Mobrey MSP422

Ultrasonic Liquid Level Transmitter

Mobrey MSP422 Ultrasonic Liquid Level Transmitter

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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Section 1 Introduction

SAFETY MESSAGES

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Explosions could result in death or serious injury.

- The Mobrey MSP422 is only for use in a non-hazardous location

Electrical shock could cause death or serious injury.

- Use extreme caution when making contact with the leads and terminals.

⚠WARNING

Any substitution of non-recognized parts may jeopardize safety. Repair, e.g. substitution of components etc., may also jeopardize safety and is under no circumstances allowed.

MANUAL OVERVIEW

This manual provides installation, configuration, and maintenance information for the Mobrey MSP422 ultrasonic level transmitter.

Section 2: Transmitter Overview

Section 3: Installation

Section 4: Starting up

Section 5: Service and Troubleshooting

Appendix A: Reference Data

Appendix B: Product Certifications

CUSTOMER SUPPORT

For the latest customer support information, visit www.mobrey.com, and then click on the quick links **Mobrey Service** or **Product Support**.

⚠CAUTION

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of, and understand, the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

PRODUCT RECYCLING/DISPOSAL

Recycling of equipment and packaging should be taken into consideration. The product and packaging should be disposed of in accordance with local and national legislation.

Section 2 Transmitter Overview

THEORY OF OPERATION

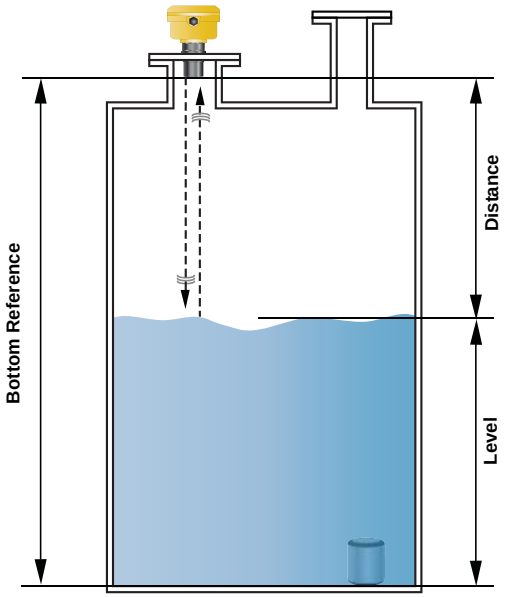
The Mobrey MSP422 ultrasonic level transmitter is designed to be mounted above a liquid and uses ultrasonic pulses to continuously measure the distance to the liquid surface. The microprocessor-controlled electronics measures the time delay between the transmitting and the receiving of the reflected signals to calculate the distance (Figure 2-1).

When programmed with the *bottom reference* of the application – usually the bottom of a tank – the MSP422 computes the liquid depth (level) and outputs a 4–20 mA signal proportional to that level.

An LCD screen inside the enclosure displays the selected measurement. Programming of the MSP422 is achieved using the integral push-buttons inside the enclosure and the menu system shown on the LCD screen.

The MSP422 may be mounted in a non-hazardous areas only.

Figure 2-1. Typical Application Using a Mobrey MSP422 Transmitter



COMPONENTS OF THE TRANSMITTER

The Mobrey MSP422 has a *housing* containing advanced electronics for signal processing, and terminals for connecting the external power supply. The *electronics* produces an ultrasonic signal from the transmitter face.

It is a two-wire, loop-powered transmitter; the two wires are used for both 24 Vdc power supply connections and the 4–20 mA analog output signal. A two-core, shielded/screened cable is required (*not supplied*).

A comprehensive specification for the Mobrey MSP422 is in the section “Specifications” on page A-1.

Figure 2-2. The Mobrey MSP Series Transmitters

Section 3 Installation

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions could result in death or serious injury:

- The Mobrey MSP422 is only for use in a non-hazardous location

⚠WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury:

Make sure only qualified personnel perform the installation.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any service other than those contained in this manual unless you are qualified.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully.

⚠WARNING

High voltage that may be present on leads could cause electrical shock:

Avoid contact with leads and terminals.

Make sure the main power to the Mobrey MSP422 transmitter is off and the lines to any other external power source are disconnected or not powered while wiring.

BEFORE YOU INSTALL

The MSP422 is used for level measurement.

The transmitter must be installed in a location where it is protected from ultraviolet radiation to prevent long term degradation of the plastics used e.g. shrouded from direct sunlight.

It is important to correctly position the transmitter for reliable ultrasonic level measurement. For maximum accuracy and stability of the level measurement reading, the transmitter should always be shrouded from direct sunlight and radiated heat.

The transmitter may be site-tuned to deal with most application conditions, but it is recommended that the following guidelines be adopted where relevant.

NOTE:
The Mobrey MSP422 is designed to be mounted in a *non-metallic fitting* or *flange*. **The use of metallic fittings/flanges is not recommended**.

General Considerations

Guidelines:

a) Installation must be carried out by suitably trained personnel in accordance with the applicable code of practice.

b) If the equipment is likely to come into contact with *aggressive substances*, it is the responsibility of the user to take *suitable precautions* that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

   Aggressive Substances are acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.

   Suitable Precautions are regular checks as part of routine inspections, or establishing, from the material's datasheet, that it is resistant to specific chemicals.

c) The equipment must only be cleaned with a damp cloth.

d) The equipment is not intended to be repaired by the user and is to be replaced by an equivalent unit. Repairs should only be carried out by the manufacturer or approved repairer.

e) The transmitter is *Double Insulated*, and therefore Protective Earthing is not required.

f) To maintain protection against the possible spread of fire, the supply to the equipment must be limited to 3.75 Amps by a fuse or other means

g) Note that if the equipment is used in a manner not specified by the manufacturer, the protection afforded by the equipment may be impaired.

h) The transmitter complies with the European Directive for Electro Magnetic Compatibility (EMC) Class B. To ensure electro-magnetic compatibility in any member state, it should not be installed in a residential area.

NOTE:
It is not advisable to mount the transmitter in close proximity to a source of electrical noise such as a variable-speed drive, or other high-powered electrical device.

MECHANICAL INSTALLATION

Mounting Considerations

Guidelines:

a) The transmitter should be mounted above the liquid surface using the 2-inch thread provided, but not closer than 12 in. (0,3 m) to the surface. The transmitter does not detect any liquid surface closer than 12 in. (0,3 m) to the transmitter face. (See "Mounting the Transmitter Above the Liquid Surface" on page 3-5).

