



LTX

RF LEVEL SENSOR

Instruction Manual

FOR MODELS

LTX01, LTX02, LTX05

Intempco	LTX01 RF LEVEL SENSOR USER MANUAL	Document No: LTX - M01 Rev. 1	Issue Date: April 2005
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TABLE OF CONTENTS

1.0 PRODUCT OVERVIEW

- 1.1 Product Features
- 1.2 Description
- 1.3 Specifications
 - 1.3.1 Electrical Specifications
 - 1.3.2 Mechanical Specifications

2.0 INSTALLATION

- 2.1 Probes
- 2.2 Probe Installation
- 2.3 Electrical Installation
 - 2.3.1 Head Mounted Transmitter Connections
 - 2.3.2 DIN RAIL Remote Transmitter Connections

3.0 CALIBRATION

- 3.1 Current Meter
- 3.2 Reset and Offset functions
- 3.3 Damping Adjust
- 3.4 Two Point Calibration
 - 3.4.1 Calibration L-H
 - 3.4.2 Calibration L-H1
 - 3.4.3 Calibration L1-H1
- 3.5 How to transfer calibration parameters

1.0 PRODUCT OVERVIEW

1.1 Product Features

- Heavy duty industrial design for metallic level tanks
- Can be used in all other tanks, metallic or non-metallic, with conductive or non-conductive liquids, by use of a concentric pipe
- Continuous loop powered 4-20mA operation
- Installed Hockey-puck or Remote DIN Rail mounted transmitters available
- Standard $\frac{3}{4}$ " NPT thread connection, others available
- Available with non-metallic, stainless or aluminum explosion proof heads
- Teflon PFA clad or bare Stainless 316 probe
- Accuracy 1% of span for same dielectric

1.2 Description

The INTEMPCO series LTX RF Remote Level Sensors are of compact heavy-duty design with connection head and installed electronics. Two types of electronics are available. Head-mounted hockey-puck type microprocessor based 4-20 mA output transmitter is standard. Also available is head-mounted remote module with DIN Rail transmitter, which can be installed up to 1000 feet away from the process, where the calibration can be performed. LTX RF Remote Level Sensors comprise of enclosure with installed or remote electronics, compression fitting and PFA clad or bare stainless probe. The microprocessor-based electronics convert frequency change, detected by the probe, into a linear, highly accurate 4-20mA signal. This compact design makes installation and setup a simple task. The advanced signal conditioning circuitry greatly minimizes the adverse affects of poor dielectric and material coating on the probe.

LTX-1 RF level transmitters can be used in metallic and non-metallic tanks (with concentric pipe), stationary or mobile equipment. Ideal for compact tanks of all types, they can be used in virtually any liquid, conductive or non-conductive. Compact and rugged, LTX Series sensors cannot be beat in performance. Some level applications include: fuel and oil tanks in mobile equipment and tanks, water based liquids in most tanks, acids compatible with Stainless 316 and PFA Teflon, MEK and other solvents, chemical holding tanks.

1.3 Specifications

1.3.1 Electrical Specifications

Supply Voltage:	12VDC – 36 VDC
Output:	4-20mA, loop powered
Max. Loop Res.:	(Vs-10)/0.02 (i.e. 700 Ω at 24VDC)
Calibration:	Via 4 push-button switches non-interactive Zero & Span
Accuracy:	$\pm 1\%$ of full span (Constant dielectric)
Repeatability:	$\pm 1\%$ of span
Damping adjust:	0-30 sec

1.3.2 Mechanical Specifications

Enclosure:	Alum. Ex. Proof and Stainless (all NEMA 4), PVC
Mounting Thread:	3/4" NPT standard. other available
Processes Temperature:	200°C max (392°F)-PFA probe 200°C + Stainless 316 probe
Pressure Limits:	100 psi (7 bar) @ 25°C (75°F) 50 psi (3.5 bar) @ 150°C (300°F) 14.5 psi (1 bar) @ 200°C (392°F)
Probe Material:	PFA Teflon jacketed or bare SS316
Ambient Temperature:	-40 to 70°C (-40 to 158°C)

2.0 INSTALLATION

Note: Unpack the instrument carefully. Inspect all components for damage. If any damage is found, please notify a INTEMPCO representative as soon as possible prior to installation.

