Mobrey ultrasonic & hydrostatic systems

Level & flow control for the water industry

Mobrey MSP ultrasonic and hydrostatic systems have a long and successful history in the demanding applications found in the water and waste water treatment industry.
This latest range of products follows on from the highly respected MSP90 products, and is built around a powerful new microprocessor, giving increased functionality and an easy to use intuitive Human Machine Interface (HMI).

A system comprises a 4-20mA loop powered transmitter and a multi-function control unit with integral programming keypad, eliminating the need for handheld programmers.
The control unit, which powers the transmitter, monitors the loop current and is available in Wall or Panel mounting options.
The whole system carries an ATEX II (1) G, certificate for use in Zone 0 areas, reducing installation and wiring costs.
Additionally ultrasonic transmitters are FM IS certified, control units are UL certified and hydrostatic transmitters are CSA IS certified.

This modular concept allows selection of the most suitable instrumentation :-

- Ultrasonic level transmitter
- Hydrostatic level transmitter
- Wall mount control unit
- Panel mount control unit.

These systems have a 4-20mA output and also include many new features designed specifically with the requirements of the industry in mind:-

- Wet well level and pump control systems, open channel flow
  - Control up to 4 pumps in duty/assist or duty/standby mode with optional pump duty rotation.
  - Can also be configured as a contents / volumetric measurement or open channel flow measurement system.
- Differential / summing capability
  - Computes difference in readings between two input signals to control screen backwash routines.
  - Will also sum two readings to total contents in two vessels or flow in two channels.
- Open channel flow and logging system
  - Calculates flow in an open channel in accordance with BS3680 Pt. 4, ISO1438/1 and ISO4359.
  - Logging of up to 7200 samples with programmable interval and automatic fast log on exceptional event, plus 2 totalisers for daily and cumulative flow totalisation.

Operation

Ultrasonic transmitters send a pulse of ultrasound down to the liquid surface and detect the reflected echo. An internal microprocessor, which is pre-programmed with the speed of sound, can then translate the time taken for the pulse to be returned into the distance between the transmitter face and the liquid surface. An integral temperature sensor in the transmitter compensates for temperature change effects on the speed of sound in the ullage space. Having established this basic distance, the transmitter calculates the depth of liquid and sends this information back to the control unit as a 4-20mA signal proportional to level.
Alternatively, a ceramic cell hydrostatic pressure transmitter can be used to sense liquid level and provide the 4-20mA signal to the control unit.

Typical applications

Pump control system

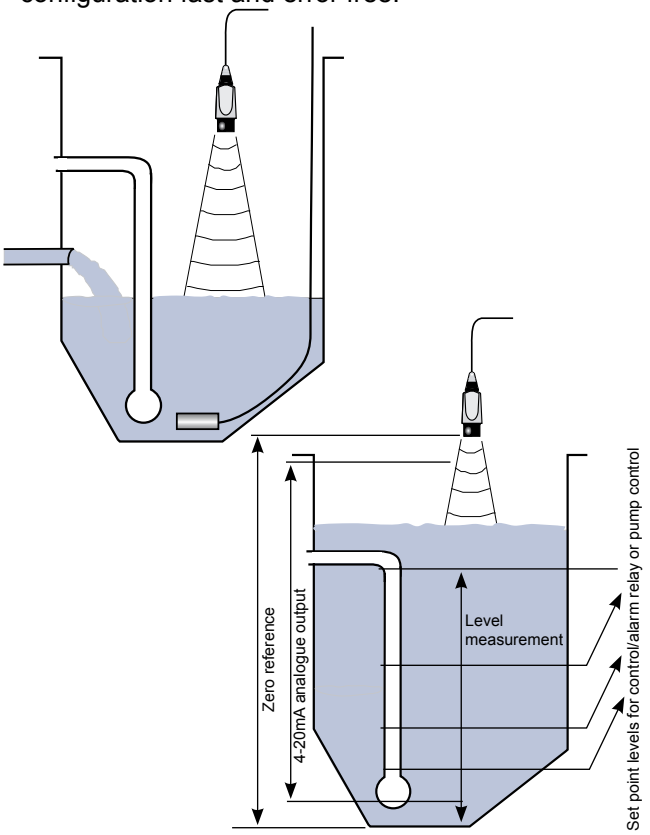
The transmitter is mounted over the liquid surface using the 1" threaded connection provided.
A locking backnut and bracket is supplied which facilitates mounting the transmitter from a spar or strut above the sump.
If a hydrostatic head pressure transmitter is used for level sensing, the transmitter is usually suspended in or clamped to the bottom of the sump.
The cable provided is run back to the control unit, which may be mounted up to 50m / 165ft away either inside or outside. Having connected the two wire transmitter cable to the appropriate terminals in the control unit and connected the power supply, the system is ready for programming with the details of the application.
Programming is simple and efficient using the membrane keypad on the fascia of the control unit and the “Wet-well wizard “ in the menu.

