



# LP-1000 Pulse Point™ Installation & Operation Manual







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**SAFETY SYMBOLS**



**WARNING:**

**IDENTIFIES CONDITIONS OR PROCEDURES, WHICH IF NOT FOLLOWED, COULD RESULT IN SERIOUS INJURY.**



**CAUTION:**

**IDENTIFIES CONDITIONS OR PROCEDURES, WHICH IF NOT FOLLOWED, COULD RESULT IN SERIOUS DAMAGE OR FAILURE OF THE EQUIPMENT.**

# LP-1000 Pulse Point™



## I. HANDLING AND STORAGE

### SAVE THESE INSTRUCTIONS

#### INSPECTION AND HANDLING

Do not dispose of the carton or packing materials.

Each package should be inspected upon receipt for damage that may have occurred due to mishandling during shipping. If the unit is received damaged, notify the carrier or the factory for instructions. Failure to do so may void your warranty. If you have any problems or questions, consult the manufacturer Customer Support at 800-778-9242.

#### DISPOSAL AND RECYCLING

This product can be recycled by specialized companies and must not be disposed of in a municipal collection site. If you do not have the means to dispose of properly, please contact the manufacturer for return and disposal instructions or options.

#### STORAGE

If the Pulse Point™ is not scheduled for immediate installation following delivery, the following steps should be observed:

1. Following inspection, repackage the unit into its original packaging.
2. Select a clean dry site, free of vibration, shock and impact hazards.
3. If storage will be extended longer than 30 days, the unit must be stored at temperatures between -40 and 70°C in non-condensing atmosphere with humidity less than 85%.



**CAUTION: DO NOT STORE A NON-POWERED UNIT OUTDOORS FOR A PROLONGED PERIOD.**

## II. GENERAL SAFETY

### AUTHORIZED PERSONNEL

All instructions described in the document must be performed by authorized and qualified service personnel only. Before installing the unit, please read these instructions and familiarize yourself with the requirements and functions of the device. The required personal protective equipment must always be worn when servicing this device.

### USE

The device is solely intended for use as described in this manual. Reliable operation is ensured only if the instrument is used according to the specifications described in this document. For safety and warranty reasons, use of accessory equipment not recommended by the manufacturer or modification of this device is explicitly forbidden. All servicing of this equipment must be performed by qualified service personnel only. This device should be mounted in locations where it will not be subject to tampering by unauthorized personnel.



**WARNING: VERY HIGH VOLTAGE IS PRESENT ON THE FORK TERMINALS.**

**ALWAYS REMOVE POWER BEFORE SERVICING.**

### MISUSE

Improper use or installation of this device may cause the following:

- Personal injury or harm
- Application specific hazards such as vessel overfill
- Damage to the device or system

If any questions or problems arise during installation of this equipment, please contact the manufacturer Customer Support at 800-778-9242.

### III. PRODUCT DESCRIPTION

#### FUNCTION

The Pulse Point™ is an electronic, vibratory level control designed for use in powders and granular solids. The Pulse Point™ uses a vibrating “tuning fork” to sense the presence of material.

The tuning fork contains two piezoelectric crystal assemblies: one “transmit” and one “receive” Piezo crystals convert electrical signals to mechanical movement, and vice versa. High-voltage pulses applied to the transmit crystal cause the tines of the fork vibrate. This vibration is mechanically coupled to the receive crystal which produces a small electrical signal (one-volt pulses). The receive crystal will produce low voltage pulses as long as the fork is vibrating.

If the fork stops vibrating, as it does when in contact with material in the vessel, the receive pulses stop. The electronics recognize this loss of signal and cause the main relay to change state.

#### APPLICATIONS

Unlike radio frequency and capacitance technology sensors, the Pulse Point™ senses material using a mechanical principle and is therefore not affected by the dielectric constant of the material. This makes it an ideal sensor in plastics, dust, shavings, and low-density powders and food. The Pulse Point™ can easily sense material as light as 0.5 lbs/ft<sup>3</sup> (8 kg/m<sup>3</sup>). It can be applied in any free flowing dry material up to 3/8” (9.525 mm) in particle size.

## FEATURES

- Multiple mounting configurations, forks, and coatings available to suit almost any application
- Universal input power; AC or DC (see specifications for input ranges)
- No calibration required
- Adjustable time delay
- Selectable fail-safe operation (high or low level)
- Adjustable Sensitivity

## TECHNICAL SPECIFICATIONS

FUNCTIONAL	
Power Requirements	Universal, (+/- 10%) 100-240 VAC 50/60 Hz or 22-65 VDC
Power Consumption	10 W AC; 3 W DC
Fuse	Slow Blow, 2A 300V (Not User Serviceable)
Operating Temperature	
Electronics	-40° to 158° F (-40° to 70° C)
Tuning Fork	-55° to 302° F (-48° to 150° C)
Outputs	
Main Relay	8A DPDT @ 277 VAC or 30 VDC (resistive)
Tuning Fork	0.46 @ 150 VAC or 1A SPDT @ 30 VDC
PERFORMANCE	
Pressure Rating	150 psi (10.5 kg/cm <sup>2</sup> ) with 1 1/2" NPT; 5 psi (0.35 kg/cm <sup>2</sup> ) with mounting plate
Time Delay	Field Adjustable; 1-6 seconds
Fail Safe	Field Selectable high/low level
Sensitivity	Minimum 0.5 lbs/ft <sup>3</sup> (8 kg/m <sup>3</sup> ); Field Adjustable
Maximum Particle Size	3/8" (9.5 mm)
PHYSICAL	
Enclosure Material	Polyester or epoxy coated aluminum or 304 SS
Tuning Fork	316 SS (standard); 316 SS with Teflon <sup>®</sup> coating
Dual Conduit Entry	3/4" NPT
Process Connections	1 1/4" or 1 1/2" NPT; Extended forks can be mounted directly through 1 1/4" or 1 1/2" NPT half coupling
Mounting Plate Material	Mild Steel; 304 SS
Extended Pipe Material	Galvanized; 316 SS
Maximum Insertion Length	15 ft (4.6m)
Shipping Weight	Integral, non-extended 10 lb (4.5 kg)

## APPROVALS

CE:

Electromagnetic Compatibility Directive 2004/108/EC

Low Voltage Directive 2006/95/EC

Hazardous Location Approvals Pending:

UL (US and Canada)

ATEX

IEC and IECEX



## IV. MECHANICAL INSTALLATION



**WARNING: VERY HIGH VOLTAGE IS PRESENT ON THE FORK TERMINALS.**

**REMOVE POWER FROM THE UNIT BEFORE INSTALLING, REMOVING, OR MAKING ADJUSTMENTS**

### GUIDELINES

The following precautions should be observed when installing and operating the Pulse Point™:

- The installation and wiring of this product must comply with all national, federal, state, municipal and local codes that apply.
- The Pulse Point™ is a precision device - handle it carefully to prevent damage to the forks.
- Do not allow moisture to enter the electronics enclosure. Conduit should slope downward from the Pulse Point™ housing. Install drip loops (or drain fitting) and seal conduit with silicone rubber product.
- The resonant frequency of the forks is 85 Hz (+/-10%); locations subject to this vibration frequency should be avoided.
- The Pulse Point™ is available with 1¼" NPT or 1½" NPT mounting.



