

LS-MC

Ultrasonic Level Transmitter



Features:

- 2-Wire loop powered
- IP67 Housing
- 12 to 30Vdc power supply
- Fast speed of response, as much as 10m per minute
- Locking nut supplied

Benefits:

- High stability & reliability
- Long term stability

Technical Overview

The LS-MC is a ultrasonic level transmitter for measurement of liquids in tanks or sumps.

The 4-20mA output represents the distance between the surface of the liquid being detected and the sensor.

The LS-MC has an integral LCD display, 3 push buttons under the lid for security, and just 8 parameters to set making it one of the simplest ultrasonic level transmitters to calibrate and use.

Specification:

Measurement range	0.3m to 8m
Output	4-20mA
Supply	12 to 30Vdc loop powered
Load impedance	750Ω max.
Cable entry	2 x M20 x 1.5mm
Max. cable run	3000m (1.86 miles)
Cable type:	
Min.	0.22mm ² (24 SWG / 23 SWG)
Max.	1.5mm ² (16 SWG / 18 SWG)
Display	Integral 4-digit LCD
Beam angle	±6° (3db)
Resolution	Better than 1mm
Accuracy (measured range)	
<1.0mm	±5mm
>1.0mm	±0.5% of measured distance
Damping	1 to 99 seconds (adjustable)
Process connection	2" BSPT
Temperature range	-20 to +70°C
Operating pressure	-0.25 to 3bar max. (20°C)
Material:	
Transducer	PVDF
Housing	Glass filled nylon
Dimensions	205.5 x 141mm overall
Protection	IP67
Conformity	EN50081-1 & EN50082-2
Country of origin	UK

Part Codes:

LS-MC

Ultrasonic 4-20mA level transmitter, c/w locking nut

Accessories

LS-NUT

Additional fixing nut

LS-FK

Adaptor flange for LS-UL3 fixings



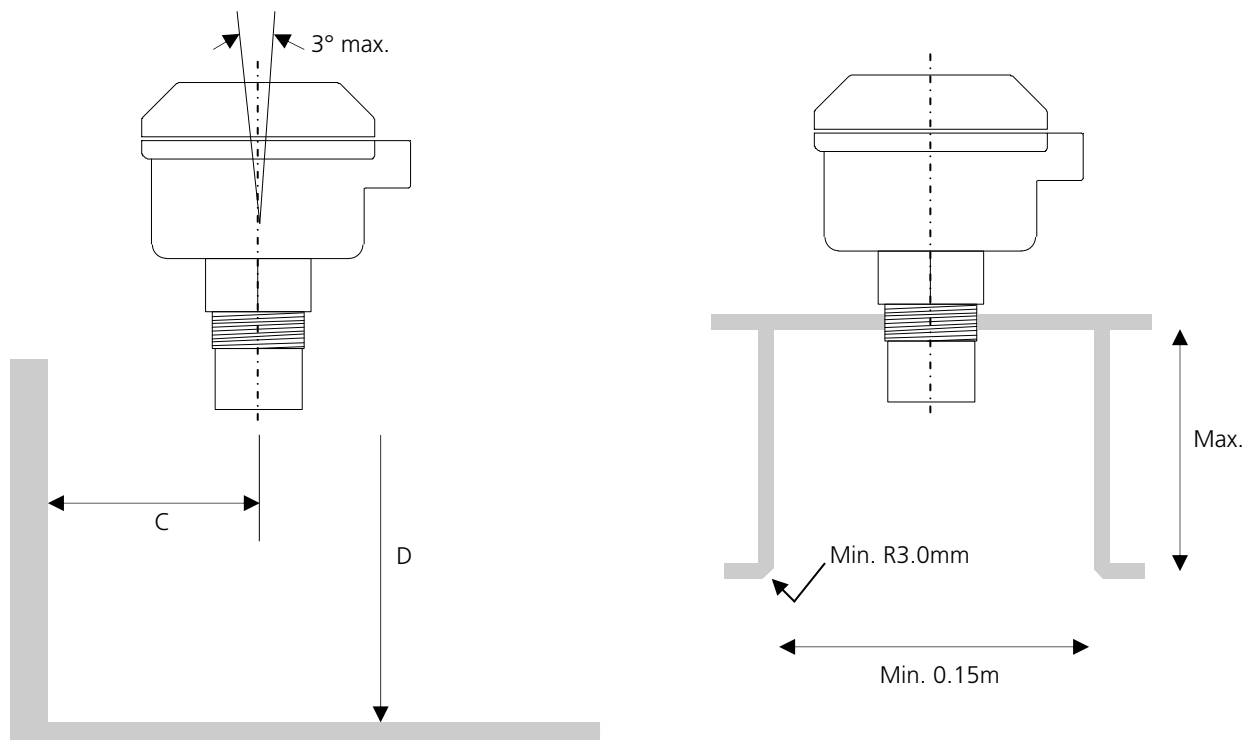
The products referred to in this data sheet meet the requirements of EU Directive 2004/108/EC

Installation:



Antistatic precautions must be observed when handling these sensors. The PCB contains circuitry that can be damaged by static discharge.