   Optional flanges and bracket kits are available to help mounting.

b) The transmitter should be mounted vertically to ensure a good echo from the liquid surface. The beam half angle of the transmitter is 6 degrees. (See Figure 3-1 on page 3-4).

c) Obstructions in the tank, or well, may generate echoes which can be confused with the real liquid surface echo. Obstructions within the beam angle generate strong false echoes. Wherever possible, the transmitter should be positioned to avoid false echoes.

d) To avoid detecting unwanted objects in the tank or well, it is advisable to maintain a distance of at least 1.3 in. from the center line of the transmitter for every foot (11 cm per meter) range to the obstruction.

e) No false echoes are generated if the transmitter is located near the side of the tank or well, and the wall is smooth and free of protrusions. However, there will still be a reduction in the echo size. It is recommended that the transmitter be mounted no closer than 12 in. (0,3 m) to the wall to avoid a large reduction in the echo size.

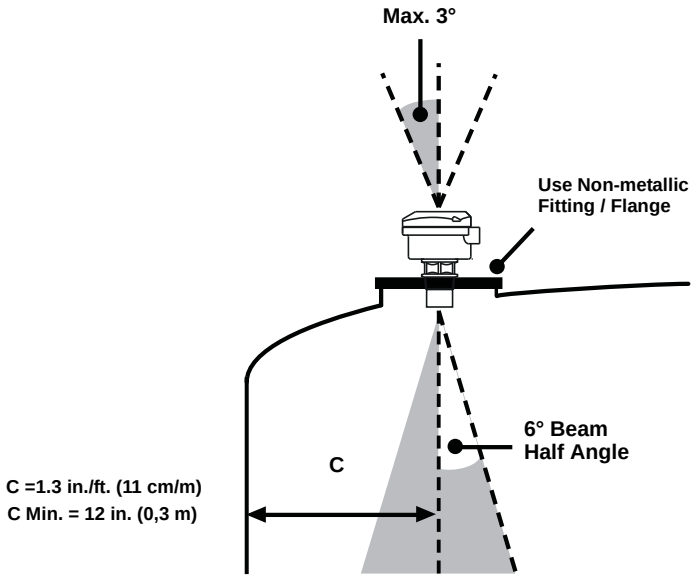
f) If the transmitter is mounted in an enclosed tank with a domed top, avoid mounting the transmitter in the center of the tank roof because this could act as a parabolic reflector and create unwanted echoes.

g) Avoid applications where heavy condensation could form on the transmitter face.

h) If the transmitter is mounted in a stand-off or nozzle, the transmitter face should protrude at least 0.2 in. (5 mm) into the tank. If this is not possible, see "Mounting the Transmitter Above the Liquid Surface" on page 3-5).

i) If the transmitter is used in environments where direct sunlight can cause high surface temperatures on exposed instruments, a sun-shade is recommended.

Figure 3-1. Min And Max Distances From Tank Wall



Liquid Surface Conditions

Guidelines:

a) Foaming liquids can reduce the size of the returned echo because foam is a poor ultrasonic reflector. Mount an ultrasonic transmitter over an area of clear liquid, such as near the inlet to a tank or well. In extreme conditions, or where this is not possible, the transmitter may be mounted in a vented stilling tube provided that the inside measurement of the stilling tube is at least 4 in. (100 mm) and is smooth and free from joints or protrusions. It is important that the bottom of the stilling tube stays covered to prevent the ingress of foams.

b) Avoid mounting the transmitter directly over any inlet stream.

In-tank Effects

Guidelines:

a) Stirrers or agitators can cause a vortex. Mount the transmitter off-center of any vortex to maximize the return echo.

b) If stirrer blades become uncovered, they create echoes as they pass through the ultrasonic beam. The transmitter can learn to ignore these *false echoes* (see "Learn About Echoes From False Targets" on page 4-10).

c) In tanks with rounded or conical bottoms, mount the transmitter off-center. If needed, a perforated reflector plate can be installed on the tank bottom directly under the transmitter center line to ensure a satisfactory return echo.

d) Avoid detecting pump casings, as the liquid falls away, by not mounting the transmitter directly above pumps. If this is not possible, fine-tuning of the transmitter on-site may be required.

Mounting the Transmitter Above the Liquid Surface

A 2-in. thread is provided to mount the transmitter. The thread form is either **2-in. BSPT** or **2-in. NPT**, and is *clearly marked* on the hexagon of the transmitter body.

NOTE:
The Mobrey MSP422 is designed to be mounted in a *non-metallic fitting* or *flange*. **The use of metallic fittings/flanges is not recommended.**

To help installation, flange accessories and bracket kits are available from Mobrey.

Procedure:

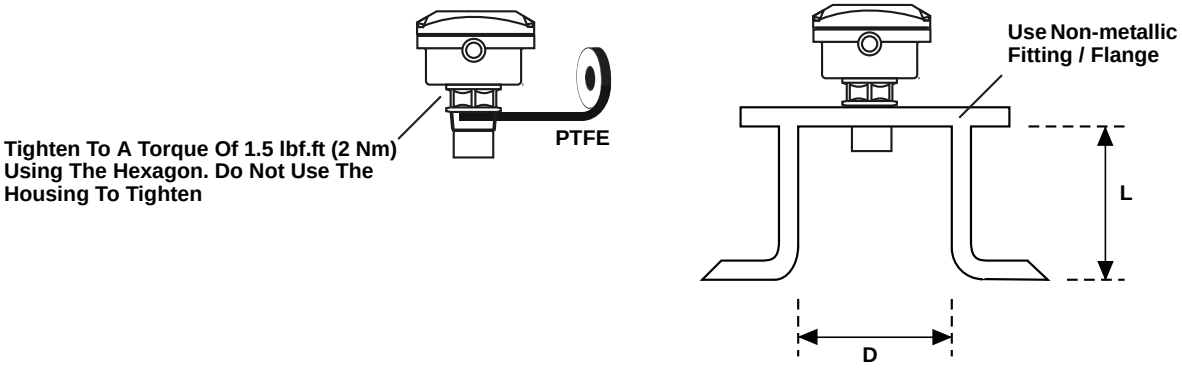
1. Ensure that the transmitter is *perpendicular* to the liquid surface to maximize the return echo size.
2. Check that the *maximum liquid level* will not enter the 12-in. (0,3 m) blanking zone of the transmitter.
3. When installing in a tank with a nozzle or stand-off (Figure 3-2 on page 3-6):
   a) Use PTFE tape on the screw thread (Figure 3-2 on page 3-6).
   b) Lower transmitter into the tank through the process connection.
   c) Turn the transmitter until it is properly secured in the process connection (Figure 3-2 on page 3-6).
   d) Tighten to a torque of 1.5 lbf.ft (2 Nm) using the hexagon. *Do not use the transmitter housing to tighten.*

NOTE:
If the transmitter face does not protrude into the vessel, note the dimensions in Table 3-1 for Figure 3-2, and ensure that the nozzle/vessel weld is smooth and free from internal weld beads or other projections.

