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Principle of Operation

Introduction

The BlueLevel Technologies Model VHS is a heavy duty solid state automatic level control instrument. It is used to detect the presence/absence of powders and granular materials at predetermined levels within bins, hoppers, silos and other types of vessels. The Model VHS operates effectively within a wide array of industrial settings such as food, plastic processing, grain, feed, biofuel, seed, chemical, concrete, cement and many others. It is especially effective with lightweight low density materials and in bins where the material density or dielectric properties may change, requiring recalibration and tuning with other technologies.

The Model VHS product line includes two primary probe styles, the single element Rod and a split-element Fork. Together these versions allow the Model VHS to work in the widest possible variety of applications.

Use

The Model VHS can be used for high (full detection), low (empty detection) and intermediate (demand detection) level monitoring, as well as plugged chute detection, applications. These instruments operate based on the proven principle of vibration dampening, which dates back to the 1950's when it was first employed to determine fluid density and viscosity. Time proven and first employed for level detection in the early 1970's, the use of vibrating element technology has been enhanced over the decades and today, as embodied within the Model VHS, this technology is extraordinarily reliable for the detection of powder and granular bulk solids. It is arguably one of the most used technologies for these applications.

Function

The Model VHS utilizes piezoelectric crystal technology to create a vibrating element (Rod or Fork probe style). The frequency is based on the mechanical structure. When not covered or in contact with the material within the vessel, the probe element is free to vibrate at its natural resonant frequency. The electronics recognizes this as the uncovered condition where material is absent at the probe. When material contacts the probe or covers it, the vibration is dampened and the electronics recognizes and indicates this condition as material being present at the probe.

The Model VHS operates as either a High or Low level indicator. It provides a locally visible LED indication and a SPDT Relay output. A Fail-Safe switch establishes the units' function as either High or Low level indication. The bi-color LED illuminates Red when the Model VHS is in the Alarm condition and Green when in the Normal condition. Alarm for a high level application is when material is detected as being present at the sensor probe. The Normal condition is when material is absent. When setup for use as a Low level indicator the Alarm state is when material is absent at the probe, while the Normal condition is the presence of the material at the probe. The Model VHS's relay output is Fail-Safe on power failure, meaning the relay output will move to the Alarm state if power to the sensor was disconnected.

Applications

General

High, low and intermediate level indication and plugged chute detection are common applications within a wide variety of industries. In addition, these units can be provided for use in top or side mounting installations. BlueLevel Technologies provides White Papers, Podcasts, Video and other Media about the use and considerations when selection level measurement and monitoring instrumentation at our website www.blueleveltechnologies.com

Mounting of Model VHS units can be from side or top of bins, including at oblique angles. Top mounted applications can be fitted with pipe extended units for lengths ranging from 20" (508mm) to 118" (3m), or with cable extended units from 39" (1m) to 65' (20m).

Care should be exercised when using the Model VHS for low level detection applications in order to prevent damage to the probe by the force of the material. A protection plate may be necessary above the Model VHS in these applications to protect the probe element from damage due to falling material and to avoid clogging (Fork unit only).

Materials

Typical powder and bulk solid materials that can be monitored using the Model VHS vibrating element point level sensor for solids include materials with density from 3.12lbs/ft^3 (0.05kg/dm^3) for the Rod probe, and from as low as 0.624lbs/ft^3 (0.01kg/dm^3) for the Fork probe. Maximum material density depends on installation and material. Typical low (empty) and intermediate (demand) level control applications may be limited to a maximum material density of 62.4lbs/ft^3 (1kg/dm^3). High (full) level indication and control with top mounted units may be higher.

