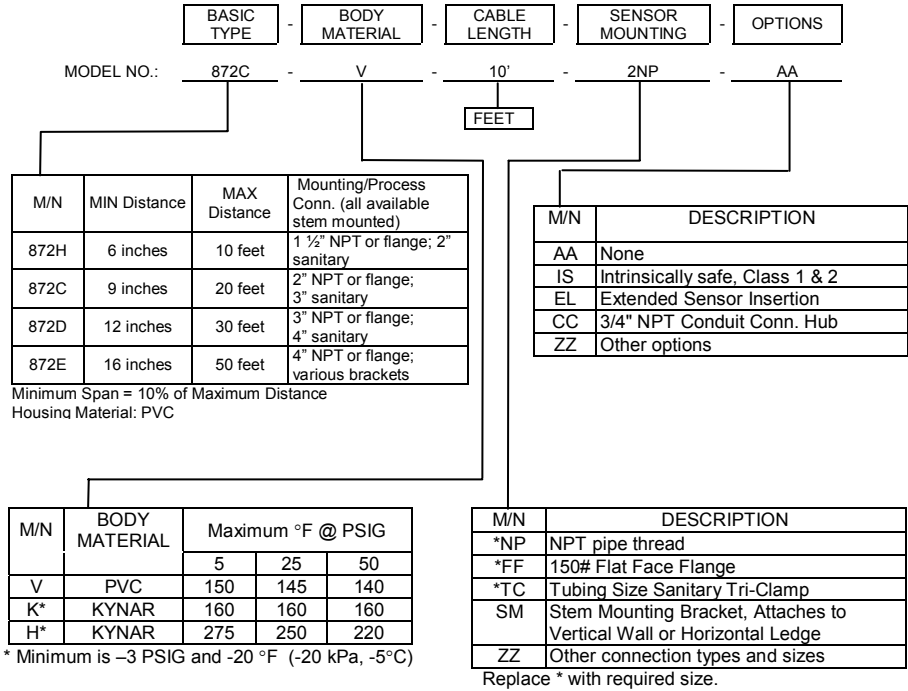




**MODEL 872
LOOP POWERED ULTRASONIC
LEVEL TRANSMITTER**



MODEL NUMBERING SYSTEM



I. GENERAL DESCRIPTION

The Model 872 is an ultrasonic measuring device that is used to monitor the level or position of a solid or liquid material in open or closed vessels. It transmits the level as an equivalent 4-20 mA signal in a current loop.

The unit is positioned over the surface of the material level to be sensed. A series of high frequency sound waves are generated during the "send" portion of the cycle. The sound waves travel through the air space between the face of the Sender/Receiver (S/R) unit and the surface of the material. The sound waves strike the material, are reflected, travel back to the S/R unit, and are detected during the "receive" portion of the cycle. The time elapsing between "send" and "receive" is measured and corrected for speed of sound variations due to temperature, and is used by the microprocessor based instrument to calculate and transmit the material level.

II. INSTALLATION

MOUNTING THE UNIT

Environment

When selecting a location and mounting the 872, the following factors should be considered.

- Temperature in the tank must not exceed the specified limits for the unit. It is important that the temperature sensor be directly exposed to the air space above the material so that it will be at the same temperature as that air.

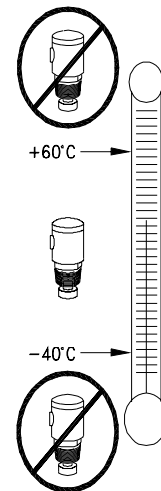
Solar heating can produce significant errors, by heating the temperature sensor. Outside installations, such as bracket mounting over a sump, should utilize a sun shield or other means of shading the unit.

- Pressure in the tank must not exceed 50 psig. Ultrasonic level instruments will not function in a vacuum. A minimum pressure of at least 10 psia is required; the standard maximum range will be decreased by 50% at this amount of vacuum.

