BULLETIN 554A

INSTALLATION & OPERATION

DuraVibe™

Model VibraRod™ Vibratory Point Level Sensor
Ordinary Location and Hazardous Location

Standard Probe

Thank you for purchasing a quality product from Monitor Technologies LLC. We realize that you do have a choice of vendors when procuring level measurement equipment and we sincerely appreciate your business!

⚠ This manual contains the information necessary to ensure a safe and successful installation. Please read and comply with the section of this manual pertaining to SAFETY. Doing so will ensure proper operation of the equipment and the safety of all personnel.

Before discarding shipping container, please inspect it thoroughly and verify that all parts ordered are accounted for. Sometimes smaller parts become stuck under carton flaps and other packaging materials.

In the event that information contained herein does not completely satisfy your requirements or answer your questions, you may contact Technical Support on our website www.monitortech.com, by telephone at 800-766-6486 (630-365-9403), or by e-mail at techsupport@monitortech.com. If your product ever requires service either in or out of warranty, please contact us and obtain an RMA number prior to shipping the unit to us.

MONITOR®

The **VibraRod**™ vibratory sensor provides reliable point level detection in a wide variety of process control applications within the powder and bulk solids market. The vibrating probe principle overcomes application difficulties associated with changes in material, temperature, and humidity while providing reliable solid state electronic circuitry that requires no calibration.

The **VibraRod** has the ability to detect a wide range of material densities. In addition, using a single-prong probe eliminates the potential problems associated with material build-up and false signaling associated with the dual-prong "tuning fork" probes.

The **VibraRod** is available in a variety of configurations, each specifically designed to satisfy particular applications. Available configurations include: standard probe and pipe extension probe.

PRINCIPLE OF OPERATION

The **VibraRod**™ line of point level sensors is a mechanical resonance system that is excited at a resonance by an electrical circuit. Two piezoelectric crystals are mounted internally at the probe's base. The electronic module generates an electrical signal that has an equivalent frequency to the probe's resonant frequency; this signal is applied to one crystal, which causes the probe to vibrate. The vibration is monitored by the second crystal which provides an electrical signal back to the electronic module. When material contacts and surrounding the probe, the vibration is dampened and the signal from the second crystal is reduced. This signal reduction is detected by the electronic module, which reacts by providing a signal out of the module through the relay contacts.

PRE-INSTALLATION CONSIDERATIONS

Choosing a Location: (See Figure 1)

1) Material Flow: When selecting a location for the **VibraRod**™ level sensor, choose a point in the vessel where the probe will be out of the direct flow of incoming and outgoing material to prevent any mechanical damage that may be caused by the pressure of the flow (See section regarding Protective Baffles). The **VibraRod** sensor must be positioned at a point where incoming material will reach and cover the probe in its normal flow, and when receding, will flow away from the probe in an even manner. Choose a position where a majority of the probe (not just the tip) will be covered. This is particularly important when detecting materials with low bulk densities. If the target material to be sensed is a powder, the **VibraRod** sensor should be installed at an incline exceeding the angle of repose (for high level detection use vertical mounting) in order to prevent powder buildup/clinging that might substantially reduce the self-cleaning effect of the vibrating rod. Also, avoid mounting the **VibraRod** sensor in a recess (See Figure 2). In addition, material flow characteristics such as "rat holing" (caving) or "bridging" (arching) of the material in the vessel should be considered.