1. Ensure the LS-MC has a clear uninterrupted path between the transducer face and lowest fluid level.
2. Mount the LS-MC away from filling points, walls and ladders with its face horizontal.
3. Mount the LS-MC at least 0.3 metres above the highest liquid level and 0.88 metres away from walls.
4. Do not over tighten the fixing nut, only tighten by hand. Use the hexagon nut, not the housing.
5. Keep the LS-MC away from high voltage/current devices and variable speed drives.
6. Shield the LS-MC from direct sunlight.
7. If used with a liquid where foaming could occur, locate the LS-MC over an area of clear liquid. Failure to comply will result in a reduced size of the return echo, thus an incorrect reading.
8. Applications where heavy condensation is likely on the instrument face should be avoided.
9. The LS-MC is not suitable for use in a hazardous area.
10. The electrical connections are Red = 24-36Vdc supply, and Blue 4-20mA output.



- C Min. 0.88m
- D Min. 0.3m
- D Max. 8m

General Information:

Operation

A programming card is supplied inside the LS-MC, a copy is on page 10. The programming card shows the pre-programmed parameters that are held in the memory.

Power Up

On power up, the LS-MC will take a few seconds to initialise, then the display will run through a set-up routine, showing a full set of figure eight's, then the software revision and finally a full set of zeros whilst the microprocessor identifies the correct return echo and confirms this repeats enough to be acceptable.

The instrument is now ready for use, and is set-up using the 3 coloured push buttons.

Refer to the programme menu which is on page 10, and also in the instrument itself on a card tucked between the electronics housing and the body.

Display Units

The LS-MC default value is meters.

The display units can be changed using the blue button ➡. Simply hold the blue button ➡ down for 10 seconds and the units will change to the next option in the following sequence :
Metres to Feet to Inches and back to Metres again.

This is indicated by the position of the decimal point in the displayed value :

Units	Display
M	8
ft.	26.24
in.	314.9

Once the units have changed from default to the next option, the blue button ➡ can be released, in which case the new units selected are confirmed, or the blue button ➡ can continue to be held down, in which case the next units option is given after a further three seconds.

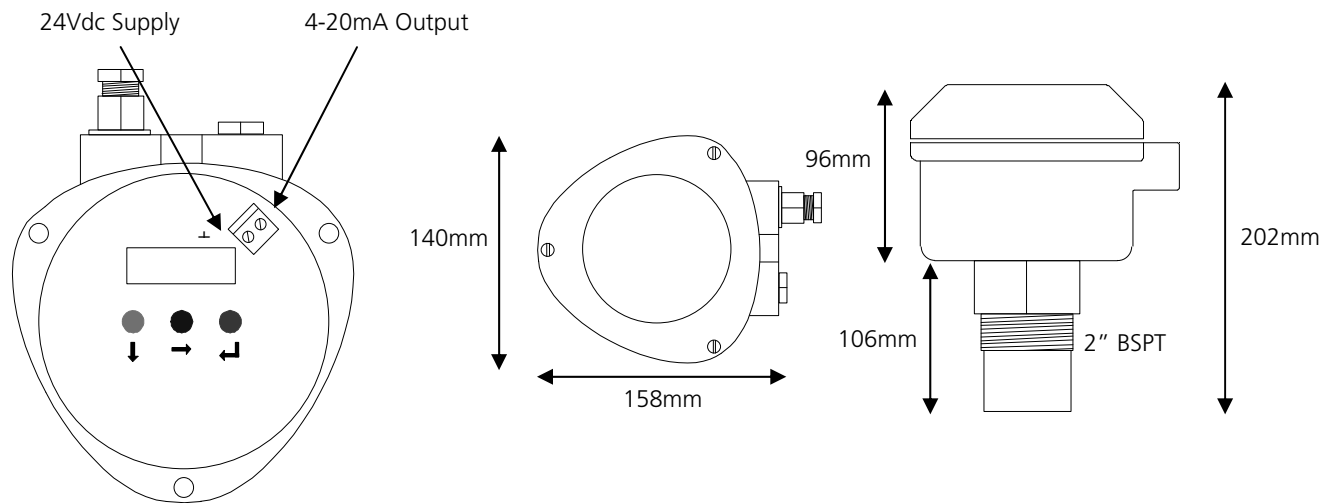
When the display units have been programmed, please note that you must use the same units when programming in the bottom reference, 4 and 20mA points.