Example materials that can be monitored with the Model VHS include:

Plastic Pellet	Dry/Free-Flowing Powders	Pills
Grains	Cement	Nuts
Flour	Cereals	Ground Plastic
Sand	Carbon Black	Chemicals
Lime	Wood Shavings/Dust	Flyash

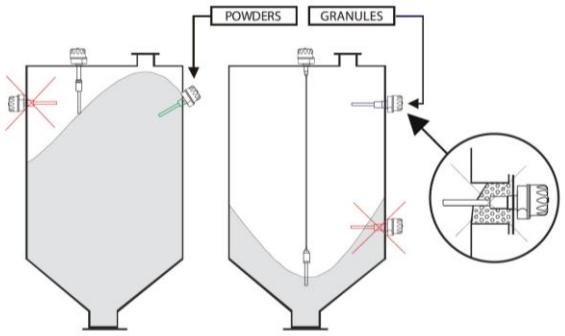
Installation

BlueLevel Technologies Model VHS point level sensors can be mounted in a variety of installations, including top and side mounting as previously discussed. The material angle of repose (caving or arching of material during filling and discharging of the vessel) should be considered before you select a mounting location. Specific installations notes to be considered follow:

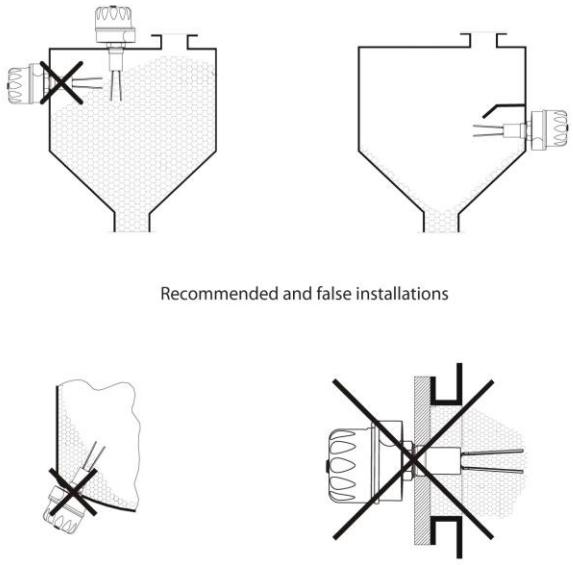
- Care should be taken to protect the Model VHS from damage due to falling material.
- Cable-extended versions for Low level applications should be mounted so that the end of the vibrating element probe is above the discharge outlet of the vessel.
- Side mounted units operating to detect powder materials should be installed at an angle inclination exceeding that of the angle of repose. This is important to enable self-cleaning of the vibrating element.
- Do not mount the Model VHS in a recess as this may allow material to pack around the element, bind and indicate a false material presence condition.
- The Model VHS enclosure can be rotated a maximum of 300° to adjust the conduit entrances to the proper location.
- If the Model VHS Fork unit is installed for use in side mount applications, the unit must be mounted such that the fork-tines stand vertically. This position is noted on the external of the hex portion of the vibrating element Fork probe.
- Do not screw the Model VHS into the process condition using the housing to turn the unit. Use the hexagonal neck.
- Refer to the Installation, Operation and Maintenance Instruction document supplied with the Model VHS for further details and safety precautions.

Proper Installation Model VHS Rod Version

	High level	Low level*
Standard	Side mount	Side or bottom mount
Pipe extended	Top mount	Side or bottom mount
Cable extended	Top mount	Top mount



Proper Installation Model VHS Fork Version



Features

A range of standard features make the Model VHS the best choice when considering vibrating element point level sensor technology:

Single Element "Rod" Probe

- Single Rod vibrating element for use with materials that may bind other designs.
- Universal power supply covers AC and DC voltage ranges including 20-255VAC/DC.
- High temperature version available for use where process temperature is maximum 320°F (160°C).
- Standard, pipe extended and cable extended versions are available.
- Local visible status indication of Normal / Alarm condition.
- Rugged powder coated cast aluminum enclosure, Type 4X, FDA compliant powder coat.
- Use of food grade materials provides compatibility with food and agriculture applications; includes FDA compliant powder coat, NSF listed anti-seize, stainless steel process connection and Rod probe.
- Fail-Safe SPDT relay output is switch selectable for either High or Low level detection applications. This protects your process against conditions that might arise from power failure to the unit.
- Two ¾" NPT conduit entrances improve wiring access.

