# 1. Description

Fig 1.

Intempco two-wire LTX03 level transmitters are designed to measure either liquid or certain dry bulk media. The 12-30 VDC 4 mA base current is the supply to the unit and provides power both for measurement and for the display. The LTX03 monitors level change by converting movement of media UP or DOWN the probe into a pulse wave form which is proportional to changes in level. The amplifier converts this pulse wave into 4 to 20 mA output signal. The conversion of level movement to an electrical signal is due to changes in electrical capacitance. The probe and a reference electrode, usually the metal tank wall, have a certain capacitance in air. As the medium displaces the air, a change occurs because of the difference in the dielectric constants of the medium and air.

The LTX03 comes complete with the transmitter mounted in an enclosure, display, fitting and probe (Fig. 1). Micro-processor based electronics are protected and potted within a metal housing. Calibration is made via four push buttons (Fig. 3) on the main board and three on the display as explained later. A variety of options including Stainless or PVC housings, rigid or flexible probes (bare or jacketed), NPT, sanitary or flange connections are available.

# 2. Installation

## *2.1 Unpacking*

Unpack the instrument carefully. Inspect all components for damage. Report any damage to Intempco within 24 hours. Check the contents of the packing slip and report any discrepencies to Intempco

## *2.2 Installation Location*

The Intempco LTX03 level sensor should be located for easy access for service, calibration and monitoring. Sensors should not be exposed to ambient temperatures below -40 °C (-40 °F) or above +70 °C (+160 °F). Special precaution should be made to prevent exposure to corrosive atmosphere, excessive vibration, shock or physical damage. It is preferable that the LTX03 is not installed in proximity to high voltage wires or other sources of high electrical noise.

## *2.3 Metal Walled Tanks*

It is a common practice to use the metal tank wall as the reference electrode. In such cases, it is required that the probe housing makes a good electrical connection to the tank wall. If there is any doubt about this connection due to the use of PTFE thread tape, gaskets, paint, rust, or any other reason, a separate grounding wire should be installed between the probe and the tank housing. In case the probe housing is non-metalic, or if the connection fitting is non-metalic, a grounding wire must be connected from the tank to the G terminal on the transmitter.

***Caution :***

***This unit contains CMOS electronics which may be damaged by static electricity. Electronics may be accessed by removing the top cover of the enclosure (head). Do not remove the transmitter face plate (and touch the electronics). There are no servicable parts.***

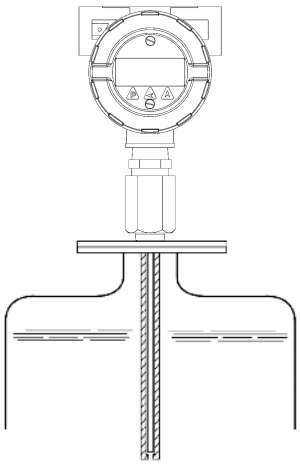


Fig 2.

## *2.4 Non-Conductive Tanks/Silos*

With plastic, concrete, wood, or any other non-conductive walled vessels a reference electrode must be inserted into a tank. Most commonly, this electrode will be in the form of a concentric, ground tube (i.e. stilling well, Fig. 2) or a metal rod installed in parallel with the probe. In all cases, a good electircal connection must be made between the reference electrode and the G terminal of the transmitter (or probe housing).

***Caution :***

***When installing units with teflon (or plastic) coated rods or cables, be careful not to damage the insulation. NPT threads have very sharp corners and teflon (or plastic) can be easily cut. In acidic and/or conductive liquids damaged units may malfunction and the metal rods can corrode.***

## 3. Wiring

All wiring between the power supply and the transmitter should be done with 18 AWG to 22 AWG shielded twisted pair. The connection is made at the terminal strip within the transmitter enclosure.

### 3.1 Head Disassembly

1. Remove the face plate of the display by turning it counter clockwise until it separates from the main head case. See page 7 step 1.

2. Two screws will be visible on the face plate of the display located at the 12 and 6 o'clock positions. Unscrew both until the display may be removed from the head case. Page 7 step 2. Be careful when removing the display as it will still be attached to the transmitter by one wire. Page 7 step 3.

***Caution :***

***Units are designed to operate on the 12 to 30 VDC power only. Application of 110 VAC will destroy the instrument.***

### 3.2 Connection

1. Make sure the power source is turned off.

2. Pull power supply wires through conduit connection.

3. Connect the positive supply wire to the (+) terminal on the transmitter located within the head. Connect the negative supply to the (-) terminal on the rear of the display that was just removed. There should be a preinstalled wire between the negative of the transmitter and the positive of the display.

