

AUTOMATION PRODUCTS GROUP, INC.

Operator's Manual

VBL Series General Purpose Vibrating Level Sensor

Rev. A2, 9/09



Automation Products Group, Inc.

APG...Providing tailored solutions for measurement applications

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W. H. Cooke & Co., Inc. Manufacturer of thermocouples & RTD's Made in the USA
Supplier of industrial controls, heaters, and sensors since 1963

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• Warranty and Warranty Restrictions

APG warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within 24 months from date of shipment from factory.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of APG which is not specifically set forth herein shall be binding upon APG. APG shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and APG's liability hereunder, in any case, is expressly limited to the repair or replacement (at APG's option) of goods.

Warranty is specifically at the factory. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/electrical protection devices. APG shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

Returns and allowances must be authorized by APG in advance. APG will assign a Return Material Authorization (RMA) number which must appear on all related papers and the outside of the shipping carton. All returns are subject to the final review by APG. Returns are subject to restocking charges as determined by APG's "Credit Return Policy".

- **Introduction**

The vibrating level sensor, VBL-12, VBL-22, and VBL-32 are made specifically for solid level measurement in containers. It is designed for minimum density of bulk solid (loose) 12 lbs. per cubic feet (0.2 g/cm³). Not only fine powders, ordinary powder, granular materials and pellets, but also for detecting sediments in the liquids such as sludge, sand, etc. The model VBL is usable in a wide range of specifications. Since the detecting point is at the tip of the vibration pipe, it is immune to buildup of the medium on the inside wall of the vessel.

- **Specifications**

Operational Versions

VBL-12: Compact

VBL-22: For extended probes

VBL-32: For flexible extension

Performance

Bulk Density: Min 0.2 g/cm³ sensitivity

Output Contact Rating: 1 SPDT, 240 V 3AAC, 30 V 3 ADC (resistive)

Vibration Frequency: Approximately 330 Hz

Sensitivity Adjustments

Very High for highly fluidized powders

High for fine powders (bulk density 0.2-0.5 g/cm³)

Standard for bulk density 0.5 g/cm³ or more (factory setting)

Low for sticky media

Loss of Power Mode: Provided (high or low) by switch

Detection Time Delay (optional field adjustable)

Covered: 1 sec.

Free: 5 sec.

Indication:

Green LED for Power status

Red LED for Relay status

Electrical

Supply Voltage: 90 to 132 VAC, 180 to 264 VAC or 24 VDC

Power Consumption: Approximately 5 VA

Physical**Material**

Housing: Aluminum die cast (ADC)

Vibration Probe: 304SS (316SS optional)

Cable Entries: G 3/4, G 1/2 or NPT 1/2

Rating: IP65/NEMA 4

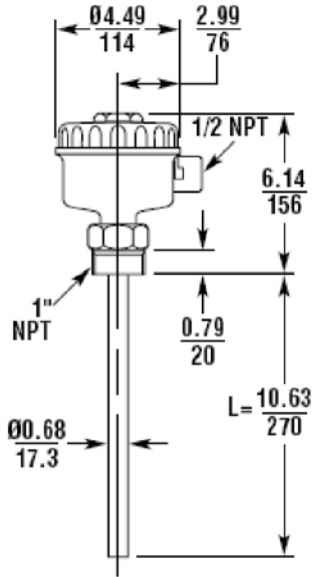
Environmental**Operating Temperature:**

	Vibration Rod	Housing
VBL-12, 22	-4 to 300°F (-20 to 150°C)	-4 to 140°F (-20 to 60°C)
VBL-31	-4 to 158°F (-20 to 70°C)	-4 to 140°F (-20 to 60°C)

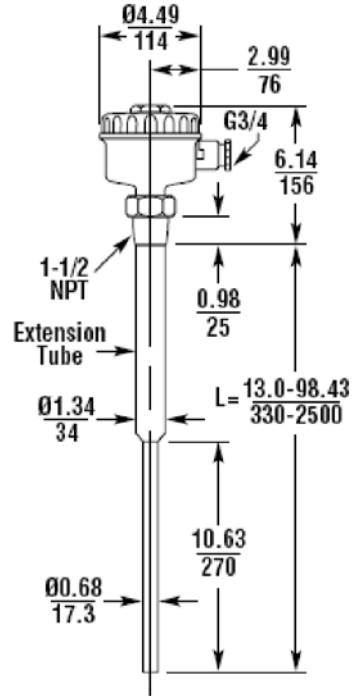
Maximum Pressure: 290 psi (20 bar)