Split-Element "Fork" Probe

- Ultrahigh sensitivity Fork probe detects materials with density as low as 0.624lbs/ft^3 (0.01kg/dm^3).
- Universal power supply covers AC and DC voltage ranges including 20-255VAC and 20-60VDC.
- Standard, short and pipe extended versions available.
- Local visible status indication of Normal / Alarm condition.
- Rugged powder coated cast aluminum enclosure, Type 4X, FDA compliant powder coat.
- Use of food grade materials provides compatibility with food and agriculture applications; includes FDA compliant powder coat, NSF listed anti-seize, stainless steel process connection and Fork probe.
- Fail-Safe SPDT relay output is switch selectable for either High or Low level detection applications. This protects your process against conditions that might arise from power failure to the unit.
- Two ¾" NPT conduit entrances improve wiring access.

Available Versions

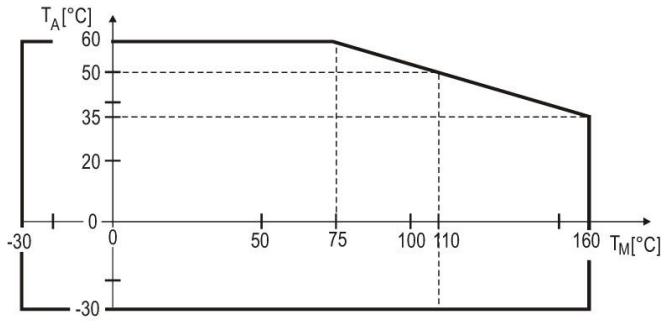
BlueLevel Technologies offers several available versions of the Model VHS vibrating element point level sensor. With the "Rod" probe style these include Standard, Pipe Extended, and Cable Extended versions. The Standard and Pipe Extended versions are also available with a High Temperature Rod probe. With the "Fork" probe style there exist the Standard and Short configurations.

Rod Probe Style

STANDARD: The Rod probe "Standard" version of the Model VHS incorporates a probe with an 8.15" (207mm) overall probe length. The Standard version can be used in high and low level control applications with material bulk densities as low as 3.12lbs/ft^3 (0.05kg/dm^3) and maximum densities up to approximately 62.4lbs/ft^3 (1.0kg/dm^3) for low level detection and more in high level applications. The Standard version Rod probe can be top or side mounted. Side mounting on an angle inclination is strongly recommended when used to detect powder materials.

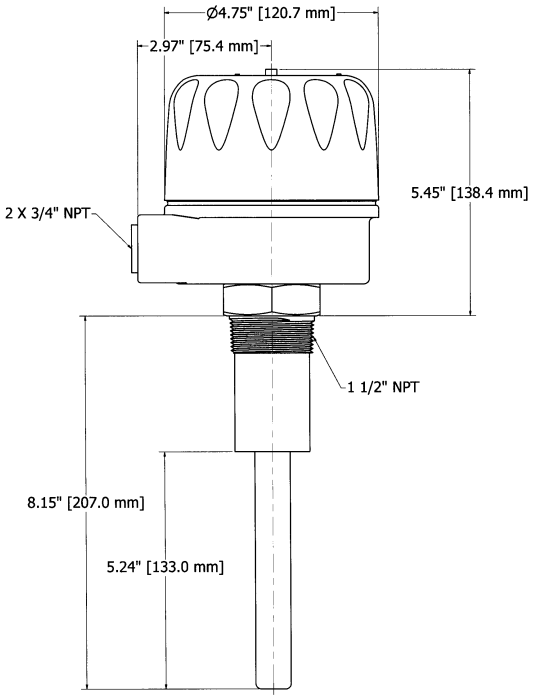
The Standard version Rod can be used with operating process temperature from -22°F to +230°F (-30°C to +110°C). Ambient temperature conditions are from -22°F to +140°F (-30°C to +60°C). The process and ambient temperatures are interdependent. As such there is a slight derating of the process maximum temperature as the ambient temperature increases.