4. Re-assemble the head by placing the display back into the head with the screws lined up properly with the screw holes and screwing the two screws carefully into place. Then screw the face plate back onto the head.

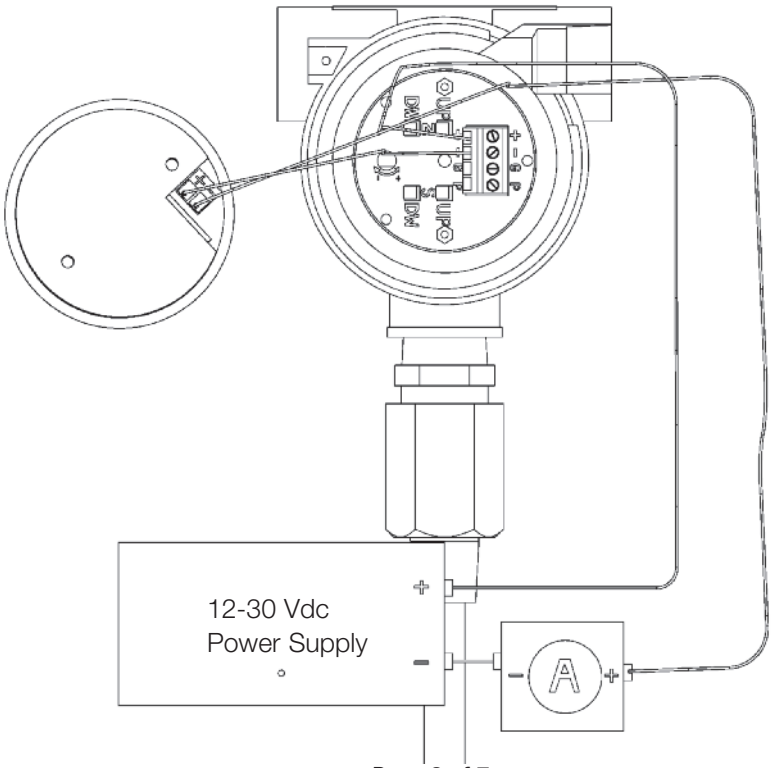
***Note :***

***Leave shield unattached at transmitter. Connect the shield to ground at the power source.***

5. Connect the loop current meter in series with the negative supply wire as follows :

   a. Negative transmitter wire to positive meter terminal. See Fig. 3.

Fig. 3



b. Negative meter terminal to negative power source terminal. See Fig.3.

6. Turn ON the power. The meter may read anywhere on the scale at either end. This is normal until calibration has been completed. Proceed to the calibration instructions.

## 4. Calibration

***Note: read entire calibration procedure before continuing. Procedure 4.2.X can be done in parallel with 4.1.X***

### *4.1.1 Current Meter*

In order to calibrate the transmitter, you must use the loop current meter. It should read currents in the range of 1.00 to 25.00 mA, with a resolution of .01 mA. Using a meter of less resolution will somewhat reduce the calibration accuracy. To calibrate the instrument :

1. Remove enclosure (head) cover.
2. Connect the loop current meter as per instructions in WIRING section (Fig. 3).
3. The loop current should now be in the range of 1.5 mA to 25 mA, which is normal at this point.

### *4.1.2 Two Point Calibration - Level Increase*

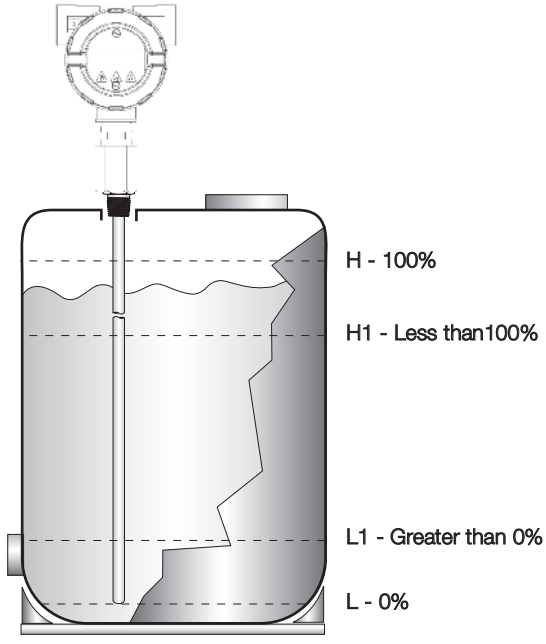



Fig. 4

Three calibration procedures are described. Follow the one which fits your application. Note the following definitions used in the calibration procedures, referring to Fig 4.