**CAUTION: WHETHER MOUNTING DIRECTLY THROUGH A SIDE WALL, OR PIPE EXTENDED AND MOUNTED VERTICALLY THROUGH THE TOP OF A VESSEL, NEVER ATTEMPT TO MOUNT THROUGH A FULL COUPLING.**



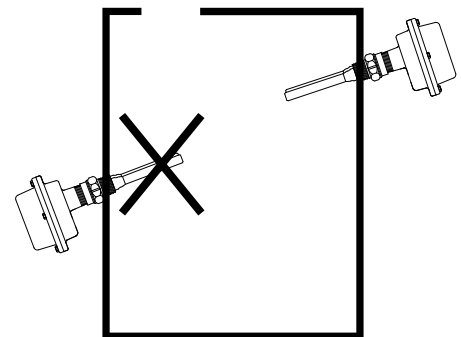
**CAUTION: ATTEMPTING TO TIGHTEN THE PULSE POINT™ BY ROTATING THE HOUSING OR FORKS MAY DAMAGE THE UNIT AND VOID THE WARRANTY.**

### MOUNTING CONSIDERATIONS

The Pulse Point™ must be located at the position where level indication is desired. The forks may be mounted through the top or side wall of the vessel. To ensure reliable operation, observe the following guidelines when choosing the mounting location.

- DO NOT mount the forks in an area where they can contact the vessel.
- The forks assembly must be horizontal or pointing downward. DO NOT mount the forks pointing upward.
- If the unit is to be used with powders, it should be installed vertically, or at a downward angle that exceeds the angle of repose to reduce material build-up on the forks.

**Figure 1: Mounting Orientation**





**CAUTION: THE MAXIMUM ALLOWABLE DOWNWARD FORCE ON THE FORKS IS 88 LBS (40 KG).**

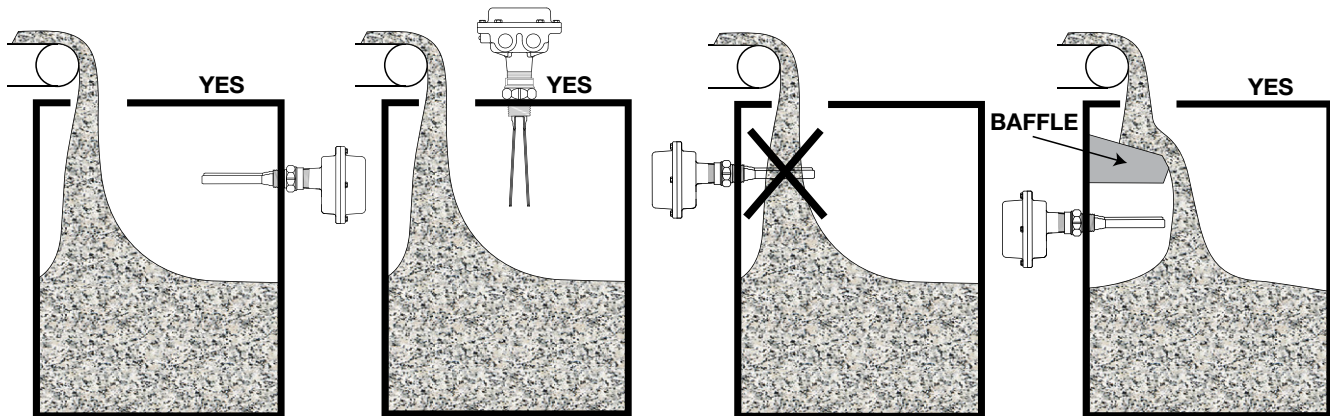
To calculate the maximum solids head height above a horizontally mounted fork, use the following equation:

$$\text{Maximum height of material (ft)} = 2200 / \text{bulk density (lbs/ft}^3\text{)}$$

Do not mount the fork directly in the flow of material. If necessary, use a baffle to protect the fork from falling material. The baffle should be placed 6 to 8 inches above the fork so that material will not become packed between the fork and the baffle.

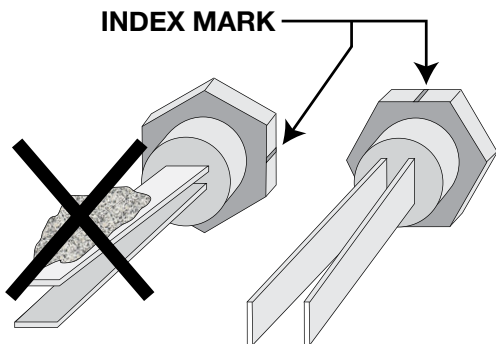
If using a remote unit, remote turtle cannot be mounted more than 100 feet away.

**Figure 2: Mounting In Relation To Flow of Material**



If the fork is mounted horizontally, it must be positioned so that the material will not accumulate on top of the tines. There is an index mark on the mounting nut to assist in proper positioning of the fork.

**Figure 3: Index Mark Positioning**



## V. ELECTRICAL INSTALLATION



**WARNING: VERY HIGH VOLTAGE IS PRESENT ON THE FORK TERMINALS.**

**REMOVE POWER FROM THE UNIT BEFORE INSTALLING, REMOVING, OR MAKING ADJUSTMENTS**

### GENERAL SAFETY

When using electrical equipment, you should always follow basic safety precautions, including the following:

- The installation and wiring of this product must comply with all national, federal, state, municipal, and local codes that apply.
- Properly ground the enclosure to an adequate earth ground.
- Do not modify any factory wiring. Connections should only be made to the terminals described in this section.
- All connections to the Pulse Point™ must use conductors with an insulation rating of 300V minimum, rated for 105C, a minimum flammability rating of VW-1, and be of appropriate gauge for the voltage and current required (see specifications).
- Do not allow moisture to enter the electronics enclosure. Conduit should slope downward from the Pulse Point™ housing. Install drip loops and seal conduit with silicone rubber product.



### DISCONNECT REQUIREMENTS FOR PERMANENTLY INSTALLED EQUIPMENT

A dedicated disconnecting device (circuit breaker) must be provided for the proper installation of the unit. If independent circuits are used for power input and main relay outputs, individual disconnects are required.

Disconnects must meet the following requirements:

- Located in close proximity to the device
- Easily accessible to the operator
- Appropriately marked as the disconnect for the device and associated circuit
- Sized appropriately to the requirements of the protected circuit (See specifications)

### PROTECTIVE EARTH GROUND

To eliminate shock hazards in the unlikely event of an internal insulation breakdown, the unit is provided with a “protective earth” (  ) lead which must be connected to earth ground. In addition, the input power ground lead must be connected to the “protective earth” (  ) terminal provided. Wire sizes must be selected such that it can safely carry the sum total of all circuits’ maximum amperage.

### CONDUIT CABLE CONNECTION

Two threaded 3/4” NPT female conduit openings are provided in the housing for input and output wiring. When only one conduit opening is used for installation, the unused opening must be sealed with a suitable type 4X / IP66 3/4”-14 NPT plug with pipe sealant in order to maintain approval requirements.

## ELECTRICAL CONNECTIONS

Note: The Pulse Point™ can be operated from 100-240 VAC 50/60 Hz or 22-65 VDC and provides reverse polarity protection in the event of a wiring error.