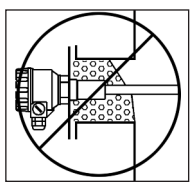


Figure 2

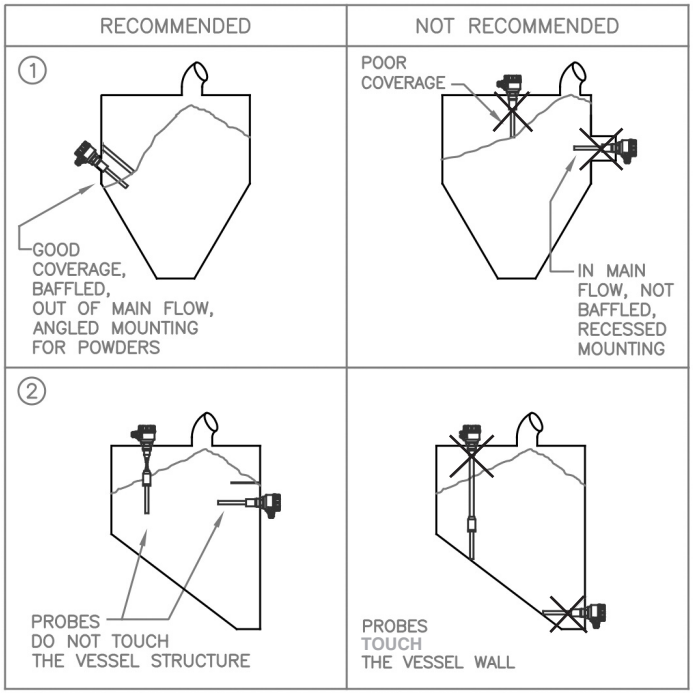


Figure 1

2) Vessel Interference: Select an area where the probe will not come in contact with internal structures of the vessel.

3) Vibration: <u>CAUTION</u> - The **VibraRod** should not be used in applications with severe vibration, such as being in close proximity to vibration devices used to promote material flow, as this could damage the probe.

4) Dynamic Material Flow: Please consider the maximum limits of bending force as shown in Figure 3 when choosing a mounting location and installing the **VibraRod** level sensor.

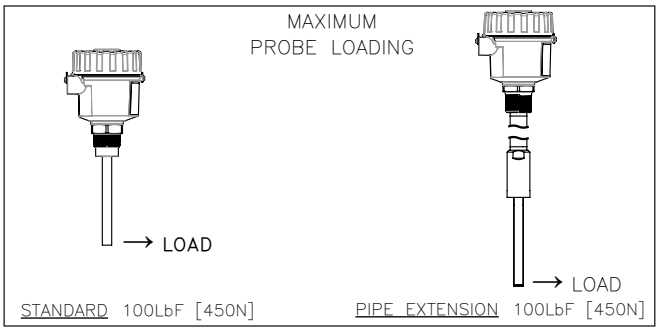


Figure 3

Also, note that the sensor may not reliably trigger / alarm unless covered by a static layer of material. Constantly moving matter may present an issue.

Protective Baffles: (See Figure 4)
The **VibraRod** is a sensitive level sensing instrument. Therefore, particular attention should be given to assure that the mechanical construction of the probe is not damaged by material. Probe deflection (bending) as little as 1/16" can render the probe inoperative. **Failure to properly protect the probe will invalidate the warranty**. Install a protective baffle above side mounted probes. The baffle can be created using a number of materials including angle iron, welded plates and pipe sections. It should be securely mounted to the vessel wall and should extend the full length of the probe. The lowest part of the baffle should be 4" to 6" above the upper edge of the probe.

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS

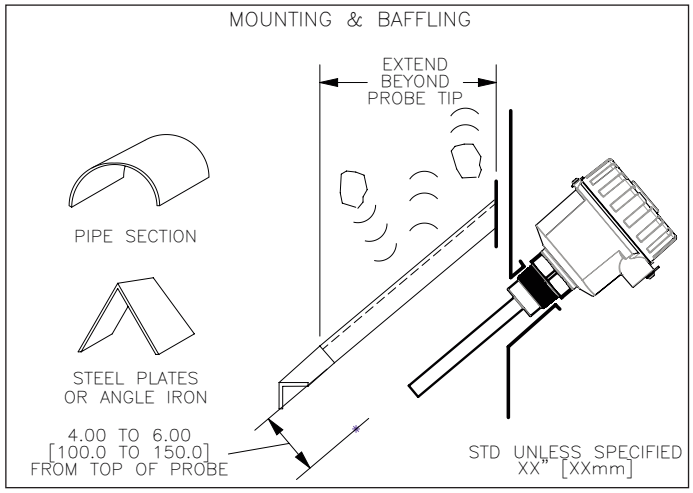


Figure 4

MECHANICAL INSTALLATION

Because of their vibratory nature, sensors like the **VibraRod™** are sensitive industrial level sensing instruments. Therefore, particular attention should be given to ensure that the mechanical construction of the probe is not damaged during and after the installation (See Figure 5). **WARNING!** Handle the **VibraRod** level sensor with great care, especially the sensing probe. Any impact on the sensing probe may result in damage to its resonance system.