Dimensions — in./mm

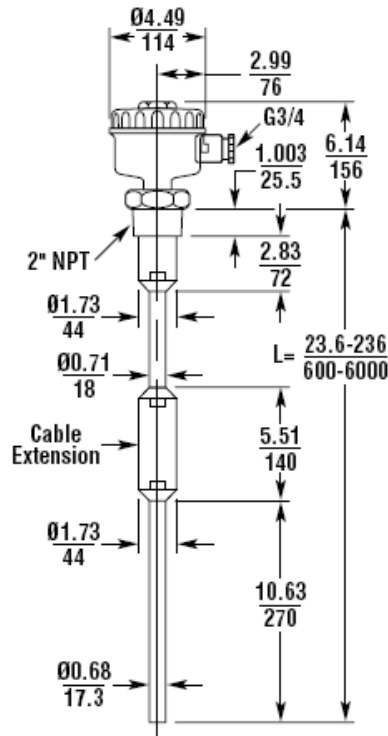
VBL-12



VBL-22



VBL-32



• Nomenclature

1. Vibration Pipe

Detecting part which touches directly to the powders. It vibrates when there's no powders, but vibration will dampen or stop when it becomes buried in the measured materials.

2. Plug for VBL-12N/NT and VBL-22N/NT

Screw to install the sensor to the tank.

3. Flange for VBL-12F/FT, VBL-22F/FT and VBL-32F

Flange to install the sensor to the tank.

4. Extension pipe for VBL-22F/FT and VBL-22N/NT

Sensor measuring length extension part.

5. Flexible cable for VBL-32F

Sensor measuring length extension part.

6. Housing

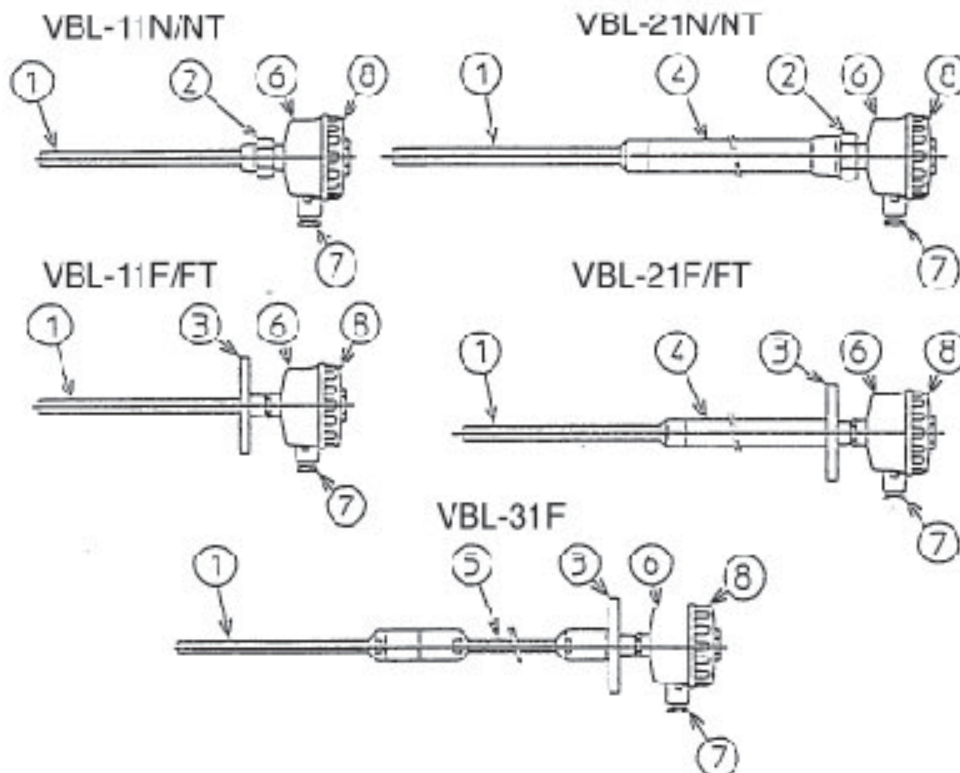
Electronic circuit is placed.

