

Mobrey

MSP90 Ultrasonic non-contact liquid level measurement and control system

Data sheet
IP2034

The ultrasonic pulse-echo system for:

- Liquid level and tank contents in any shape vessel
- Pump control and alarm duties
- Flow in flumes and over weirs
- Open channel flow measurement

Features

- Choice of corrosion resistant transducers
- Wall, rack & panel mounting
- Intrinsically safe
- Continuous level measurement and control with 5 programmable relays and 4-20mA current output.
- Built-in two line display to show level, volume, flow and totalised flow in any units, plus % bar graph.
- Simple calibration with user friendly infra-red programming device.
- Choice of ultrasonic transducers, including long range, PTFE or stainless steel.
- Easy and economical to install using standard instrument cable.
- Safe 24V signal on transducer cable makes hazardous area installation easy
- 10m PTFE transducer for greater chemical resistance

Description

MSP90 is the time proven non contact level control system from Solartron Mobrey.

A system comprises an ultrasonic transducer mounted above the liquid surface and a microprocessor controlled electronic control unit which may be mounted up to 500m away, connected by standard 3 core shielded instrument cable.

The system is configured on site with a simple hand held infra-red programmer, using the parameter programming method.

The easy configuring routine is one of the major benefits of the MSP90, allowing commissioning of a system within minutes without the need to open the cover of the control unit. One programmer can programme any number of control units.

Operation

An ultrasonic transducer sends a pulse of ultrasound down to the liquid surface and detects the reflected echo. The microprocessor control unit, 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 transducer face and the liquid surface.

Having established this basic distance, the MSP90 can then display this value, or use it in calculations to determine other values such as liquid depth, tank contents or volumetric flow if in a flow channel application.

There are 5 relays which may be programmed to operate at any desired levels for alarm or pump control duties and a 4-20mA proportional signal for re-transmission.

All MSP transducers have integral temperature sensors to compensate for temperature change effects on the speed of sound in the ullage space.



Typical applications

Level measurement in sumps, wetwells or storage tanks

Mount the transducer over the liquid surface using the bracket or flange provided, then programme the control unit with the tank depth.

The control unit will now give a 4-20mA current output proportional to level in the tank or sump.

The relays may be programmed to operate at desired levels for pump control and/or alarm duties.

MSP90 can be programmed to cope with many liquid surface conditions, including foams and turbulence.

Control relays and functions

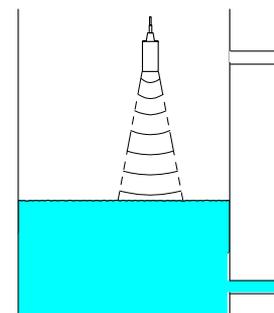
MSP90 has 5 relays which may be used for pump control, all programmable independently. To meet the needs of the water industry, several pump control routines are pre-programmed and may be selected by the user.

- 3 of the relays can be chosen to autosequence, giving 2 or 3 sump pump rotation to produce even pump wear. Pumps can have common or independent 'off' levels.

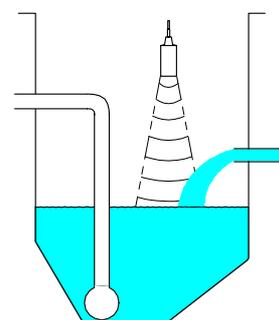
- Choice of autosequence or manual select for lead pump.
- Pump control can be in either Duty/Standby or Duty/Assist mode.
- Each of the 3 relays has a battery backed 4 digit "hours run" counter to enable monitoring of pump run times.
- The fourth relay can be programmed as a pump on/off or level alarm function.
- Time delay between relay on signals prevents electrical or hydraulic overload.
- Any relay can be programmed as a rate of rise or fall alarm.
- Periodic pump out of the sump can be programmed optionally once in up to 10 days. Pump 'run-on' time can be programmed for up to 9 minutes.

Fail safe alarm relay

The fifth SPCO relay is a fail safe alarm which de-energises on mains failure, lost echo or other system fault. May also be programmed as a high and low level alarm.



