: 12 volt dc from associated Elecropulse control room unit (type L or R).
Output signal: current pulses 2mA at 240Hz approximately square wave signalling to Elecropulse control room unit.
Operating frequency: 1 MHz or 3.7 MHz as required for the associated liquid or interface sensor.
Ambient temperature: - 25°C to +85°C. With potted electronics lower temperature limit is - 40°C.

Earthing
Amplifier and sensor circuits are floating with respect to sensor housing. With metal bodied sensor, normal practice is that the sensor body is earthed.
Electropulse control room electronics

1. Electropulse MEP3L Stand alone readout unit

Relay output
- Rating: 500VA PF 0.4 on MEP3L at 250V rms
- Ambient temperature: -10°C to +65°C
- Power Consumption: 7VA
- Cable Entry: Via cutouts in the base through rubber grommets to terminal strip
- Protection: IP20

2. Electropulse MEP3R Rack mounted readout card

Alarm relay output
- Energised for "Normal" condition after preset delay.
- De-energised for "Fault" condition.
  (i) DPCO option, relay contact rating for MEP3R is 45VA at 250V rms.
  (ii) SPCO option, relay contact rating for MEP3R is 500VA at 0.4PF

Fault relay output
- De-energised for "Normal" condition.
- Energised for "Fault" condition.
  SPCO relay, contact rating for MEP3R is 500VA at 0.4PF

Common specification

Function
- Provides power supply to sensor head amplifier and detects sensor state.
- Operates output relays and front panel LED indicators, providing delay adjustments and control test system.
- Monitors plant wiring integrity.
- Design concept - fail safety

Hazardous area approval
- Units are available approved to ATEX II (1) G [Exia] IIC. This allows suitably specified plant cabling to be led directly in the hazardous area and connected to the Electropulse head amplifiers.

Specification
- Input: 220/240V AC ± 10% 50/60 Hz
- 110/120V AC ± 10% 50/60 Hz
- Front panel LED indicators
  - Green - Normal condition
  - Red - Alarm condition
  - Amber - Fault condition

NOTE:
- Fault condition always triggers alarm. Normal condition is gap sensor wet, or Hi-Sens dry.
- Delay: Alarm to normal: less than 100msec Normal to alarm: screwdriver adjustable from 1 to 10s.
- Normal to fault: less than 100 msec.
- Test: Front panel push to test switch simulates alarm or fault conditions and triggers alarm relay (also fault relay on MEP3R).

Output:
- Supply to Electropulse head amplifier (12V dc) is fully floating (galvanically isolated). The output is short circuit proof for short periods only.
### Ultrasonic Liquid Level Sensor Selection

#### Notes:
- Full details of Mobrey Measurement ultrasonic sensors for use in sludge blanket level or sludge density measurements are given in leaflet No IP50.
- Liquified petroleum gas (LPG): Hi-Sens sensors will not operate in LPG's such as propane & butane, which are low SG/low density.
- Carbon dioxide (CO): ultrasonic gap sensors will not operate in liquid CO, which is highly attenuative.
- Most sensors are available with flange mounting. Consult factory for details.
- Sensor operation may be upset by highly aerated or heavily contaminated liquids. Consult factory if in doubt.
- For pressure above 50 bar, always consult factory before specifying.
- *See note below.