7. Cable Gland

Cable entry to enter the cable.

Sizes are JIS F 20a (G 3/4) and JIS F 15c (G 1/2) (Optionally available.)

8. Cover for the sensor.



• Electronics

9. Terminals

Output terminal for power connection and sensor relay contact signal.

10. Power Indicator

Green lamp lights when the sensor power is on.

11. Alarm Indicator

Red lamp lights when the sensor detects the measuring materials.

12. Sensitivity Setting Volume

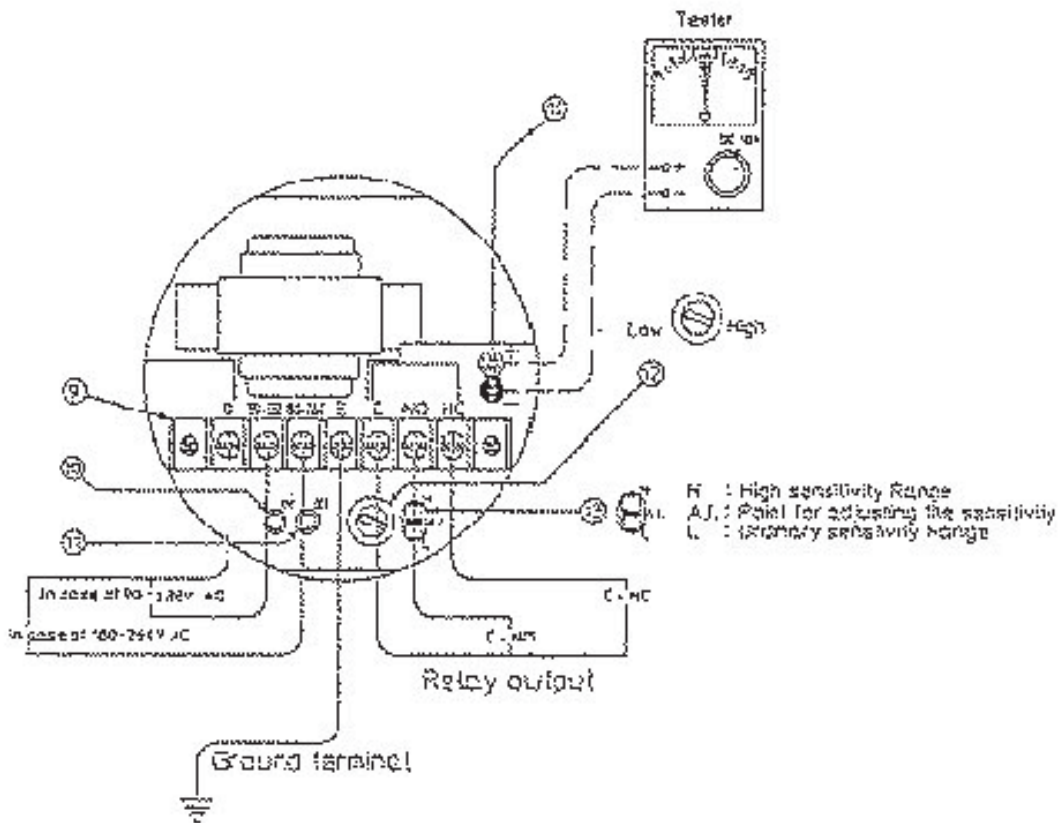
To set the sensor detecting sensitivities or to check the operating condition.

13. Sensitivity Setting Switch

To set the sensor detecting sensitivities or to check the operating condition.