Derating Diagram for Model VHS Rod Version



Ambient temperature (T_A) versus medium temperature (T_M)

Standard "Rod" Version



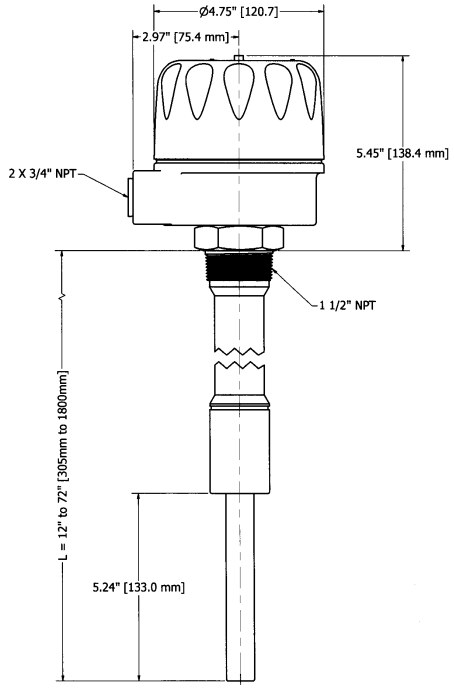
PIPE EXTENDED: The Model VHS Pipe Extended version of the Rod probe is for use as a high level control sensor only. These units are top mounted in a bin or silo and extend the sensing point into the vessel with an overall length from 12.0" to 72.0" (305mm to 1.8m). Consult with the BlueLevel Technologies factory for longer lengths. The pipe extension is made from 316SS Schedule 40 pipe. Pipe extended units are shipped fully assembled and ready for installation.

The Pipe Extended version can be used with operating process temperature from -22°F to +230°F (-30°C to +110°C). Ambient temperature conditions are from -22°F to +140°F (-30°C to +60°C). The process and ambient temperatures are interdependent. As such there is a slight derating of the process maximum temperature as the ambient temperature increases.

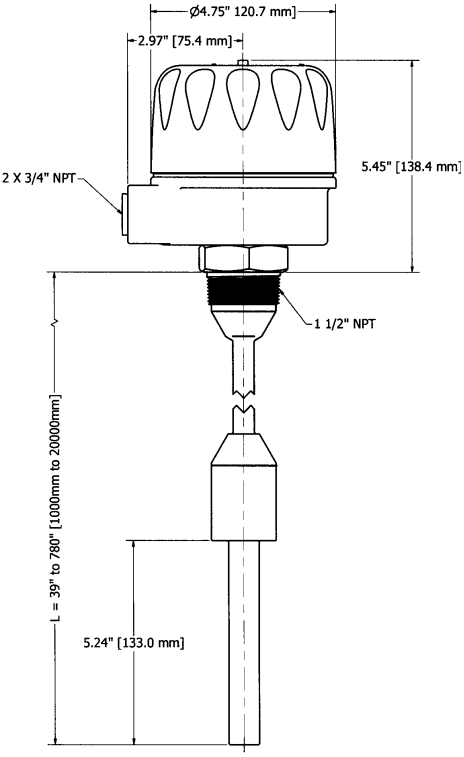
HIGH TEMPERATURE OPTION: The Standard and Pipe Extended version Rod style are available with a High Temperature probe style to allow use with continuous process temperatures up to 320°F (160°C). The process and ambient temperatures are interdependent. As such there is a slight derating of the process maximum temperature as the ambient temperature increases.

CABLE EXTENDED: The Model VHS Rod probe style can be provided in a cable extended version with overall length from 39" to 780"/65' (1000mm to 20000mm) to extend the sensing point into the vessel beyond that of the typical pipe extended unit. This version is used for top mount installations in high or low level control applications. The cable is polyethylene coated and steel reinforced for high strength. Process medium temperature is from -13°F to +194°F (-25°C to +90°C). The process and ambient temperatures are interdependent. As such there is a slight derating of the process maximum temperature as the ambient temperature increases.

