

Model 173 | HART®

Installation, Operation and Maintenance Manual



Delta Controls
CORPORATION

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LTK

MODEL NUMBERING SYSTEM

BASIC TYPE	HOUSING & RATING	MOUNTING LOCATION	OPTIONS
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MODEL EXAMPLE 173 - 4XR - 10'D - AA

ELECTRONICS ONLY
(ORDER PROBE SEPERATELY)

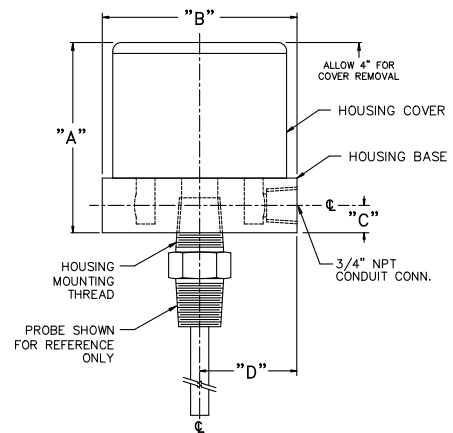
BASIC TYPE	
M/N	DESCRIPTION
173	BASIC XMTR

MICROPROCESSOR CONTROLLED
7500 SU MAX RANGE

HOUSING & RATING	
M/N	HOUSING & RATING *
4X#	4X HOSEPROOF PVC
7W#	EXPLOSION PROOF CLASS 1, DIV. 1, GRPS BCD, EFG ALSO 4 HOSEPROOF
7T#	SAME, EXCEPT; ALL 304 S.S. MATERIAL
	REPLACE "#" WITH ONE OF THE FOLLOWING: "I" = MOUNTED INTEGRAL ON THE PROBE HEAD "R" = REMOTE SURFACE MOUNTED (INTER- CONNECTING CABLE REQUIRED)
	<ul style="list-style-type: none"> HOUSING ARE THIRD PARTY LISTED CSA AND NRTL/C

MOUNTING LOCATION	
M/N	CABLE REQUIRED
AA	NO CABLE, INTEGRAL MOUNT
#P	POLY JACKETED CABLE (160 DEG F MAX)
#D	TEFLON JACKETED CABLE (450°F MAX)
	REPLACE "#" WITH TOTAL LENGTH OF CABLE REQUIRED (IN FEET)

OPTIONS	
M/N	DESCRIPTION
AA	NONE
ZZ	CUSTOM CONFIGURATIONS



HOUSING	DIMENSIONS			
	A	B	C	D
4X PVC	3.83	5.12	0.625	2.56
7X-P	4.4	4.7	0.83	2.55

I. GENERAL DESCRIPTION

The Model 173 probe style transmitter is microprocessor based and utilizes digital techniques and algorithms. It is used for critical measurement of liquid/solid level and interface position. It is insensitive to variations in liquid conductivity, fluid coatings or solids buildup. The instrument utilizes highly stable crystal references and filters. This allows it to reliably transmit the level of low dielectric materials. The probe is normally inserted vertically down into the liquid from the top of the tank.

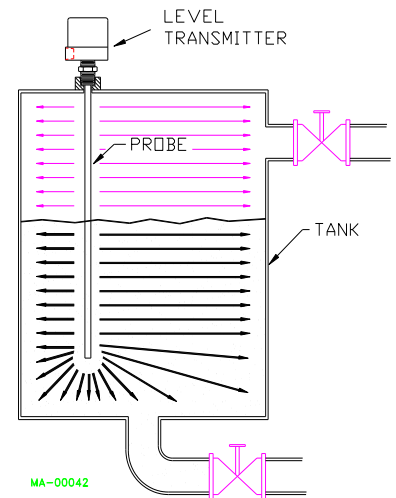
Model 173, integrally mounted on probe, can be provided for penetration or mounting at any angle & can be up to 125 feet long. The integral electronics module is potted in epoxy for improved reliability & stability.

