



#### Features and Benefits

- Maintenance free
- Simple set-up procedure
- IP68 housing (2m for 24 hours)
- Low consumption
- Locking nut supplied

#### Technical Overview

The LS-UT ultrasonic level sensor is designed for level measurement in tanks or sumps and provides a 4-20mA output.

Measurement is by non-intrusive ultrasonic pulse echo technology so any liquid or slurry can be measured. The unit is IP68 and fixes in the top of the tank. An LCD display provides local indication of the level and push-buttons enable easy setup on site of the empty and full levels.

#### Product Codes

**LS-UT** 4-20mA Ultrasonic level transmitter

#### Specification

Measurement range	0.4 to 8 meters
Output	4-20mA into 250Ω @ 24Vdc
Loop voltage	20 to 38Vdc reverse polarity protected
Current	0.5W @ 24Vdc
Resolution	1mm
Accuracy	0.25% of measuring range
Update interval	200 m/s average
Display	4 Digits
Cone angle	12° included
Minimum span	100mm
Ultrasound frequency	50KHz ±10%
Pressure	-0.25 to 2bar @ 20°C
Cable gland thread	M20
Mounting	2" BSP
Materials:	
Housing	Polypropylene
Sensor	UPVC
Dimensions	131 x 94mm dia.
Weight	600g
Operating temperature	-10 to +60°C
Protection	IP68 (immersion in water for 24 hours)
Country of origin	UK
Conformity	EMC, CE & UKCA Marked

#### WEEE Directive:



At the end of the products useful life please dispose as per the local regulations. Do not dispose of with normal household waste. Do not burn.



## General Information

- The LS-UT has a 'dead band' of 0.4m from its sensor face. Ensure that the highest liquid level does not enter this 'dead band'. Liquid closer than 0.4m will result in false measurements.
- With the vessel empty ensure the signal path under the LS-UT is clear of obstructions. Obstructions will provide return echoes and will be mistaken for the liquid level.
- Where possible always mount via a plastic fitting or other synthetic material, try to avoid mounting directly to a metal surface. Always use the supplied gasket between the body of the unit and the fitting.
- Ensure there are no aggressive substances i.e. acidic liquids, vapours or gasses in the application that may attack the enclosure materials or PVC sensor.
- Vapours and fumes will affect the sensor accuracy, if the concentration is consistent providing a stable environment then the instrument will function normally, but if variations are present or there is atmospheric stratification the instrument accuracy will be affected. An example where vapour is often found is acetic acid.
- Ultrasonic transmitters do not work well when foam is present, as it attenuates the ultrasound thus preventing a reasonable echo returning to the sensor. If foam is present, and it is not possible to avoid, then a 'stilling pipe' should be used.
- Turbulence and splashing can result in erratic readings; if this cannot be avoided consider using a 'stilling' pipe.
- Take care not to mount the LS-UT over any inlet as incoming liquid will be sensed by the LS-UT resulting in a false reading.
- Do not use the LS-UT where condensation is present, as it may collect on the sensor and cause errors.
- If the LS-UT is mounted in an enclosed tank, do not mount the instrument in the centre of the tank as dished tank ceilings can act as parabolic reflectors. This means that the transducer will be the focal point and will receive amplified false echoes. It is usual to mount at about ½ vessel radius from the centre.
- Environments exposed to direct sunlight for long periods generate very hot surfaces; if the LS-UT is likely to be exposed to these conditions it is advisable to use a sun screen.
- The LS-UT complies with national regulations on Electro Magnetic Compatibility however it is recommended that the instrument is not located in close proximity to other sources of electrical noise e.g. inverter drives, welding equipment or close to electrical distribution power lines.