#### Table of Ultrasonic Sensors

<table>
<thead>
<tr>
<th>Fitting</th>
<th>Wetside Material</th>
<th>Design or Duty</th>
<th>Liquid Type</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Sensor active</th>
<th>Approvals*</th>
</tr>
</thead>
<tbody>
<tr>
<td>332SD</td>
<td>1&quot; BSPT dual</td>
<td>316 steel (cast)</td>
<td>Standard</td>
<td>-70°C to +150°C</td>
<td>56b</td>
<td>Wet</td>
<td>H</td>
</tr>
<tr>
<td>302SD</td>
<td>3/4&quot; BSPT dual</td>
<td>316 steel (cast)</td>
<td>Standard</td>
<td>-70°C to +150°C</td>
<td>105b</td>
<td>Wet</td>
<td>H, P</td>
</tr>
<tr>
<td>352SD</td>
<td>1/2&quot; BSPT dual</td>
<td>316 steel (cast)</td>
<td>Dual point</td>
<td>-70°C to +150°C</td>
<td>105b</td>
<td>Wet</td>
<td>H, P</td>
</tr>
<tr>
<td>HL3SD</td>
<td>1/2&quot; BSPT inside</td>
<td>316 steel (cast)</td>
<td>Hi-Sens high alarm</td>
<td>-70°C to +130°C</td>
<td>100b</td>
<td>Dry</td>
<td>H</td>
</tr>
<tr>
<td>HD3SD</td>
<td>1/2&quot; BSPT inside</td>
<td>316 steel (cast)</td>
<td>Hi-Sens dual point</td>
<td>-70°C to +130°C</td>
<td>100b</td>
<td>Dry</td>
<td>H</td>
</tr>
<tr>
<td>312SY</td>
<td>1&quot; BSPT dual</td>
<td>Epoxy &amp; 316 st.st</td>
<td>Aerated liquids</td>
<td>-70°C to +130°C</td>
<td>21b</td>
<td>Wet</td>
<td>H</td>
</tr>
<tr>
<td>312SU</td>
<td>1&quot; BSPT dual</td>
<td>P.P.S.</td>
<td>Corrosive liquids</td>
<td>-70°C to +130°C</td>
<td>3.5b</td>
<td>Wet</td>
<td>H</td>
</tr>
<tr>
<td>312SR</td>
<td>1&quot; BSPT dual</td>
<td>Polypropylene</td>
<td>Corrosive liquids</td>
<td>-70°C to +65°C</td>
<td>3.5b</td>
<td>Wet</td>
<td>H</td>
</tr>
<tr>
<td>323SY</td>
<td>1/4&quot; BSPT inside</td>
<td>Epoxy &amp; 316 st.st</td>
<td>Dirty liquids</td>
<td>-70°C to +130°C</td>
<td>21b</td>
<td>Wet</td>
<td></td>
</tr>
<tr>
<td>393SD</td>
<td>1/4&quot; BSPT inside</td>
<td>316 steel (cast)</td>
<td>Dirty liquids</td>
<td>-70°C to +150°C</td>
<td>56b</td>
<td>Wet</td>
<td>H, P</td>
</tr>
<tr>
<td>373SD</td>
<td>1/4&quot; BSPT inside</td>
<td>316 steel (cast)</td>
<td>Multi-point (2-6)</td>
<td>-70°C to +150°C</td>
<td>56b</td>
<td>Wet</td>
<td>H, P</td>
</tr>
<tr>
<td>30HSD</td>
<td>1 1/2&quot; outside</td>
<td>316 steel (cast)</td>
<td>High temperature</td>
<td>+1°C to +250°C</td>
<td>50b</td>
<td>Wet</td>
<td></td>
</tr>
<tr>
<td>39HSD</td>
<td>1/4&quot; BSPT inside</td>
<td>316 steel (cast)</td>
<td>High temperature</td>
<td>+1°C to +250°C</td>
<td>50b</td>
<td>Wet</td>
<td></td>
</tr>
<tr>
<td>362SJ</td>
<td>1/4&quot; BSPT dual</td>
<td>Epoxy &amp; 316 st.st</td>
<td>Cryogenic</td>
<td>-210°C to +65°C</td>
<td>70b</td>
<td>Wet</td>
<td></td>
</tr>
<tr>
<td>366SJ</td>
<td>M6 inside</td>
<td>Epoxy</td>
<td>Miniature</td>
<td>-210°C to +65°C</td>
<td>3.5b</td>
<td>Wet</td>
<td>H</td>
</tr>
<tr>
<td>389ST</td>
<td>1 1/2&quot; Flange</td>
<td>P.T.F.E.</td>
<td>Corrosive liquids</td>
<td>-20°C to +130°C</td>
<td>105b</td>
<td>Wet or clear</td>
<td>H, P</td>
</tr>
<tr>
<td>402SD</td>
<td>1/4&quot; BSPT dual</td>
<td>316 steel (cast)</td>
<td>Interface duty</td>
<td>-70°C to +150°C</td>
<td>280b</td>
<td>Wet</td>
<td></td>
</tr>
<tr>
<td>422SD</td>
<td>1/4&quot; BSPT dual</td>
<td>316 steel (cast)</td>
<td>High pressure</td>
<td>-70°C to +150°C</td>
<td>105b</td>
<td>Wet or clear</td>
<td>H, P</td>
</tr>
<tr>
<td>433SD</td>
<td>1/4&quot; BSPT inside</td>
<td>316 steel (cast)</td>
<td>Interface duty</td>
<td>-70°C to +50°C</td>
<td>105b</td>
<td>Wet or clear</td>
<td>H, P</td>
</tr>
<tr>
<td>442SD</td>
<td>1/4&quot; BSPT dual</td>
<td>316 steel (cast)</td>
<td>Across pipeline</td>
<td>-70°C to +150°C</td>
<td>105b</td>
<td>Wet or clear</td>
<td>H, P</td>
</tr>
<tr>
<td>621SY</td>
<td>Clamp on 18-70mm dia.</td>
<td>Epoxy</td>
<td>Non-penetration</td>
<td>-20°C to +130°C</td>
<td>n/a</td>
<td>Wet full</td>
<td></td>
</tr>
<tr>
<td>601SY</td>
<td>Clamp on to flat sight</td>
<td>Epoxy</td>
<td>Non-penetration</td>
<td>-20°C to +130°C</td>
<td>n/a</td>
<td>Glass full</td>
<td>H</td>
</tr>
</tbody>
</table>