Pipe Extended "Rod" Version



Cable Extended "Rod" Version



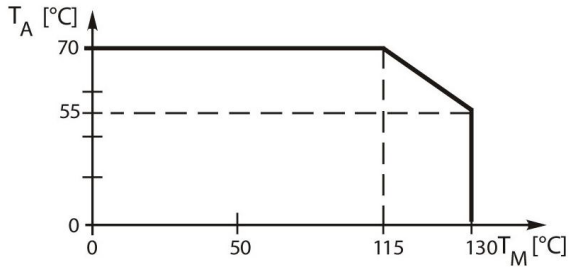
Fork Probe Style

The Fork probe style of the Model VHS is recommended for top mounted installations in applications applicable to the Fork style probe. Side mounting is recommended only where the fork tines will be easily freed from the material being sensed. For side mounting the Fork unit should be installed so that the tines of the fork will be standing vertically.

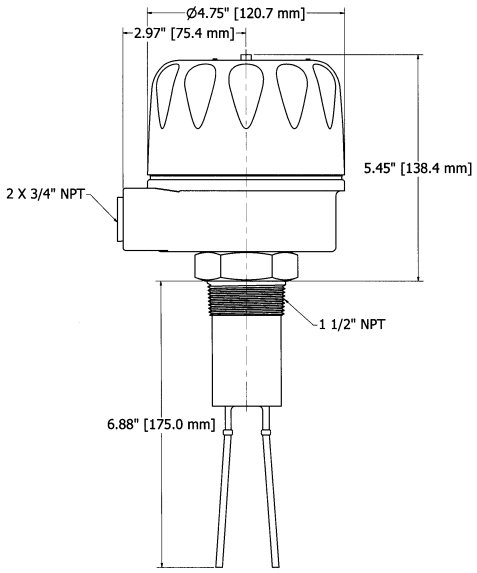
STANDARD: The Standard version of the Fork probe style incorporates a probe with a 6.9" (175mm) overall probe length. The Standard version can be used in high and low level control applications with material bulk densities as low as 0.624lbs/ft^3 (0.01kg/dm^3). Maximum densities as much as 62.4lbs/ft^3 (1.0kg/dm^3) are possible with proper installation. The Standard version of the Fork unit can be top or side mounted. Side mounting requires protection against falling materials.

The Standard version Fork can be used with operating process temperature from -40°F to +266°F (-40°C to +130°C). Ambient temperature conditions are from -22°F to +140°F (-30°C to +60°C). The process and ambient temperatures are interdependent. As such there is a derating of the process maximum temperature as the ambient temperature increases.

Derating Diagram for Model VHS Fork Version

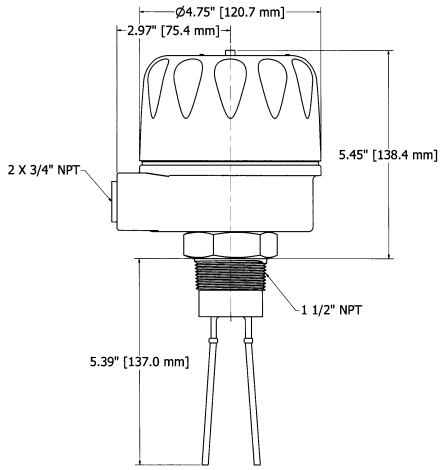


Model VHS Fork Standard Version



SHORT: The Short version of the Fork probe incorporates a probe with only a 5.4" (137mm) overall probe length. The Short version can be used in high and low level control applications with material bulk densities as low as 0.624lbs/ft3 (0.01kg/dm3). Maximum densities as much as 62.4lbs/ft^3 (1.0kg/dm^3) are possible with proper installation. The Short version Fork can be top or side mounted. Side mounting requires protection against falling materials.