***L*** = the level of material which corresponds to 4.00 mA of loop current, i.e., the 0 %
***L1*** = a material level higher than ***L***
***H1*** = a material level higher than ***L1*** but less than ***H***
***H*** = the level of material in the vessel which corresponds to 20.00 mA of loop current, i.e., the 100 % level.

***Note :***

***To avoid the possibility of a "dead zone", L must be at least two (2) inches above the end of the probe for conductive media and four (4) inches above for non-conductive media.***

***Calibration L-H*** = when material in tank can be set to L (0 %) and H (100 %).

***Calibration L-H1*** = when material in tank can be set to L (0%) and H1 (less than 100 %).

***Calibration L1-H1*** = when material in tank can be set to L1 (greater than 0 %) and H1 (less than 100 %).

***Note :***

***Calibration procedure L-H gives the most accurate results and is the recommended procedure in all cases.***

### *4.1.3 Reset and Offset Functions*

There may seem to be a malfunction with the transmitter when the 4-20 mA power loop is activated for the first time. The mA reading may be below 4 mA or above 20 mA and pressing the Z and S push buttons does not change the output. If this occurs, transmitter must be re-initialized by performing the OFFSET and RESET functions as per instructions below. OFFSET and RESET functions (or values ) are factory set.

***Note :***

***Push buttons may have to be depressed for up to a minute before the value changes.***

Perform the OFFSET function first.

To re-OFFSET the transmitter, lower the level in the tank to below the probe. Press Z-UP and S-UP push buttons at the same time, then release in 1 or 2 seconds. The transmitter will now show a default value close to 4 mA.

In very rare cases, a problem of calibration still may persist. This is because the values of the minimum and maximum are not properly distributed. The RESET function may have to be perfomed. To RESET the transmitter, simply press Z-DW and S-DW push buttons at the same time, then release the two push buttons after 1or 2 seconds. Then re-OFFSET the transmitter by pressing Z-UP and S-UP push buttons at the same time. The transmitter will now show a default value close to 4 mA.

***Note :***

***When you RESET the transmitter, always perform the OFFSET after the RESET function.***

### *4.1.4 Damping Adjust*

This feature, primarily designed for agitated tanks and factory set at 0 sec. (max. CW, neg. direction) via a single turn pot, sets a time delay on the output signal. The time delay range is 0-10 sec. approx. For non-agitated tanks a zero setting is fine. Increase the setting for agitated tanks by turning the pot CCW.

The Damping adjust can also be used as an output filter. In certain applications, such as poorly grounded tanks in electrically noisy enviroments and/or tanks containing a low dialectric (non-conductive /oil based media), the 4-20mA output, may oscillate. Increase the DAMP ADJ by turning the pot in + dir. (CCW), and observe the output. It should stabilize. When adjusting Z or S UP & DW push buttons, turn the DAMP ADJ pot back to minimum condition.

### *4.1.5 Calibration Procedure L-H*

***THE ZERO, TANK IN L (LOW) STATE, MUST ALWAYS BE CALIBRATED FIRST.***

Turn the DAMP ADJ pot to max CW (neg.) direction.

1. Fill the tank to its L (0%) level (with probe covered).
2. Depress UP or DW buttons on Z until meter reads 4.00 mA. Do not change the zero controls from now on. If changed, the material will have to be returned to the L (0%) level.

***Note :***

***If a 4.00 mA value cannot be reached, then perform OFFSET AND RESET functions***

3. Fill the tank to the desired H (100 %) level.

***Note :***

***The loop current may not rise in proportion to the rising material level in tank. Instead it may rise more rapidly or more slowly than the material level. The span, S, UP or DW buttons may be used occasionally to maintain the loop current approximatelly proportional to the tank filling or just below the 20.00 mA reading.***

4. After the tank has been filled to H (100%), depress SPAN UP or DW buttons as required to obtain a meter reading of 20.00 mA. If 20.00 mA reading has been obtained, the calibration is complete.