Vertical uniform tanks



Sumps and wetwells

Tank contents measurement

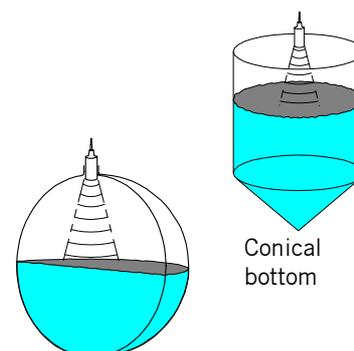
MSP90 has several standard tank shapes pre-programmed so that tank contents can be calculated. There is also a scaling factor available to allow the display to show tank contents in any volumetric units chosen. Other special tank shapes may be entered into the microprocessor memory as a ten point graphical/look up table.

MSP transducers may be mounted directly onto a tank flange or cover, or may be mounted on a standoff. Acceptable standoff dimensions depend upon the transducer type being used; consult manual for full details.

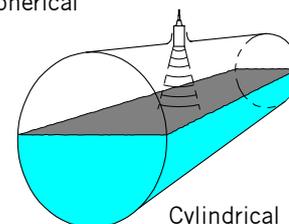
Reference pin option

Reference pins can be fitted to maintain accuracy in changing ullage conditions, for example, rapid temperature changes or ullage gas density changes.

The pin provides an echo to the transducer from a fixed distance, and is used by the microprocessor as a reference signal, so that the true echo from the liquid surface can be automatically calibrated in line with the changing ullage conditions above the liquid.



Spherical



Cylindrical horizontal

Open channel flow measurement

Derived from liquid level upstream of a weir or flume of standard design.

- The MSP90 is mounted above the flow, upstream of the obstruction.
- Established standards relate the flow through such obstructions to a function of liquid level. This flow may be displayed in any flow units. The MSP90 microprocessor is pre-programmed with the 3/2 and 5/2 power laws.

Flow laws:

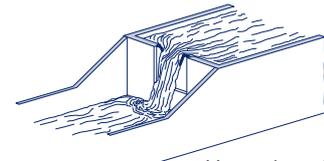
Typical applications for flow measurement are:

- Venturi flumes with 3/2 power law
- V-notch weir with 5/2 power law
- Parshall type flumes where the power law is between 3/2 and 5/2
- Broad crested weirs 3/2 power law

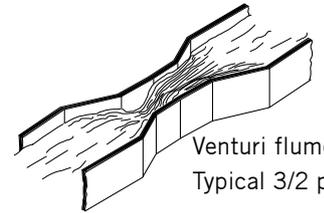
Flow calculations to national standards

In this application the flow characteristics can be programmed into the MSP90's microprocessor memory as a 10 point graphical tabulation. On receipt of your flume or V-notch details, Solartron Mobrey can provide an exact height/flow relationship for programming into the MSP90 on site. The relay outputs are available as flow rate alarms or may be selected to operate as a pulse output to drive an external totaliser or as a flow proportional sampler.

The current output proportional to flow rate can be used for remote monitoring, telemetry or local chart recorders.



V notch weir
Typical 5/2 power law



Venturi flume
Typical 3/2 power law

For applications where improved overall accuracy is required, a reference pin option is available to provide immediate speed of sound compensation as air temperature changes.

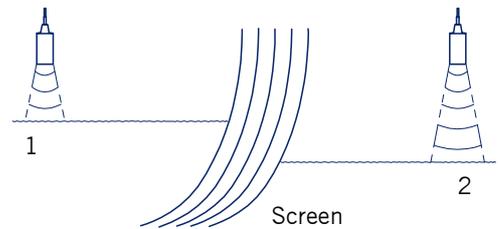
Differential level measurement across screens: MSP92

The MSP92 control unit has connections for two separate MSP transducers. These transducers can be used in combination, as level measurement on either side of a sewage works or cooling water intake screen or as flow meters on twin inlet channels.

The MSP92 software identifies four separate functions based on these two transducers :

- 1) Level, contents or flow under transducer 1
- 2) Level, contents or flow under transducer 2
- 3) Level difference between transducer 1 and 2
- 4) Sum of the functions chosen in 1 and 2

The single current output, relays and LCD readout can be allocated to any of the above functions.



In a screen application, the 4-20mA output can be allocated to represent the difference in level across the screen, 2 relays could be allocated to this differential to initiate cleaning cycles when required, and other relays could be allocated to alarm on upstream and downstream levels.