#### Notes and Approvals:
- *See note below.
- A suffix in the form X*** may be used where a special option is supplied.
- When ultrasonic crystals with a non-standard operating frequency are supplied, the suffix used will be in the form M*.
- *Note: Sensors for adjacent head use have 3m cable supplied.
- Control boxes MCU: Standard with 3m Cable, non-approved.
- Electrosensor MES or electropulse MEP: ATEX approved. Fitted with integral head amplifier.
- Electrosensor MES: ATEX approved. Fitted with integral industrial head amplifier.
- Electropulse MEP: ATEX approved. Fitted with integral marine head amplifier.

#### Table of Sensor Compatibility

<table>
<thead>
<tr>
<th>CODE</th>
<th>Sensor compatibility with Mobrey Measurement Systems</th>
<th>Not permissible with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>Sensor operation may be upset by highly aerated or heavily contaminated liquids. Consult factory if in doubt.</td>
<td>Not 362, 366, 442, 621, 312SY</td>
</tr>
</tbody>
</table>

#### Table of Special Options

<table>
<thead>
<tr>
<th>CODE</th>
<th>Standard Options</th>
<th>Permissible with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Sensors available in extended length versions</td>
<td>302, 352, 312SY, 393, 373</td>
</tr>
<tr>
<td>1-6</td>
<td>Specifies number of points on 337 Type</td>
<td>HL3, HD3, 362, 389</td>
</tr>
<tr>
<td>1-5</td>
<td>Specifies sensor gap size on 433 Type: 1 = 100mm; 2 = 200mm; 3 = 300mm; 4 = 450mm; 5 = 150mm</td>
<td>343 only</td>
</tr>
<tr>
<td>32-80</td>
<td>Specifies size of 621 Type. Contact factory for details</td>
<td>621 only</td>
</tr>
</tbody>
</table>

#### Table of Special Options

<table>
<thead>
<tr>
<th>CODE</th>
<th>Special Options</th>
<th>Test switch on Electropulse integral head amplifiers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X123</td>
<td>A suffix in the form X*** may be used where a special option is supplied</td>
<td></td>
</tr>
</tbody>
</table>
### Adjacent amplifier electronics

<table>
<thead>
<tr>
<th>MEP</th>
<th>Code</th>
<th>Mobrey electropulse Code Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>ATEX approved</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Amplifier type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>Adjacent mounted sensor head amplifier IP65</td>
</tr>
<tr>
<td>Xi</td>
<td>Reverse acting amplifier (IP65)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 MHz frequency</td>
</tr>
<tr>
<td>4</td>
<td>3.7 MHz frequency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Circuitry</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Single unit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>P</td>
<td>Polycarbonate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Test facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Standard</td>
</tr>
<tr>
<td>T</td>
<td>Test switch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Standard</td>
</tr>
<tr>
<td>P</td>
<td>Potted</td>
</tr>
</tbody>
</table>

**Typical model no.**

### Control room electronics

<table>
<thead>
<tr>
<th>MEP</th>
<th>Code</th>
<th>Mobrey electropulse Code Unit Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Instrinsically safe (ATEX)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Unit Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Rack card</td>
</tr>
<tr>
<td>L</td>
<td>Stand alone unit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage input</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Relay Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>DPCO Relay</td>
</tr>
<tr>
<td>S</td>
<td>SPCO Option</td>
</tr>
</tbody>
</table>

**Typical model no.**

### Rack Unit

<table>
<thead>
<tr>
<th>MEP</th>
<th>Code</th>
<th>Mobrey Electropulse Code Unit Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Instrinsically safe (ATEX)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Rack (for cards of one type only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Rack</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of connections</th>
</tr>
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<tbody>
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<td>01-14</td>
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