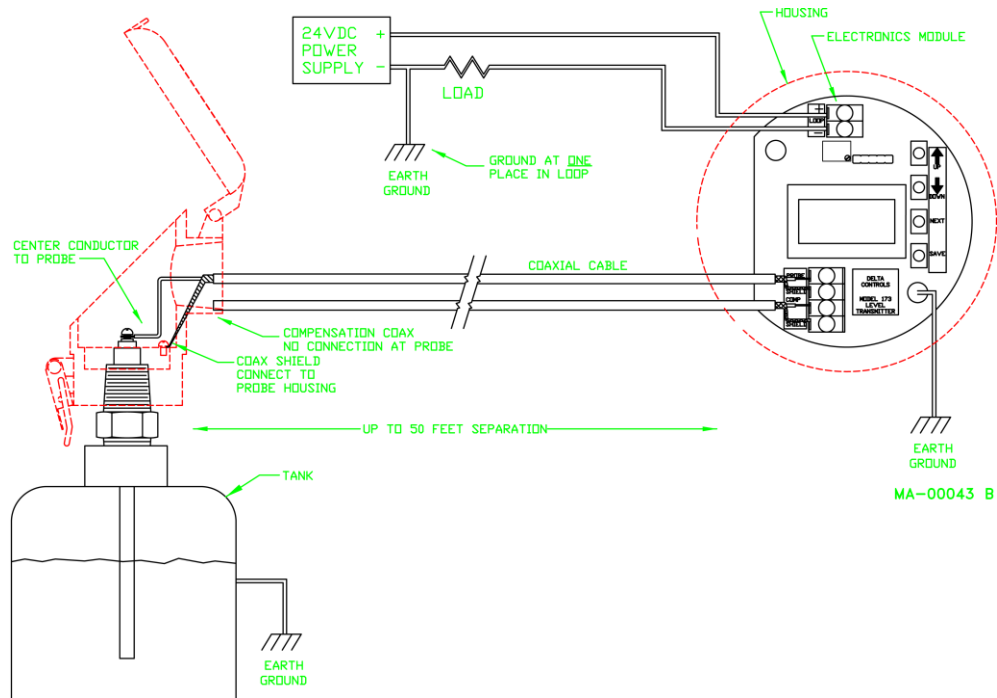
It will accurately measure almost any kind of liquid, including: water, oil, gasoline, acid, caustic, soup, milk, gear lube, and antifreeze. It is particularly advantageous when used in fuel oil tanks, cooling tower basins, fruit juice holders, chlorine storage tanks, irrigation channels, and pharmaceutical reactors. The loop-powered, 4-20 mADC signal is ideal for driving controllers, displays, and supervisory computers.

It will correctly transmit the position of an interface by sensing the ratio of the admittance of the two liquids. Typical interfaces include foam/effluent, gasoline/acid, and oil/water. The interface can be accurately detected even though it may be "cloudy" or carrying a "rag layer". Up to 10 calibration points allow the 173 to linearize the measured level to account for round, cylindrical or irregular tank shapes.

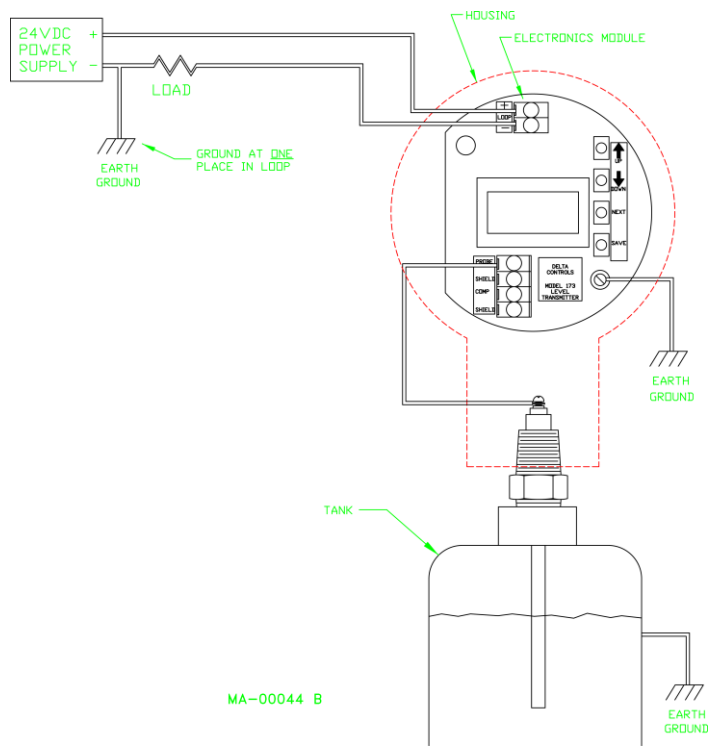
THEORY OF OPERATION

The Model 173 utilizes admittance technology to measure how much of its sensing probe is covered by the material of interest. This is accomplished by generating a radio frequency signal which travels from the sensing probe to the ground reference (usually the tank wall). The dielectric constant of the material is higher than that of the gas above the material, so energy flows more easily through the material. The amount of material then determines how much energy is transferred. The amount flowing (very small and low level in all cases) is a highly repeatable measure of the material level or interface position. The amount is integrated and applied to a 10-position lookup table to produce the 4-20 mADC signal.