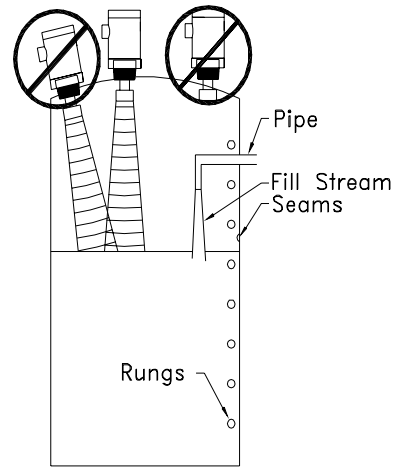
- If the S/R unit is mounted outdoors and subject to wind interference, then a stilling well or pipe may be required to prevent the signal from being blown away. The size and type of well is dependent on the application and the S/R unit used. Stilling wells are typically used in wastewater basins and in open top reservoirs. Consult the factory if there is any doubt as to your needs.

Location

- The unit must be mounted so that the ultrasonic beam strikes the liquid perpendicular to its surface.



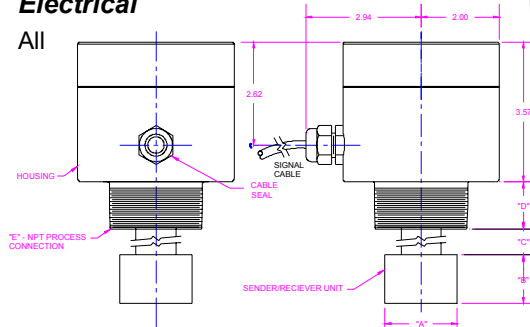
- The unit should not be mounted in the center of a tank or mounted in the symmetrical center of a large plate of metal such as a manhole cover; resonant vibrations of the cover may result and cause a problem.
- Obstructions that will be in the path of the sound pulses must be avoided (i.e., reinforcing members, ladders, agitator blades). A stilling well can be used to avoid these problems and those due to turbulence on the surface. A stilling well should have a smooth inner wall, and a diameter at least 0.1 inch greater than the O.D. of the S/R unit.



- A heavy foam layer lying on the top of the material surface will absorb the sound pulses and interfere with the measurement. Often, a stilling well can be used to eliminate or minimize this problem. See above discussion.
- Avoid mounting locations subject to excessive vibration or high levels of radiated heat.
- If the unit is to be mounted on a nozzle or standpipe, be sure that the internal surface of the transition (where the nozzle intersects the tank) is smooth. Protruding lips and weld beads can disrupt the ultrasonic signal pulse.
- The face of the unit must be at least 9 inches above the highest anticipated material level.