Pump control relays and functionality

The MSP pump control system has 5 relays which may be allocated to control or alarm duty, all programmed independently and all freely assignable. To meet the needs of the water industry, the following features are provided as standard :-

- All relays have an adjustable band with user defined on/off points
- Up to 4 pumps can be controlled using 4 of the relays, either in standard sequential mode or in one of the popular control routines:
- Duty / Standby
- Duty / Assist
- Pumps can have common or independent off levels
- Choice of manual select or autosequence for the lead pump
- Scum line prevention routine to vary trip points and avoid scum build up
- Real time clock allows override of control routine to empty sump during low cost electricity periods

The control unit uses this information to drive control relays which can be freely assigned by the operator. Alternatively, tank contents or volumetric flow in an open channel flow application can be calculated. There are 5 built-in relays and a 4-20mA current output. A clear 4 line display on the unit shows the measured variable or may be programmed to show other operational information. A bargraph representation of the current output and relay status are also displayed.
Programming is simple and efficient using the integral membrane keypad on the fascia of the control unit. The menu structure is easy to navigate and Mobrey “Wizards” are built-in to make configuration fast and error free.



Time delay between relay-on signals prevents electrical or hydraulic overload
User defined periodic pump down routine and frequency to empty sump
Relay energised or “run times” are logged and stored to enable monitoring of pump run times.
Calculation of pumped volume allows pump efficiency to be monitored and reported should efficiency fall below a user defined value.

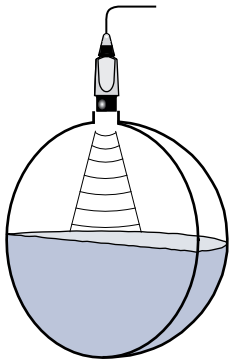
Other relay functions

The 5th relay is normally a failsafe alarm relay (loss of echo, mains failure or other system fault) but may be re-programmed as a standard alarm or control relay. Any relay can be programmed as a rate of rise or rate of fall alarm, temperature, level, contents/volume or flow out of limits alarm or pump efficiency alarm.

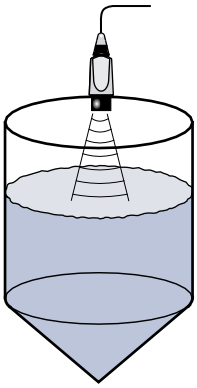
Tank contents system

The MSP tank contents system has several of the most popular tank shapes pre-programmed so that the tank contents/volume can be calculated.
These include: –

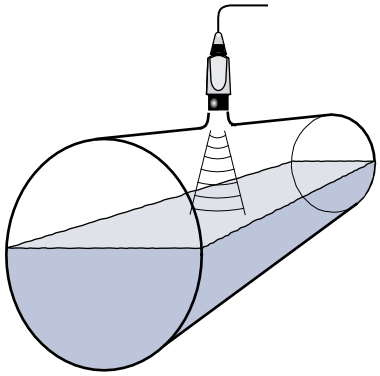
- Vertical cylinder
- Conical bottom cylinder
- Horizontal cylinder
- Horizontal cylinder with domed ends
- Spherical tank



Spherical tank



Conical bottom cylinder



Horizontal cylinder

A scaling factor may be entered to allow the display to show contents in any volumetric units chosen, many of which are pre-programmed.
Units of measure are shown on the display.
Other special tank shapes are accommodated by using the 20 point look-up table. The user simply enters the volume at each of 20 user selectable points over the height of the tank and the system will inter-polate to show volume at any level.