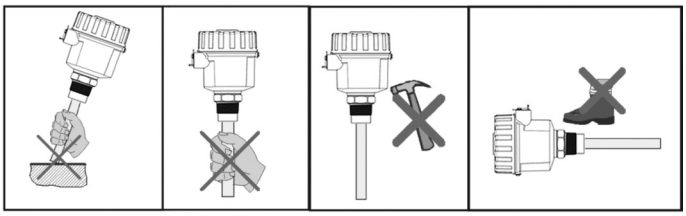


Figure 5: Prevent mechanical damage.

Prior to installation, it is recommended that the **VibraRod** be tested for functionality on a sample of material (See Setup). The unit may not function with granular material where the particle size is large (1" [25 mm] diameter maximum) even though the bulk density is within the specified density range due to the potentially small surface contact between the material and the probe.

Probe Mounting: (See Figure 4)

1) **Coupling Mount:** Cut a hole into the vessel suitable for a 1-1/4" NPT pipe coupling. Position a half-coupling as desired on the vessel and weld into place. Thread the **VibraRod** into the coupling and tighten by rotating the process connection. Pipe joint sealant or Teflon® tape may be used to achieve pressure-sealing capability if desired.
   WARNING! Never attempt to tighten the **VibraRod** by rotating its housing! Do **NOT** use any type of "strap wrench".
2) **Housing Orientation:** Once the **VibraRod** is securely mounted in the mounting coupling, rotate the housing approximately 360° maximum (by hand-only) to reach the desired cable outlet position.
3) **Pipe Extension Installation:** The **VibraRod** pipe extension configuration, when top mounted, is intended for high-level detection only. If side mounted, baffling is advised and maximum pipe length is 24" (0.61m).

Pipe Extension Reinforcement: (See Figure 6)
Mechanical reinforcement of the pipe extension should be considered whenever installing a probe length greater than 60" (1.5m). The pipe extension should be anchored to the sidewall with braces to reduce mechanical stress at the connection point of the extension and to protect the **VibraRod** from damage. When bracing, never weld or drill into the pipe extension since the electrical wires within the extension may be damaged. Use mechanical clamping techniques.

⚠ **Bracing and Haz-Loc Pipe Extensions:**
The integrity of pipe extension model warrants extra consideration when installing. On either top mounting or side mounting, one must consider the potential for material side-loading forces that could put increased strain on the pipe at the connection point and then install mechanical bracing as appropriate. Top-mount pipe extensions over 60" (1.5m) or side-mount pipe extensions over 18" (0.46m) should be considered for supplemental mechanical support.