MSPLOG for logging applications

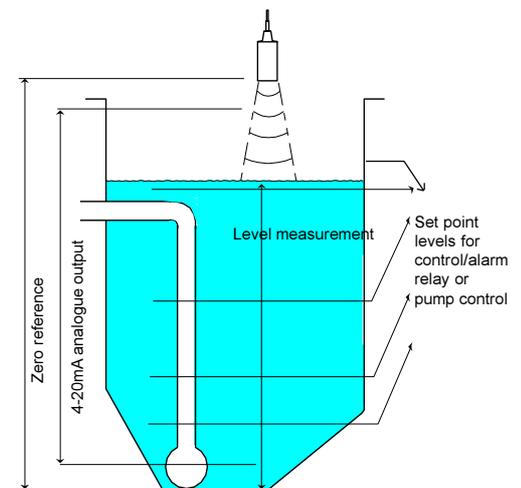
MSPLOG has all the measurement and control functions of the standard MSP90, with the addition of a logging capability. Used on flow applications, both average flow and totalised flow are logged for retrieval via an RS232 output using the Mobrey LOGVIEW windows software package or the Mobrey Hand Held Communicator (HHC).

Programming

Programming the MSP90 is very simple. The system is able to compute the distance to the liquid surface, and provided that the tank depth, or zero reference is programmed in, then liquid height is easily computed.

By programming in the relevant dimensions of the tank, then liquid contents in any units is available. The relay on and off points can be programmed at any position within the total span, and their function - either alarm or pump control/sequencing - can be selected. The 4-20mA current output can be defined as either the total span or any proportion of the span.

All programming is carried out using an infra red hand held programmer, which operates without having to open the enclosure whether it be wall mounted or multicard (rack panel) mounted.



MSP90-11 Wall mounted control unit

The MSP90 control unit provides 24V power to the transducer and contains the microprocessor which computes the outputs based on the transducer signal.

The control unit is mounted in the control room and is 24V dc or mains powered. All outputs are accessed by removing the lower terminal box lid to reveal the terminal strip.

With an IP65 rating, the control unit may be mounted inside or outside. The only consideration is that the hand held remote programmer must be held within 2m of the control unit to ensure reliable communication.

Outputs

Current output

The current output is selectable for either 0-20mA or 4-20mA rising or falling with level. The span can be selected over the whole or part of the range.

Control relays

4 SPCO relays may be allocated to pump control or level alarm duty, all programmable independently. Relays may be programmed to auto-sequence pumps in duty/assist or duty/standby mode.

Operational features

Contents measurement

Look up tables relating to volume of typical tank shapes are built in to the MSP90 memory, eg cylinders, horizontal and conical bottomed tanks. A 10-point graphical tabulation is also provided for irregular shaped tanks where the height to contents ratio is known.

Auto test routine

Once set up on site, an auto test routine can be initiated to simulate the liquid level rising from zero to high level and back. This enables site

MSP90-61 Multicard control unit

The MSP Multicard unit is designed for rack or panel mounting and will perform the same functions as the MSP wall mounted control unit.

Up to 7 multicards can be fitted to one 19" Eurorack, alternatively the unit can be supplied with a 'panel mount' kit, the MSP-PMK*. This kit comprises various panel mount cartridges, which can house either one, two or four control units.

Please note that if more than three multicards are mounted in a 19" rack, air circulation and a fan are required. The unit is best mounted at eye level.

Pump run times are logged for

interrogation. Any relay can be programmed as rate of rise or rate of fall alarm.

A relay can be allocated as a temperature alarm as tank temperature is continuously monitored by the transducer.

Alarm relay

The fifth SPCO relay is fail safe, which de-energises on mains failure, lost echo or other system fault. May also be reconfigured as a control relay.

checking of relay control, analogue output, indicated level and all external system control and ancillary circuits

Synchronisation

Synchronisation is standard, allowing several transducer cables to be laid in common cable tray without cross-talk problems.

Programmable lost echo action

In the event of a lost echo, the system may be programmed to drive the current output to either 0, 4, 20 or 22mA, or to hold the last valid reading.



Totaliser

An integral 8-digit totaliser will record pumped volume or flow through a channel.

Any control relay may be programmed to give a pulsed output of the flow total. A second totaliser is used to give a sampler trigger pulse output on a control relay; this sampler can also act as a coarse totaliser.

Inputs

4-20mA current input accepted from other sensors, such as a pressure transmitter which may be profiled if non-linear.