Control relays and the 4-20mA output may be driven by the level reading or volume calculation. The display can be configured to show both level and volume, or the ullage volume above the liquid in the tank.

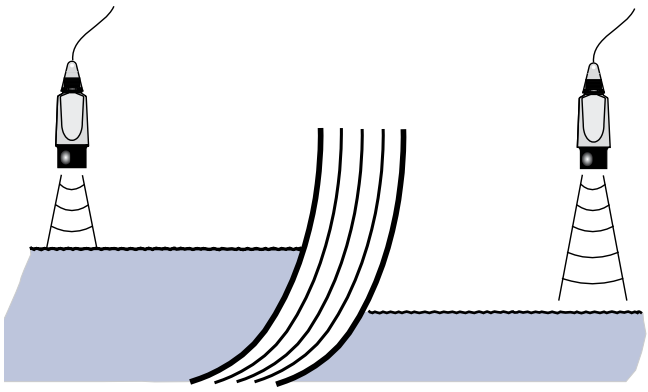
Differential level system

It is sometimes necessary to know the difference in two levels, for example, across an inlet screen where the level difference is an indicator of the state of the screen

The MSP differential level system is designed to operate with two HART level transmitters, and can be programmed to perform calculations on the two input signals –

- Level, contents/volume or flow under transmitter 1
- Level, contents/volume or flow under transmitter 2
- Level difference between transmitter 1 and 2
- Sum of the level, contents or flow under both transmitters

The control relays and current output can driven by any of these functions, and the display can be configured to show the reading of each transmitter plus either the difference or the sum of the readings.
The MSP transmitters used in this application are HART/SMART and are connected in series on a simple two wire bus.



Differential level

Open channel flow measurement

The flow in an open channel may be derived by measuring the liquid level upstream of a weir or flume of a standard design.

V notch weir: Typical 5/2 power law

Venturi flume: Typical 3/2 power law

In OCF applications, the level transmitter is mounted upstream of the channel restriction or obstruction in accordance with the recommended standards. These standards also define the relationship between the liquid level at that point and the flow through the channel.
The popular V-notch weir (5/2), Venturi flume (3/2) and Parshall flow laws which have been used for many years are pre-programmed in the MCU900 control unit, along with other popular flow laws. Where flow measurement has to be in accordance with BS3680 or the Environmental Agency requirements (EA consented flows), the MCU900 has a 20 point look-up table which can be programmed with a dedicated stage discharge curve for the flow structure.

If the user does not have the curve available, Mobrey offers to calculate the curve for certain structures based on dimensional and flow data provided by the user. A data sheet is produced detailing all of the MCU900 parameters and their values which require programming, together with a projection of the uncertainty for the specific application.

Structures for which discharge curves can be provided include:-

- V-Notch
- Venturi flumes
  - Rectangular
  - Semi-circular
  - Trapezoidal
- Triangular profile (Crump) weirs
- Broad crested weirs
- Flat V weirs
- Parshall flumes
- Manning formula
  - Round pipe
  - Rectangular channel

MCU Flow logging system

In many instances, it is required that the flow and totalised flow be logged for download at a later date. The MSP flow logging system has an on-board logger which can log up to 7200 samples at user definable intervals. In the event of flow exceeding a limit value, fast logging is automatically triggered until the flow reverts to normal.
In addition, 365 daily totalised flow values are also logged along with the maximum instantaneous flow during each 24 hour period.
A second totaliser is provided to totalise cumulative flow through the flow structure.
All data is real time stamped and stored for download via an RS232 connection on the control unit.