### *4.1.6 Calibration Procedure L-H1*

***THE ZERO, TANK IN L (LOW) STATE, MUST ALWAYS BE CALIBRATED FIRST***

Turn the DAMP ADJ pot to max CW (neg.) direction.

1. Fill the tank to its L (0%) level (with probe covered).
2. Depress UP or DW buttons on Z until meter reads 4.00 mA. Do not change the zero controls from now on. If changed, the material will have to be returned to the L (0%) level.

***Note :***

***If a 4.00 mA value cannot be reached, then perform OFFSET AND RESET functions***

3. Fill the tank to the highest point possible (under 100%), and record this level as H1. The most accurate calibration will be obtained with the greatest separation between L and H1.

***Note :***

***The loop current may not rise in proportion to the rising material level in tank. Instead it may rise more rapidly or more slowly than the material level. The SPAN, S- UP or S-DW buttons may be used occasionally to maintain the loop current approximatelly proportional to the tank filling or just below the 20.00 mA reading.***

4. To determine the loop current at H1 level use the following formula :

$$mA = \frac{(H1 - L)}{(H - L)} \times 16 + 4$$

***Example :***

***L*** = 12" (30.5 cm) from the bottom of the tank
***H1*** = 72" (183 cm) from the bottom of the tank
***H*** = 96" (244 cm) from the bottom of the tank

$$mA = \frac{(72 - 12)}{(96 - 12)} \times 16 + 4 = 15.43$$

The correct loop current is 15.43 mA.

Depress SPAN S-UP or S-DW buttons as required to obtain a meter reading of 15.43 mA. If 15.43 mA reading has been obtained, the calibration is complete.

### *4.1.7 Calibration Procedure L1-H1*

***THE ZERO, TANK IN L (LOW) STATE, MUST ALWAYS BE CALIBRATED FIRST***

Turn the DAMP ADJ pot to max CW (neg.) direction.

1. Fill the tank to its L1, some point above 0 % level and record this level as L1. See Fig. 4. To determine the loop current at L1 level use the following formula :

$$mA = \frac{(L1 - L)}{(H - L)} \times 16 + 4$$

***Example :***

***L*** = 12" (30.5 cm) from the bottom of the tank
***L1*** = 24" (61 cm) from the bottom of the tank
***H*** = 96" (244 cm) from the bottom of the tank

$$mA = \frac{(24 - 12)}{(96 - 12)} \times 16 + 4 = 6.28$$

The correct loop current is 6.28 mA..

2. Depress Z-UP or Z-DW buttons on ZERO until meter reads 6.28 mA. Do not change the ZERO controls from now on. If changed, the material will have to be returned to the L (0 %) level.

***Note :***

***If a 6.28 mA value cannot be reached, then perform OFFSET AND RESET functions.***

3. Fill the tank to the highest point possible (under 100 %), and record this level as H1. The most accurate calibration will be obtained with the greatest separation between L1 and H1.

***Note :***

***The loop current may not rise in proportion to the rising material level in the tank. Instead it may rise more rapidly or more slowly than the material level. The SPAN, S-UP or S-DW buttons may be used occasionally to maintain the loop current approximatelly proportional to the tank filling or just below the 20.00 mA reading.***

4. To determine the loop current at H1 level use the following formula :

$$mA = \frac{(H1 - L)}{(H - L)} \times 16 + 4$$

***Example :***

***L*** = 12" (30 cm) from the bottom of the tank
***H1*** = 72" (183 cm) from the bottom of the tank
***H*** = 96" (244 cm) from the bottom of the tank

$$mA = \frac{(72 - 12)}{(96 - 12)} \times 16 + 4 = 15.43$$

The correct loop current is 15.43 mA.

Depress SPAN S-UP or S-DW buttons as required to obtain a meter reading of 15.43 mA. If 15.43 mA reading has been obtained, the calibration is complete.

### *4.2.1 Calibration Procedure - Display*

### ** Note - this procedure can be done in parallel with procedures 4.1.X*

1. Apply power to the unit. It should go through a self diagnostic and then display the current reading of the input signal.

2. Ensure that the tank level is at its lowest point possible.

3. Pressing P once should put the readout into the Low (Zero) calibration setting. It will flash

+LLLL

and then display the current value.

Initially the least significant bit will be flashing. This indicates that this is the bit being controlled by the Up arrow. The value can be incremented by pressing the up arrow. Each digit can be individually changed by going from one to the other using the left arrow and then using the up arrow to obtain the desired number.