Multi-function display

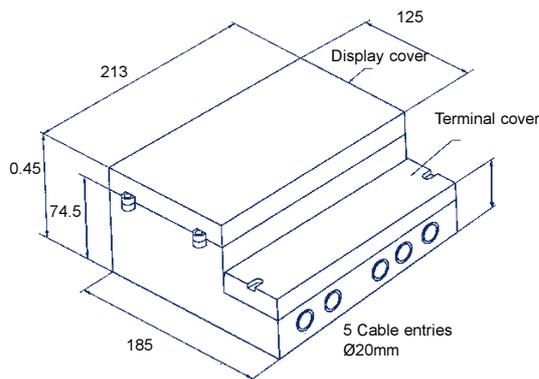
A built-in display shows measured value and percentage of full reading as a bar graph.

Alternatively, the bar graph can be changed to totaliser value, or changed to show another measured or calculated variable, such as temperature.

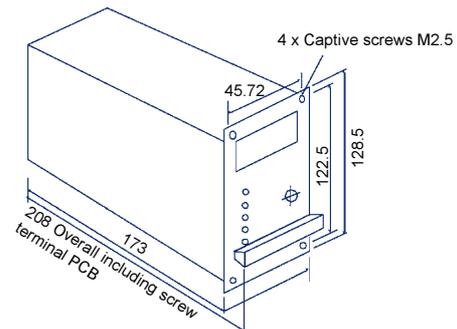
The display includes programming indicators and relay status on the wall mount unit. The Multicard unit uses LED's to indicate relay status.

Technical specification

	Wall mount	Multicard
Supply voltage:	24V dc, 115V or 230V ac +/- 15%, 50 or 60Hz	24V dc, 115V or 230V ac +/- 15%, 50 or 60Hz
Power consump.:	5W dc or 15VA ac	7.5W dc or 7.5W dc 15VA ac
Current output:	0-20 or 4-20mA isolated into 1Kohm Resolution: 12-bit	0-20 or 4-20mA isolated into 1Kohm Resolution: 12-bit
Relays:	5 off, each 5A SPCO at 240V ac	5 off, each 5A SPCO at 240V ac
Totaliser:	Open collector transistor, 24V dc/250mA max.	Open collector transistor, 24V dc/250mA max.
Current input:	0/4-20mA into 128 ohm, 8-bit resolution	0/4-20mA into 128 ohm, 8-bit resolution
Weatherproofing:	IP65	IP20 (IP65 front when mounted in MSP-PMK*)
Material:	Polycarbonate	
Cable entry:	5 positions (see dimensional drawing)	
Connection:	Screw terminals	Screw terminals at rear
Temperature:	Operating temperature range -20°C to +45°C	Operating temperature range -20°C to +45°C
LCD display:	4 digit primary value (level, flow etc) 8 digit totaliser or 20 segment bar graph Relay status icons	4 digit primary value (level, flow etc) 8 digit totaliser or 20 segment bar graph
LED indicator: 1 red	LED flashes to confirm echo received	1 red LED flashes to confirm echo received
RS232 comms:	MSPLOG only	MSPLOG only
Certification:	[EExia] IIC	[EExia] IIC

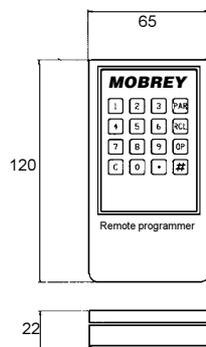


Dimensions: Wall mount unit



Dimensions: Multicard unit (standard 19" rack)

Remote programmer



The RPD is powered by readily available 'AA' batteries and will communicate with the control unit over a maximum distance of 2m.

Local interrogation

The MSP90 control unit may be locally interrogated using the Mobrey Magnetic Screwdriver. Scroll through parameter

The MSP remote programmer (RPD) is a hand-held infrared device used to program and calibrate the MSP90 control unit to provide all the measurement and control functions. Simply aim the RPD at the control unit and use the keypad to access the parameters for reading and programming. The control unit has two levels of access and asks the user to enter via the keypad the level required - read only or program, thus preventing accidental re-programming. The outputs of the control unit are frozen at their last values when program mode is selected.

Icons on the LCD of the control unit show programming status at all times.

settings by touching the magnetic tip of the Mobrey MSP-MMS against the 'target' icon on the MSP90 fascia.