Data can be collected using a portable PC, and is easily stored and manipulated using the Mobrey LogView windows software. See brochure IP122 for full details of Mobrey LogView.

Functionality

The MCU900 control relays may be allocated as flow rate alarms or may be selected to operate as a pulse output to an external totaliser. There is also the facility to allocate a relay as a low- flow cut off so that totalisation errors are avoided in very low flow conditions.
The current output is proportional to flow rate and is used for remote monitoring, telemetry or local recorders.

The system will totalise flow and show both instantaneous flow and totalised flow on the display, in different units of measurement if required.

There is also the facility to connect up to two digital (voltage free contact) inputs to the system which may be used to inhibit measurement or force alarms or other routines to start upon external signals.
For further details, ask for datasheet IP2039.

Programming the MSP system

The system is easily programmed using the membrane keypad on the fascia of the control unit – no handheld programmer is necessary.

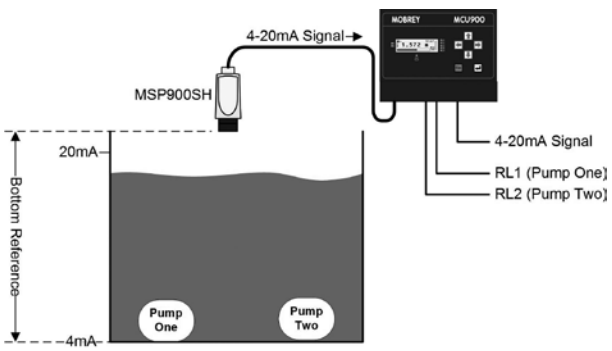
A user friendly menu structure is employed, guiding the user through the steps needed to ensure correct operation.
This Human Machine Interface (HMI) is common to other Mobrey products, so the operator does not have to learn and remember a variety of programming techniques.
When used with a Mobrey HART compatible ultrasonic level transmitter, the MCU control unit keypad is also used to configure the transmitter and set the 4-20mA current input range.

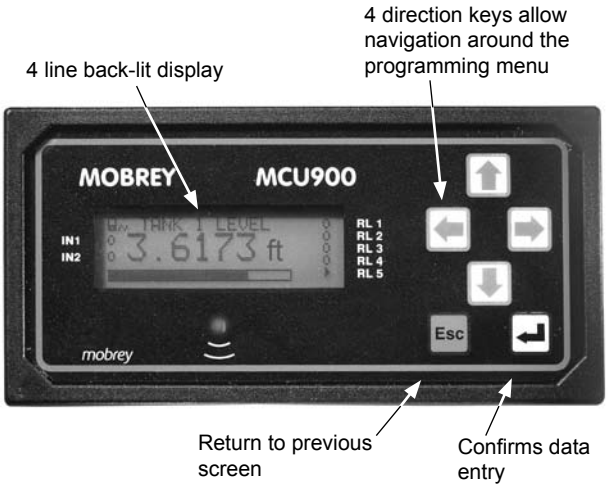
With standard 4-20mA transmitters, the 4-20mA range is fixed and the MCU control unit is simply programmed to operate over all or just a portion of the current input.
For the more involved applications, such as pump control using control routines or open channel flow measurement, the control unit will offer “Wizard” assistance to ensure all of the necessary data is entered in the correct memory locations.

The control unit is fitted with a clear back-lit 4 line display which is used to present the operator with programming and set-up options. Once commissioning is complete, the display will show the measured variable such as level or flow, a bargraph representation of the current output and the status of all input and outputs. Alternatively, the display can be configured to show a multitude of other information as the operator chooses.