Electrical

All



Wiring

wiring, fusing, and hookup must be done in exact accordance with the

DIMENSIONS			
MODEL	"A"	"B"	"C"
872H	1.45	2.00	1-1/2"
872C	1.90	2.00	2"
872D	2.85	2.73	3"
872E	3.81	*	*

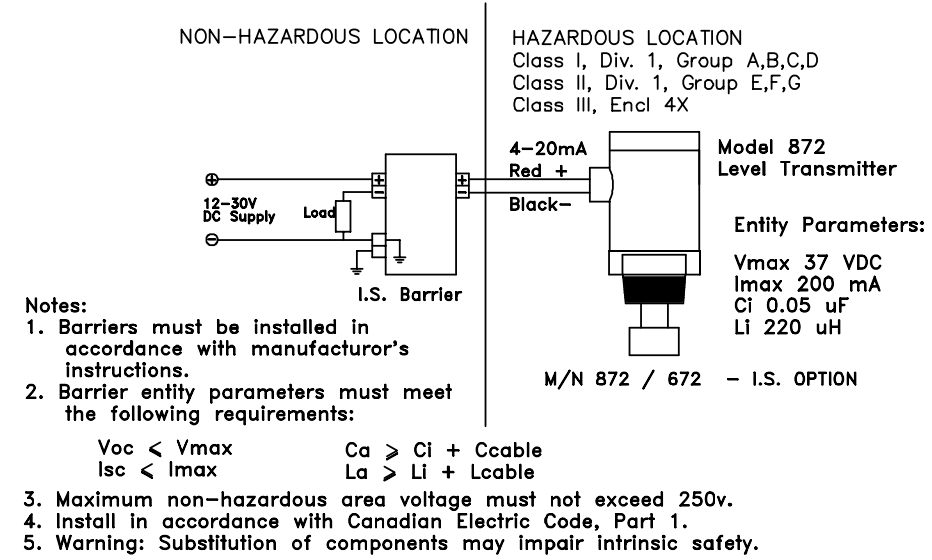
* DETERMINED BY FLANGE SIZE

governing code; this takes precedence over any instruction or implied method contained in this manual or other commentary provided by Delta Controls Corporation, other persons, or other organizations.

Wire the 4-20 mA connections as shown in the wiring diagram with a twisted or shielded pair. The 4-20 mA signal is isolated from earth ground. The output signal loop must be earth grounded at a single point within the loop.

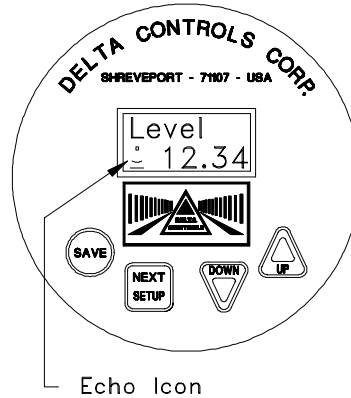
For intrinsically safe operation in hazardous areas, use an I.S. rated 872 and an intrinsically safe power supply or a suitable safety barrier with a non-I.S. power supply located in the safe area.

The Model 872 contains reverse polarity protection.



III. OPERATING THE MODEL 872

The Model 872 user interface consists of an LCD display and 4 setup pushbuttons. The temperature characteristics of the display are such that you should only calibrate the unit when the ambient temperature is between 0°F and 140°F. Outside this temperature range, the transmitter will operate properly, but the display may be difficult to read.



Animated Echo Status Icon

An animated icon on the display shows whether or not the instrument is receiving an echo. As the unit transmits, a stylized sound wave is shown to descend from the S/R unit to the surface on the display. If an echo is being received, the sound wave is seen to reflect upward and back to the

S/R unit. If no echoes are being received, the sound wave does not appear to reflect upward.

Pushbuttons



Pressing the SAVE button saves all setpoint and calibration values. The display will indicate "Saving..." to verify that the values are being saved.



Pressing this button causes the value displayed to be decremented. Holding the button down causes the value to continue downward at an ever increasing rate.



Pressing this button causes the value displayed to be incremented. Holding the button down causes the value to continue upward at an ever increasing rate.



Pressing this button shifts the display to the next setup parameter.

SETUP PARAMETERS

LEVEL	The level as a <i>percent</i> of full scale. 0% corresponds to an output of 4.00 mA. 100% corresponds to an output of 20 mA.
CAL PT 1	Calibration level point number 1. See calibration procedure
CAL DIST1	Calibration Distance for point number one. See calibration procedure
CAL PT 2	Calibration level point number 2. See calibration procedure
CAL DIST1	Calibration Distance for point number one. See calibration procedure
BLANKING	Blanking is an instrument function which makes the transmitter insensitive to echoes received from objects closer than the blanked distance. See the discussion of blanking below.
FILTER	This parameter is used to adjust the dampening of the level measurement. See the discussion of filtering below.
DISTANCE	This is the measured distance in inches between the S/R unit and the material surface. This parameter is used to verify that the unit is measuring properly.

LOE ACTN This parameter determines how the unit responds to a loss of echo. A loss of echo condition is reached when the unit fails to receive an echo on 50 consecutive shots. On loss of echo, if LOE ACTN is set to 0, the loop current will hold constant. If LOE ACTN is set to 1, the loop current will drop below 4.0 mA. If LOE ACTN is set to 2, the loop current will rise above 20.0 Ma.