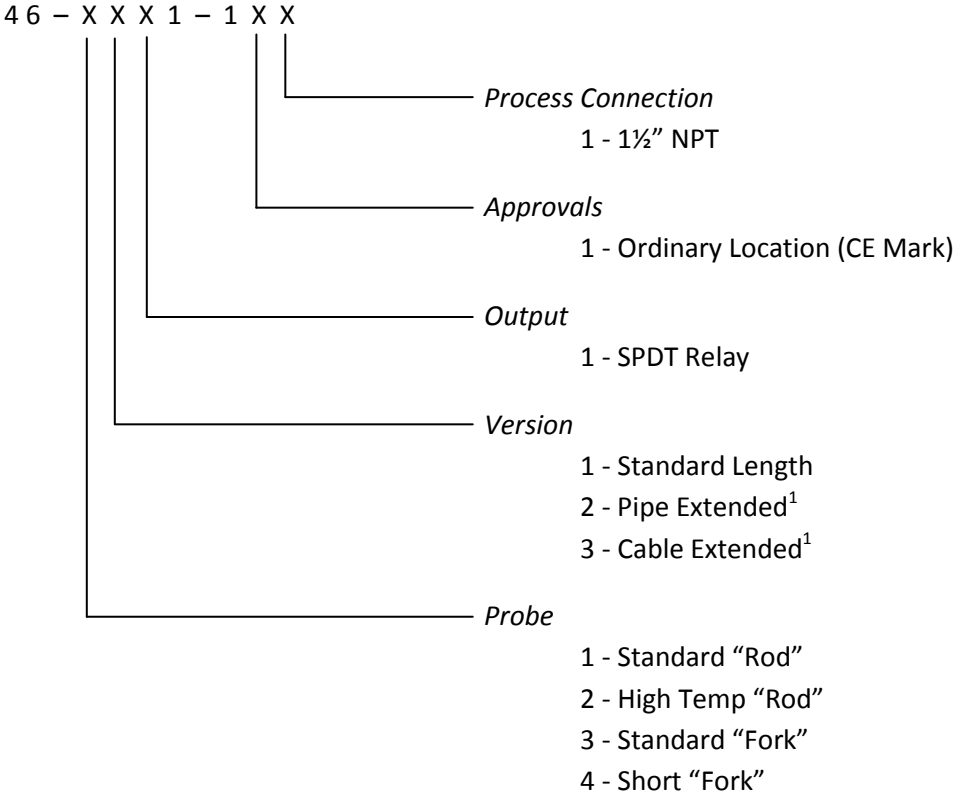
Model VHS "Fork" Short Version



The Short version Model VHS Fork can be used with operating process temperature from -40° F to +266° F (-40° C to +130° C). Ambient temperature conditions are from -22° F to +140° F (-30° C to +60° C). The process and ambient temperatures are interdependent. As such there is a derating of the process maximum temperature as the ambient temperature increases.

Ordering Information

Model VHS Vibrating Element Point Level Sensor for Solids
Part Number Structure



[1] Rod probe styles only.

Technical Data

Power Supply:	Universal
Rod Probe Style	20-255VAC/DC; AC 50/60Hz
Fork Probe Style	20-255VAC/20-60VDC; AC 50/60Hz
Power Consumption:	
Rod Probe Style	≤ 2.5VA / ≤2W
Fork Probe Style	≤ 1.7VA / ≤ 3W
Ambient Temperature:	-22° F to +140° F (-30° C to +60° C)
Process Temperature:	
Rod Probe Style	
Standard and Pipe Extended Versions	-22° F to +230° F (-30° C to +110° C)
High Temp Standard and Pipe Extended Versions	-22 F to +320° F (-30° C to +160° C)
Cable Extended Versions	-13° F to +194° F (-25° C to +90° C)
Fork Probe Style	-40° F to +266° F (-40° C to +130° C)
Maximum Pressure:	
Rod Probe Style	
Standard and Pipe Extended Versions	368psi (25bar)
Cable Extended Version	88psi (6bar)
Fork Probe Style	588psi (40bar)
Enclosure:	NEMA Type 4X, IP65, Die-Cast Aluminum with FDA Compliant Powder Coat
Output:	SPDT Relay, 8A @ 250VAC, Fail-Safe on Power Failure
Fail-Safe Selection:	Switch Selectable, High or Low
Density Selection:	Switch Selectable, LOW or HIGH
Rod Probe Style	LOW - density ≤ 6.2lbs/ft^3 (0.1kg/dm^3) HIGH - density> 6.2lbs/ft^3 (0.1kg/dm^3)
Fork Probe Style	LOW - density ≤ 31.1lbs/ft^3 (0.5kg/dm^3) HIGH - density > 31.1lbs/ft^3 (0.5kg/dm^3)
Time Delay:	Rod Probe - Switch Selectable Covered: <1.8sec or 5 ± 1.5sec Uncovered: <2sec or 5 ± 1.5sec Fork Probe - Fixed Delay Covered: ≤0.5sec Uncovered: ≤1sec @ HIGH density setting ≤2sec @ LOW density setting
Process Connection:	1½" NPT
Conduit Entry:	Two (2) ¾" NPT