4. When installing using a bracket kit (Figure 3-3 on page 3-6):
   a) Attach bracket to the disc using the 3 screws provided.
   b) Attach bracket and disc to a support. The combined weight of bracket and disc is 16 oz (0,5 kg). For transmitter weight, see "Specifications" on page A-1.
   c) Use PTFE tape on the screw thread of the transmitter (Figure 3-2 on page 3-6).
   d) Insert the transmitter into the disc.
   e) Tighten to a torque of 1.5 lbf.ft (2 Nm) using the hexagon. *Do not use the transmitter housing to tighten.*

NOTE:
The bracket kit contains a stainless steel angle bracket and PVC threaded disc, which may be used to mount the transmitter on a support over the liquid surface. The bracket and disc dimensions are in Figure A-4 on page A-4.

Figure 3-2.
Mounting The Mobrey MSP422
Using A Nozzle/Stand-off

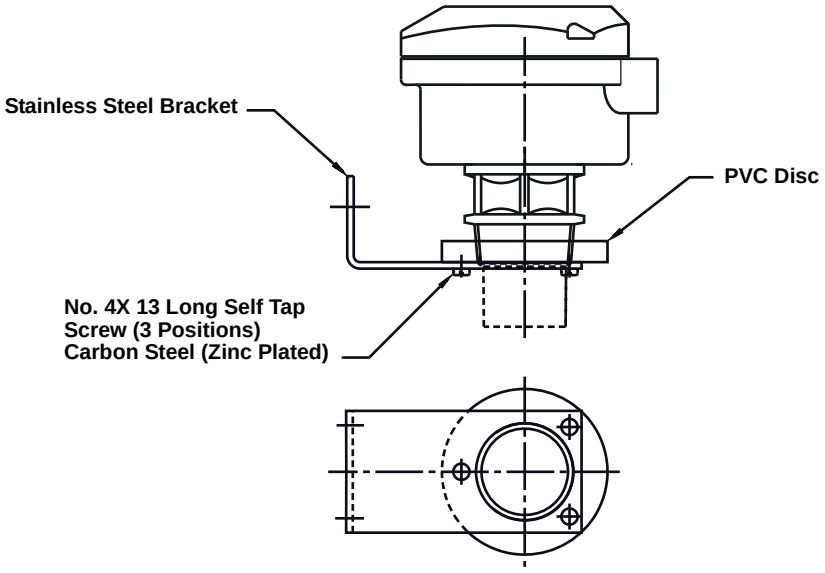


NOTE:
If the transmitter face does not protrude into the vessel, note the dimensions in Table 3-1 for Figure 3-2, and always ensure that the nozzle/vessel weld is smooth and free from internal weld beads or other projections.

Table 3-1. Nozzle Diameter Size (D) and Max Length (L)

Nozzle Diameter Size (D)	Maximum Nozzle Length (L)
DN50 (2 in.)	4 in. (100 mm)
DN80 (3 in.)	6.3 in. (160 mm)
DN100 (4 in.)	6.3 in. (160 mm)
≥DN125 (5 in.)	11.8 in. (300 mm)

Figure 3-3.
Mounting the Mobrey MSP422
Using a Bracket Kit



Note: Combined weight of bracket and disc is 16 oz (0,5 kg)

ELECTRICAL INSTALLATION

NOTE!
The MSP422 is not intrinsically safe certified, and is therefore for use in non-hazardous (Ordinary Location) installations only.

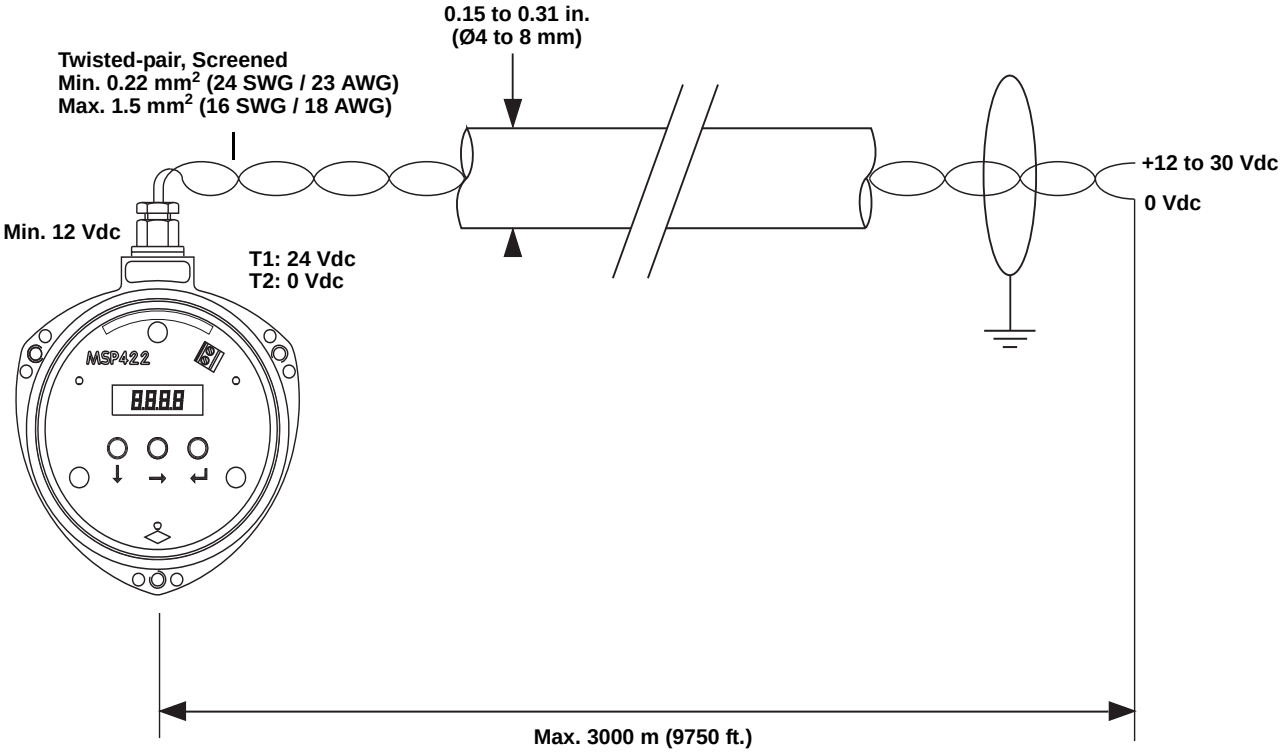
Cabling the Transmitter

The Mobrey MSP422 is a two-wire, loop-powered transmitter requiring an external 24 Vdc power supply. There is one M20x1.5 cable entry. A suitable conduit system or cable gland must be used to keep the weather-proof rating.