### PULSE POINT™ INTEGRAL MODEL ONLY

#### Input Power Connections

1. Refer to Figures 4 and 5 when connecting input power to the unit
2. Loosen the housing cover screws and remove cover



**CAUTION: IF THE UNIT WAS SUPPLIED WITH A GASKET AVOID FOLDING, CUTTING, OR TEARING GASKET. DAMAGING THE GASKET CAN ALLOW MOISTURE TO ENTER THE ENCLOSURE AND DAMAGE THE UNIT.**

Note: Two threaded  $\frac{3}{4}$ " NPT female conduit openings are provided in the housing to separate input and output wiring.

3. Pull approximately 4" of cable through conduit closest to the grounding bracket and strip as follows:
  - a. Ground –  $\frac{3}{8}$ " (9 to 10 mm)
  - b. Power Leads –  $\frac{1}{4}$ " (6 to 7 mm)
4. Attach incoming ground lead to grounding bracket as shown in Figure 5

Note: The Pulse Point™ incorporates pluggable terminal blocks for ease of connection. If the terminal block is unplugged while making connections, ensure it is seated properly when reinstalled.

5. Attach power leads to terminal block as shown in Figure 5
6. Check that all wires are held tightly in place by lightly pulling each conductor

#### Main Relay Connections

7. Refer to Figure 4 and 6 when connecting to the main relay
8. Pull approximately 4.5" of cable through conduit and strip  $\frac{1}{4}$ " (6 to 7 mm)
9. Attach leads to terminal block as shown in Figure 8
10. Check that all wires are held tightly in place by lightly pulling each conductor
11. Reinstall the gasket if necessary
12. Replace cover and tighten screws

## PULSE POINT™ REMOTE MODEL ONLY

### Input Power Connections

1. Refer to Figures 5 and 7 when connecting input power to the unit
2. Loosen set screw that locks cover in place
3. Unscrew the housing cover and remove

Note: Two threaded  $\frac{3}{4}$ " NPT female conduit openings are provided in the remote housing to separate input and output wiring from the remote probe wiring.

4. Pull approximately 6" of cable through conduit closest to grounding bracket and strip as follows:
  - a. Ground –  $\frac{3}{8}$ " (9 to 10 mm)
  - b. Power Leads –  $\frac{1}{4}$ " (6 to 7 mm)
5. Attach incoming ground lead to grounding bracket as shown in Figure 5

Note: The Pulse Point™ incorporates pluggable terminal blocks for ease of connection. If the terminal block is unplugged while making connections, ensure it is seated properly when reinstalled.

6. Attach power leads to terminal block as shown in Figure 5
7. Check that all wires are held tightly in place by lightly pulling each conductor

### Main Relay Connections

8. Refer to Figure 6 and 7 when connecting to the main relay
9. Pull approximately 9" of cable through conduit and strip  $\frac{1}{4}$ " (6 to 7 mm)
10. Attach leads to terminal block as shown in Figure 6
11. Check that all wires are held tightly in place by lightly pulling each conductor

### Remote Fork Connections

12. Refer to Figure 8 when connecting the remote fork (probe)
13. Pull approximately 2.5" of cable through conduit and strip  $\frac{3}{16}$ " (4 to 5 mm)
14. Connect factory supplied cable to terminals block as shown in Figure 8
15. Check that all wires are held tightly in place by lightly pulling each conductor
16. Replace cover
17. Tighten set screw to lock cover in place
18. Loosen the remote fork housing cover screws and remove cover



**CAUTION: IF THE UNIT WAS SUPPLIED WITH A GASKET AVOID FOLDING, CUTTING, OR TEARING GASKET. DAMAGING THE GASKET CAN ALLOW MOISTURE TO ENTER THE ENCLOSURE AND DAMAGE THE UNIT.**

19. Pull approximately 4" of cable through conduit and strip  $\frac{3}{16}$ " (4 to 5 mm)
20. Connect factory supplied cable to terminals block as shown in Figure 8
21. Check that all wires are held tightly in place by lightly pulling each conductor
22. Reinstall the gasket, if necessary
23. Replace cover and tighten screws