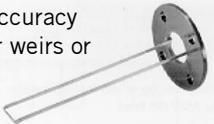
Transducers

Solartron Mobrey MSP90 level measurement systems may be used in many applications where the benefits of non-contact instrumentation allow measurement of difficult liquids. Due to the wide variety of liquids, a range of transducers is offered so that the needs of each application are met successfully.

The MSP90 range of transducers, designed specifically for the water industry, come factory fitted with a fixed length of

transducer cable and a ¾" taper thread for economical pipe or bracket mounting. Specify the T12 model for aqueous non-corrosive liquids, or T28 for corrosive liquids.

The industrial MSP110 range of transducers offers a wider choice of wetside materials, including 316 stainless steel, and longer operating ranges to 20m. A junction box for site connection and mounting flange or bracket are factory fitted as required.

Model	Description	Application	Features
MSP90 - T12 - C	Standard rubber faced for aqueous liquids	General purpose use for level, contents or flow measurement. ¾" threaded mounting	Integral amplifier electronics in the body. Factory fitted transducer cable.
MSP90 - T28 - C	Standard PTFE for corrosive liquids	Used on alcohols, acids, hydrocarbons, solvents, organic liquids, latex and other chemicals.	
MSP110-T18B-C MSP110-T18F-C	Industrial PVC transducer	General purpose use for level, contents or flow measurement.	Integral amplifier electronics in the body. 100% PVC wetside construction.
MSP110 - T52B - C MSP110 - T52D - C	Long range rubber faced for aqueous liquids	General purpose use for level, contents or flow measurement. May also be used in applications with shorter range requirement where difficult ullage or liquid surface conditions require use of a more powerful transducer.	Long range use up to 20m
MSP110 - T28F - C	PTFE for non-water based & corrosive liquids	Used on liquids such as alcohols, acids, hydrocarbons, solvents, organic liquids, latex and other chemicals.	PTFE wetside
MSP110 - T22F - C	PTFE wetside transducer for corrosive liquids	Used on corrosive liquids such as alcohols, acids, solvents, organic liquids, latex and other chemicals. Use with reference pin kit for volatile liquids. Flush faced for minimal vessel intrusion	PTFE wetside
MSP110 - T32D - C MSP110 - T32S - C	316 stainless steel wetside transducer for liquids	Used in vessels where higher temperatures and pressures are present, or where CIP cycles are used. Ideal for applications where hygiene is critical.	Solid 316SS wetside Stainless steel facing allows steam cleaning
Reference pin kits MSP-T2R MSP-T6R MSP-T7R	Used with: T22 PTFE T12 & T18B T12 & T18F	Used on applications where consistent maximum accuracy is required, such as open channel flow in flumes or weirs or tank contents with volatile liquids. Reference pin is made from 316 SS and on T2R model for corrosive liquids is ECTFE (Halar) coated	