To cable the transmitter:

1. Make sure that the power supply is switched off.
2. Remove the cover of the transmitter housing.
3. Pull the cable through the cable gland/conduit.
4. Wire the transmitter as shown in Figure 3-4.
5. Connect the cable screen (shield) to ground at one end only.
6. Replace the cover, tighten the cable gland.

Figure 3-4. MSP422 Wiring



After Completing the Wiring

To maintain the weather-proof rating and hazardous area protection of the transmitter, ensure all cable glands, blanking plugs, and seals are in good condition.

Check that the cover seal is in good condition, and not twisted or misaligned in the seal location groove. When replacing the cover, tighten the three cover screws evenly to exert uniform pressure on the cover seal.

Lightning / Surge Protection and Other Loop Devices

If the area is prone to lightning strikes or voltage surges, a suppressor device may be installed between the transmitter and the control unit.

If an additional loop-powered device or separately powered device is included in the two-wire loop, the transmitter must receive a minimum voltage of 12 Vdc at 21 mA loop current. (See "Load Limitations" on page A-2).

Section 4 Starting up

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

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⚠WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury:

Make sure only qualified personnel perform the installation.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any service other than those contained in this manual unless you are qualified.

OVERVIEW

The Mobrey MSP422 ultrasonic level transmitter is operated from a menu of parameters, each held in a specific memory location within the transmitter. The memory locations may be pictured as a matrix, and navigated for programming the instrument using ↓ and → steps.

The Integral Display Menu structure is shown in Figure 4-1 on page 4-3.

The transmitter is pre-programmed at the factory with a value in each parameter location so that when the power is first applied, the transmitter gives a sensible reading.

This section details the local programming using the push-buttons provided inside the transmitter.

Power Up

When the power is turned on, the transmitter takes several seconds to initialize. The display will run a set-up routine, first illuminating all display characters, and then showing the software revision number. Finally, a full set of zeros is displayed while the microprocessor identifies the correct return echo. After these checks are complete, the display indicates the live measurement based upon the factory default values in memory.

On a new instrument aimed at a good target, the transmitter calculates a level reading based upon the default value for the bottom reference.

The transmitter is now ready to be set-up with details of the application.

The transmitter may be programmed prior to, or after, installation. All programmed data is retained in the transmitter memory after the power is turned off.

Before Programming

Important notes to help you program the transmitter:

a) Do not allow rain, or water, to enter the transmitter during programming or the circuit boards may be damaged.

b) See the instructions below on how to use the push-buttons to navigate through the programming menu and select or enter application data.

c) Push the buttons firmly, but not too hard, to avoid damaging the circuit boards. Also, to avoid entering incorrect data, do not push the buttons too fast.

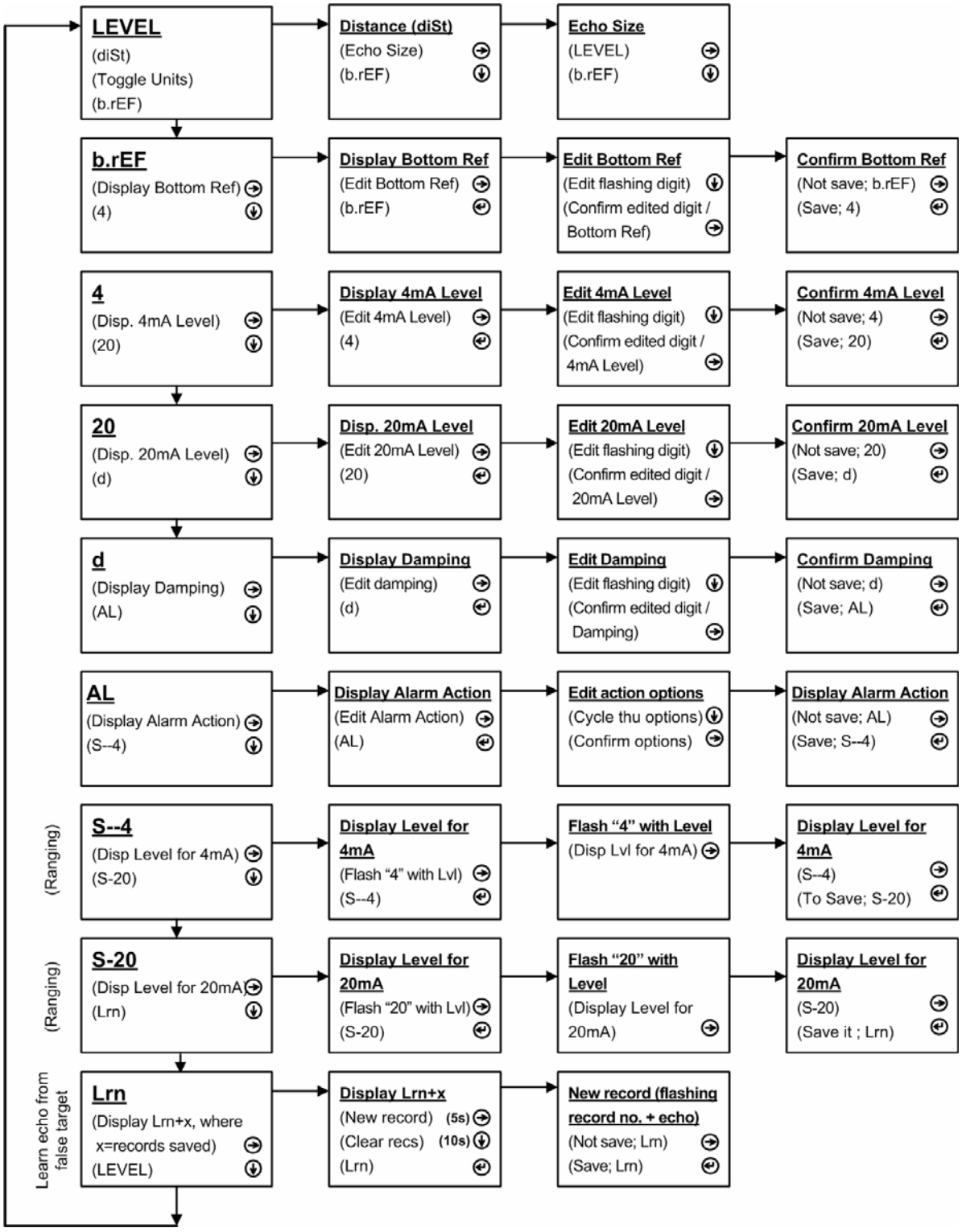
d) Holding down the green button ↓ scrolls through any option list.