The 4-20mA output may be set to operate over all or just a part of the total measuring range. There is no theoretical limit on the minimum span of the current output, although in practice a span below 100mm is not recommended. With small spans, be aware that a high value of damping will greatly affect the performance of LS-MC.

The 4mA level may be set above or below the 20mA level to suit the monitoring or control equipment.

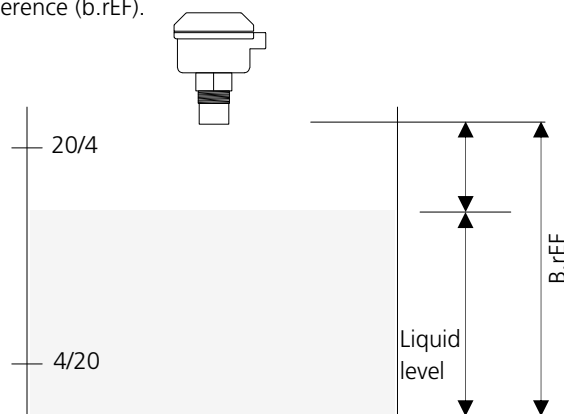
Note: The LS-MC measures and calculates at all times in metres. The units of display are derived as a last operation using a pre-programmed conversion factor.

Connections & Dimensions:



First Measurements:

With the LS-MC installed and display units selected, the display will now be showing what the instrument thinks is the liquid level. This is a value calculated by the microprocessor, being the difference between the distance to target being measured and the default value for the datum or bottom reference (b.rEF).



Before changing any of the default values, use blue button \rightarrow to scroll along to the next piece of information, which is the distance to target as measured by the LS-MC from the front (transmit) face. This value is shown alternately with the text "diSt" to remind the user the LS-MC display is in distance mode. You can now quickly check correct operation against a manual measurement if required.

Tip: A feature of the LS-MC useful at this stage is that it can be used as an electronic tape measure. With an empty tank or vessel, the LS-MC will read the distance to the bottom of the tank. This can be noted and used when setting b.rEF later.

Press blue button \rightarrow again to scroll the display to show the echo size on a scale of 0-100. (It is possible to record a value greater than 100, but do not worry about this!). With the display in this mode, the central ":" cursor will flash once for every echo received, which under normal circumstances will be approximately once per second.

Tip: It is useful at this point to check that the maximum echo size available is being received. Adjust the position of the instrument until the highest echo size is shown continually. In most applications, the signal strength will vary over a wide range : 20 – 80.

Press blue button \rightarrow now to return to the original level reading and to start the calibration routine.

Note that the output of the LS-MC will vary during programming as the various default values are changed. The display will automatically revert to the level or distance reading from any other display after a period of 4 minutes.

Settings:

Setting the correct bottom ref. (b.rEFF):

1. Press green button ↓ and the display will scroll from the level reading to "b.rEFF".
2. Press blue button →. to enter the editing menu for b. The display will show the present value of the b.rEF parameter.
3. If this value is correct, press red button ←, then green button ↓ to scroll on to the next menu option.

• Or

To change the value, press blue button → to edit :-

The first digit of the display will flash and may be changed using green button ↓. Once correct, press blue button → to select the next digit and then green button ↓ to edit, or the blue button → again to move to the next digit. Continue this sequence until all 4 digits are correct, and then press the blue button → a final time to confirm the new b.rEF value (none of the digits should now be flashing).

If the new value is incorrect, the edit sequence for b.rEF can be started again by pressing the blue button →. If the new value is correct, press the red button to save the b.rEF programmed in and the display will automatically scroll on to the 4mA (4) setting menu.

Setting The 4 and 20mA Levels (4 & 20):

The 4mA level may be set above or below the 20mA level to suit the monitoring or control equipment.

If you wish to set the 4 and 20mA levels by ranging the LS-MC to a fixed target, such as the level in the tank at any particular time, skip these menu options by pressing the green button ↓ 2 times to arrive at the set damping option.