The INTEMPCO series LTX RF level sensor should be located for easy access for service and monitoring. Sensor installed transmitter or remote electronics and DIN rail should not be exposed to temperature below -40°C (-40°F) or above 70°C (158°F). This is very important when process temperatures are high and heat can conducted up to the enclosure and to the remote electronics. Special precaution should be made to prevent exposure to corrosive atmospheres, excessive vibration, shock or physical damage. It is preferable that the LTX is not installed in proximity to high voltage wires or other sources of high electrical noise.

2.1 Probes

For conductive liquids, such as water and acids PFA Teflon coated probes are always used. For non-conductive liquids, such as oils, diesel fuel and MEK solvents PFA Teflon coated probes can also be used. Bare stainless probes are used for high temperature applications. The probe length is customer specified for the height of material desired to be measured.

2.2 Probe Installation

Standard probe entry in to a tank is via a 3/4" NPT opening. Other fitting sizes are available as options.

TO SCREW IN PROBE (THREADED ENTRY) USE WRENCH ON LOWER HEX ONLY. DO NOT USE A PIPE WRENCH. Use pipe sealent as required.

LTX installation considerations depend on the type of application. The following are the main points to consider while installing the probe.

(a) **Reference ground:** This is VERY IMPORTANT and is typically the metal walls of the tank. For non-metallic tanks, a concentrically shielded probe is required in which case the shield provides its own ground. IMPORTANT: For standard threaded entry and flange entry probes (without concentric shield), make sure the fittings are clean to ensure (by use of OHM meter) a GOOD ELECTRICAL CONNECTION BETWEEN THE PROBE HEAD ENCLOSURE AND THE TANK (reference GND on the remote transmitter, GREEN WIRE).

(b) **The distance between the probe and the ground reference:** This only applies to standard probes without concentric shields. The closer the distance to the tank wall, the greater the sensitivity of measurement.

(c) **Parallelism between the probe and the reference ground:** This only applies to standard probes without concentric shields. The probe should be installed parallel to the tank wall to insure a linear output.

(d) **Location:** Avoid installing LTX type probes in nozzles or recesses where material can accumulate and give false readings.

(e) **The measurement accuracy:** The accuracy is affected by the temperature change of the material in the tank. The percentage of error is depends on the material used in the tank. If the temperature change is excessive, temperature correction will be required. Contact INTEMPCO representative for more information.

(f) **Mobile objects in the tank:** Moving objects in the tank close to the non-shielded probe such as agitator blades, moving baffles etc. appear as moving ground references to a capacitance probe and could cause measurement errors. In applications where these objects are present, a concentrically shielded probe, must be used.

2.3 Electrical Installation

2.3.1 Head Mounted Transmitter Connections (Refer Figure 1.)

Note: All wiring between the power supply and the head mounted hockey-puck transmitter should be done with 18 AWG to 22 AWG wiring. A shielded twisted pair cable may be used.

CAUTION: Units are designed to operate on 12 to 36 VDC power only. Application of 110 VAC will destroy the instrument.

1. Make sure the power source is turned **OFF**
2. Remove the head cover and pull supply wires through the conduit connection.
3. Verify that the positive side of the probe (Blue wire) is connected to the "P" terminal of the transmitter and that the probe reference ground (Green Wire) is connected to the "G" terminal of the transmitter.
4. Replace the transmitter enclosure (head) cover until time to calibrate.
5. Connect the positive side of the loop to the "+" terminal of the transmitter.
6. Connect the loop current meter in series with the negative supply wire as follows:
 - a) Negative "-" transmitter wire to the positive meter terminal.
 - b) Negative "-" meter terminal to negative "-" power source terminal.
7. 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.

Note: Leave the shield unattached at the transmitter and the power supply. If the output signal is noisy connect the shield to ground of the power source.