e) Pressing the red button ↵ at certain locations in the menu returns you to the previous level in the menu (see Figure 4-1 on page 4-3).

   Note, however, if the red button ↵ is pressed after a menu option selection has been made or new data has been entered (i.e. stopped flashing), this option selection / new data will automatically be saved (see Figure 4-1).

MSP422 Menu Map

Figure 4-1. MSP422 Menu Map



PROGRAMMING THE MSP422

Refer the Integral Display menu on a card tucked between the housing and body, and in Figure 4-1 on page 4-3.

Display Units

The display units are indicated by the position of the decimal point in the displayed PV value:

Units	Display
m	8.000
ft.	26.24
in.	314.9

Default values are as follows:

MSP422-B28: **m**

MSP422-N28: **ft.**

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure showing how to access all the menu options and return to the PV display.

To change the display units:

a) Start from the PV display (see the note above.)

b) Hold down the blue button → for 10 seconds, but do not release it yet.

c) The display units will then change according to the following sequence:

   MSP422-B28: Metres to Feet, Feet to Inches, and Inches to Metres.
   MSP422-N28: Feet to Inches, Inches to Metres, and Metres to Feet.

d) Continue to hold down the blue button → to change to the next display unit in the above sequence after every three seconds.

e) Confirm the display units by releasing the blue button →.

The same units must be used when programming in the bottom reference and the 4 and 20 mA points.

The 4–20 mA output may be set to operate over all or just a part of the total measuring range. There is no limit on the minimum span of the current output, although a span below 4 in. (100 mm) is not recommended.

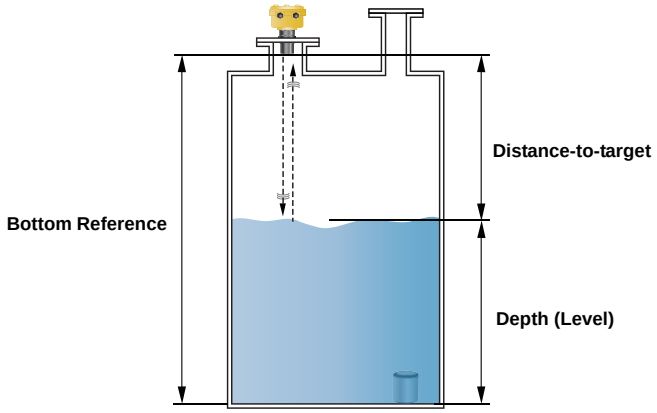
The 4 mA level may be set above or below the 20 mA level to suit the monitoring or control equipment.

NOTE:
The MSP422 measures and calculates in metres. The display units are derived as a last operation using a pre-programmed conversion factor.

First Measurements

With the transmitter installed and display units selected, the display will show what the instrument calculates as the liquid depth (level). This value is calculated by the microprocessor as being the difference between the distance-to-target being measured and the default value for the datum or bottom reference (**b.rEF**).

Figure 4-2. Bottom Reference



Before changing any of the default values, press the blue button → to change the PV display to indicate **distance-to-target**, as measured by the transmitter from the transmitter face. This value is shown alternately with the text "**diSt**" to indicate the display is in distance mode. The calculation can be checked against a manual measurement if required.

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

Press the blue button → again to get to the echo size. This is a scale of 0 to 100. (It is possible to record a value greater than 100). With the display in this mode, the central ":" cursor will flash once for every echo received, which under normal circumstances will be once per second.

NOTE:
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 continually shown. In most applications, the signal strength will vary over a wide range: 20 to 80.

Press the blue button → again to return to the original level reading and start the calibration routine.

NOTE:
The output of the transmitter 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 four minutes.

Setting the Bottom Reference

Screen display: **b.rEF**

Defaults: **8.000** (m), **26.24** (ft.), **314.9** (in.)

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change the bottom reference (b.rEF) setting:

a) If entering the menu system from the PV display, press the green button ↓ to indicate the "**b.rEF**" menu option (see above note.)

b) Press the blue button → to enter the menu for **b.rEF**. The display indicates the present **b.rEF** value.

c) If this value is correct, press the red button ↵, and then press the green button ↓ to get to the next menu option.

d) Press the blue button → to start editing. The first digit flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new **b.rEF** value. None of the digits should now be flashing.

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**b.rEF**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting 4 mA and 20 mA Levels

Screen display: **4** and **20**

4mA level defaults: **0.000** (m), **00.00** (ft.), **000.0** (in.)

20mA level defaults: **7.500** (m), **24.60** (ft.), **295.2** (in.)

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

NOTE:
To set the 4 and 20 mA levels by ranging the transmitter to a fixed target, such as the level in the tank at any particular time, skip these menu options by pressing the green button ↓ twice to get to the next menu option.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change the 4 mA value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**4**" menu option is indicated (see above note.)

b) Press the blue button → to enter the menu for the 4 mA level. The display indicates the present value of the 4 mA level.

c) If this value is correct, press the red button ↵, and then press the green button ↓ to get to the next menu option.

d) Press the blue button → to start editing. The first digit will flash to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new 4 mA level. None of the digits should now be flashing.

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**4**" re-appears; re-start at step (b) or press ↓ for the next menu.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change the 20 mA value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**20**" menu option is indicated (see above note.)

b) Press the blue button → to enter the menu for the 20 mA level. The display indicates the present value of the 20 mA level.

c) If this value is correct, press the red button ↵, and then press the green button ↓ to get to the next menu option.

d) Press the blue button → to start editing. The first digit flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new 20 mA level. None of the digits should now be flashing.