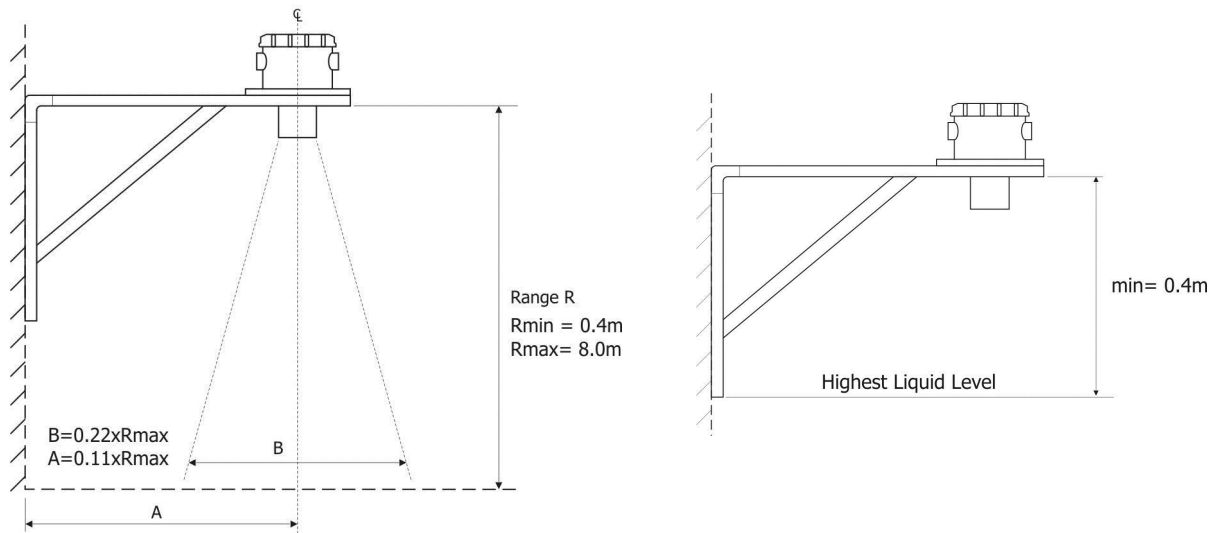
## Positioning

The LS-UT has a beam angle of 12° to the half power point (3dB). The ultrasound is transmitted from the sensor in a cone shape, this inclusive cone shaped area must be clear of obstruction otherwise the LS-UT will receive echoes from the obstructions and not the liquid. The total beam coverage area can be calculated as shown measurement 'B'. Even small obstructions such as small diameter pipes, seams and protrusions can generate strong 'false' echoes.

If the ultrasonic signal overlaps the inside wall of the vessel the echo will still be valid but of a lower amplitude, however problems arise when the internal vessel wall is not smooth i.e. has protrusions or seams as is often the case, so it is advisable to mount so the beam does not overlap the vessel wall. To avoid false echoes from the side wall or other obstructions the ultrasonic sensor should be mounted at least 0.11m per metre of maximum range away from the obstruction, measured from the centre line of the LS-UT, see measurement 'A'. If this is not possible it may still be possible to obtain good measurements provided the liquid has a good reflective surface but there must always be a minimum spacing of 0.4m from the sensor to the tank wall.

Remember it is important to visually inspect the vessel when it is empty to ensure there are no obstructions (i.e. pumps or stirrers) that would be unnoticeable when the vessel is full. If obstructions can't be avoided consider using a 'stilling tube'.

## Positioning (continued)



The LS-UT has a 'dead band' of 0.4m from its sensor face. Ensure that the highest liquid level does not enter this 'dead band'. Liquid closer than 0.4m will result in false measurements, which may appear as distances several times the real liquid level.

## Stand-off Pipe

If the vessel is being totally filled the 0.4m clearance requirement can be obtained by using a 'stand off' pipe, this moves the physical position of the LS-UT above the vessel.

1. Must be completely smooth inside with no seams or protrusions.
2. Recommended minimum 100mm internal diameter
3. End of pipe must be cut off at a 45° angle
4. The maximum length is 0.5m
5. Drill a small diameter hole at top of pipe to let any trapped air escape

## Stilling Pipe

A stilling pipe can be used to overcome foaming liquids and obstructions which otherwise would be sensed by the LS-UT.

It is important that the internal wall of the stilling tube is smooth and free from seams and protrusions.

When foam is present it is preferable that the end of the stilling tube is never allowed to become uncovered thus preventing foam from entering the tube. Where a stilling well is used to avoid an obstruction the stilling well must be at a lower level than the obstruction.

Stilling wells can be used in clean liquids only as dirty liquids will contaminate the inside of the well. The pipe should have a minimum internal diameter of 100mm, and an air vent hole drilled at the top to relieve the pressure built up in the pipe as it fills with liquid.

## Mounting

It is essential to mount the instrument (or sensor on a remote model) correctly to ensure reliable operation.

Metal nuts and bolts should not be used to fasten the LS-UT to a vessel or mounting bracket as it may cause unwanted 'ringing' resulting in erratic operation, most often seen as the output current and LCD reading ramping up and down. The LS-UT should be screwed into an intermediate non-metallic fitting. On The LS-UT PTFE tape can be used on the thread if necessary and hand tight is sufficient, be careful not to over tighten.