IV. CALIBRATION PROCEDURE

There are two ways to calibrate the Model 872. These are:

Two Point Calibration:

1. Measure the level of material in the tank or set the level in the tank to a known level. Press the NEXT button until CAL PT 1 is displayed. Press the UP or DOWN buttons until the level in the tank is displayed as a percentage of full scale. Then press SAVE.
2. Change the level of material in the tank to another known level. The amount of change is not critical, however the farther apart the two calibration points are, the more accurate the calibration will be. Press the NEXT button until CAL PT 2 is displayed. Press the UP or DOWN buttons until the new level in the tank is displayed as a percentage of full scale. Then press SAVE.
3. Set BLANKING and FILTERING as required. The unit is now calibrated. Press the NEXT button until LEVEL is displayed.

Bench Calibration (Note: Steps 1 – 4 must be done in the order given.)

1. Press the NEXT button until CALPT 1 is display. Press the UP or DOWN button until 0 is displayed. Then Press the SAVE button.
2. Press the NEXT button until CALDIST 1 is displayed. Press the UP or DOWN buttons until the display indicates the distance in inches to the desired zero scale (4mA) material level. Then press SAVE.
3. Press the NEXT button until CALPT 2 is display. Press the UP or DOWN button until 100 is displayed. Then Press the SAVE button.
4. Press the NEXT button until CALDIST 2 is displayed. Press the UP or DOWN buttons until the display indicates the distance in inches to the desired full scale (100%) material level. Then press SAVE.
5. Set BLANKING and FILTERING as required. The unit is now calibrated. Press the NEXT button until LEVEL is displayed.

Blanking

When an ultrasonic S/R unit transmits sends out a signal, it takes a certain amount of time for the S/R unit to stop vibrating or "ringing." While the S/R unit is ringing, it produces a false signal in the receive circuitry. All ultrasonic level

sensors must therefore turn off their receivers for a short time after transmitting until the S/R unit has stopped ringing. This means that echoes from surfaces within a certain distance from the S/R unit can not be detected. This region is called the deadband or blanking region. The Model 872C constantly measures the ringing time of its S/R unit and adjusts its blanking interval automatically.

Normally, blanking does not need to be adjusted. However, if there is an object in view of the S/R unit, but above the highest liquid level, it may be desirable to extend the blanking region beyond the object. For example, suppose the unit is mounted 20 inches above a grating and is looking at a level through a hole in the grating, depending on the size of the hole, it is possible that there could be an echo received from the grating. In order to operate properly, blanking should be set an inch or so beyond the distance to the grating, say 21 or 22 inches.

CAUTION! Care must be taken to assure that the liquid level does not rise into the blanked region. If this happens, the echo from the surface will arrive at the S/R face during the "blanking" time. The echo will bounce off the S/R unit or the top of the tank, travel back down to the material surface and reflect up to the S/R unit a second time. This second echo (which arrives after the blanking period and during the "sensing" time) will be processed by the instrument since the blanking interval has expired. The instrument will measure and interpret this second echo as being from a level at twice the distance that it actually is. The result is a transmitted signal value that appears to indicate a tank that is not quite full when in fact it may be overflowing.

To set BLANKING, Press the NEXT button until BLANKING is displayed. Press the UP or DOWN buttons until the desired BLANKING distance in inches is displayed. Then press SAVE.

Filtering

In cases where the material in a tank is agitated, or when there are waves on a liquid surface during filling, it may be desirable to smooth out the level measurement so that the average level is displayed or transmitted. The Model 872C provides a filter parameter to control the amount of smoothing. A filter value of 1 provides no smoothing. A filter value of 7 provides maximum smoothing (distance averaging).

CAUTION! Increasing the filtering slows the response time of the instrument. This means that during rapid filling or emptying operations, the transmitted level signal could be several inches behind the actual level elevation. In cases where the level in a tank can change rapidly, it is recommended that you use a minimum amount of filtering to prevent pumps from running dry or possibly overflowing a tank because the output level signal is tracking behind the actual level position.