Materials of Construction:

Enclosure	Powder Coated Die-Cast Aluminum
Probe	316Ti Stainless Steel
Pipe Extension (Rod only)	316 Stainless Steel
Cable Extension (Rod only)	Polyethylene Coated, Steel Reinforced

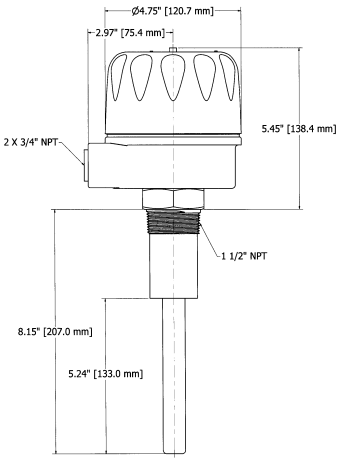
Weight:

Rod Probe Style, Standard Version	5.4lbs (1.68kg)
Fork Probe Style, Standard Version	4.5lbs (2.01kg)

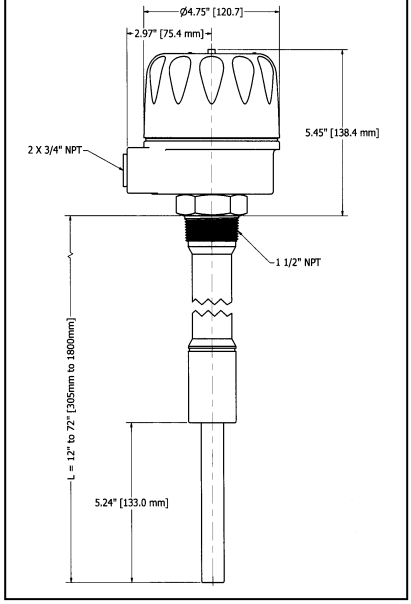
Certifications: CE Mark

Dimensions:

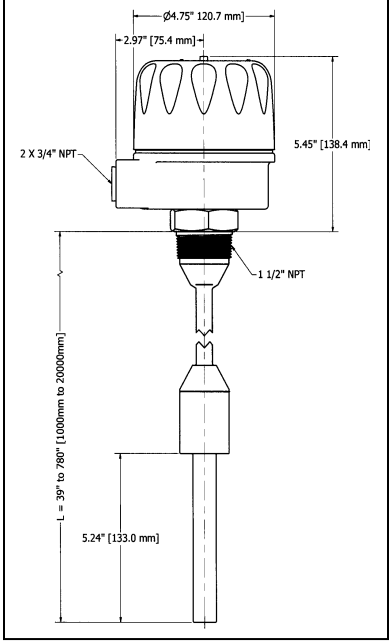
Standard Version "Rod"



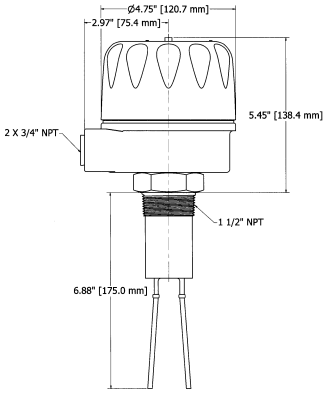
Pipe Extended "Rod" Version



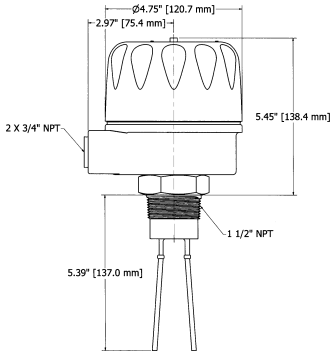
Cable Extended "Rod" Version



Standard Version "Fork"



Short "Fork" Version



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