Wiring Diagram for Remote Mounted Module



Wiring Diagram for Integral Mounted Module

II. INSTALLATION

MOUNTING THE UNIT

Select a mounting point and hook-up arrangement in accordance with good instrument practice. The unit must be installed in accordance with governing codes, such as the National Electric Code. The sensing portion of the probe rod should normally be vertical and should span the distance between material elevations where 0% and 100% signal are to be set. Further, it should extend at least 3" both above and below these points.

Integral mounting produces a simple one-piece unit, which generally results in lower installed costs. To install, mount the transmitter housing on the head of the probe, remove the cover and the two nuts holding the potted transmitter unit in place. Remove the unit from the housing and attach the wire terminal lug to the "PROBE" terminal of the transmitter. The "COMP" terminal is not used with integrally mounted probes. Replace the transmitter unit and its two hold-down nuts. Consult the wiring diagram for proper Power Loop connections.

Remote mounted units may usually be mounted up to 75 feet away from the sensing probe. The maximum range is decreased by 14 pF per foot of separation. Thus, with a 75-foot separation, the maximum range is decreased and limited to a maximum of 100 feet of water. A second coaxial interconnecting cable is required to compensate for thermal changes in the capacitance of the probe cable. See Figure 3 for proper coaxial cable connections.

Electrical Wiring

All wiring, fusing, and hookup must be done in exact accordance with the 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. The Model 173 contains reverse polarity protection.

III. OPERATING THE MODEL 173

The Internal display and pushbuttons can be used to set up the 173 electronics module, but it is generally easier to set up the device using a HART communicator.

The Type 173 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 30°F and 125°F (0 to 50°C). Beyond this temperature range, the transmitter will operate properly but the display may be difficult to read.

PUSHBUTTONS PURPOSE

SAVE	Pressing the SAVE button saves all calibration values. The display will indicate “Saving” to verify that the values are being saved.
DECREASE	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.
INCREASE	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.
NEXT	Pressing this button shifts the display to the next setup parameter.

SETUP PARAMETERS

PV	Process Variable. Typically, this is the interface level or position on the probe, either as a length or as a percentage. It can also represent volume or other units derived from level. The units of measure are selected below.
Loop mA	The current in milliamperes being sent by the transmitter
Loop %	The current being sent by the transmitter as a percentage, where 0 % represents 4mA and 100% represents 20mA
Units	The units of measure being used for PV and the calibration points. This value can be length (in, ft, cm, mm), percent, or undefined. Undefined units would typically be selected for any other desired units (such as volume units) not mentioned above.
4 mA =	Lower Range Value - The interface level position corresponding to 4mA. The units of measure are selected in Units above.
20 mA =	Upper Range Value - The interface level position corresponding to 20mA. The units of measure are selected in Units above.
Num Pts	The number of calibration points to be used.
Point 1	Calibration point number one. The value for this and other Points below is in the units selected in Units above.
Point 2	Calibration point number two.
Point 3	Calibration point number three.
Point 4	Calibration point number four.
Point 5	Calibration point number five.
Point 6	Calibration point number six.
Point 7	Calibration point number seven.
Point 8	Calibration point number eight.
Point 9	Calibration point number nine.
Point 10	Calibration point number ten.

The following less common parameters can be accessed by pressing and holding the NEXT button while pressing and releasing the INCREASE button, then releasing the NEXT button.

SETUP PARAMETERS – Less Common

Version	Software revision number
Inpnt 1	This is the measured net capacitance at calibration point 1
Inpnt 2	This is the measured net capacitance at calibration point 2
Inpnt 3	This is the measured net capacitance at calibration point 3
Inpnt 4	This is the measured net capacitance at calibration point 4