Figure 4: LP-1000 Integral Enclosure with Cover Removed

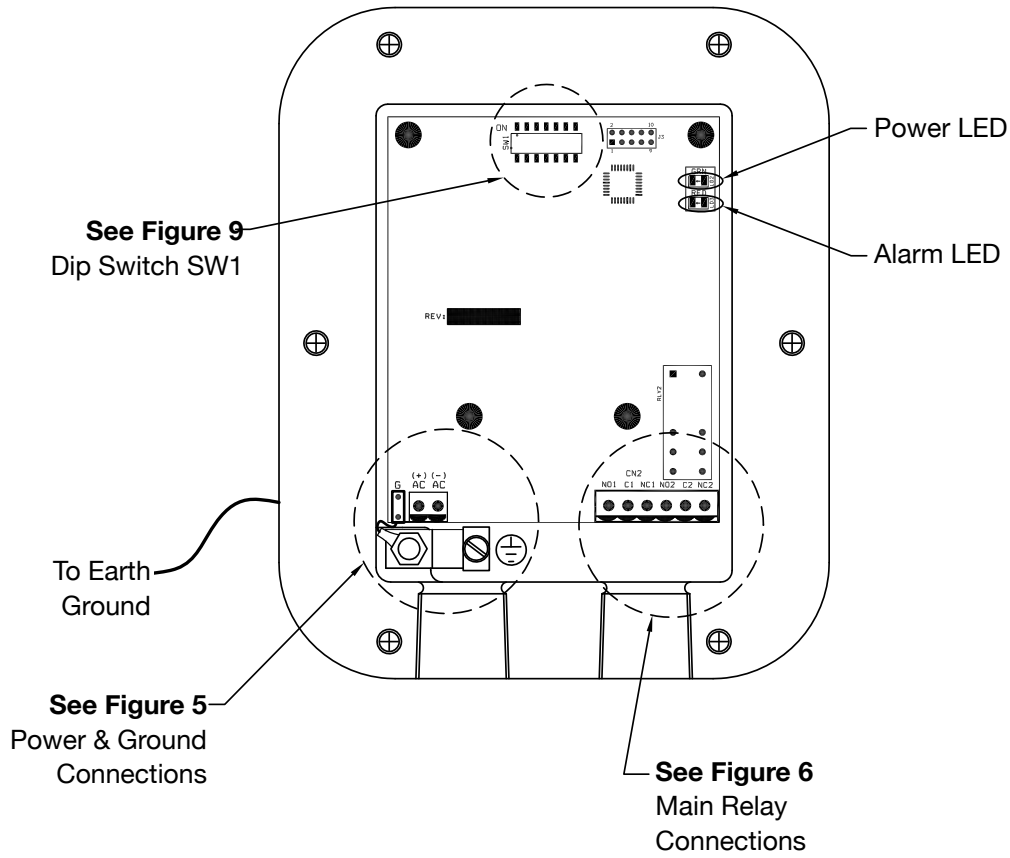


Figure 5: Power and Ground Connections

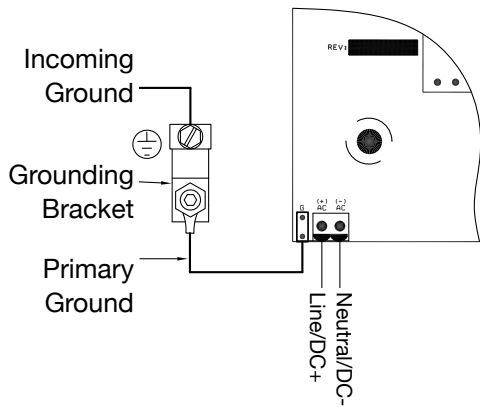


Figure 6: Main Relay Connections

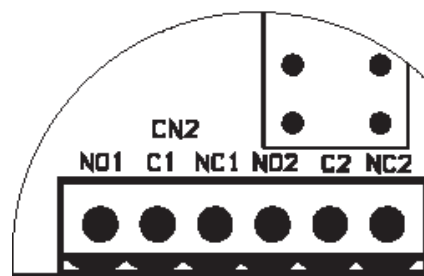


Figure 7: LP-1000 Remote Enclosure with Cover Removed

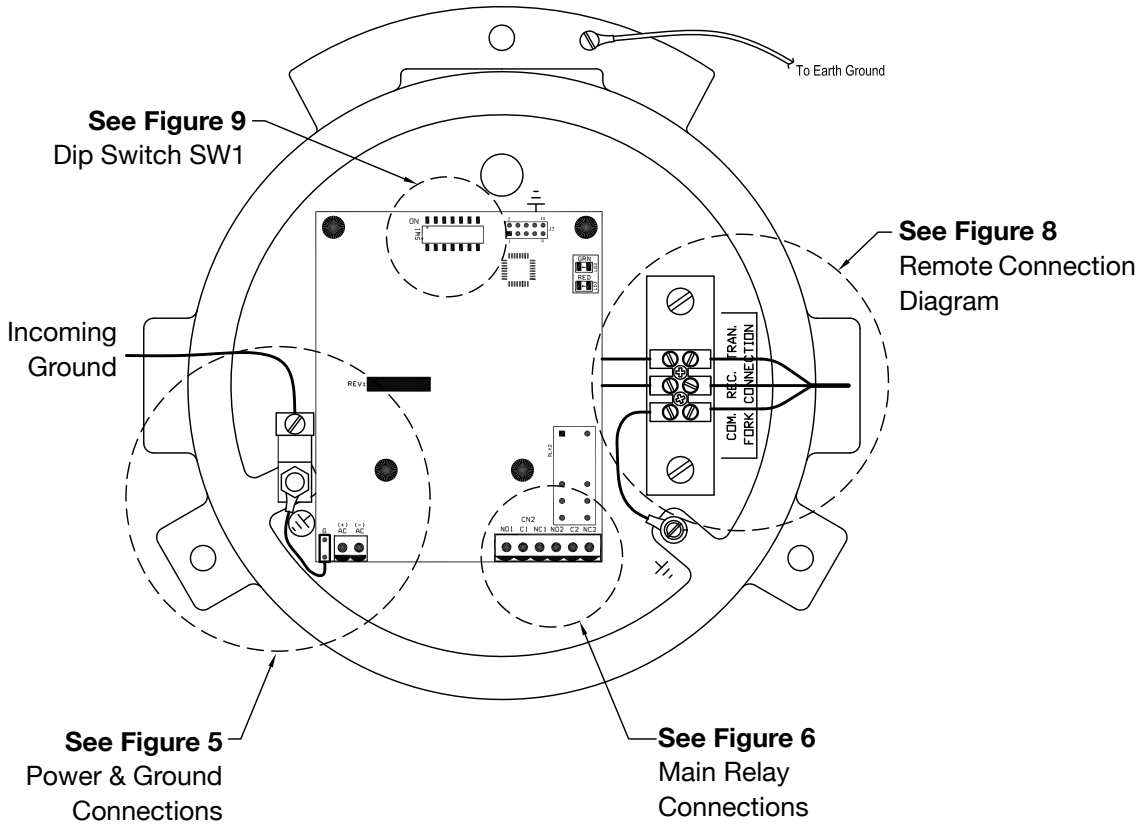
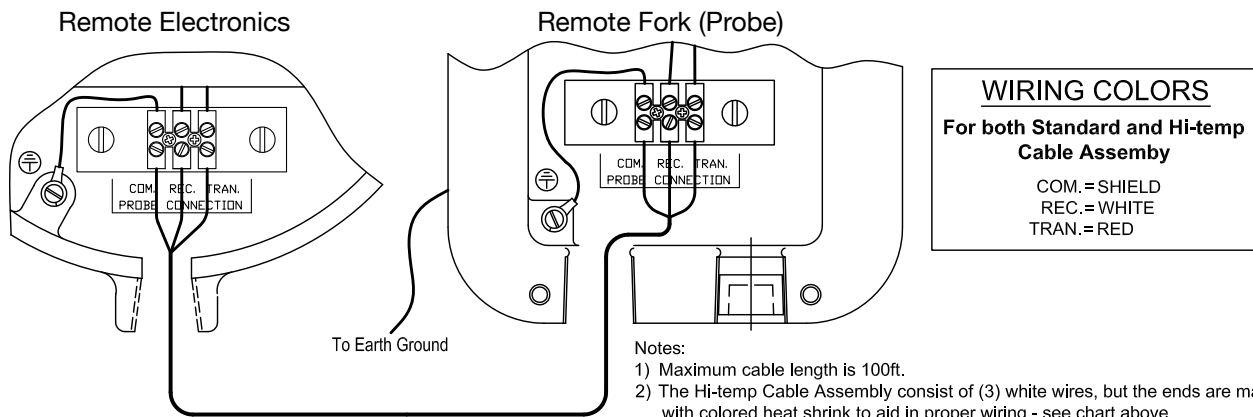


Figure 8: Remote Connection Diagram



## VI. SET-UP



WARNING: VERY HIGH VOLTAGE IS PRESENT ON THE FORK TERMINALS.

REMOVE POWER FROM THE UNIT BEFORE INSTALLING, REMOVING, OR MAKING ADJUSTMENTS

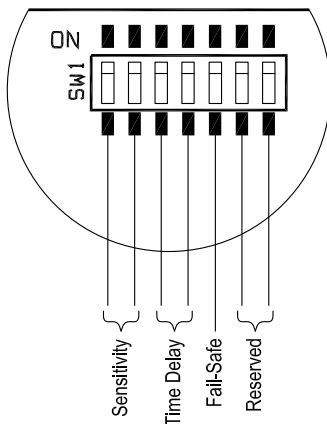
### OPERATION

The Pulse Point™ does not require calibration. When power is applied to the unit, the tines of the fork will begin vibrating (if the fork is not impeded by contact with material or some other object). The green Power LED will be illuminated whenever power is applied to the unit. The status of the red Alarm LED is determined by the selected fail-safe mode and whether or not the fork is vibrating. (Refer to Fail-Safe Operation section.)

### PRODUCT OVERVIEW

Figures 4 and 7 show the electronics of the integral and remote versions of the Pulse Point™ respectively. The Figures show the location of the electrical connections, dip switches SW1, and the Power and Alarm LEDs. This section will discuss configuring the Pulse Point™ for optimum performance in a given application. The settings of the Pulse Point™ are controlled by SW1 as shown in Figure 9.

Figure 9: Switch Functions

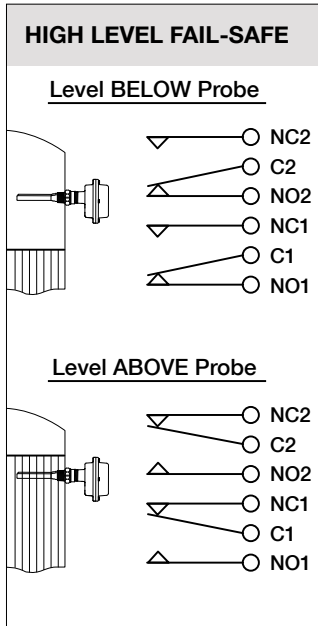




## FAIL-SAFE SELECTION

The Pulse Point™ is factory set for high level fail-safe operation. The Fail-Safe is controlled by SW1, position 5. Refer to Figure 10 to determine the Fail-Safe mode that suits your application.