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**20**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting the Output Damping

Screen display: **d**

Default: **10**

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

A value of zero may be edited, in which case no smoothing is applied to the Current Output and transmitter readings immediately change the output.

NOTE:
The MSP422 transmits nominally at once per second. Therefore, a damping time of zero will not necessarily give an immediate response.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change the output damping:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**d**" menu option is indicated (see above note.)
b) Press the blue button → to enter the menu "**d**". The display indicates the present damping value.
c) If this value is correct, press the red button ↵ and then the green button to get to the next menu option.
d) Press the blue button → to start editing. The first digit flashes to indicate it can be edited.
e) Press the green button ↓ repeatedly to edit the flashing digit.
f) Press the blue button → to select the next digit. The digit flashes to indicate it can be edited.
g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.
h) Press the blue button → to confirm the new damping value. None of the digits should now be flashing.
i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.
j) If the new value is incorrect, press the blue button → to exit to the menu. The "**d**" re-appears; re-start at step (b) or press ↓ for the next menu.

Selecting the Action on Alarm Condition

Screen display: **AL**
Default: **Hold**

The transmitter signals an alarm condition if the target echo is lost for more than 10 seconds.

There are three options for an alarm condition:

Hi The current on the two-wire loop will increase to 21 mA and remain there until a correct target echo is recovered. The display flashes alternately "**LE**" and the alarm action.

Hold The current will freeze at the value it was last reading and remain there until a correct target echo is recovered. The display flashes alternately "**LE**" and the last valid reading.

Lo The current on the two wire loop will decrease to 3.6 mA and remain there until a correct target echo is recovered. The display flashes alternately "**LE**" and the alarm action.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change from the default action of **Hold**:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**AL**" menu option is indicated (see above note.)

b) Press the blue button → to enter the menu "**AL**". The display indicates the present action setting.

c) If this action is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The action flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to scroll through the actions.

f) Press the blue button → to confirm an action. The flashing then stops.

g) If the new action is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new action is incorrect, press the blue button → to exit to the menu. The "**AL**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting 4 mA and 20 mA Levels Using Ranging

Screen display: **S--4** and **S-20**

NOTE:
If the 4 and 20 mA levels are programmed as described above, this menu can be skipped; **it overwrites previously entered data for them**. Press the green button ↓ to get to the final menu option, "**Lrn**".

This is for setting the 4 mA or 20 mA levels by ranging the instrument to a known target, e.g. the present level in a vessel.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change the 4 mA level:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**S--4**" menu option is indicated (see above note.)

b) Ensure the target is the 4 mA level and, with the display indicating that level, press the blue button →.

c) The display indicates the present 4 mA level setting, not the new level reading. If this setting is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The display flashes alternately "**4**" and the new level reading.

e) Press the blue button → to confirm the new level reading is the new 4 mA level.

f) If the new 4 mA level is correct, press the red button ↵ to save. The display changes to the next menu option.

g) If the new 4 mA level is incorrect, press the blue button → to exit to the menu. The menu option "**S--4**" re-appears; re-start at step (b) or press ↓ for the next menu option.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To change the 20 mA level:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**S-20**" menu option is indicated (see above note.)

b) Ensure the target is the 20 mA level and, with the display indicating that level, press the blue button →.

c) The display indicates the present 20 mA level setting, not the new level reading. If this value is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The display flashes alternately "**20**" and the new level reading.

e) Press the blue button → to confirm the new level reading is the new 20 mA level.

f) If the new 20 mA level is correct, press the red button ↵ to save. The display changes to the next menu option.

g) If the new 20 mA level is incorrect, press the blue button → to exit to the menu. The menu option "**S-20**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Learn About Echoes From False Targets

The MSP422 has an easy-to-use "**Lrn**" (Learn) routine that allows the instrument to learn up to two false echoes, which can then be ignored in future operations.

If the application is simple and there are no false echoes, press the green button ↓ to exit the integral display menu and return the instrument to indicating the level reading on the display.

If an echo other than the true liquid surface echo is detected and an incorrect level reading is indicated, the instrument can learn to ignore this false echo. The "**Lrn**" routine may be used at any time, either during or after setting-up or if a problem occurs later.

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To store a false target echo:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**Lrn**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**Lrn**" menu. The display indicates "**LrnX**" where "X" (0, 1 or 2) is the number of stored false target echoes.

c) To exit to the menu at this stage, press the red button ↵ and then the green button ↓ to get to the next menu option.

d) To store a new false echo, hold the blue button down → for five seconds.

e) The display now alternately flashes "**Lrn**" and the false target position. After four seconds, the false echo target position is stored and the display re-indicates "**LrnX**" alternating with the distance to the stored echo.

f) Press the red button ↵ to save this false echo and exit to the menu.

However, if this false echo shouldn't be saved, press the blue button → to exit to the menu.

g) To store another false target echo, re-start from step (b).

h) Press the green button ↓ to exit the menu and return to the PV display.

NOTE:
If there are two false echoes stored ("**Lrn2**"), the transmitter will not allow another echo to be stored until the memory is cleared (see next procedure.)

NOTE:
When a false echo is stored, the transmitter sets up a 'window' around the false target and ignores any echo from that window, unless the echo received from the liquid surface is larger than the stored false echo. There may be no change in the transmitter output current while the liquid level moves through this window, which is equivalent to a distance of 8 in. (20 cm).

NOTE:
See Figure 4-1 on page 4-3 for a map of the programming menu structure and how to access all the menu options.

To clear all the stored false echoes:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**Lrn**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**Lrn**" menu.

c) With the display indicating "**LrnX**", press and hold the green button ↓ for ten seconds to clear the memory. The display then indicates "**Lrn0**".

d) Press the red button ↵ to exit to the menu.

e) Press the green button ↓ to exit the menu system and change to the PV display.

FINAL CHECKS

Final checks:

a) Check the display is reading correctly.

b) You may wish to check echo size again before re-fitting the enclosure lid.

c) 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.

d) Carefully set the cover on the transmitter, and tighten the three cover screws equally to seal the instrument.

e) Check that the cable gland is securely tightened and check sealing on the cable sheath.

POWER FAILURE

All parameters are held in EPROM memory. In the event of a power failure, or disconnection from the power supply, the transmitter will remember all of it's last parameter values and will resume correct operation once power is restored.

Section 5 Service and Troubleshooting

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

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⚠WARNING

Explosions could result in death or serious injury.