Always ensure the sensor is perpendicular to the liquid surface to ensure the best possible quality of echo.

### Connections

Via 2-core flying lead:

<b>RED</b>	20 to 38Vdc
<b>BLUE</b>	4-20mA output

### Programming

After applying power allow up to 5 seconds for the unit to stabilise, during this period the LCD may show random characters. Following this the LCD will briefly show the temperature in degrees centigrade and then a measurement in metres. Whilst displaying a measurement the decimal point will flash on and off, indicating to the user that the product is running ('run' mode). Approximately every minute thereafter the LCD will briefly show the temperature. The mA output current is not affected whilst the temperature is displayed.

- Once the vessel dimensions and liquid levels are known the LS-UT can be programmed, this is done by accessing the programme mode of the LS-UT. Once in programme mode there are 3 basic operations in setting up the LS-UT.
  - Scaling the level in (A) MANUAL Mode (B) AUTO Mode  
Entering the 4mA and 20mA values in metres
  - Setting the Display  
Configure the LCD to show the depth or distance in metres or as a percentage
  - Setting the Lost Echo  
The transmitter sends out a burst of energy then waits for the reflected pulse. If there are no reflected pulses the LCD will read 'LE' (Lost Echo). Under LE conditions the output current will be forced to '4mA', '20mA', '21mA' or 'Hold' the last good reading, user programmable. In applications where intermittent foam is prevalent the Hold option may be the preferred option. Where a loss of reflected echo is usual, then it will be application specific as to the best choice. 21mA is outside the normal range so can be used to identify a Lost Echo condition by external equipment.
- Pressing the M key will jump back a level, several presses and it will return the LS-UT to 'run' mode, indicated by a flashing decimal point.
  - Keeping a record of the programming values will ease programming should it need to be repeated or checked at a later date.

#### Step 1 Scaling the 4mA level

##### (A) Setting up in MANUAL Mode

Operation	Display	Notes
Press M	XX:XX	Decimal point disappears, LCD characters freeze and the colon is fixed
Press ↑↓↑↓	Ent	LCD reads - - - - when up/down keys pressed
Press E	4mA	This is the low level setting ( depth mode)
Press E	X.XXX	Set the 4mA point. Use the ↑↓ arrows until you reach the number you want.
Press E	donE 4mA	You have now stored the number manually in the memory
Press M	Ent	You are leaving the Manual set up
Press M	X X:XX	
Press M	X.XXX	Flashing decimal point indicates system is running

##### (B) Setting up in AUTO Mode

Operation	Display	Notes
Press M	X:XX	Decimal point disappears, LCD characters freeze and the colon is fixed
Press ↑↓↑↓	Ent	LCD reads - - - - when up/down keys pressed
Press ↑	Auto	You are entering Auto set-up
Press E	4mA	This is your 4mA low setting ( depth mode)
Press E	X.XXX	Decimal point starts flashing; you can hear the sensor ticking. Ensure the tank is empty. Wait until the LCD displays a correct stable measurement before pressing Enter.
Press E	donE 4mA	LCD displays 'done' momentarily then 4mA. You have now stored the tank empty value automatically in the memory
Press M	Auto	You are leaving the Auto set up
Press M	X X:XX	
Press M	X.XXX	Flashing decimal point indicates system is running

## Programming (continued)

### Scaling the 20mA level

#### (A) Setting up in **MANUAL Mode**

Operation	Display	Notes
Press M	X:XX	Decimal point disappears, LCD characters freeze and the colon is fixed
Press ↑↓↑↓	Ent	LCD reads - - - - when up/down keys pressed
Press E	4mA	
Press ↑	20mA	This is the High level setting ( depth mode)
Press E	X.XXX	Set the 20mA point. Use the ↑↓ arrows until you reach the number you want.
Press E	donE 20mA	LCD displays 'done' momentarily then 20mA. You have now stored the tank full value automatically in the memory
Press M	Ent	You are leaving the Manual set up
Press M	XX:XX	
Press M	X.XXX	Flashing decimal point indicates system is running

#### (B) Setting up in **AUTO Mode**

Operation	Display	Notes
Press M	XX:XX	Decimal point disappears, LCD characters freeze and the colon is fixed
Press ↑↓↑↓	Ent	LCD reads - - - - when up/down keys pressed
Press ↑	Auto	You are entering Auto set-up
Press E	4mA	
Press ↑	20mA	This is your 20mA High setting ( depth mode)
Press E	X.XXX	Decimal point starts flashing; you can hear the sensor ticking. Ensure the tank is full. Wait until the LCD displays a correct stable measurement before pressing Enter.
Press E	donE 20mA	LCD displays 'done' momentarily then 20mA. You have now stored the tank full value automatically in the memory
Press M	Auto	You are leaving the Auto set up
Press M	XX:XX	
Press M	X.XXX	Flashing decimal point indicates system is running