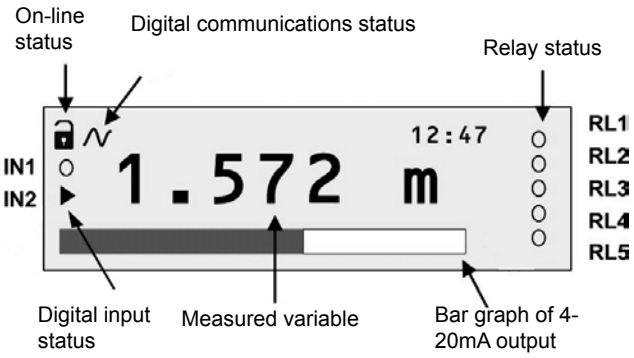
Easy to follow 'quick start' set-up instructions

Each system is supplied with a highly visual 'quick-start' manual which guides the user through the 'Wizard' set-up procedure. See diagram right.

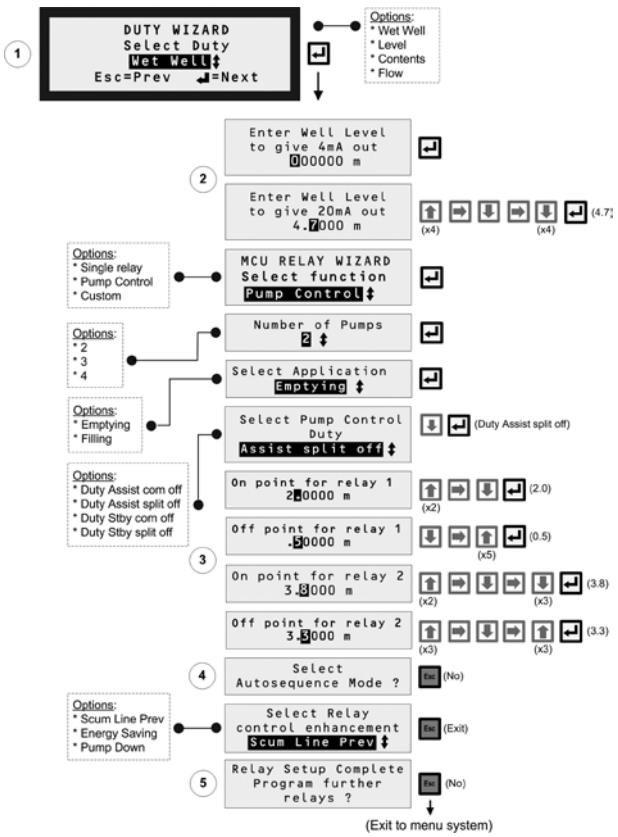




Front panel display and keypad (imperial display shown)



4 line display (metric display shown)



Set-up procedure

MCU900W Series wall mounting control units

Housed in a tough IP65 or NEMA4 Polycarbonate enclosure, the control unit can be mounted either inside or outside. All wiring terminals and mains selector switch (115 or 240V ac) are accessed by removing the lower terminal box lid, leaving the main electronics compartment undisturbed.
The enclosure is pre-drilled with 5 cable entries (M20) and glands and blanking plugs are supplied.

Inputs

• Any 4-20mA signal from a transmitter. The MCU will power a 24V dc transmitter with a max load of 25mA, or can accept input from a separately powered transmitter. Transmitters may be located in a hazardous area as the power supply is fully protected. No additional safety barriers are required. Alternatively, the unit will accept a digital input from a HART/SMART transmitter and allow access to Universal and some Common Practice commands.
• 2 Voltage free contact closure digital inputs.
• Mains power, 115V ac or 230V ac or 24V dc.

Outputs

• 4-20mA current output proportional to measured variable. May be scaled over the whole or part of the range, and can be profiled or scaled to suit.
• 4 control relays, user selectable as alarm, control or fault duty. Full range of pre-programmed pump control routines.

MSP900SH Series ultrasonic level transmitters

These 24V dc loop powered transmitters are factory sealed and fitted with cable ready to install on aqueous applications. Manufactured from UPVC, the transmitter is designed to give a 4-20mA output proportional to liquid level (or distance to level). Power is supplied by the control unit, and the transmitter is configured with the application details using the control unit keypad or HART communicator.