Inpnt 5	This is the measured net capacitance at calibration point 5
Inpnt 6	This is the measured net capacitance at calibration point 6
Inpnt 7	This is the measured net capacitance at calibration point 7
Inpnt 8	This is the measured net capacitance at calibration point 8
Inpnt 9	This is the measured net capacitance at calibration point 9
Inpnt 10	This is the measured net capacitance at calibration point 10
RANGE	Selects the maximum input range of the instrument. 0 (default)=0-2000pF, 1=0-600pF, 2=0-200pF. 0 is usually the most appropriate setting for desalter applications, which usually have a probe capacitance greater than 1000pF.
DAMPING	The measurement time constant in seconds. Higher numbers provide more smoothing.
4mA TRIM	This value is used to trim the 4mA value.
20mA TRIM	This value is used to trim the 20mA value.
ALRM ACTN	Tells the unit how the loop current behaves when internal diagnostics find a fault. 0=drive high (above 22mA), 1=drive low (below 3.5mA), 2=hold last value, 3=ignore fault.
HART ADDR	This is the HART address used to respond to HART command 0.
LOOP CNTRL	Used to control the current loop behavior. 0=Loop current follows process variable, 1=Loop current fixed at 4.00mA (used for multidrop HART), 2=loop fixed; current can be manually set by adjusting the Loop mA parameter. Note that LOOP CNTRL=2 is used for testing only and reverts back to 0 on device reset or cycling power.
RAW	Probe, Comp, Ref1 and Ref2 raw values are used at the factory for diagnostic purposes.
Probe	Capacitance measured at the Probe terminal.
Comp	Capacitance measured at the Comp terminal.
Net	Net Capacitance (Probe-Comp). This value gets stored in the Inpt 1-10 values during calibration.
OFFSET CAL	When set to 0, changing a calibration point only affects that point – all others are unchanged. When this is set to 1, changing a calibration point shifts all active calibration points by the same amount. OFFSET CAL reverts to 0 after any calibration.
BOARD TEMP	Electronics module temperature in °C. This value is only used diagnostically to evaluate circuit accuracy.
MEM CMD	Factory use only.
Up Sns Lim	Maximum capacitance that can be measured by the circuit. Value depends on RANGE parameter setting.

IV. CALIBRATION

- Access a parameter by pressing the NEXT button until the desired parameter is displayed.
- Modify a selected parameter by pressing the INCREASE or DECREASE button until the desired value is displayed. Press SAVE to save changes.
- You can enter calibration points in any order. When you press SAVE, the instrument automatically sorts the calibration points in order of increasing level.
- Calibration points can be anywhere on the sensing probe, but for best results, should be as widely separated as possible. For typical interface position measurement, only two calibration points are needed. For more unusual needs, such as to account for nonlinearities due to tank geometry, you can enter up to 10 calibration points. Again, they should be as widely separated as possible.
- To remove a calibration point: Access the point. Press and Hold the DECREASE button and press the NEXT button. The display will indicate “DELETED”. Deleting a point will reduce the value of Num Pts by

one. Note that there must be at least two calibration points, so you can only delete a point if Num Pts is greater than 2.

- To remove all calibration points and reset the unit to factory default conditions, do the following: Press and Hold NEXT, press and release INCREASE, DECREASE, and SAVE in that order.

Calibration Procedure:

1. Press "NEXT" until the UNITS parameter is displayed. Press "INCREASE" or "DECREASE" to select the desired units of measure. Then Press "SAVE"
2. Press "NEXT" until the Num Pts parameter is displayed. Modify the parameter as desired for the number of calibration points you will be using. (Usually, the minimum value of 2 is set here.)
3. Press the "NEXT" button until calibration point #1 is shown on the display.
4. Press the "INCREASE" or "DECREASE" push button until the process value corresponding to the current interface position, appears on the display.
5. Press "SAVE" to hold this value in memory.
6. Change the level as much as practical. Generally, at least a 20% of full-scale change should be made. The more change made, the better the resulting calibrated accuracy will be.
7. Press the "NEXT" button until calibration point #2 is shown on the display.
8. Press the "INCREASE" or "DECREASE" pushbuttons until the percent of output signal value, corresponding to the current interface position, appears on the display.
9. Press "SAVE" to hold that value in memory.
10. Repeat steps 6-9 for up to 10 calibration points.
11. Calibration is now complete. Push "NEXT" until the Process Variable is displayed.

V. TROUBLESHOOTING:

Visually inspect the unit for mechanical defects such as broken wires, etc. Check to see that supply power is provided. There must be 11-35v at the loop terminals. If the display is blank, turn the 22-turn contrast trimmer above the display until the display is readable. If that does not work and power is ok, the module must be replaced. The unit performs a self-test on power up. If the unit says "Testing Bad" during this self-test, the unit must be replaced. If the unit passes the self-test, any remaining problems are probably in the probe (shorted probe, open probe wire), the Comp cable (shorted or open), or in the grounding of the unit (see proper grounding on the wiring diagram). If these items seem ok, try re-calibrating the unit.

Model 173 Basic specifications

Level range: Dependent on the probe selected, see Application Note # PROB-298 and probe data sheets.

Minimum Level Span: 10pF

Maximum Range: 2000 pF

"Zero" Suppression: to 1900pF

Output: 4-20 mADC, 2 wire, loop powered, isolated

Loop Supply Voltage Range: 14-35 VDC

Max Loop Impedance: 450 ohms @ 24V, 950 @ 35V

Ambient Operating Temperature: -20 to +175°F (+80°C)

Accuracy and Stability: Within 0.2% of full scale

Temperature Effect: 0.1 pF; typically less than 0.1" water;
0 to +150°F (-18 to 67 °C)