1. Press the blue button → to enter the editing menu for the 4mA level. The display will show the present value of the 4mA level.
2. If this value is correct, press the red button ← then the green button ↓ to scroll on to the next menu option.

• Or

Press the blue button → to edit this value:

The first digit of the display will flash and may be changed using green button ↓. Once correct, press blue button → to select the next digit and then green button ↓ to edit, or the blue button → again to move to the next digit. Continue this sequence until all 4 digits are correct, and then press the blue button → a final time to confirm the new 4mA value (none of the digits should now be flashing).

If the new value is incorrect, the edit sequence for 4mA can be started again by pressing the blue button →. If the new value is correct, press the red button ← to save the 4mA level programmed in and the display will automatically scroll on to the 20mA (20) setting menu.

Press the blue button → to enter the editing menu for the 20mA level. The display will show the present value of the 20mA parameter.

If this value is correct, press the red button ←, then the green button ↓ to scroll on to the next menu option.

• Or

Press the blue button → to edit this value:-

The first digit of the display will flash and may be changed using green button ↓. Once correct, press blue button → to select the next digit and then green button ↓ to edit, or the blue button → again to move to the next digit. Continue this sequence until all 4 digits are correct, then press the blue button → a final time to confirm the new 20mA value (none of the digits should now be flashing).

If the new value is incorrect, the edit sequence for 20mA can be started again by pressing the blue button →.

If the new value is correct, press the red button ← to save the 20mA level programmed in and the display will automatically scroll on to the damping (d) setting menu.

Settings:

Setting the damping applied to the output (d):

The damping value entered is actually a time constant in seconds which is applied as smoothing to the level reading and the output current. A new value may be entered up to a value of 999 seconds. A large value will have the effect of smoothing out rapid changes of level and will also smooth out the effects of turbulence and ripples on the liquid surface. (It would be highly unusual to select a value greater than 30 seconds.)

You may choose to enter a value of zero, in which case no smoothing will be applied to the current output and changes in reading immediately change the current output. (note, as the LS-MC transmits at nominally once per second, a damping time of zero will not necessarily give an immediate response).

1. Press the blue button **➡** to enter the editing menu for the damping time .
The display will show the present value of damping.
2. If this value is correct, press the red button **⬅**, then the green button to scroll on to the next menu option.

• Or

Press the blue button **➡** to edit this value:-

The first digit of the display will flash and may be changed using green button **⬇**. Once correct, press blue button **➡** to select the next digit and then green button **⬇** to edit, or the blue button **➡** again to move to the next digit. Continue this sequence until all 3 digits are correct, and then press the blue button **➡** a final time to confirm the new damping value (none of the digits should now be flashing).

If the new value is incorrect, the edit sequence for damping can be started again by pressing the blue button **➡**.

If the new value is correct, press the red button **⬅** to save the damping value programmed in and the display will automatically scroll on to the alarm action menu. (AL)

Selecting the output current output on alarm condition:

The LS-MC will signal an alarm condition in the event that the target echo is lost for a period of 10s or more.

The user can select what action the current output will take in this case.

Hi

The current on the two wire loop will drive up to 21mA and remain there until the correct target echo is recovered. The display will flash "LE" and the last reading.

Hold

The current will freeze at the value it was last reading and will remain there until the correct target echo is recovered. The display will flash "LE" and the last reading.

Lo

The current on the two wire loop will drive down to 3.6mA and remain there until the correct target echo is recovered. The display will flash "LE" and the last reading.

To change the action from the default action Hold, enter the menu using, the blue button **➡** to show the current action. Press blue button **➡** to enter edit mode. With the display flashing use green button **⬇** to display the required action and then press blue button **➡** to select this action and the display will stop flashing. Press red button **⬅** to save and scroll on to the menu that allows setting of the 4mA and 20mA levels against a known target.

Setting the 4 and 20mA levels using actual liquid levels in tank (S--4 and S-20):

If you have already programmed the 4 and 20mA levels as above, you do not need to enter this menu. All the programming is now complete and you should press the green button **⬇** to move to the final "Lrn" option in the main menu.

Settings:

If, however, you wish to set the 4 or 20mA level by ranging the instrument to a known target - perhaps the level in the vessel at this time - then press the blue button ➡ to enter this menu.

The first option is to set the 4mA level. Ensure the target is at the desired 4mA level and, with the display reading the new value, press the blue button ➡. The display will show the present value for the 4mA setting. Press the blue button ➡ again to edit the 4mA level, and the display will alternately flash "4" with the current level reading.