To set FILTERING, Press the NEXT button until FILTERING is displayed. Press the UP or DOWN buttons until the desired FILTER value is displayed. Then press SAVE.

Troubleshooting

1. Measure the voltage at the instrument. It must be between 12 and 30 VDC. Display flashing can indicate that voltage is too high or too low.
2. Check the Distance parameter to see if the unit is measuring distance properly, and whether or not the distance measurement tracks the changes in level.
3. Check the animated echo indicator to see if an echo is being received.

Echo not being received.

Is the distance to the surface greater than specified maximum range of the transmitter? Note that the range is limited to a maximum of 10 feet on clean granular solids.

Is there foam on the surface of the liquid? Foam can absorb sound and prevent echoes. A stilling well may be required in these cases.

Insufficient supply voltage can cause reduced range.

If the air between the unit and the surface contains heavy vapors or droplets, the sound can be reflected or diffused when it passes from pure air into vapors. This often happens during emptying operations as clean air is drawn into a vapor filled tank. A stilling well may improve the situation.

Dust may be present and dense enough to deflect the sound waves and shorten the maximum range on granular solids materials.

DISTANCE tracks level changes, but is inaccurate.

If the temperature of the S/R unit is significantly different from that of the air between the S/R unit and the surface, errors will result.

If the air between the S/R unit and the surface contains dense vapors, then the speed of sound calculated value could be affected. This can result in an erroneous measured distance.

DISTANCE is measured properly, but output signal is incorrect.

Check the values of the CALPT1, CALDIST1, CALPT2, and CALDIST2 parameters. The transmitted output (0-100%) indicated by CALPT1 should correspond to the distance CALDIST1 in inches. The transmitted output (0-100%) indicated by CALPT2 should correspond to the distance CALDIST2 in inches. If they do not, re-calibrate the Model 872C.

Unit is getting an echo, but the measured distance does not track the actual distance.

Does the measured distance correspond to some physical feature within the view of the S/R unit? This could be tank bracing, weld beads, agitator blades, the open end of a standpipe, ledges, or such. Remove the obstruction, move the S/R, add a standpipe, or try increasing the blanking distance past the obstruction.

V. Model 872 Basic Specifications

Output.....	4-20 mADC loop signal, isolated
Loop Impedance.....	550 ohms at 24 VDC; 900 ohms at 30 VDC.
Range.....	6 inches to 50 feet in 4 ranges (see Model Numbering System)
Accuracy.....	Better than 0.25% of max range
Ultrasonic Update Rate.....	Approx. twice per second
Damping (response time).....	Adjustable
Indication.....	0-100%of level or outage
Calibration Entry.....	4 push button entry switches
Memory Protection.....	Non-volatile
Temperature Compensation...	Automatic, temperature sensor is located in the body of the S/R unit.
Ultrasonic Beam Angle.....	7 @ 3dB down boundary
Power Requirements.....	12-30 VDC
Wiring Connections.....	#22 stranded flying leads,10ft
Intrinsically Safe.....	Yes, with "IS" option, and used in an intrinsically safe signal loop. Class I, Divisions 1 and 2, Groups ABCD; Class II, Groups EFG;
Entity Parameters.....	Vmax 37 Volts Imax 200mA Ci 0.05uF Li 220uH
Ambient Temperature Range.	-10 F to 150 F (Basic unit)
Process Temperature Limits..	-40 F to 275 F (such as CIP steaming)
Housing.....	Type 4X; Hoseproof with cover open or closed
Process Pressure limits.....	12 PSIA (vacuum) to 50 PSIG (Note that vacuum conditions decrease range)
Process Connections.....	NPT; ANSI, DIN or JIS Flange
Sanitary.....	Flange; 3A Authorized
Maintenance.....	Scheduled periodic maintenance is not normally required
Approvals.....	CSA NRTL/C (USA and Canada); 3A;

S/N _____

Software Version 5.10