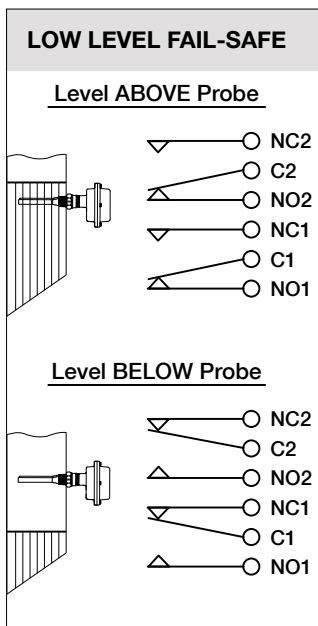
Figure 10: Fail-Safe Operation



### HIGH LEVEL FAIL-SAFE OPERATION (DEFAULT)

- DIP switch SW1-5 is OFF.
- Alarm State (material above the forks):
  - Main Relay is de-energized
    - Relay NC contacts are closed
    - Relay NO contacts are open
  - Alarm LED is on
- Non-Alarm State (material below the forks):
  - Main Relay is energized
    - Relay NC contacts are open
    - Relay NO contacts are closed
  - Alarm LED is off

Note: If the electrical power fails, the main relay turns OFF, giving the same indication as if material is above the fork.



### LOW LEVEL FAIL-SAFE OPERATION

- DIP switch SW1-5 is ON.
- Alarm State (material below the forks):
  - Main Relay is de-energized
    - Relay NC contacts are closed
    - Relay NO contacts are open
  - Alarm LED is on
- Non-Alarm State (material above the forks):
  - Main Relay is energized
    - Relay NC contacts are open
    - Relay NO contacts are closed
  - Alarm LED is off

Note: If the electrical power fails, the main relay turns OFF, giving the same indication as if material is below the fork.

## TIME DELAY SETTINGS

This setting will delay the time between when the LP-1000 senses material and the main relay changes state. **The delay is only in this direction, regardless of fail-safe setting.** There is no added delay when the material leaves the fork. There is a fixed internal delay when material leaves the fork and this delay varies from 1 to 3 seconds as the sensitivity is changed from lowest sensitivity (high vibration) to high sensitivity (lowest vibration). Duration of an additional delay is determined by SW1 positions 3, and 4 as described in the table below. The LP-1000 is factory set for the minimum delay.

SW1 Position 3	SW1 Position 4	Delay (seconds)
OFF	OFF	1-3
OFF	ON	1
ON	OFF	3
ON	ON	6

## SENSITIVITY SETTINGS

There are four different sensitivity ranges on the LP-1000 that can be selected using SW1 Position 1 and 2. The Pulse Point™ is factory set for the lowest sensitivity. The table below is for illustration purposes, of a vertically mounted unit only, and results will vary depending on material properties and conditions. The values in this table are shown with material density of 0.8 lbs/ft<sup>3</sup> at 77° F (25° C). For units mounted horizontally, where sensitivity settings are less significant; it is recommended that SW1 Positions 1 & 2 be “ON” position to minimize material build-up on the forks.

SW1 Position 1	SW1 Position 2	Fork Voltage	Insertion Depth (inches)
OFF	OFF	FACTORY RESERVED	
OFF	ON	190	1.8
ON	OFF	206	2.1
ON	ON	223	2.4

## VII. MAINTENANCE

### PREVENTATIVE MAINTENANCE

No scheduled preventative maintenance is required for the Pulse Point™ units when properly applied and installed correctly. There is no cleaning required for the unit before or during installation.

## VIII. TROUBLESHOOTING

	SYMPTOM	POSSIBLE CAUSE	SOLUTION
The unit is not responsive	Main relay not Functioning and Power LED is not illuminated	No power, Blown fuse	Apply proper AC/DC voltage to the board and recheck the unit. If power is present and Power LED is not illuminated, then the main fuse is blown; Replace electronics.
	Main relay is functioning and Power LED is illuminated	Electronic failure, or main relay contacts are fused	Replace Electronics

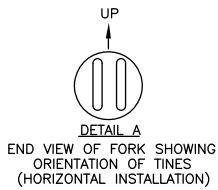
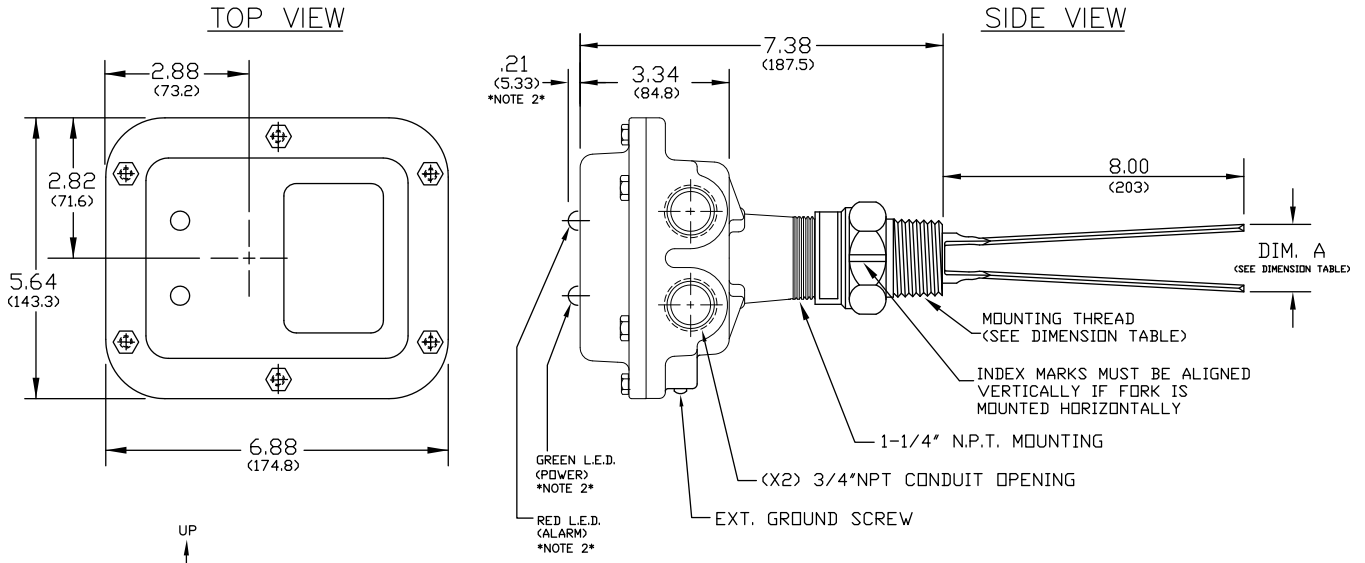
Contact your local factory representative if additional assistance is needed. Please provide the following information:

- Model number
- Date of Purchase
- Application information (type of material, mounting configuration, etc.)
- Description of problem

If your local representative is unable to determine the cause of difficulty, you will be referred to a factory engineer. Equipment shipped back to the factory without proper authorization will be refused and returned at the shipper's expense.