- The Mobrey MSP422 is only for use in a non-hazardous location

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

Make sure only qualified personnel perform the installation.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any service other than those contained in this manual unless you are qualified.

High voltage that may be present on leads could cause electrical shock.

Avoid contact with leads and terminals.

Make sure the main power to the Mobrey MSP422 transmitter is off, and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

SERVICING

The only maintenance required is to occasionally check the transmitter face to ensure it remains clean and check that the cover seal, wiring, and cable glands are in good condition.

There are no spare parts for the Mobrey MSP422. If a problem persists, contact Mobrey Measurement for advice.

DIAGNOSTICS FOR THE MSP422

General Troubleshooting

No Display

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

No Level Reading

Check that the instrument is ticking about once per second. If there is no ticking, the instrument should be replaced.

Error Messages

Flashing “LE” With “0000”

The transmitter is not receiving a return echo, which could mean the liquid surface is poor or that it is beyond the range of 26 ft. (8 m) of the instrument. Change the position of the transmitter or contact Mobrey Measurement for information on longer range instruments

This means that the transmitter is not receiving a return echo, possibly because the liquid surface is poor or beyond the range (26 ft./8 m) of the instrument. Re-locate the instrument or contact Mobrey Measurement for details of longer range instruments.

Flashing “LE” With Level Reading

This means that the transmitter is no longer receiving satisfactory echoes from the liquid surface. This may be because of one of a variety of reasons, for example, excessive foaming, turbulence, or ullage vapors.

First, check that the transmitter face is free from contamination and condensation. The transmitter will operate with some condensation on the face, but excessive condensation may cause operational problems. If the vessel cannot be adequately vented to prevent condensation forming, contact Mobrey Measurement for alternative solutions.

Second, check that the instrument is still vertically aligned above the liquid surface and check the echo received size. If the echo size is small (<3), re-position the transmitter or modify the vessel for the transmitter to operate above a more acceptable area of the liquid surface.

Lost echo (LE) is signalled when there has been no return echo for 10 seconds. Within the 10 seconds, the output will remain fixed. If, after the 10 seconds, no satisfactory has been received, the output will increase to the current selected level and the display flashes alternately “**LE**” and the last valid level reading.

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

Appendix A Reference Data

SPECIFICATIONS

General	
Product	Mobrey MSP Series Ultrasonic Level Transmitters: Level and Distance measurement
Measurement Principle	Ultrasonic, time-of-flight
Measuring Performance	
Measurement Range	1 to 26 ft. (0,3 to 8 m)
Level Resolution	Better than 0.06 in. (1 mm)
Level Accuracy Under Reference Conditions(1)	± 0.2 in. (5 mm) for < 3.3 ft. (1 m), ± 0.5% of measured distance for > 3.3 ft. (1 m)
Blanking Distance (Dead Zone)	12 in. (0,3 m)
Update Interval	Display: 500 ms; Current Output: 200 ms
Display / Configuration	
Integral Display	4 digit display for live measurement and for configuration purposes
Display Units	m, ft, or in,
Output	Level
Output Units	Set by Display Units selection
Configuration Tools	Standard integral push-buttons with LCD
Electrical	
External Power Supply	12 to 30 Vdc Loop-powered (two-wire)
Earthing	None required
Current Output	Analog 4–20 mA
Signal On Alarm	Low = 3.6 mA. High = 21 mA
Saturation Levels	Low = 3.8 mA. High = 20.5 mA
Cable Entry	M20 x 1.5 conduit entry for a cable gland
Output Cabling	Single twisted-pair and shielded, min. 0,22 mm^2 (24 AWG), max. 1,5 mm^2 (15 AWG)
Materials of Construction	
Wet-side Material	PVDF
Body And Cover Material	Glass-filled Nylon
Cover Seal	Silicone rubber
Cover Screws	316 Stainless Steel
Transducer Body Seal	EPDM
Mechanical	
Mounting Thread Size	2-in. NPT, or 2-in. BSP. Optional flange accessories available
Weight of Transmitter	2.0 lb (0,9 kg)
Measuring	
Temperature Compensation	Automatic Integral temperature compensation

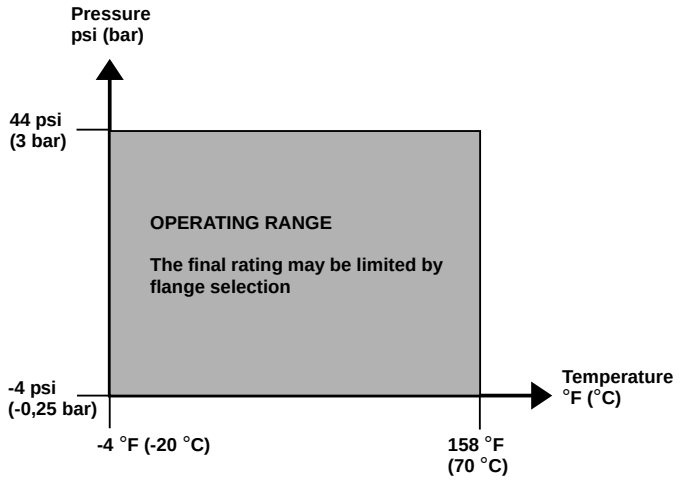
Environment	
Ambient Temperature(2)	–4 to 158 °F (–20 to 70 °C)
Process Temperature	–4 to 158 °F (–20 to 70 °C)
Process Pressure	–4 to 44 psi (–0,25 to 3,0 bar)
Ingress Protection	IP 66
Electromagnetic Compatibility	EN61326 (Class B)
Certifications	CE-mark

(1) Temperature: 68 °F (20 °C), Pressure: 1013 mbar (atmospheric pressure), and Relative Humidity: 50%.
(2) See page A-2 onwards for approval temperature ranges.

TEMPERATURE AND PRESSURE RATINGS

The process temperature/pressure rating depends on the design of the transmitter in combination with the flange materials.

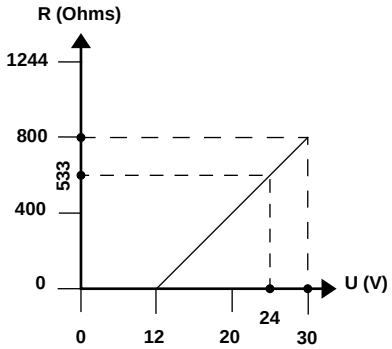
Figure A-1. Process Temperature and Pressure Diagram



LOAD LIMITATIONS

The maximum load resistance can be determined from Figure A-2.