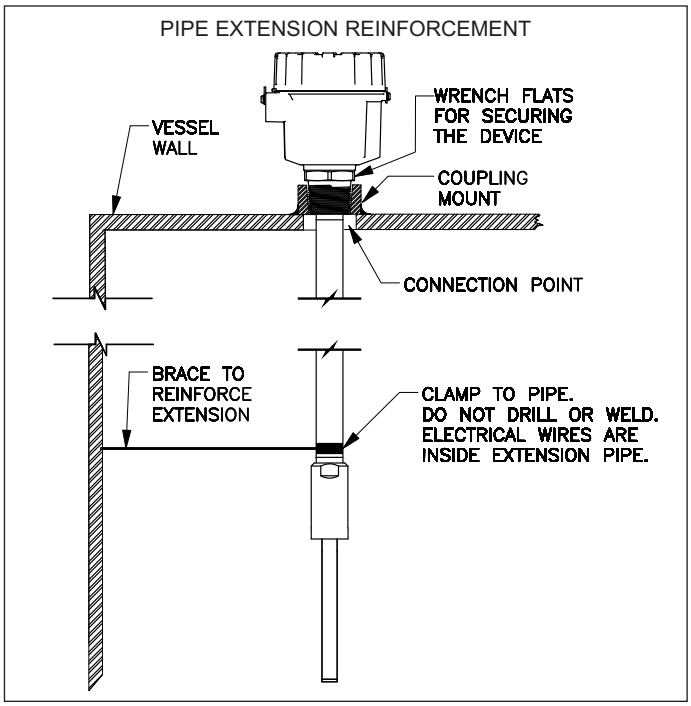


Figure 6

ELECTRICAL INSTALLATION

Hazardous Location Precautions:
Observe the regulations listed in the NEC (USA) or CEC (Canada) regarding equipment in hazardous locations when installing the hazardous location models of the **VibraRod™** level sensor in hazardous classified locations. Wiring must be performed according to the authority having site jurisdiction and is the sole responsibility of the installer to ensure such.

It is important to note that the hazardous location models are certified with two protection concepts: The probes and wires from them to the enclosure is an intrinsically-safe circuit but is still Haz-Live. The enclosure and electronics within are not intrinsically-safe and protection is by dust-ignition proof enclosure.

Factory Wiring:
The probe wires internal to the housing are connected to the frontside of the PCB. DO NOT alter this connection. Doing so will likely cause improper operation of the sensor and likely permanent damage. (See Figure 7)

Permanently Connected Equipment:
Disconnecting devices shall be included in the system installation. In installations where multiple circuits are used (i.e. independent circuits for power input and relay output), individual disconnects are required. The disconnects shall be within close proximity of the equipment, accessible to operators, and marked appropriately as the disconnect for the associated circuit. Assure the disconnect ratings are appropriately sized to the circuit protected (See Specifications). The MAINS power that connects to the sensor MUST provide circuit protection and NOT exceed 30A total.

Circuit Separation (Standard version only)**:**
Two cable entry locations are provided to aid in maintaining separation of "hazardous live" (typically mains voltages such as 115VAC and 230VAC) and limited circuits (typically control voltages less than 30Vrms or 42.5VDC). However, since the **VibraRod** sensor's single wiring compartment can not absolutely protect against physical contact between multiple circuits, it is required that all wiring used must have an insulation rating of 300V minimum, and a temperature rating of 176˚ F (80˚ C) minimum.

Protective Earthing:
Each **VibraRod** level sensor is provided with a "protective conductor terminal" which shall be terminated to the local earth ground potential of the facility to eliminate shock hazard in the unlikely event of internal insulation breakdown. Select wire size that can carry in excess of the sum of all circuits maximum amperage.

1) Remove the housing cover to access the terminal blocks and operating mode switches. All wires must be routed through the conduit openings.

2) Power Input: (See Figure 7) The **VibraRod** sensor is provided with a HI / LOW voltage, AC/DC universal power supply. If using a DC power supply, polarity is irrelevant.

3) Do not remove the green wire from J1 MAINS terminal because it is an internal connection. For grounding the unit, either use the grounding screw terminal on the outside of the housing or use the internal grounding screw terminal on the circuit board (J1 MAINS). The earth ground screw should be connected to a quality "ground" to eliminate shock hazard.