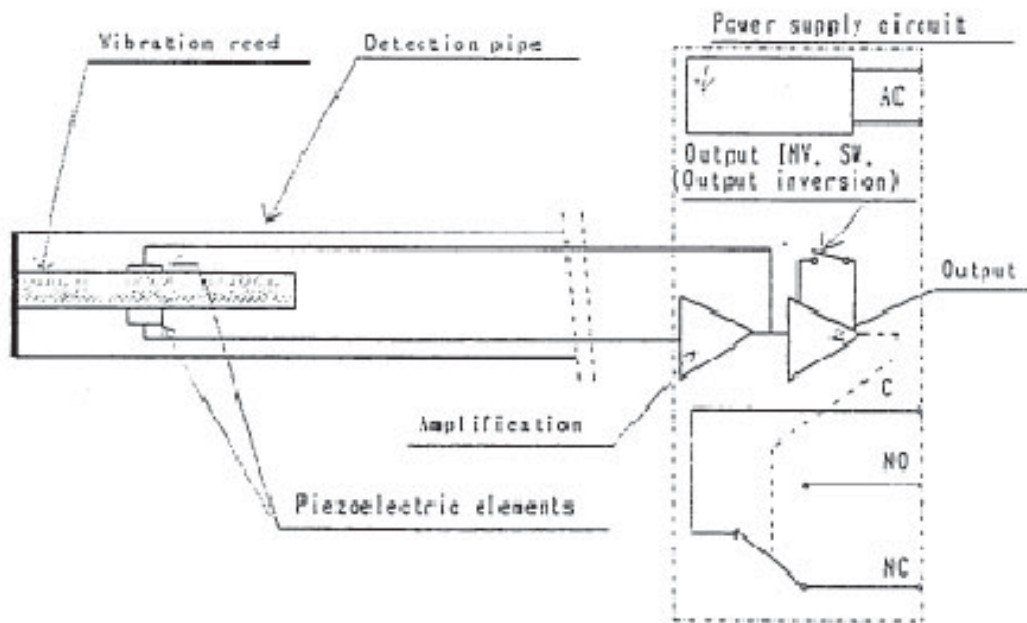
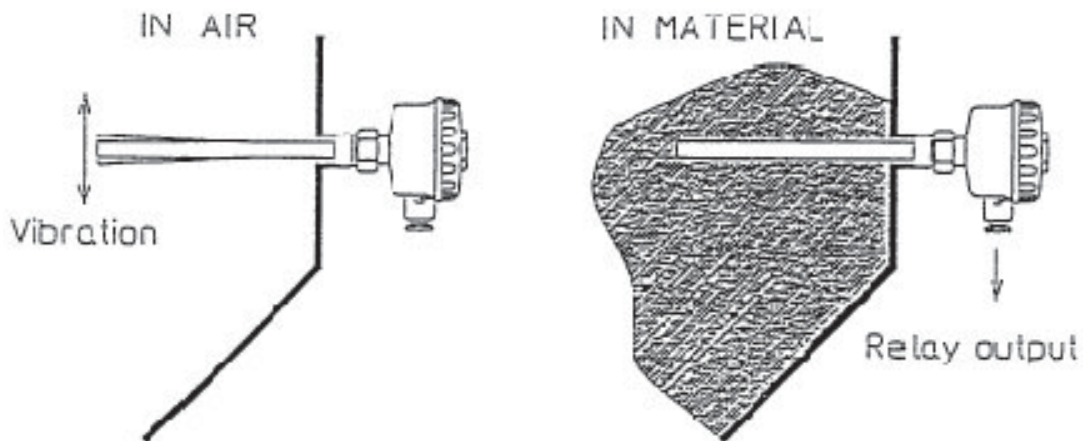
14. Meter Test Points

Meter test points for performance check and fine adjustment of sensitivity: [Red for positive (+) point and Black for negative (-) point.]



• **Principle of Operation**

The vibration rod vibrates by installing piezo-electric element and acceleration pickup mounted vibration board at the tip of the internal pipe. The piezoelectric element provides vibration and the acceleration pickup detects changes in the vibrational frequency. Covered with solids dampens vibration of the vibration pipe. The electronic circuit detects the damping of these vibration pipe. The electronic circuit detects the damping of these vibration and converts into an relay output.



• Installation

Unpacking

This unit has been thoroughly inspected and carefully packed at the factory to prevent damage shipment. When unpacking, open shipping cartons of unit and inspect the units for shipping damage. If there is evidence of damage, notify the carrier immediately. Also verify the contents for properly ordered units.