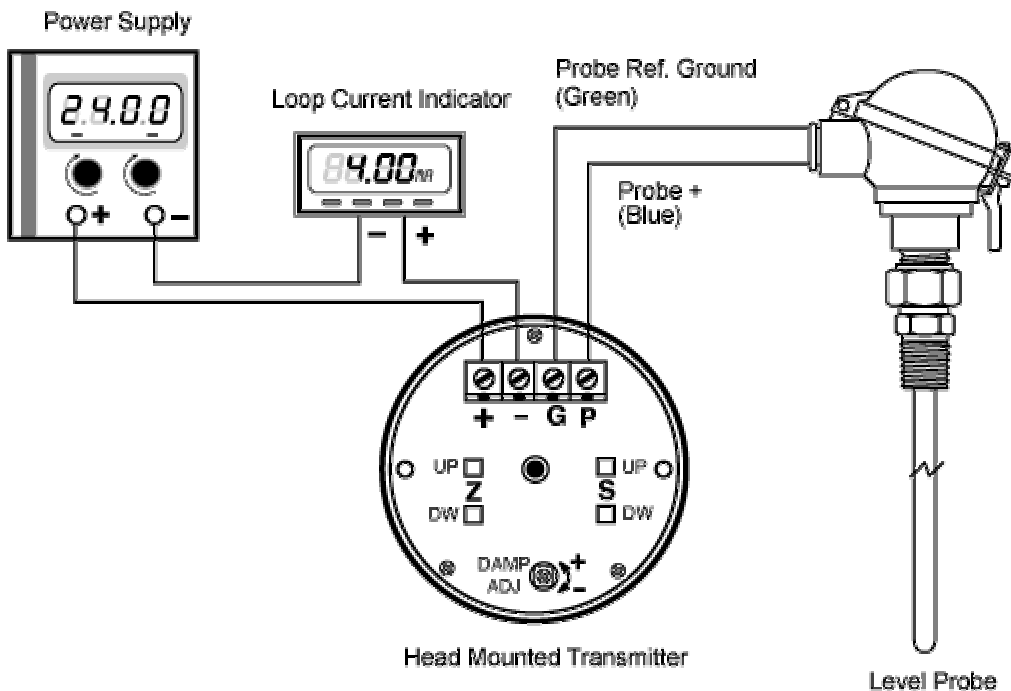


Figure 1. Head Mounted Transmitter

2.3.2 DIN RAIL Remote Transmitter Connections (Refer Figure 2.)

Note: All wiring between the power supply and the DIN rail transmitter should be done with 18 AWG to 22 AWG wiring. A shielded twisted pair cable may be used. Between DIN RAIL transmitter and the remote electronic module installed in the head, use a shielded twisted cable with 3 or 4 conductors, 18AWG to 22 AWG. Cable runs of up to 300 M (1000 ft) are permitted.

CAUTION: Units are designed to operate on 12 to 36 VDC power only. Application of 110 VAC will destroy the instrument.