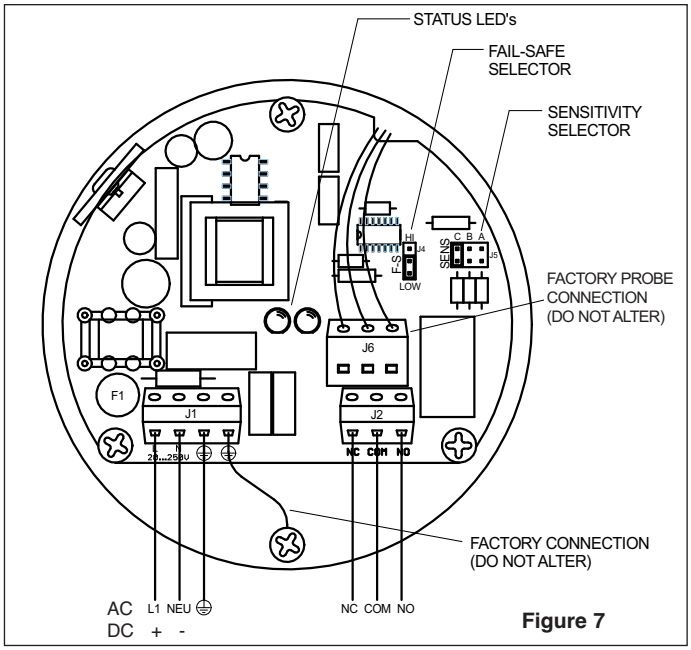


Figure 7

4) Output Contact Connections: The SPDT relay contacts can be used to indicate whether or not material is being detected by the sensor within the vessel. These outputs are also influenced by the setting of the Fail-Safe switch (See Setup). The output contact(s) can be used to switch high voltage/high current loads as listed in the Specifications. Whenever possible, use an independent voltage source to operate the loads. Select wire size that can deliver suitable voltage and current for the application. Follow all electrical codes and use proper wire gauge size. Tighten cable glands as well as housing cover after installation to ensure proper sealing for "Type 4X" environmental protection.

Conduit Entries: Conduit entry threads should be lubricated with a material such as lithium grease to ensure water ingress protection required to ensure the Enclosure "Type 4X" rating.

SETUP

Complete set-up of the **VibraRod™** is accomplished simply by adjusting the sensitivity and fail-safe settings. Each application can be adjusted independently for optimum operation.

Material Density:
The SENSITIVITY selector should be set in accordance with the density of the target material:

Position A, high sensitivity. For materials with density over 10.0~12.5Lbs/Ft^3 (160~200kg/m^3). Recommended for loose and light materials, greatest sensitivity of detection.

Position B, medium sensitivity position: For materials with density 12.5~15.6Lbs/ft^3 (200~250kg/m^3). Recommended for modest density materials.

Position C, low sensitivity position: For materials with density 18.7~21.8Lbs/ft^3 (300~350kg/m^3). Recommended for thick and heavy materials, least sensitivity of detection.

If the material to be sensed can potentially form heavy deposits on the probe, selection "LOW sensitivity" (Position "C") should be chosen. This will provide additional immunity to product buildup while still enabling the circuit to sense the presence of material.

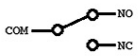
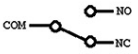
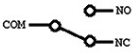
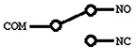
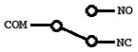
POWER SUPPLY	FAIL-SAFE	PROBE	STATUS LED	RELAY
NORMAL	HI	No Material (Vibrating)	GREEN	 Energized
		Covered Material (Not Vibrating)	RED	 Relaxed
	LOW	No Material (Vibrating)	GREEN	 Relaxed
		Covered Material (Not Vibrating)	RED	 Energized
FAIL	HI or LOW	Material or No Material	NOT LIT	 Relaxed

Table 1

Fail-Safe (Selector "J4" in Figure 7)**:**
Selection of the fail-safe mode (See Table 1) will permit the output contacts to be triggered in a manner that assures proper control of loads in the event of power failure. To obtain fail-safe operation, use the relaxed output as an alarm, thus a power failure will also be considered as an alarm. Depending on which condition is most critical to signal (high level or low level), the selection can be made by positioning the switch to one of the following:

FAIL-SAFE "HIGH" Position: When no material is present, the relay will be energized. The relay will be relaxed when material is sensed, or if power failure occurs.

FAIL-SAFE "LOW" Position: When material is sensed, the relay will be energized. The relay will de-energize when no material is sensed, or if power failure occurs.

Status LED (See Table 1):

Green LED: Indicates power is applied and no material sensed.

Red LED: Indicates power is applied and material is sensed.

Not Illuminated: Indicates improper connected or no supply voltage, or damaged circuit.

TROUBLESHOOTING

PROBLEM: Sensor will not sense material.

CAUSE/SOLUTION:

1) Verify power is applied to the sensor.
2) Verify sensor status by observing LED's: GREEN = not sensed, RED = sense, no light = no power.
3) Verify sensitivity setting. Position sensitivity selection in position Highest Sensitivity "A" thereby making the probe more sensitive to "difficult to sense" materials.
4) Verify probe coverage when sensing is expected. The sensor is not designed to be "tip sensitive". Permit significant probe coverage before expecting material sensing.
5) Verify electrical connections.

PROBLEM: Sensor remains in "DETECT" mode even when material is absent.