9700 Series hydrostatic level transmitters

The 9700 range of hydrostatic level transmitters are manufactured in 316 Stainless steel with a corrosion resistant flush fitting ceramic sensing face.
The transmitters are 24V dc loop powered and are factory fitted with the required length of vented cable, sealed IP68/NEMA6P to 120m / 390ft.
Options with remote Zero and Span are available to order.

MCU900P Series panel mounting control units

All of the MCU functionality is available in this small panel mounting format. Extending just 163 mm (6.3 inches) into the panel, connection is made to two part terminal blocks on the rear of the unit.
Please note that if several units are mounted in the same panel, allow room for air to circulate between units. An air circulation fan is recommended for installations of 3 or more units in the same panel.

• 5th Relay, normally a fail safe fault relay, but may be re-allocated to alarm duty.
• A relay may be allocated to give a pulsed output based on totalised flow through an open channel flow structure.

Features

• Wizard assisted simple menu programming
• Clear visual output using back-lit LCD display
• Patented echo recognition software techniques to ensure reliable level tracking. Includes tools to deal with stirrers, agitated surfaces, false echoes and other common application problems.
• Pre-programmed linearisation functions, plus a 20 point user programmable curve facility.
• Auto-test routine to simulate liquid level rising and falling such that all alarms and outputs are tested. Includes a set-current option to test other loop instrumentation.

MSP900SH Series

9700 Series

Controller technical specification

Electrical	ATEX certified	UL Certified
Supply	AC: 98 - 132V ac, 198 - 254V ac 50/60Hz, Power consumption: 10VA nom, 18VA max. DC: 15-30V dc / 9W max.	As ATEX N/A
Current input	4-20mA and / or HART Digital comms (Rev. 5) Supplies 23 Volts from 400Ω source resistance	✓
Trigger inputs	2 voltage free contact closures	✓
Current output	4-20mA isolated into 1 Kohm (12 bit)	✓
Relays	5 SPCO, 5A at 240V ac	✓
Cable entry	5 positions pre-drilled. 2 glands and 3 blanking plugs provided	✓
Cable connection	*Wall mount*: Cage clamp terminal blocks in separate terminal compartment *Panel mount:* 2 part cage clamp terminal blocks at rear	✓
Mechanical		
Material	*Enclosure & keypad:* Polycarbonate	✓
Size	*Wall mount:* 213mm / 8.72" wide x 185mm 7.28" high x 84mm / 3.3" deep *Panel mount:* Cut out 139mm 5.47" wide x 69mm / 2.7" high. Allow 165mm/6.5" clearance behind panel	300w x 300h x 133d 122" x 12" x 5.2"
Enclosure rating	*Wall mount:* IP65 indoor/outdoor *Panel mount:* IP42 (indoor mount); IP65 Hood kit available	NEMA4X
Environmental	Installation category: 115V: Cat.III, 230V: Cat.II Pollution degree: 2 Altitude: 2000m/6500ft max. Relative humidity: 100%	✓ ✓
Temperature	-40°C to +55°C / -40°F to +130°F (Use of an air circulation fan is recommended if 3 or more panel mounting units are installed in the same cabinet)	✓
Approvals	ATEX II (1) G [EEx ia] IIC	CL1 Div1 Grps A, B, C, D CL1 Zone 0 IIC -40°C to +50°C / -40°F to +130°F