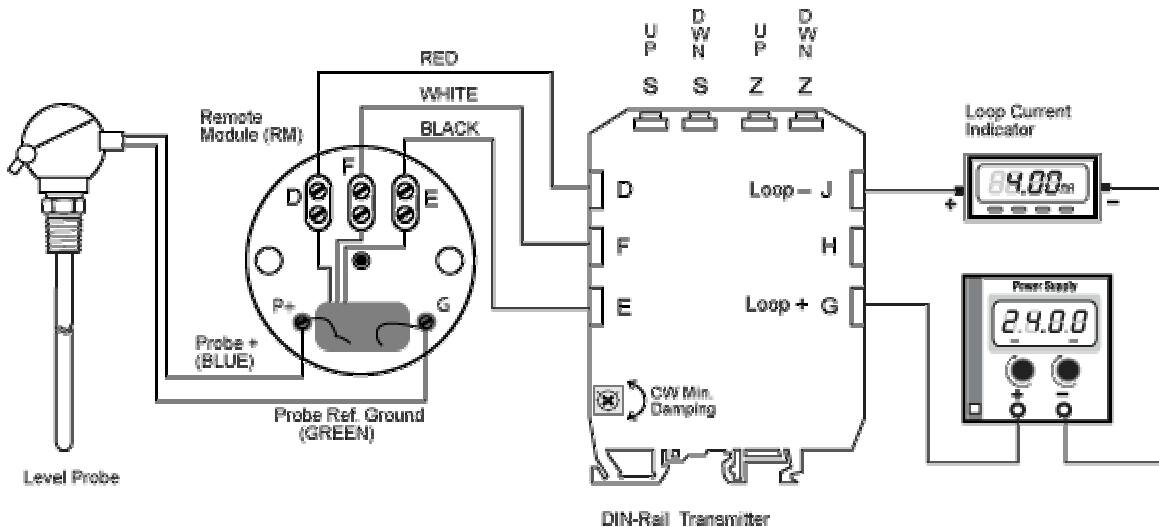


Figure 2. DIN-RAIL Transmitter with Head-Mounted Remote Module

The **Remote Module (RM)** is normally installed inside the enclosure or head of the LTX level sensor. The “Blue Wire” (Probe +) and “Green Wire” (Probe Ref. Ground) are factory connected. Verify that they are connected and do not connect any other wires to these two terminals.

1. Make sure the power source is turned OFF.
2. Connect the “D ” terminal of RM (Red Wire, power Vr) to the terminal “D ” of the DIN-RAIL Transmitter.
3. Connect the “E ” terminal of RM (Black Wire, ground Gr) to the terminal “E ” of the DIN-RAIL Transmitter.
4. Connect the “F ” terminal of RM (White Wire, signal S) to the terminal “F ” of the DIN-RAIL Transmitter.
5. Connect the “G ” terminal (“+ ” loop) of the DIN RAIL to the positive side of the power supply.
6. Connect the “J ” terminal (“- ” loop) of the DIN RAIL to the positive side of the meter.
7. Connect the negative of the power supply to the negative of the meter.

Note: Leave the shield unattached at the transmitter and the power supply. If the output signal is noisy connect the shield to ground of the power source.

3.0 CALIBRATION

Install the LTX RF Level Sensor as per installation instructions in section 2.0. In order to perform the calibration it is very important to be able to vary the level in the tank (empty or fill). If this cannot be done, proper calibration is not possible.

Decrease the level in the tank until only about 1 to 2 inches of the probe are covered or to the minimum level possible.

3.1 Current Meter

In order to calibrate the transmitter, you must use the loop current meter (as shown in Figure 1 or 2). It should read in the range of 1.00 to 25.00 mA, with a resolution of 0.01mA. Using a current meter with less resolution will somewhat reduce the calibration accuracy. To calibrate the instrument:

1. Remove cover of the enclosure head (in case of Head Mounted version).
2. Connect the loop current meter as per instructions in wiring section meter (as shown in Figure 1 or 2).
3. Turn the power ON. The loop current should now be in the range of 1.5 mA to 38 mA, which is normal at this point.

If the tank is nearly empty or somewhat below the mid-level and the output reads between 1.5 to 12 mA, press Z UP or Z DW push buttons. If the output varies accordingly, the Reset and Offset functions, as in section 3.2, needs not be performed. If pressing Z UP and Z DW push buttons does not vary the output, go to section 3.2.

3.2 Reset and Offset functions

OFFSET and **RESET** functions (or values) are factory set. They may have to be changed by the customer in special cases only. Follow the procedure below.

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.

Note : Push button may have to be depressed for up to a minute before the value may change.

The **OFFSET** function may have to be performed. To re-OFFSET the transmitter, lower the level in the tank to below the probe (material is not in contact with the probe, this is very important). Press Z UP and S UP push buttons at the same time, then release in 2 to 3 seconds. The transmitter should not show a default value close to 4 mA.

In very rare cases, a problem still may persist. This is because the values of the minimum and maximum are not properly distributed. The **RESET** function may have to be performed. To **RESET** the transmitter, simply press Z DW and S DW push buttons at the same time, then release the two push buttons after 2 to 3 seconds. Then re-OFFSET the transmitter as per instructions above. The transmitter should now show a default value close to 4 mA.

Important Notes:

- (a) The OFFSET function has to be performed with the tank empty.
- (b) If a RESET function is to be performed by the customer, then the factory OFFSET value is automatically cancelled. So, the OFFSET function should always be applied after a RESET function.