Environment

The VBL should be installed in an area which meets the following conditions:

- The ambient temperature range is within the following:

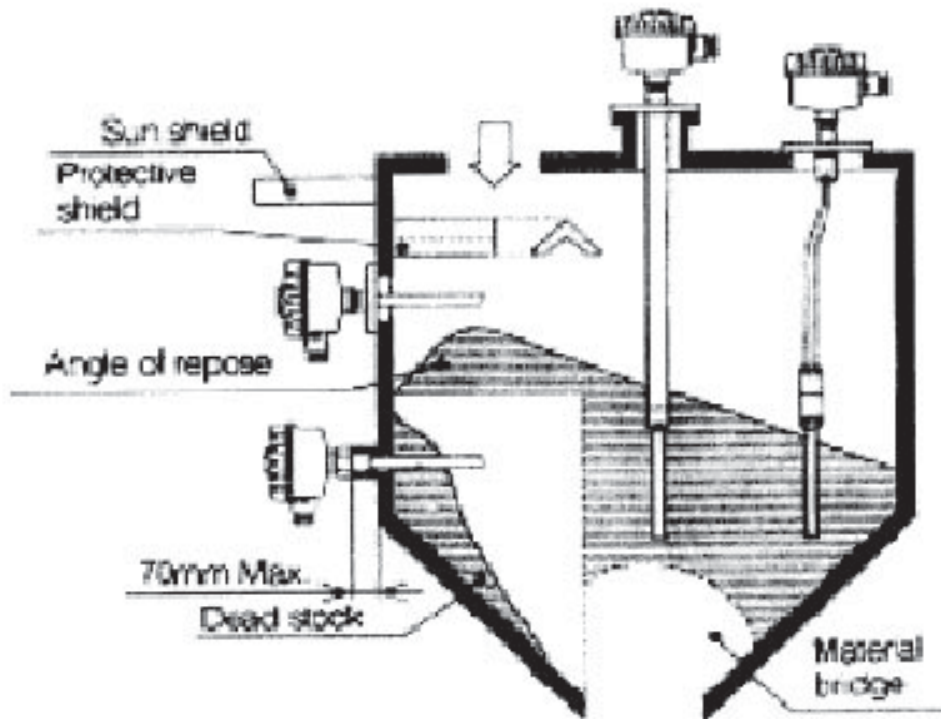
	Housing	Probe
VBL-12/22/32	-20 to +60°C	-20 to +150°C
VBL-12-T/VBL22-T	-20 to +50°C	-20 to +150°C

Note: Install a sun shield over the housing if exposed to direct sunlight. Do not install in an area where the ambient temperature drops rapidly (for example, 40°C to 0°C). This may cause dew and damage the sensor.

- Locate away from splashing water. The housing protection is IP65.
- No corrosive gases (such as NH₃, SO₂, Cl₂, etc.).
- Nonhazardous area.
- Ample space is provided for maintenance/inspection.

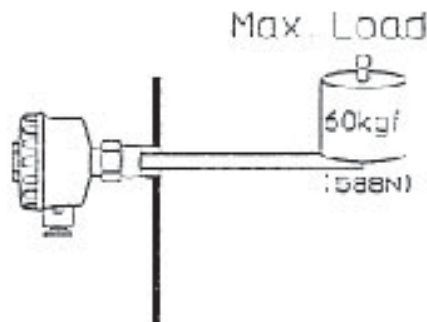
Location

- Locate the VBL at the position where the material level will actually make contact with the probe. In case of high level control, pay attention to the angle of repose. In case of low level control, prevent from being surrounded by dead stock.
- The maximum length for the threaded boss/standoff pipe is 70 mm.
- The vibration rod should not be in contact with standoff pipe or tank wall.
- The VBL may be mounted in any position or orientation. However, it is recommended that the cable entry be pointed downward where possible to prevent intrusion from rain or splashing.
- In case of negative or positive pressure in the container, use suitable pipe compound, gaskets or thread tape.

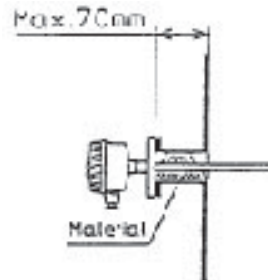


Installation

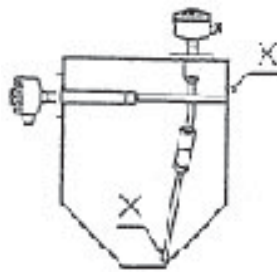
- The maximum load at the tip of the vibration is 60 kgf. If it exceeds, the vibration pipe will be bent. Install the guard at least 100 mm above the vibrating pipe if necessary.



- The maximum length for the threaded boss/mounting nozzle is 70 mm. If exceeds 70 mm, the sensor will detect the dead stock despite there aren't any measuring materials in case of horizontal mounting.