Press blue button ➡ to confirm the correct value for the 4mA level then press red button ◀ to save and exit to the 20mA setting menu.

To set the 20mA level, ensure that the target is at the desired 20mA level and, with the display reading the new value, press the blue button ➡. The display will show the present value for the 20mA setting. Press the blue button ➡ again to edit the 20mA level, and the display will alternately flash "20" with the current level reading.

Press blue button ➡ to confirm the correct value for the 20mA level then press red button ◀ to save and exit to the "Lrn" menu.

Blocking unwanted echoes from false targets:

The LS-MC has an easy to use "Lrn" (Learn) routine which allows the user to teach the instrument up to 2 false echoes and then ignore them in future operation.

If the application is straight forward and there are no false echoes, press the green button ⬇ now to exit the programming menu and return the instrument to normal operation, showing the level reading on the display.

If, once the LS-MC is in operation, an echo other than the true liquid surface echo is detected, and an incorrect level reading is displayed, the instrument can be taught to ignore this false echo. This routine may be used at any time, either during or after set-up or should a problem occur later.

Press blue button ➡ to enter the Lrn menu. The display will show "LrnX", where X is 0,1 or 2 and is the number of false target echoes already stored. To store a new false echo, press the blue button ➡ for greater than 5s.

Note : If there are already 2 false echoes stored (Lrn2) then the LS-MC will not allow the user to store another echo until the memory is cleared. (see below).

The display will now flash the false target position alternating with "Lrn". After 4s the false target is stored and the display shows "LrnX". If for any reason this target is not to be saved then press the blue button ➡ and the "Lrn" sequence may be repeated or aborted. Otherwise, press the red button ◀ to save the false target echo and return to the main menu.

To store another false target echo, navigate down the main menu to "Lrn" and repeat the sequence again.

Note: When a false target echo is stored, the LS-MC effectively sets up a 'window' around the false target and will ignore any echo from within that window unless the echo from the liquid surface is larger than that from the false target.

The user may therefore see no change in the LS-MC output current whilst the liquid level moves through this window, which is equivalent to a distance of around 200mm.

To clear the LS-MC of all false echoes stored, simply press blue button ➡ to enter the Lrn menu then with the display showing "LrnX" press the green button ⬇ for 10s to completely clear the memory. The display will now show "Lrn0".

Changing operation to distance mode:

If the LS-MC is to be used to measure distance rather than level, the display can now be changed accordingly. With the display showing the level reading, press the blue button ➡, the display will now show the distance to target alternating with "Dist".

Note: The display will continue to alternate between the distance to target and "Dist" whilst in distance mode.

Settings:

Power Failure:

All parameters are held in E² PROM memory, so in the event of a power failure or disconnection from the power supply the LS-MC will remember all of its last parameter values and will resume correct operation once power is restored.

Final Checks:

- Check the display is reading correctly.
- You may wish to check echo size again before re-fitting the enclosure lid.
- Check that the cover seal is in place in the cover and is good condition. It should not be twisted or kinked in any way.
- Carefully set the cover on the LS-MC with the text on the cover label at right angles to the conduit entry, and tighten the three cover screws equally to seal the instrument.
- Check that the cable gland is securely tightened and sealing on the cable sheath.

Fault Finding & Error Messages:

No display:

Check power supply. Ensure a minimum of 12v dc at the instrument terminals. Check cable insulation is not preventing contact at the terminal block.

No level reading:

Check instrument is pulsing. You should be able to hear the transducer "ticking" about once per second. If there is no sound, the instrument should be replaced.

Error messages:

Flashing "LE" with "0000". This means that the LS-MC is not receiving a return echo possibly because the liquid surface is poor or beyond the range (8m/26ft) of the instrument. Re-locate the instrument.

Error messages (continued):

Flashing "LE" with a level reading. This means that the LS-MC is no longer receiving satisfactory echoes from the liquid surface. This may be because of one of a variety of reasons, excessive foaming, turbulence or ullage vapours.

First, check that the instrument transmit face is free from contamination and condensation. The LS-MC will operate with some condensation on the face, but excessive condensation may cause operational problems. The vessel should be adequately vented to prevent condensation forming.

