



# **Installation and Operating Instructions**

**Series AVI-PSM**

**SMART RF DRIVEN SHIELD LEVEL SWITCH**

## **General Safety Notes**

**CAUTION: DO NOT USE ADOPT MONO-COMPOSITION ENCAPSULAN (acetic acid will decay electrical component). USE SPECIAL DOUBLE-COMPOSITION ENCAPSULAN (non-erosive), please consult factory for the type of this material.**

- 1. For personnel and equipment safety, please use care when lifting and installing equipment. Total weight about 5 kg or higher with certain longer cable probes and over 15 kg with flanges.**
- 2. Please read this manual before using.**
- 3. Pay attention to sure everything is safety when installing the equipment in the field.**

## SECTION 1 INTRODUCTION

### 1.1 System Description

This instructions manual is for the AVI-PSM Series smart RF admittance level switch, which used for most level measurements and control. It is suitable for almost all industrial or civil applications where measuring level of liquids, powders, slurries and interface. The equipment can be either installed indoor or outdoor, no special mounting requirements needed.

The AVI-PSM series is a level switch comprised of one electronic unit, one connecting coaxial cable and one rigid or cable sensing element (and also it could be called probe). These components can be connected in an integral configuration or a remote configuration which all electrical components are mounted away from the measuring point and the sensing element. The sensing element can be manufactured of many different metals and insulators depending on the specific application. See figure 1.1 as AVI-PSM series integral system scheme.

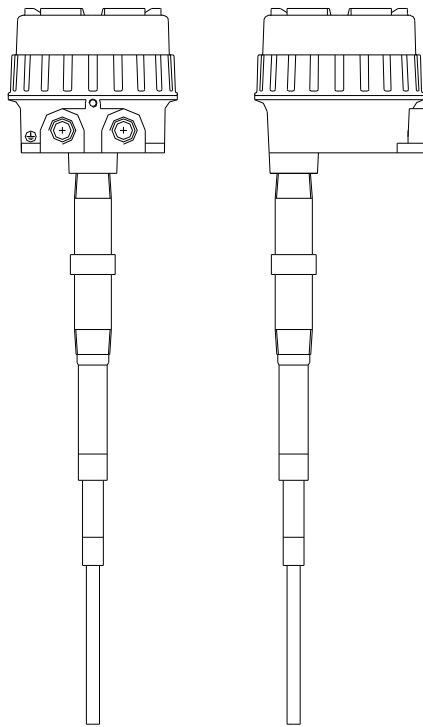


Figure 1.1 AVI-PSM series RF level switch

These AVI-PSM series RF level switch are followed the standards which listed below:

### 1.2 Operation Principle

Radio Frequency admittance level technology uses a basic capacitance technology to detect the difference in materials, i.e. air/powder, air/liquid, oil/water. But it has advanced features for rejecting coatings, more reliable and stable operation, higher accuracy and remote electronics.

Radio Frequency admittance technology employ a capacitance bridge and differs from capacitance technology in the electronics; cable and sensing element uses a driven shield circuit to stabilize the coaxial cable. The electronic unit's measuring (probe) signal is also passed through a parallel in-phase amplifier internally. This additional signal is connected to the shield of the coaxial cable and then is passed to the sensing element's shield connection. This driven shield amplifier is an in-phase amplifier with a gain of 1. The signal on the shield has the same potential, phase, and frequency as the measuring signal but is electrically isolated from the measuring signal and measuring circuit. Since the center wire & shield wire of the coaxial cable have the above relationship, there is no potential difference between them. No potential difference means that no current flows between the conductors, and no current flow (leakage) from the center wire to the shield means there is no capacitance between them (capacitance equal zero.) As a result, build-up on the sensor, cable length and cable temperature have no affect on the measurement. A separate ground wire connects the probe ground to the electronic amplifier ground.