- The vibration pipe will not vibrate despite there aren't any measuring materials.



- When used as a high level control, calculate the angle of repose for measuring materials and install the vibration rod where it surely covers.
- When using as a low level control, install the guard above the vibration rod as bridge or overload is anticipated.

• Adjustment Procedure

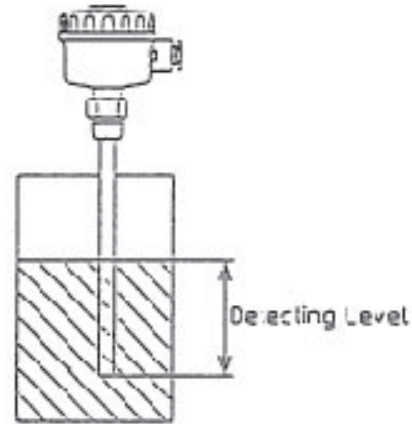
Fundamentally, the model VBL needs no adjustments. But adjust the detecting sensitivity for:

- Fine powders
- Highly fluidized powders
- Sticky and buildup materials.
- Improper adjustment

Powder Detecting Sensitivity

The adjustment of the detecting sensitivity depends on bulk density, fluidity, buildups concentrate features and so on. Accordingly, the data written below will be nearly general. See the table below:

Polycarbonate pellet (PC pellet), salt, powdered coffee's detecting sensitivities are written below for your reference.



Detecting Levels

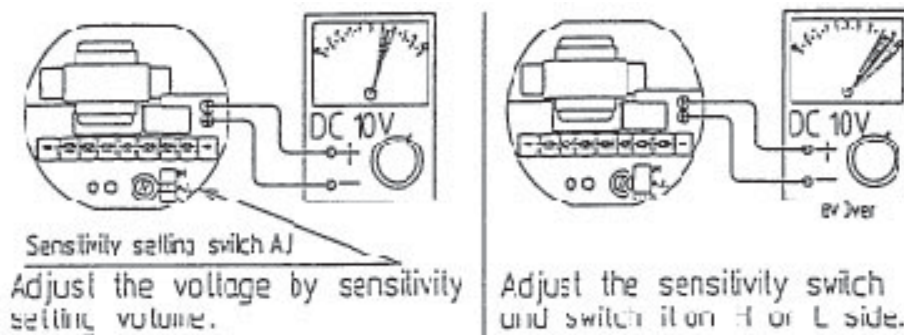
Standard	Super High		
Powder Names	Bulk Density	Sensitivity	Sensitivity
Salt	1.4	Less than 20 mm	Less than 20 mm
PC Pellet	0.7	Less than 40 mm	Less than 10 mm
Powdered Coffee	0.26	Undetectable	Less than 80 mm

Standard Sensitivity: The sensitivity when shipping

Super High Sensitivity: The most high detecting sensitivity.

Adjusting the detecting sensitivity

- Prepare the following equipment:
 - 0 ~ 10 V AC range tester. (In case of voltmeter, input resistive more than 10 Ω .)
 - Small-sized slotted blade screw driver.
- Clean up the vibration pipe. While adjusting, make sure the measuring materials are not contacting the vibration rod. If it contacts, exact adjustment will be impossible.
- Turn on the power supply if it is not on.
- Wait for 5 seconds.
- Set the sensitivity setting switch to AJ (middle point).
- Plug in the positive reed to positive (red) meter test point and negative reed to negative (black) meter test point. Adjust the tester to voltage range which can detect the direct current 0 ~ 10 V every 0.5 V.



- Super-high sensitivity for highly fluidized powders. Adjust the check terminal voltage to 4.5 ~ 5.5 V by sensitivity setting volume. Set the sensitivity switch to H (high sensitivity range).
- High sensitivity for fine powders. Adjust the check terminal voltage to 2 ~ 3 V by sensitivity setting to L (ordinary sensitivity range).
- Low sensitivity for sticky and build-up material. Adjust the check terminal voltage to 4.5 ~ 5.5 V by sensitivity setting volume. Set the sensitivity switch to L (ordinary sensitivity range).

Consult APG for repair or replacement in case of indicating the incorrect voltage.