# IX. DIMENSIONAL DRAWINGS

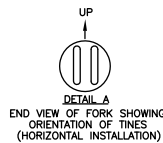
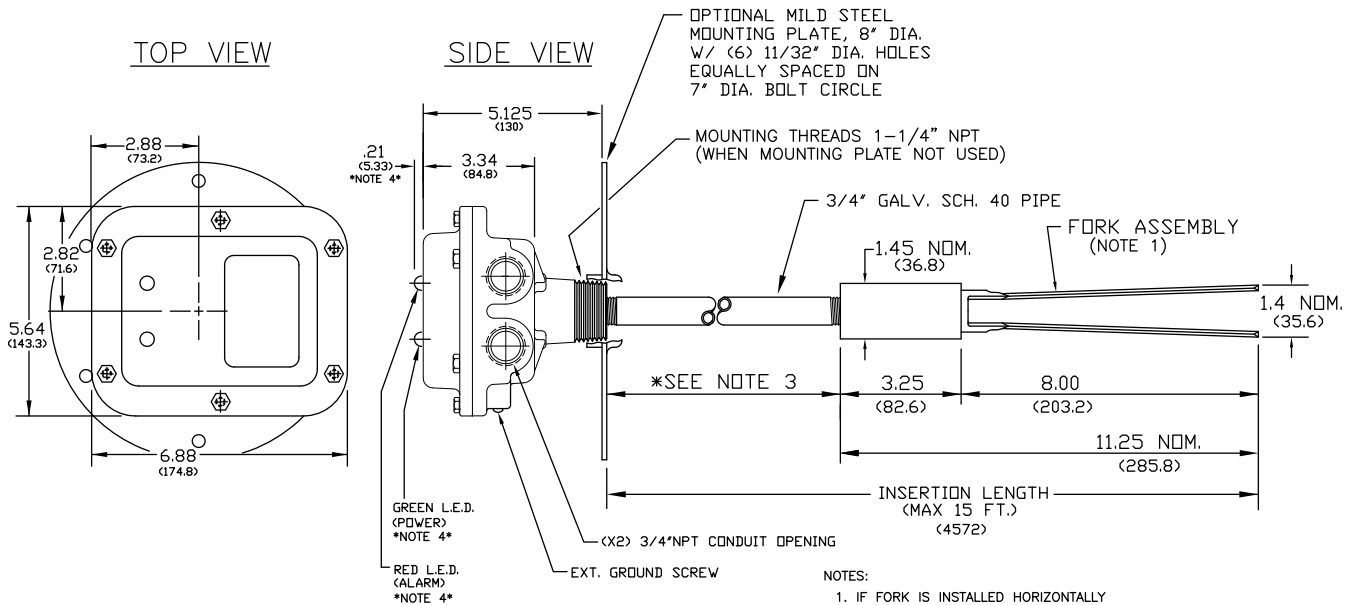
## Type 1A and 2A: Standard Dimensions for LP-1000/2000 with 1 1/4" or 1 1/2" NPT Mounting



\*NOTE\*  
 1-INSTALL FORKS WITH OPENING BETWEEN TINES ALIGNED WITH CONDUIT HOLES IN FRAME AS SHOWN.  
 2-LP1000 AND REMOTE FORKS WILL NOT HAVE LIGHTS.

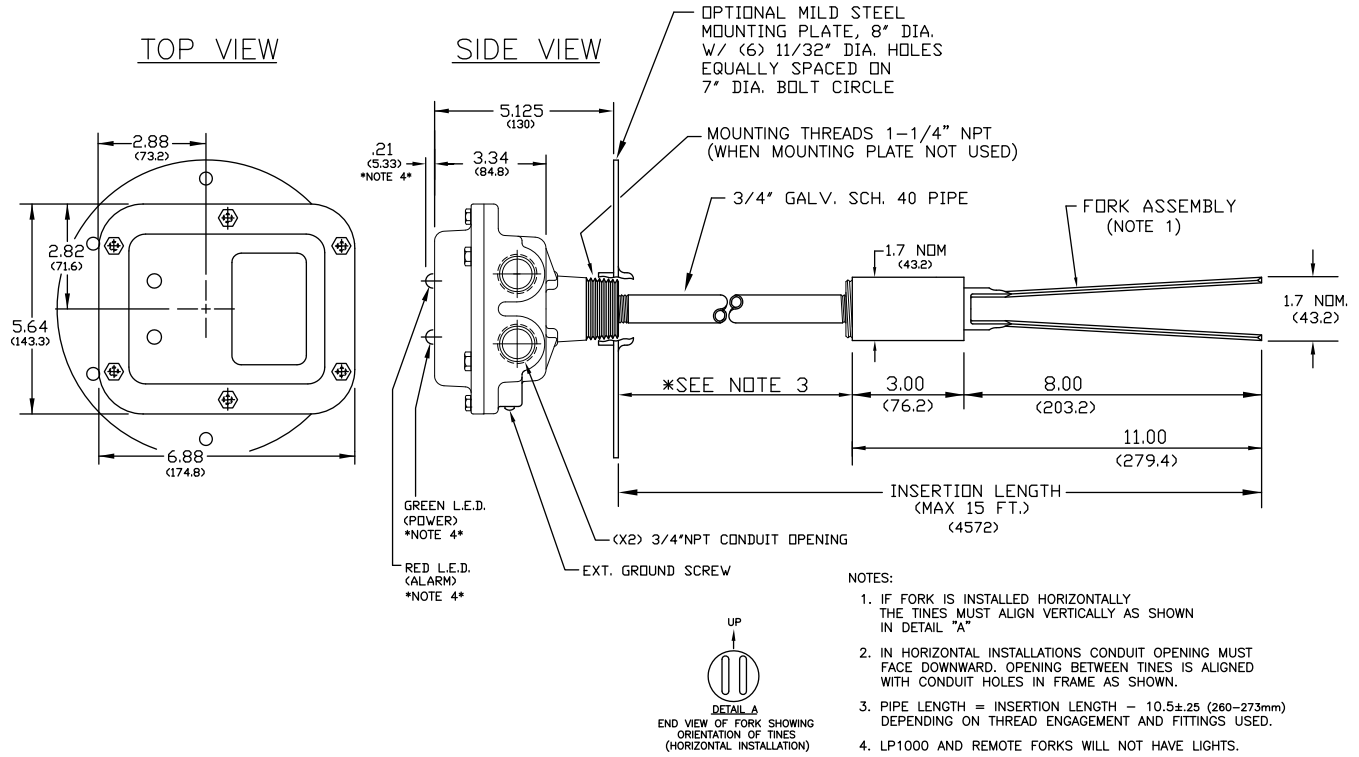
DIMENSION TABLE		
MOUNTING THREAD	1-1/4"	1-1/2"
DIM A	1.4" NOM (35.56mm)	1.7" NOM (43.18mm)

## Type 4B & 4D: Galvanized 3/4" Pipe Extension Dimensions for LP-1000/2000 with 1 1/4" NPT Mounting Shown with optional 8", Mild Steel Mounting Plate