### Step 2 Setting the Display, meters or percentage

Operation	Display	Notes
Press M	XX:XX	Decimal point disappears, LCD characters freeze and the colon is fixed
Press ↑↓↑↓	Ent	LCD reads - - - - when up/down keys pressed
Press ↑	Auto	
Press ↑	diSP	This is the display set-up.
Press E	dEP / dist or PErC	Will show either Depth or distance, not both <sup>1</sup> or %.
Press ↑	PErC	Use the up or down key to scroll to the desired setting
Press E	donE dEP	Momentarily displays 'done' then whichever the user has chosen. The choice is now stored in memory, in this example depth
Press M	diSP	You are leaving the display set up
Press M	XX:XX	
Press M	X.XXX	Flashing decimal point indicates system is running

<sup>1</sup>If the 4mA setting is set closer to the sensor face than the 20mA, the menu will give the option of distance (diSt) or percentage (PErC).

If the 20mA setting is set closer to the sensor face than the 4mA the display will give the option of depth (dEP) or percentage (PErC).

## Programming (continued)

### Step 3 Setting the Lost Echo (LE)

	Display	Notes
Press M	XX:XX	Decimal point disappears, LCD characters freeze and the colon is fixed
Press ↑↓↑↓	Ent	
Press ↑	Auto	
Press ↑	diSP	
Press ↑	LE	This is the Lost Echo set-up
Press E	XXmA	
Press ↑ or ↓	XXmA	Use the up or down key to toggle through the desired options 4, 20, 21mA or HOLD
Press E	donE XXmA	Momentarily displays 'done' then XXmA. Pressing Enter stores the chosen setting as the Lost Echo value
Press M	LE	You are leaving the Lost Echo set up
Press M	XX:XX	
Press M	X.XXX	Flashing decimal point indicates system is running

When the LS-UT is in the normal 'run' mode the LCD will have a flashing decimal point. If the decimal point is not flashing and the unit is not under or over range (see next paragraph) the LS-UT will not make any measurements.

If the LCD shows an over-range signal ----- or an under-range signal ~ \_ \_ \_ \_ \_ the liquid measurement is outside the range programmed by the user. This may or may not be a problem, if only a few millimetres it can be ignored, but if it is several centimetres the user may wish to consider re-programming the unit. This sometimes happens when vessels are filled or emptied slightly more than usual.

If left, the system will automatically resume normal operation when normal conditions return. Careful user programming allowing for application variations will eliminate this.

## Troubleshooting

Symptom	Cause	Action
Gives Lost Echo LE	Target out of range Application Dusty or steamy Excess foam on liquid	Check system specification Check installation & Tank condition Re-site Transducer
Reading Static when level changes	Unit processing wrong target	Move transducer to better location
No loop current output	Power Failure	Check Power supply and output to LS-UT and load resistance isn't too high
Reading Erratic False Reading	Target Unsteady Target within dead-band Fumes Electrical Noise Obstructions present Detecting the end of a guide tube or getting multiple echoes	Move transducer to a better location Raise transducer >0.4m above top water level Check installation Move transducer to a better location Check under target for obstruction, if guide pipe is used ensure it is clear
Reading ----- Or ~ _ _ _ _	Target outside top or bottom water level, (outside the programmed values).	This may only be by a small amount ~1mm so check levels and Re-calibrate system if necessary
Reading occasionally goes high when vessel is not full. Output current and LCD reading ramps up and down	Spurious echo detected, Acoustic coupling to bracket, Detecting the end of a stilling pipe or guide tube	Move transducer to a better location Ensure the unit is not directly mounted to metal or metal mounting bolts are not used. Loosen nylon mounting bolts. Use foam gasket Alter guide tube arrangement
Failure to operate correctly at mid to high range current	Load resistance too great	Check load resistance isn't too high. Check equipment connected to loop.
'Err' display on LCD whilst programming the 4mA & 20mA points	4mA and 20mA points set too close	Re-span so the range is >100mm
No measurement, LCD decimal point is stationary or Stationary dash/digit on LCD	LS-UT is in Programme mode	Press the 'M' key repeatedly until the decimal point flashes.

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