CAUSE/SOLUTION:

1) Verify sensor status by observing LED's: GREEN = not sensed, RED = sense, no light = no power.
2) Verify the probe is not in direct contact with any internal vessel structure. If so, reposition sensor.
3) Verify sensitivity setting. Position sensitivity selection in position Lowest Sensitivity "C" therefore making the probe less sensitive to "easy to sense" materials and more immune to material buildup.
4) Ensure there is no material buildup on probe. Product buildup across the probe surface or between the probe and vessel wall may create false detection. Clean probe if necessary.

PROBLEM: Output contacts perform opposite of designations (N/O, N/C).

CAUSE/SOLUTION:

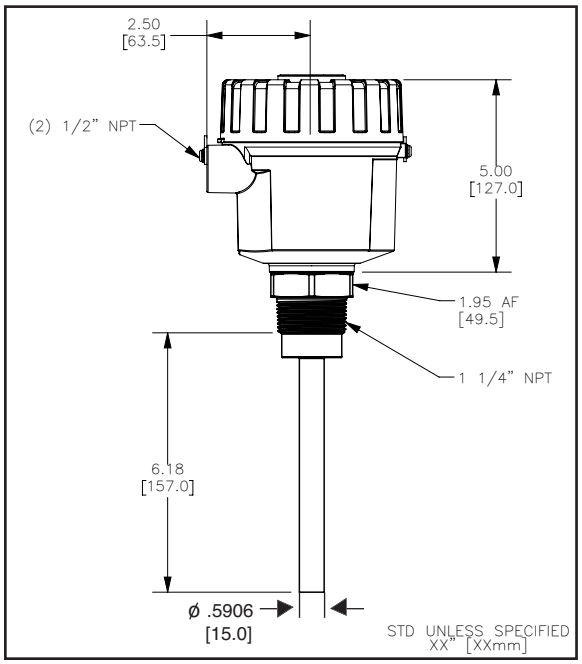
1) Check Table 1 for correct fail-safe switch selection. Swap wire terminations of N/O and N/C if necessary. Changing the fail-safe selection is not recommended unless fail-safe feature is not a concern to the application.

MAINTENANCE

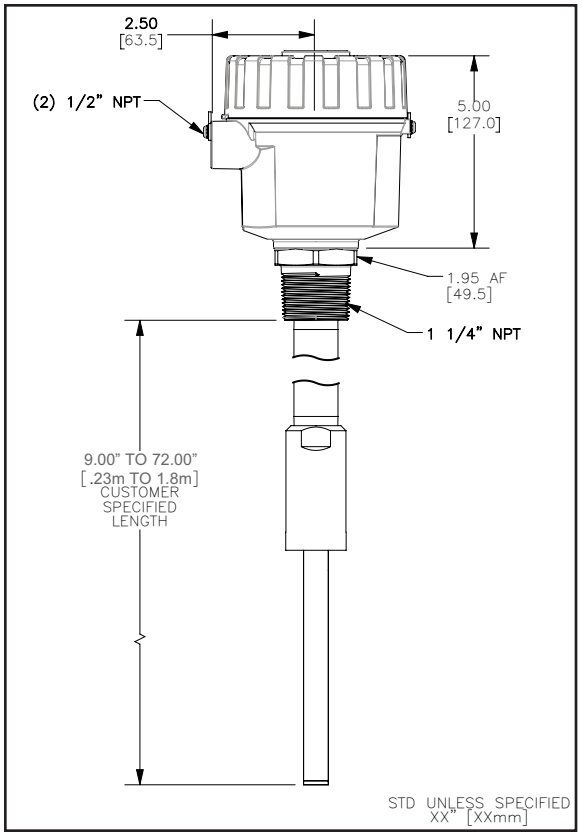
The **VibraRod™** level sensor is a maintenance-free product and should be serviced by Monitor Technologies LLC personnel only. If operation appears inappropriate, see the Troubleshooting section of this bulletin. If proper operation is not achievable, consult the factory.

MECHANICALS

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS



Standard Probe



Pipe Extension Probe

SAFETY

General Safety:

CAUTION! It is essential that all instructions in this manual be followed to ensure proper operation of the equipment and safety of operating personnel. Use of equipment in a manner not specified by the manufacturer may impair protection provided by the equipment. The use of this symbol is used within this manual to highlight important safety issues. Please pay particular attention to these items.