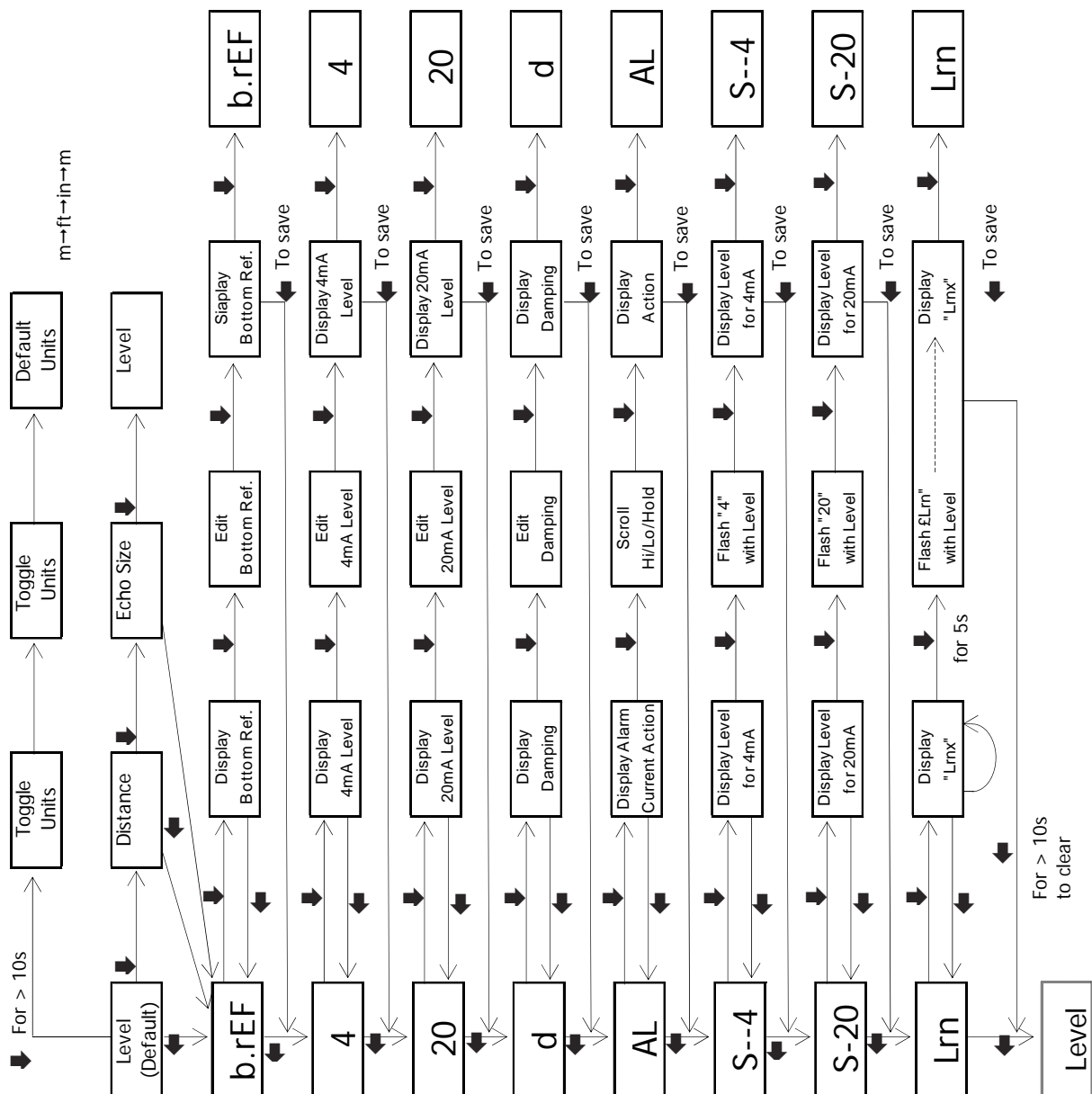
Check the instrument is still vertically aligned above the liquid surface, then check the echo received size. If the echo size is small (<3), re-locate the transducer or modify the vessel so that the LS-MC can operate above a more acceptable area of the liquid surface.

Lost echo (LE) will not be signalled until there has been no return echo for a 10 second period. Within the 10 seconds, the output will remain fixed. If the 10 seconds elapses and no satisfactory has been received, the output will drive to the current level selected and the display will flash the last valid level reading alternately with "LE".

If, however, a satisfactory echo is received within the 10 seconds, a new output is established and the LE timer is re-set.

Programming Menu:

Default Values	Site Settings
8.000	
0.000	
7.500	
10	
Hold	
0.000	
7.500	
Lrn0	



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