Figure A-2. Load Limitations



NOTE
R = Maximum Load Resistance
U = External Power Supply Voltage

DIMENSION DRAWINGS

Figure A-3. Transmitter Dimensions (Nylon-filled Glass Housing)

Note: Dimensions are in inches (mm)

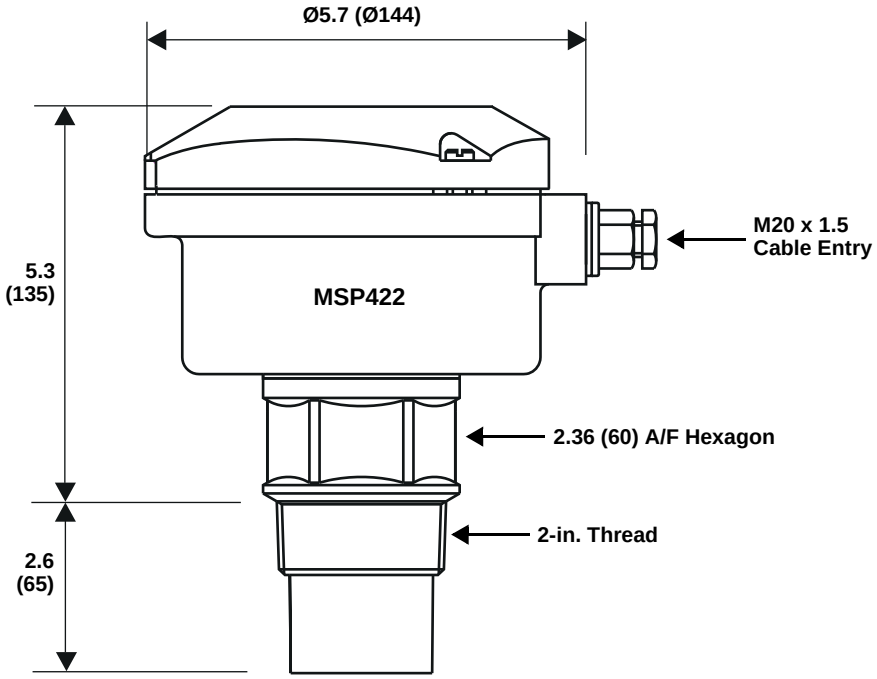
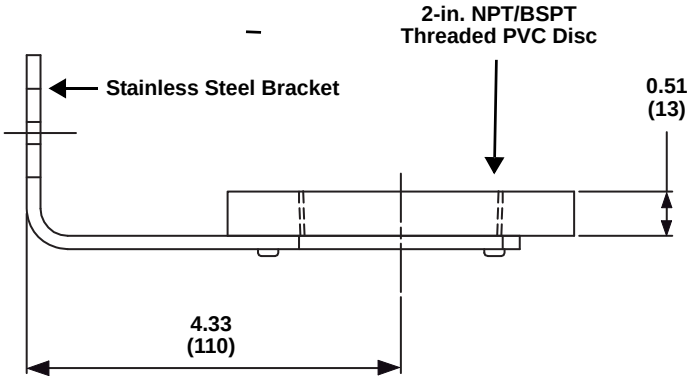


Figure A-4. The 2-in. NPT/BSPT mounting bracket

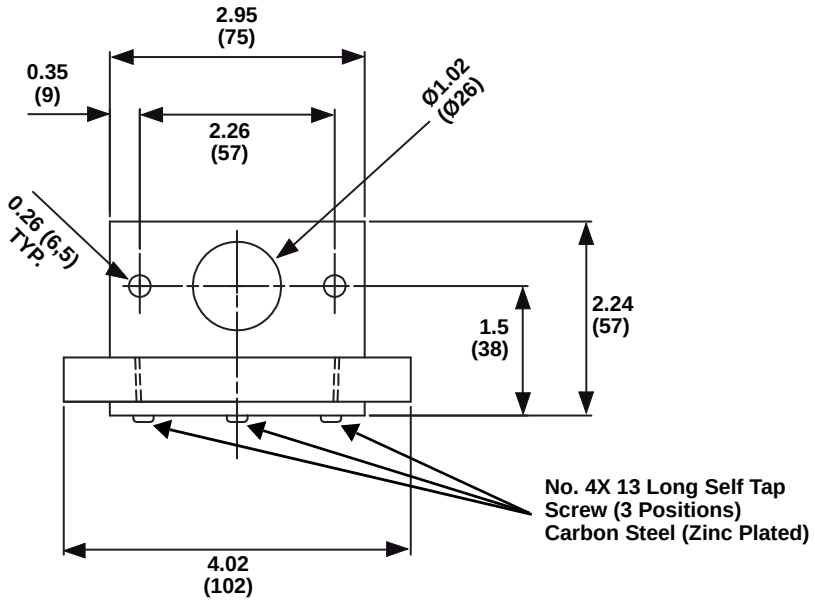
Note: Dimensions are in inches (mm)

Note: The combined weight of bracket and disc is 16 oz. (0,5 kg)

SIDE VIEW



END VIEW



ACTUAL VIEW WITH TRANSMITTER MOUNTED

Appendix B Product Certifications

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions could result in death or serious injury:

The Mobrey MSP422 is only for use in a non-hazardous location

⚠WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury:

Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any service other than those contained in this manual unless you are qualified.

⚠WARNING

High voltage that may be present on leads could cause electrical shock:

Avoid contact with leads and terminals.

Make sure the main power to the transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

MANUFACTURING LOCATION

Mobrey Limited – Slough, Berkshire, United Kingdom

EUROPEAN UNION DIRECTIVE INFORMATION

NOTE:
Refer to the housing label to identify the approvals for your transmitter. The EC declaration of conformity for all applicable European directives for this product can be obtained by contacting our local sales representative.

Pressure Equipment Directive (PED) (97/23/EC)

- The MSP422 is outside the scope of the PED Directive

Electro Magnetic Compatibility (EMC) (2004/108/EC)

- EN 61326-1:2006

NON-HAZARDOUS LOCATION CERTIFICATIONS

NOTE:
Refer to the housing label to identify the approvals for your transmitter.

American and Canadian Certifications

Factory Mutual (FM) Ordinary Location Certification

The transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Canadian Standards Association (CSA) Ordinary Location Certification

The transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory as accredited by the Standards Council of Canada (SCC).

Reference Manual
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Mobrey MSP422

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