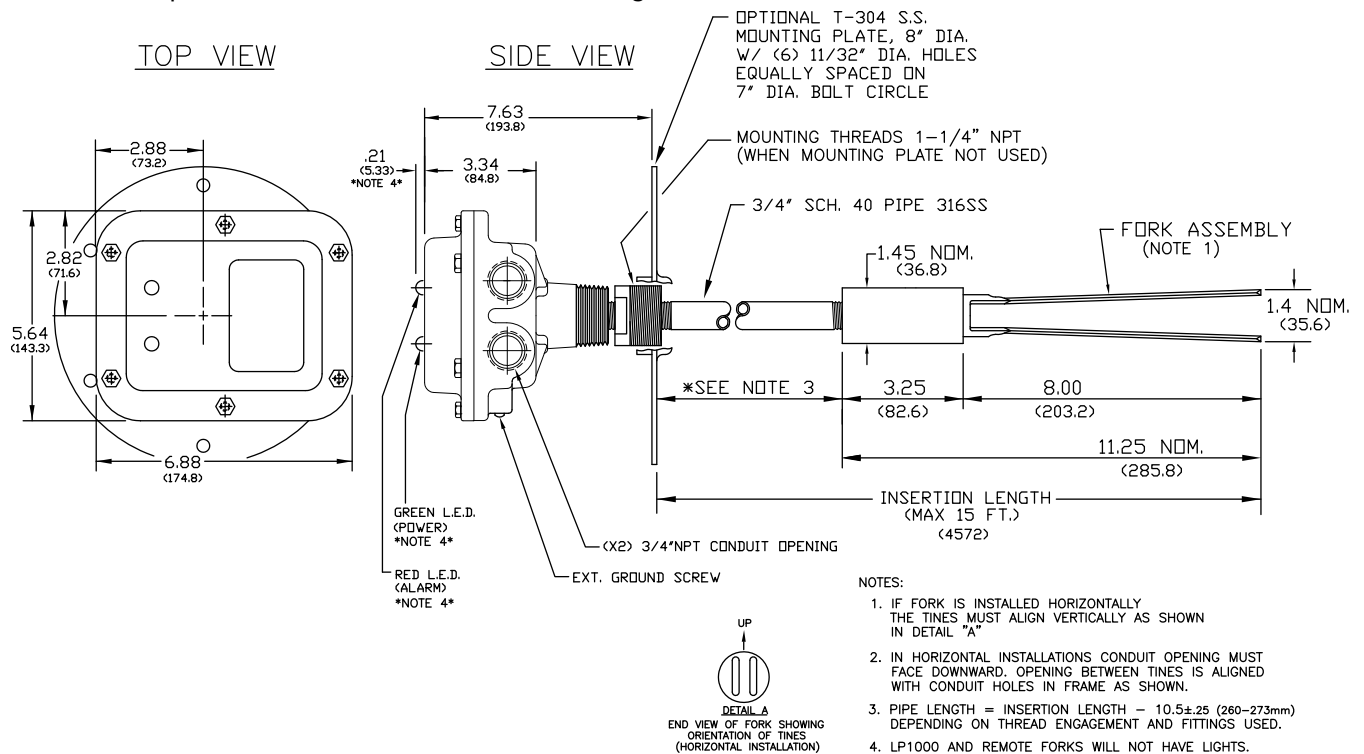


NOTES:  
 1. IF FORK IS INSTALLED HORIZONTALLY THE TINES MUST ALIGN VERTICALLY AS SHOWN IN DETAIL "A"  
 2. IN HORIZONTAL INSTALLATIONS CONDUIT OPENING MUST FACE DOWNWARD. OPENING BETWEEN TINES IS ALIGNED WITH CONDUIT HOLES IN FRAME AS SHOWN.  
 3. PIPE LENGTH = INSERTION LENGTH - 10.5±.25 (260-273mm) DEPENDING ON THREAD ENGAGEMENT AND FITTINGS USED.  
 4. LP1000 AND REMOTE FORKS WILL NOT HAVE LIGHTS.

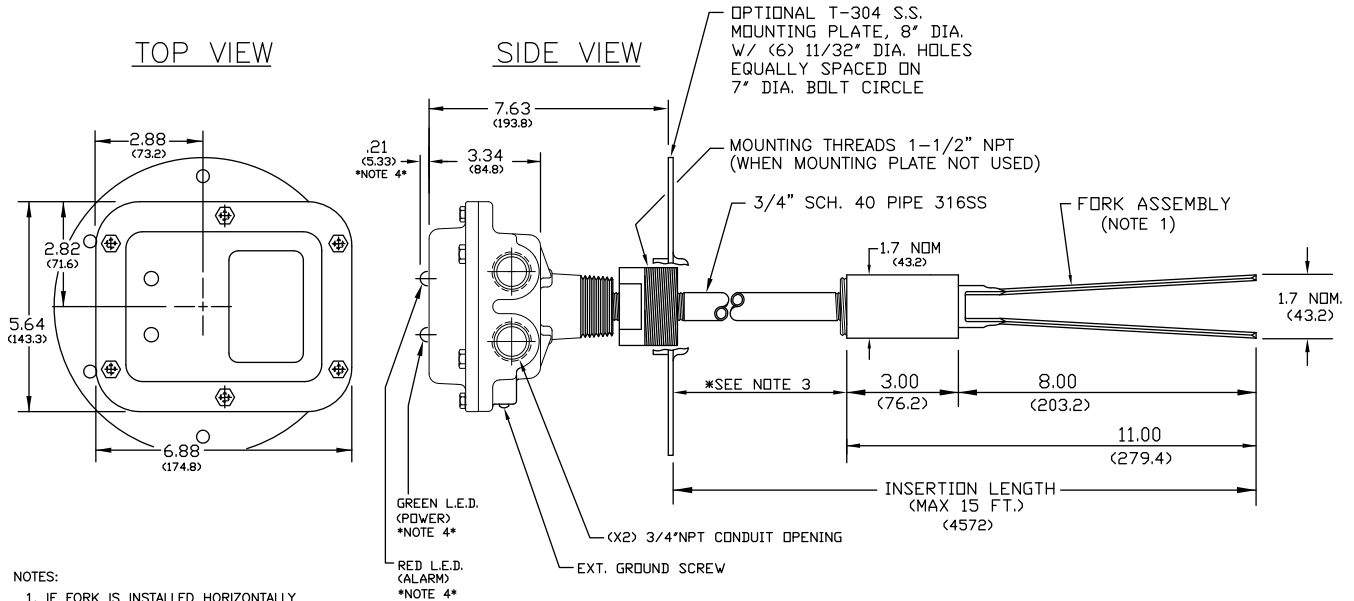
**Type 3B & 3D: Galvanized 3/4" Pipe Extension Dimensions for LP-1000/2000 with 1 1/2" NPT Mounting**  
Shown with optional 8", Mild Steel Mounting Plate



**Type 4C & 4E: 316 Stainless Steel 3/4" Pipe Extension Dimensions for LP-1000/2000 with 1 1/4" NPT Mounting**  
Shown with optional 8", 304 Stainless Steel Mounting Plate

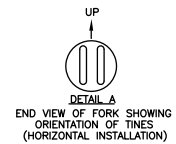


**Type 3C & 3E: 316 Stainless Steel 3/4" Pipe Extension Dimensions for LP-1000/2000 with 1 1/2" NPT Mounting**  
Shown with optional 8", 304 Stainless Steel Mounting Plate