MSP110-T52D-C



MSP110-T18F-C



MSP110-T28F-C



MSP110-T32S-C



MSP90-T28-C



MSP90-T12-C with
bracket kit



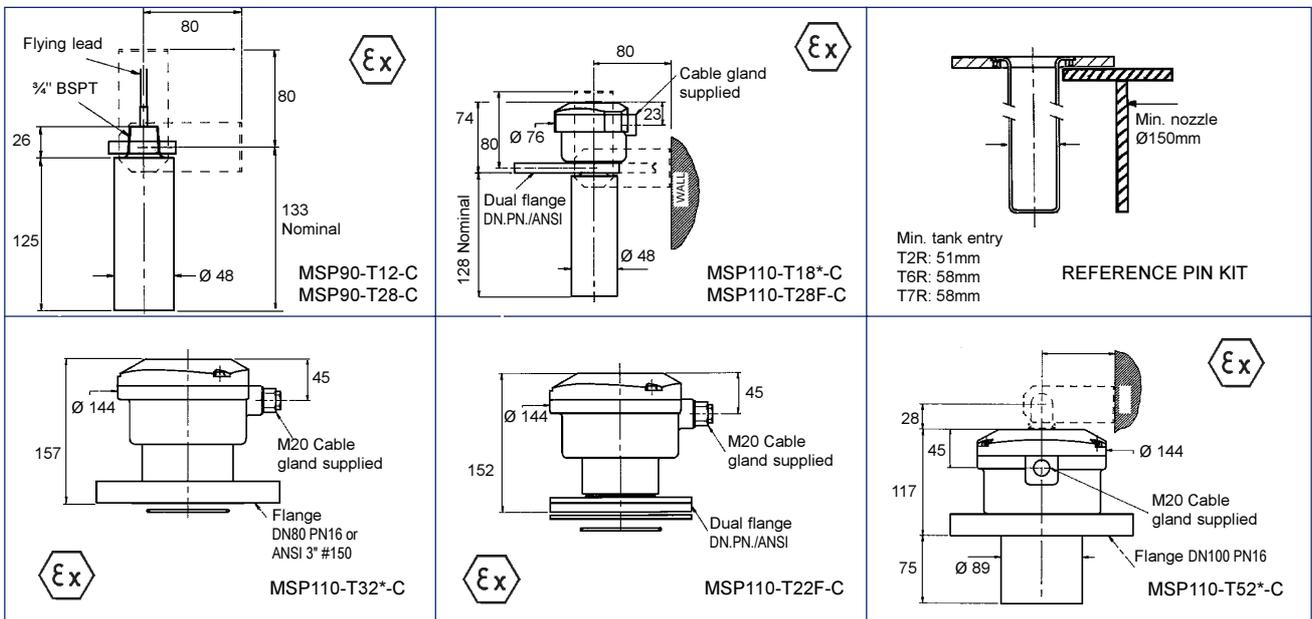
MSP110-T52B-C



MSP110-T22F-C

Technical specification

	MSP90- T12-C MSP110-T18*-C	MSP90- T28-C MSP110- T28F C	MSP110- T52*-C	MSP110- T22F-C	MSP110- T32*-C
Range:	0,3 to 12m	0,4 to 10m	0,5 to 20m	0,3 to 10m	0,4 to 10m
Operating temperature:	-20°C to + 60°C (-15°C to + 60°C with ref pin)	-20°C to + 70°C	-20°C to + 60°C	-40°C to + 70°C (-20°C to + 60°C with ref. pin)	-20°C to + 60°C wetside, -20°C to +60°C ambient +60°C
Maximum temperature:	+60°C	+70°C	+60°C	+70°C	+60°C
Operating pressure:	0,25 bar to 3 bar at 20°C	0,25 bar to 3 bar at 20°C	-0,25 bar to 2,5 bar at 20°C	-0,25 bar to 3,0 bar at 20°C	-0,25 bar to +7 bar at 50°C, 5 bar at 60°C
Wetside material:	MSP90: PVC body/ rubber facing MSP110: 100% PVC wetted parts	PTFE body	PVC body and flange thermoplastic rubber facing	PTFE with PTFE 'O' ring seal & flange	316SS with PTFE sleeved 'O' ring seal & gasket
Mounting: bracket, flange or thread	MSP90: ¾" BSPT thread. MSP110: Flanged ANSI 2" #150/DN50 PN10 or universal bracket	MSP90: ¾" BSPT thread. MSP110: Flanged ANSI 2" #150/DN50 PN10	Flanged DN100/PN16 or universal bracket	Flanged ANSI 2" #150/DN50 PN10	Flanged DN80 PN16 or ANSI 3" #150
Accessories:	Reference pin kits (see over) Mounting kits for MSP90 models			with carbon steel backing ring Reference pin kit (see over)	
Housing:	MSP110: Glass filled nylon IP66/IP67 weatherproof rating			MSP90: Supplied factory fitted with 3m flying lead sealed to IP68.	
Cable entry:	M16 cable gland supplied				
Cable type:	3 core 16/0,2 screened to BS5308 20 ohms max. per core				
Cable termination:	3 way terminal block with wire clamp plates				
Ultrasonic beam angle:	+/- 6° (200mm dia. per metre range)				
Mounting consideration:	Avoid mounting within 500mm of the vessel wall.				
REFERENCE PIN KIT	The reference pin kit provides a reference target used by the MSP90 control unit to compensate for variations in the speed of sound in the ullage space. This change in speed of sound will affect the measurement accuracy and can be caused by variations in the ullage gas density or rapid/large changes in the ullage/air temperature. The reference pin system enables automatic re-calibration of the measured answer in seconds, thus providing consistent maximum accuracy. Note: Min. operating range is increased to 515mm when a reference pin is used.				