4. Pressing P again will save the low setting and put the display into the High (span) calibration setting.

The display will momentarily show

+HHHH

and then display the current value.

5. Ensure that the tank is filled to its highest possible point.

6. The left arrow will allow the appropriate digits to be selected and the up arrow will change the value of the selected digit. Minor corrections in non-linearity can be corrected using the ten turn pot on the rear of the instrument. Only use this adjustment for span, not zero adjustments.

7. Pressing P again will save the span setting and place the display into the decimal selection mode.

The display will momentarily display

+PPPP

and then return to displaying the current readout value.

8. Press the left arrow to move the decimal location to its appropriate place.

9. Press the P button to complete the calibration process.

## Electrical Specifications

*Transmitter*

| | |
|---|---|
| **Supply Voltage :** | 12 VDC - 30 VDC |
| **Output :** | 4-20 mA, loop powered |
| **Maximum Loop Res.:** | [Vs - 10] / 0.02 (i.e. 700 Ω @ 24 VDC) |
| **Calibration :** | Via 4 push-button switches non-interactive settings |
| **Capacitance Range :** | 10 pF to 10000 pF |
| **Accuracy :** | ±1% of full span (constant dielectric) |
| **Repeatability :** | ±0.1 % of span |
| **Damping Adjust :** | 0-30 sec. |
| **Ambient Temperature :** | -40 to 70°C (-40 to 158°F) |

*LCD Display*

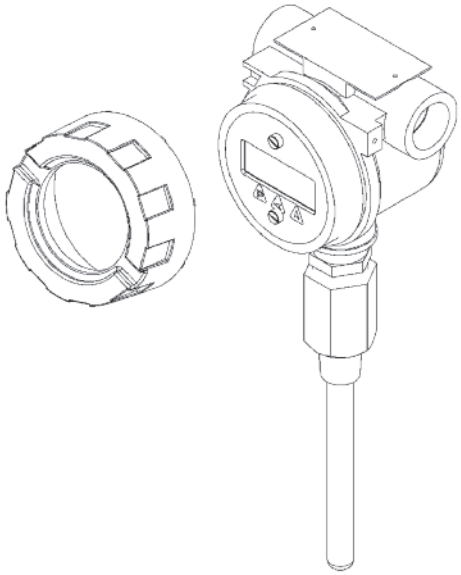
| | |
|---|---|
| **Indication Accuracy :** | ±0.1% of calibrated range, ±1 digit |
| **Stability Over Time :** | ±0.1% of calibrated range ±1 digit over 6 months |
| **Calibration :** | Via 3 push-button membrane switches |
| **Dispaly Height :** | 0.30" (7.6mm) |
| **Over Indication :** | Indication of "1" on display |
| **Response Time :** | 75 ms |
| **Failure Mode :** | Failure will not affect the loop integrity |
| **Voltage Drop :** | 5.5 VDC at 20mA |

## Mechanical Specifications

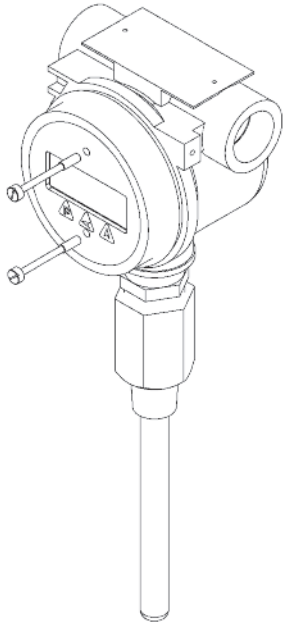
| | |
|---|---|
| **Enclosures** | **XD3** : Class I, Div 1 Gps. B,C & D, Class II, III Div 1 Gps. E,F & G, NEMA TYPE 4X (IP68) |
| **Mounting Thread :** | 3/4" NPT standard, others available |
| **Process Temperature:** | 200 °C max (392 °F)-consult factory for higher temperatures |
| **Pressure Limits:** *(PH Model only)* | 500 psi (34 bar) @ 25 °C (77 °F)<br>250 psi (17 bar) @ 150 °C (302 °F)<br>14.5 psi (1 bar) @ 200 °C (392 °F) |
| **Probe Mat'l :** | PFA Teflon jacketed, or bare SS316 |

*Head Disassembly Procedure*

Step 1



Step 2



Step 3