3.3 Damping Adjust

This feature, primarily designed for agitated tanks is factory set at 0 sec. (max. CW, neg. direction) via a single turn pot. This 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. For agitated tanks, increase the time delay setting 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 environments and/or tanks containing a low dielectric (non-conductive /oil based media), the 4-20mA output, may oscillate. In that case, increase the DAMP ADJ by turning the pot in CCW direction, and observe the output; it should stabilize.

NOTE: The DAMP ADJ pot must be turned back to minimum time delay, max. CW (neg.) direction, when performing the calibration (by pressing Z or S buttons).

3.4 Two Point Calibration – Level Increase

Three calibration procedures are described here. Follow the one, which best suits your application. Note the following definitions used in the calibration procedures, referring to Figure 3.

- 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 one inch above the end of the probe for conductive media and two inches above for non-conductive media.

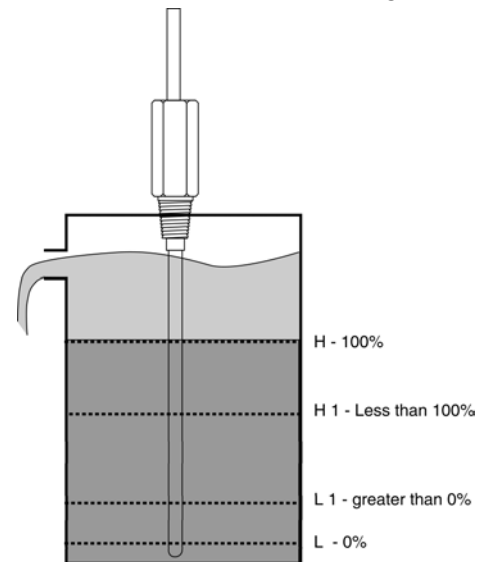


Figure 3.

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

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

3.4.3 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.

The following are the important points for all calibration procedures:

- (a) Set the “Damping” to the minimum value, CW direction.
- (b) If there is no change in output when performing “Zero” adjustment first, perform a “Reset” and “Offset”, with the tank empty or at L (Figure 3.) level, before starting calibration.
- (c) Perform the “Zero” adjustment first.
- (d) During the first calibration, even if the “Zero” value is correct always press Z-UP or Z-DWN at least one or two times and re-adjust to the correct value. That will allow the transmitter to record that value as its “Zero ” reference for the non-interactive calibration feature.
- (e) Never press Z-UP or Z-DWN push buttons when the tank is full or more than 50% full. That will cause the transmitter to record that value as its “Zero” reference and will affect the calibration.
- (f) When calibration is finished, be sure there is nothing that can interfere physically with the calibration push buttons.
- (g) When calibration is completed, avoid moving or touching the probe wire (Blue). That may cause an offset on the output reading.
- (h) After the first calibration, if a small re-adjustment is necessary, use Z-UP or Z-DWN if the tank is at less then 50% full and S-UP or S-DWN if higher than 50% full.
- (i) When calibration is completed, apply silicone over all the connectors to prevent corrosion where applicable.

3.4.1 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 RESET and OFFSET functions as explained in section 3.2.

- 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 approximately 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.

Note: If a 20.00 mA value cannot be reached, then perform RESET and OFFSET functions as explained in section 3.2 and re-start the calibration.

3.4.2 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 RESET and OFFSET 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 approximately proportional to the tank filling or just below the 20.00mA reading.

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

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

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

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

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

Note: If a 15.43mA value cannot be reached, then perform RESET and OFFSET functions and re-start the calibration.

3.4.3 Calibration procedure L1-H1

THE ZERO, TANK IN L1 (LOW) STATE, MUST ALWAYS BE CALIBRATED FIRST.

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

1. Fill the tank to L1, some point above 0% level and record this level as L1 (Refer Figure 3.). 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 6.28mA.

2. Depress Z-UP or Z-DW buttons on ZERO until meter reads 6.28mA. 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 RESET and OFFSET 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 approximately proportional to the tank filling or just below the 20.00mA 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 15.43mA.

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

Note: If a 15.43 mA value cannot be reached, then perform RESET and OFFSET functions and re-start the calibration.