Ordering codes and information

A Mobrey non-contact ultrasonic liquid level system comprises 3 modules; a control unit to process the signals and give control and measurement outputs, a transducer for

mounting above the liquid, and an infra-red remote programming unit. To order a system, select the modules from the tables below, along with the kits and accessories required:-

Control unit

Wall mount	Description	
MSP90-11-C	230/115V ac mains powered wall mounting controller	
MSP90-11-24-C	24V dc powered wall mounting controller	
MSPLOG-11-C	As MSP90-11 but with logging capability. See leaflet IP275	
MSPLOG-11-24-C	24V dc powered. As MSP90-11 but with logging capability. See leaflet IP275.	
MSP92-11-C	As MSP90-11 but with differential capability	
Multicard		Panel mount kits
MSP90-61-24-C	24V dc powered multicard version	MSP-PMK1 Panel mounted housing for one unit
MSP90-61-115-C	115V ac powered multicard version	MSP-PMK2 Panel mounted housing for two units
MSP90-61-230-C	230V ac powered multicard version	MSP-PMK4 Panel mounted housing for four units
MSP92-61-115-C	115V ac powered version with differential capability	
MSP92-61-230-C	230V ac powered version with differential capability	
MSPLOG-61-115-C	115V ac powered version with logging capability	
MSPLOG-61-230-C	230V ac powered version with logging capability	

Transducer

Model number	Description	Reference pin kit
MSP90-T12-C	PVC transducer, 3/4" BSPT mounting 3m cable 12m range	MSP-T6R or MSP-T7R
MSP90-T12-C-L	PVC transducer, 3/4" BSPT mounting, cable length to order* 12m range	MSP-T6R or MSP-T7R
MSP90-T28-C	PTFE transducer, 3/4" BSPT mounting 3m cable 10m range	Not available
MSP90-T28-C-L	PTFE transducer, 3/4" BSPT mounting cable length to order* 10m range	Not available
MSP110-T18B-C	PVC transducer, bracket mounting 12m range	MSP-T6R
MSP110-T18F-C	PVC transducer, ANSI 2"/DN50 flange 12m range	MSP-T7R
MSP110-T52B-C	PVC transducer, bracket mounting 20m range	Not available
MSP110-T52D-C	PVC transducer, DN100 flange 20m range	Not available
MSP110-T22F-C	PTFE transducer, ANSI 2"/DN50 flange 10m range	MSP-T2R
MSP110-T28F-C	PTFE transducers ANSI 2"/DN50 flange 10m range	Not available
MSP110-T32D-C	St. St. transducer, DN80 flange 10m range	Available on request
MSP110-T32S-C	St. St. transducer, ANSI 3" flange 10m range	Available on request

* 10m & 20m cable lengths available from stock

Remote programmer

Model number	Description	Accessory
MSP-RPD	Hand held infra-red remote programmer. May be used with any number of control units. Includes one Mobrey Magnetic Scroller for local interrogation.	MSP-MMS Extra magnetic scroller

Transducer accessories

		For use with
MSP-BRK1	Universal bracket kit (316 Stainless steel)	T12
MSP-FLG1	ANSI 2" # 150/DN50 PN10 mounting flange (PVC)	T12
MSP-T2R	Reference pin kit (PTFE flange/Halar coated pin)	T22F
MSP-T6R	Ref. pin kit (bracket mount models only: MSP90-T12 requires MSP-BRK1 also)	T12, T18B
MSP-T7R	Ref. pin kit (flange mount models only: MSP90-T12 requires MSP-FLG1 also)	T12, T18F
MSP-SUB1	Submersible shield kit	T12

Solartron Mobrey Limited

158 Edinburgh Avenue Slough Berks England SL1 4UE
Tel: 01753 756600 Fax: 01753 823589
e-mail: sales@solartron.com www.solartron.com
a Roxboro Group Company

Bestobell Mobrey GmbH Deutschland tel: 0211/99 808-0
Solartron Mobrey Ltd China tel: 021 6353 5652
Mobrey sp z o o Polska tel: 022 871 7865
Mobrey AB Sverige tel: 08-725 01 00
Mobrey SA France tel: 01.34.30.28.30
Mobrey SA-NV Belgium tel: 02/465 3879
Solartron Mobrey USA tel: (281) 398 7890

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