• Sensitivity

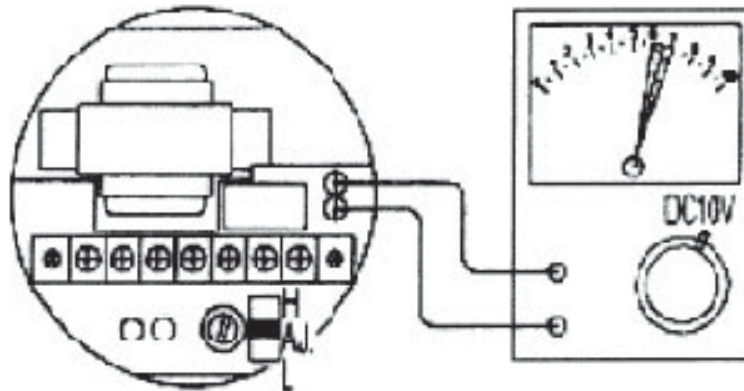
The sensitivity can be adjusted by using the sensitivity switch and by adjusting the voltage.

H with 4.5~5.5 VDC: for highly fluidized materials.

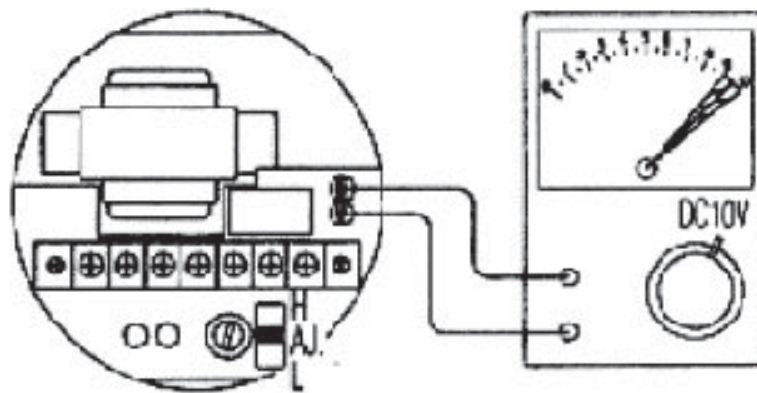
L with 2.0~3.0 VDC: for light materials.

L with 4.5~5.5 VDC: standard adjustment (bulk density 0.2/cm³ or more)

L with 6.0~7.0 VDC: for sticky materials.



Set the
Turn s



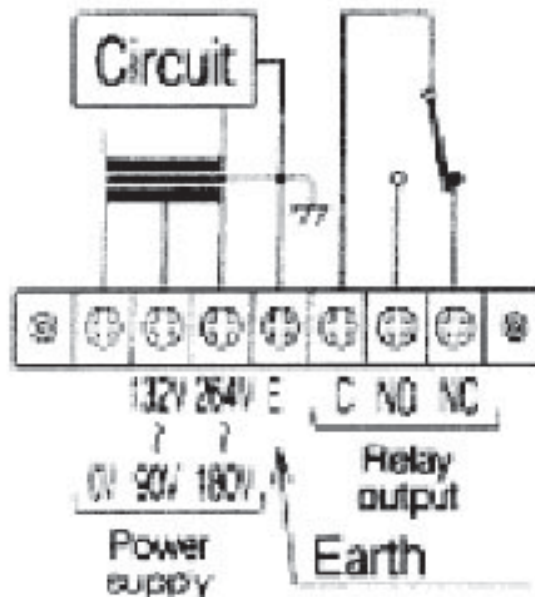
After adjustment, set the switch to H or L and make sure 8~10 VDC can be read.

• Wiring

Wiring should be in accordance with all local codes. Control cable should be a minimum of 0.75 mm².

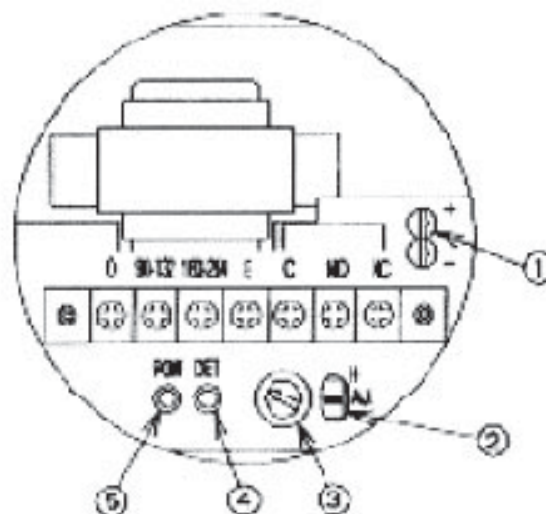
- Contact capacity
 - 240 V 3 A AC (Resistive)
 - 30 V 3 A DC (Resistive)
- Power supply
 - 90 to 132 V AC 50/60 Hz
 - 180 to 264 V AC 50/60 Hz
- Power consumption
 - 5 VA