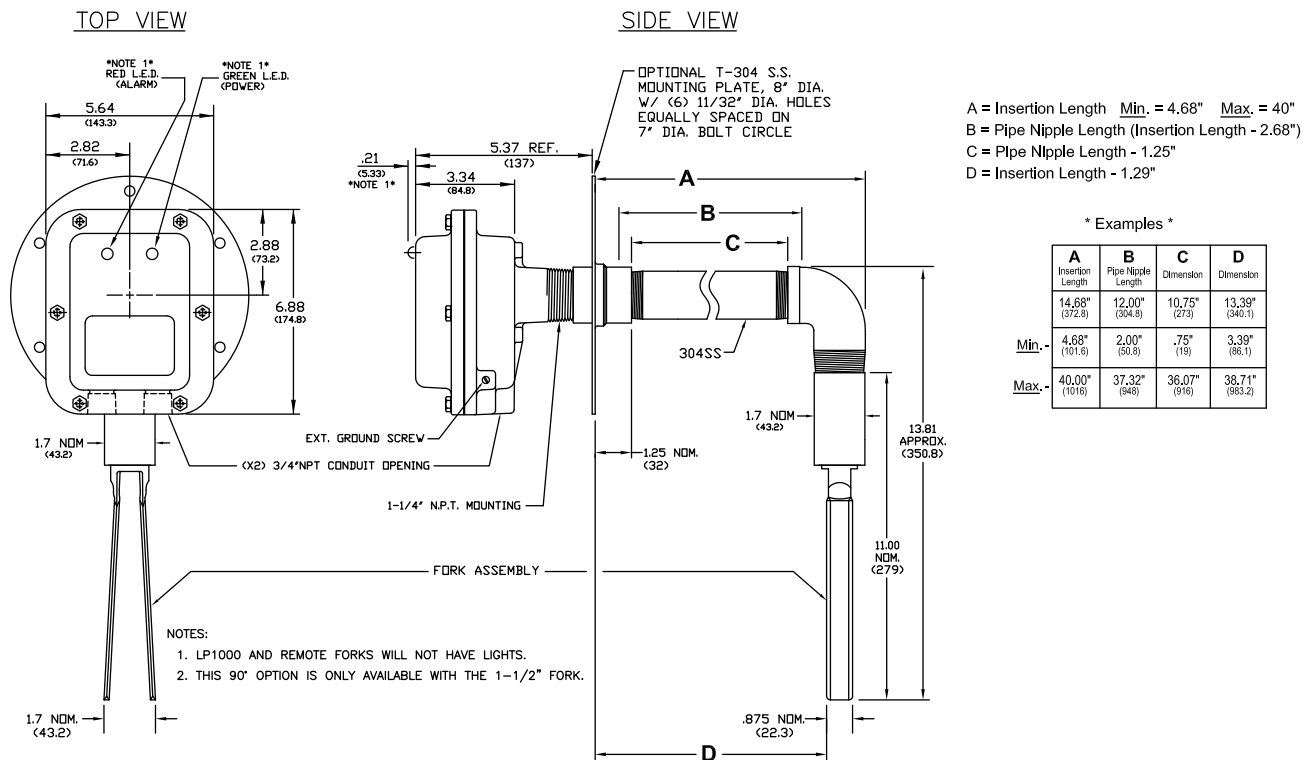


NOTES:

- IF FORK IS INSTALLED HORIZONTALLY THE TINES MUST ALIGN VERTICALLY AS SHOWN IN DETAIL "A"
- IN HORIZONTAL INSTALLATIONS CONDUIT OPENING MUST FACE DOWNWARD. OPENING BETWEEN TINES IS ALIGNED WITH CONDUIT HOLES IN FRAME AS SHOWN.
- PIPE LENGTH = INSERTION LENGTH - 10.5±.25 (260-273mm) DEPENDING ON THREAD ENGAGEMENT AND FITTINGS USED.
- LP1000 AND REMOTE FORKS WILL NOT HAVE LIGHTS.



**Type 5F: 90° Fork Extension Dimensions for LP-1000/2000 with 1 1/2" NPT Mounting**  
Shown with required 8", 304 Stainless Steel Mounting Plate



A = Insertion Length Min. = 4.68" Max. = 40"  
 B = Pipe Nipple Length (Insertion Length - 2.68")  
 C = Pipe Nipple Length - 1.25"  
 D = Insertion Length - 1.29"

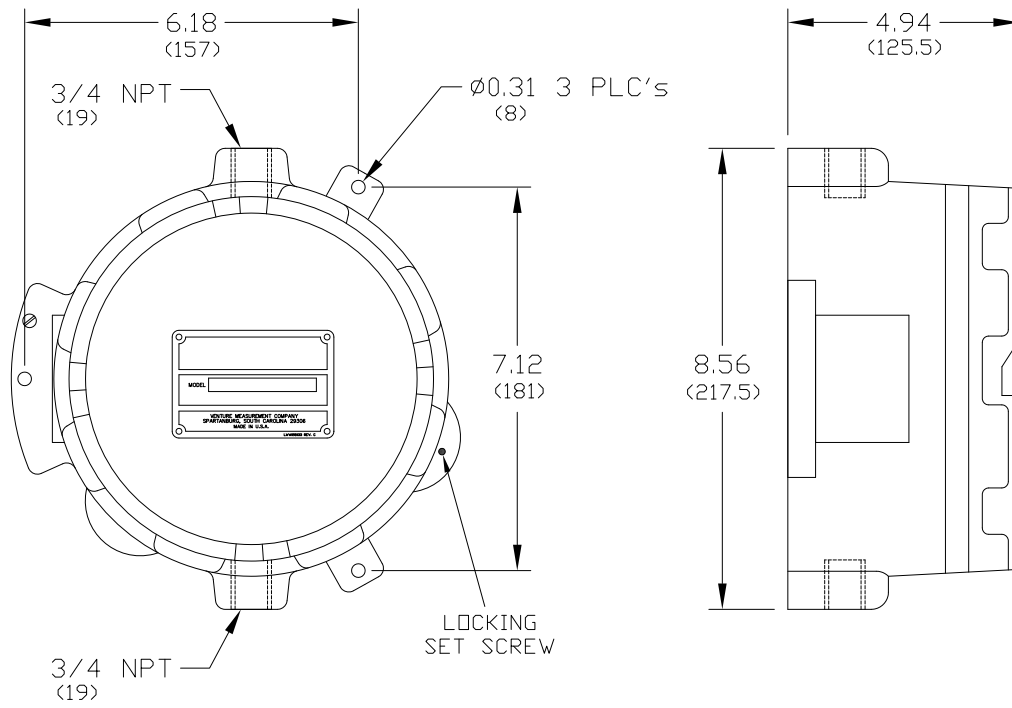
\* Examples \*

	A Insertion Length	B Pipe Nipple Length	C Dimension	D Dimension
	14.68" (372.8)	12.00" (304.8)	10.75" (273)	13.39" (340.1)
<u>Min.</u>	4.68" (101.6)	2.00" (50.8)	.75" (19)	3.39" (86.1)
<u>Max.</u>	40.00" (1016)	37.32" (948)	36.07" (916)	38.71" (983.2)

NOTES:

- LP1000 AND REMOTE FORKS WILL NOT HAVE LIGHTS.
- THIS 90° OPTION IS ONLY AVAILABLE WITH THE 1-1/2" FORK.

### Remote Turtle Dimensions for LP-1000





150 Venture Boulevard  
Spartanburg, SC 29306  
Tel: (800) 778-9242  
Fax: (864) 574-8060  
sales@bindicator.com  
www.bindicator.com

**venture**  
MEASUREMENT

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