Electrical Shock Caution:

The **VibraRod™** level sensor can be powered with HIGH VOLTAGE. No operator serviceable parts are inside. All servicing is to be performed by qualified personnel. Extreme care shall be taken if the unit's cover is removed and live electrical terminations are exposed. To avoid electrical shock, do not contact any exposed electrical connections. Each unit is provided with a "protective ground" connection, which shall be terminated to earth ground potential. This terminal shall be used to reduce shock hazard in the unlikely event of internal insulation breakdown.

EMC Emissions:

Meets: EN 61326-1: Electrical Equipment for Control Use, EMC.
EN 55011: Radiated and conducted emissions (Class A - industrial).

EMC Immunity:

EN 61000-4-2: Electrostatic discharge (industrial).
EN 61000-4-3: RF radiated EM fields (industrial).
EN 61000-4-4: Electrical fast transients (industrial).
EN 61000-4-5: Electrical surges (industrial).
EN 61000-4-6: RF conducted EM energy (industrial).
EN 61000-4-11: Voltage dips, short interruption and voltage variation immunity (industrial).

WARRANTY

Monitor Technologies LLC warrants each **VibraRod™** to be free from defects in material and workmanship under normal use and service for two (2) years from the date of purchase. The purchaser must notify Monitor of any defects within the warranty period, return the product intact, and prepay transportation charges. The obligation of Monitor Technologies LLC under this warranty is limited to repair or replacement at its factory. This warranty does not apply to any product which is repaired or altered outside of Monitor Technologies' factory, or which has been subject to misuse, negligence, accident, incorrect wiring by others, or improper installation. Monitor Technologies LLC reserves the right to change the design and/or specifications without prior notice.

SPECIFICATIONS

Power Requirements:	22-27VDC (±10%); 22-232VAC (±10%), 50/60 Hz
Power Consumption:	≤ 4VA (AC); ≤ 3W (DC)
Altitude:	6562 ft (2000m) max
Installation Category:	II
Pollution Degree:	2
Process Temperature:	
Standard Probe:	-4˚ to 176˚ F (-20˚ to 80˚ C)
Pipe Extension Probe:	-4˚ to 176˚ F (-20˚ to 80˚ C)
Ambient Temp (all units):	-22˚ to 149˚ F (-30˚ to 65˚ C)
Output Relay:	
VAC:	SPDT isolated; 3A @ 250VAC max
VDC:	SPDT isolated; 3A @ 30VDC max
Sensitivity:	**A:** 10.0~12.5lbs/ft³ (160~200kg/m³) **B:** 12.5~15.6lbs/ft³ (200~250kg/m³) **C:** 18.7~21.8lbs/ft³ (300~350kg/m³)
Fail-Safe:	Switch Selectable: High or Low
Housing:	Powder coated die-cast aluminum; NEMA 4X, ENCLOSURE TYPE 4X, IP66
Process Connection:	1-1/4" NPT (VibraRod), 1-1/4" NPSC (Vessel)
Pressure Rating:	
Standard Probe:	145psi (10bar)
Pipe Extension Probe:	145psi (10bar)
Conduit Connections:	1/2" NPT
Local Indicator:	Bi-color LED: Green = No material, Red = Material present, No light = No power
Probe Material:	
Standard Probe:	304SS
Pipe Extension Probe:	304SS with 304SS 3/4" pipe, Max 6ft / 1.83m (Top Mount), Max 2ft / 0.61m (Side Mount)
Weight:	
Standard Probe Version:	Approx. 3.25 lbs (1.5 kg)
Approvals:	$CSA_{US/C}$: Ordinary Locations; Class II, Groups E, F, G; Class III Dust Ignition Proof with Intrinsically Safe Probe

CE Mark

CHINA RoHS 2

BULLETIN
554A

Monitor Technologies LLC
44W320 Keslinger Rd. ▼ Elburn, IL 60119 ▼ 630-365-9403 ▼ 800-766-6486 ▼ monitor@monitortech.com ▼ www.monitortech.com