Transmitter technical specification

	Ultrasonic transmitter	Hydrostatic transmitter
Range	0.3 to 12m 1 to 39ft	0 to 120m/400ft water (specify exact range on order)
Power supply	24V dc 2 wire loop powered	24V dc 2 wire loop powered
Output	4-20mA	4-20mA
Digital Comms.	HART / SMART	None
Ambient temperature	-40° to +60°C / -40° to +140°F	-20° to +80°C / -4° to +176°F
Maximum temperature	-40° to +60°C / -40° to +140°F	-20° to +80°C / -4° to +176°F
Operating pressure	0bar to +3bar / +43psi	Up to 120m / 400ft water
Material of construction	UPVC (Stabilised)	316SS/Ceramic
Rating	IP68 / NEMA 6P (3m / 12ft)	IP68 / NEMA 6P (120m / 400ft)
Cable	2 core screened	2 core screened, vented.
Cable sheath	PVC	Polyurethane
Cable length	3, 20 or 50m/9, 65 or 164ft All cables may be shortened or extended on site.	To order
Mounting	1" BSPP + bracket	Suspended or clamped
Certification	ATEX II 1 G EEx ia IIC T6 FM CL1 Div1 Grps A, B, C, D CL1 Zone 0 AEx ia IIC T6 CSA Ex ia IIC T6	ATEX II 1 G EEx ia IIB T4 CSA CL1 Div1 Grps C, D II 1 G EEx ia IIB T4
Technical data sheet	IP2032	0078

Ordering Information

Select the most appropriate transmitter and a control unit from the tables below.

Ultrasonic level transmitters

MSP900S		Ultrasonic level transmitter, range 12m / 39ft, PVC construction.
	H	HART digital communications
	P	Profibus PA digital communications
	-A	ATEX/CSA certified II 1G/EEx ia IIC T6 1" BSPP + bracket in 316SS
	-U	FM/CSA certified CL1 Div1 Grps A, B, C, D 1" NPT + bracket in 316SS
	/3	3m / 10ft of factory fitted PVC sheathed instrument cable
	/8	8m / 26ft of factory fitted PVC sheathed instrument cable (Profibus models only)
	/20	20m / 64ft of factory fitted PVC sheathed instrument cable
	/50	50m / 163ft of factory fitted PVC sheathed instrument cable

Hydrostatic level transmitters

9710	Hydrostatic level transmitter, range as specified on order 316SS construction with ceramic sensing cell, IP68/NEMA 6P (120m) Specify range required on order : Max range = 100m H_20 Polyurethane factory fitted and sealed cable, state length required on order. Intrinsically safe: ATEX II 1 G, EEx ia IIB T4, CSA II 1 G EEx ia IIB T4, CL1 Div1 Grps C,D

Full part number will depend upon options chosen and will be specified on quote/order acknowledgement.

Control units

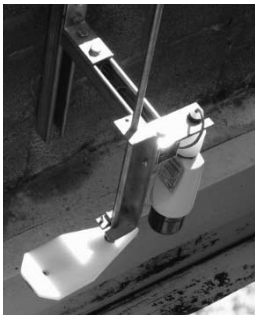
MCU901		Control unit for pump control, level, contents & flow duty
MCU902		Control unit for differential level or summated flow duty
MCU90F		Control Unit with on-board logging capability for open channel flow duty
	WX	Wall mounting enclosure
	PX	Panel mounting format
	-A	ATEX certified II (1) G [EExia]IIC : IP65 enclosure
	-U	UL certified CL1 Div1 Grps A, B, C, D : NEMA 4X enclosure

Ordering information: Accessories

MSP-BRK4	316 Stainless steel bracket for mounting or suspending MSP900SH transmitter.
MSP-FLG4	2" ANSI #150 / DN50 PN16 combined flange in PVC for mounting MSP900SH tx
MSP-HVD	Head verification device for regular checking of OCF system performance.
MSP-LogView	PC windows based software for data collection, concatonation and manipulation of logged data. Allows trending, graphical and tabular display of data.

Site services (UK and Ireland only)

Mobrey has considerable expertise in the area of open channel flow measurement. We offer an on-site service to verify existing flow structures and instrumentation in accordance with BS3680.The service includes a full survey, report, remedial works, final certification and maintenance thereafter if required.



To ensure continued accuracy of instrumentation, the Mobrey head verification device may be retro-fitted to most installations. Comprising a target on a swivel arm, the device supports the transmitter at a fixed distance above the target plate. When the instrument is to be checked for accuracy, the target is swung under the head and the simulated flow reading checked against a certified value for that installation.

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