Caution: Make sure the supply voltage matches the markings on the circuit board terminals. Applying the wrong voltage or miswiring will damage the sensor and may cause injury.



• Start Up

1. Test Points
 - For fine adjustment of the sensitivity.
2. Sensitivity Switch
 - To set high or low sensitivity.
3. Sensitivity Volume
 - To adjust the sensitivity.
4. Detection Status LED
5. Power Status LED



• **Maintenance**

In general, the sensitivity properly set VBL needs no maintenance. But in order to use the sensor stable for a long time, maintenance and inspection are needed in periodic intervals.

Inspection

Inspection is held to examine

- If the sensitivity is set to proper sensitivity.
- If it is affected by the build-up.
- If the sensor is operating correctly.

Proceed as follow:

- Make sure the measuring materials are not touching the vibrating pipe. Replace the sensor out of the tank if necessary.
- Supply power to the sensor.
- Make sure which the sensor sensitivity is set. Super-high, high, standard (shipping sensitivity) or low.
- Prepare the 0 ~ 10 VDC range voltmeter.
- Plug the voltmeter leads to the test points, positive to Red (+) and negative to Black (-).
- See the table below. Ensure both A and B stated voltage can be read for each set sensitivity.

Set Sensitivity	Position for Sensitivity Setting Switch and Voltage Reading	
	A	B
Super-high	H: 8 ~ 9 V	AJ: 4.5 ~ 5.5 V
High	L: 8 ~ 9 V	AJ: 2.0 ~ 3.0 V
Standard	L: 8 ~ 9 V	AJ: 4.5 ~ 5.5 V
Low	L: 8 ~ 9 V	AJ: 6.0 ~ 7.0 V

- If the voltage reading is accomplished, the sensitivity adjustment is correct. Nevertheless malfunction occurs. See Troubleshooting section.
- If the voltage reading is low, clean up the build-up on the vibration rod. Then adjust the sensitivity volume in the state of sensitivity setting switch is AJ until the correct voltage can be read. Otherwise, the sensor is defective. Consult APG for repair/replacement.

- If the voltage reading is high, the sensitivity adjustment is not properly set. Adjust the sensitivity volume in the state of sensitivity setting switch is AJ until the correct voltage can be read. Otherwise, the sensor is defective. Consult APG for repair/replacement.

Maintenance

In order to use model VBL for a long time, maintenance is needed in periodic intervals. Periodic inspections are important to maintain good service.

Maintenance method is as follow:

- A large amount of build-up on the tip of the vibration rod will cause wrong signal output. Clean build-up in periodic intervals in case of measuring strong adherence materials.
- Make sure the raindrops (waterdrops) are not intruding inside the housing. For outdoor use, the waterdrops will intrude easily if the housing cover or the cable entry is loose. Intrude of the waterdrops will cause an erroneous signals, make sure to tighten periodically. A crack of water-drop-proof O-ring (special article) between housing and cover will deteriorate the water-drop-proof. Replace it with new ones.
- Depending on the measuring materials, the sensor will cause corrosion or rubbing. Make sure the corrosion and rubbing are not outbreaking or progressing periodically,

• Troubleshooting

Problem

Not detecting powders when covered.

Possible Causes

- Powder build density is too small. Bulk density under 0.2 cannot be detected.
- Power supply not connected.
- Material too fluid.
- Effected by heavy hopper vibration.

Remedies

- Set high sensitivity
- Connect power supply.
- Install sensor in a better location.

Problem

- It keeps detecting powders while the hopper is empty.

Possible Causes

- Heavy deposit on vibration rod.
- Material has dead stock.

Remedies

- Clean vibration rod.
- Install sensor in better location or isolate dead stock.

Notes

Notes

Notes

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