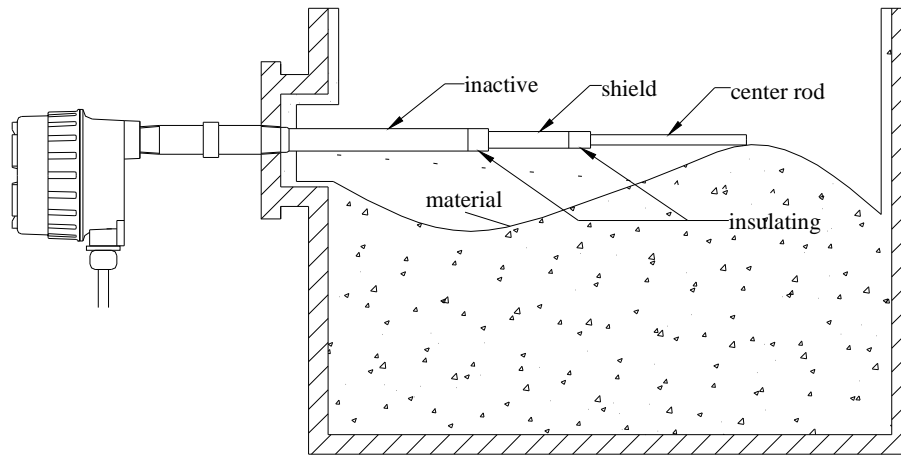
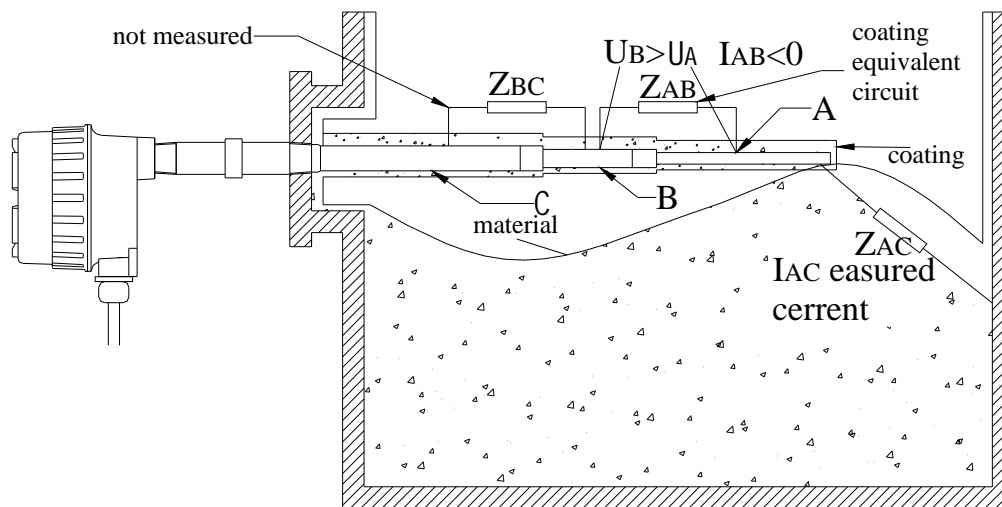


Figure 1.2 Sensing element construction

The RF admittance technology eliminates the effect of build-up on the sensing element (usually called coating), using a five layer coaxial configuration sensing element (See figure 1.2 sensing element in vessel). The measuring element is the center rod, Driven Shield is the middle element, and the inactive (ground) is the outside element. Each element is isolated from each other with an appropriate insulation material. As explained in the coaxial cable description, the same signals are connected to the sensing element; center wire to measuring element, shield to the driven shield element, and ground to ground. There is no potential difference between the measuring element & shield element. Even when the coating is thick and conductive, the impedance of the build-up is very low and measurable current will not pass from the measuring element to the shield or ground. The electronic unit only measures the current between the sensing element & probe ground (vessel wall). i.e.  $U_A = U_B$ ,  $I_{AB} = (U_A - U_B) * Y_L = 0$ . See figure 1.3 equivalent sketch. The shield to ground (vessel wall) potential is difference but this current is not part of the measurement circuit so it does not affect the measurement. A proprietary amplifier circuit keeps the potential on the driven shield element intrinsically safe and in balance with the measuring circuit. With this technique the measurement circuit is not affected by build-up on the sensing element. Only when material in the vessel raises up to touch the center rod (measuring sensing element) could make the current flow through the material from the center rod to ground to change the state of the alarm loop output current.



1.3 Equivalent sketch

## SECTION 2 SPECIFICATION:

### 2.1 System specification:

Measuring rate of facility: measurement category II, transient rated voltage 2500V. Do not use the equipment for measurements out category I and II.

Output: DPDT reply (double pole double throw)

Contact Rating: 250VAC: 1A inductive, 3A non-inductive

Indicators: Three states LED. Red- level alarm; Green-system normal; Yellow-instrument self checking failure or the probe shield terminal short circuit to the earth.

Power requirement: 30-265VAC, 50/60Hz or 21-27VDC (No polarity required), auto check.

Dissipation power: 2W

Resolution: 0.2 pF or better. (Standard condition.)

Repeatability : <1mm(0.04") (Conductive material)

<20mm (0.79") (Insulating material)

Load resistance(Driven ability): Center wire to shield 500 ohm

Shield to ground 150 ohm

Fail safe: High (HLFS) or low (LLFS) field adjustable

Response time: less than 1s

Delay time: 1 ~ 70S in 16 section

Ambient Operating Temp.(electronics) : -40~+70°C (-40~158°F)

Ambient humidity: <100% RH (while 25°C)

Storage Temp.: -40~+85°C (-40~185 °F)

Re-calibration: Unit could be reset in the field, and then when it power on again, the unit will finish calibration automatically

Process material setting: Be divided into conductive material and insulating material, could be selected in the field.

Range setting: 130pF and 30pF could be selected in the field.

Alarm mode: High or low level alarm and its fail safe function could be selected in the field.

Barrier: Built-in limiting current and four-limiting voltage barrier

ESD (for unit):4KV/8KV

RFI (Built-in filter): the whole system has passed spatial 10V/m electromagnetic field and 3V/m electromagnetic field current infusing tests

Sensing Element IL: 0.5m (19.7") standard, 0.1m(3.9")~20m(787.4") optional

Inactive Length: Max length 50m(164 ft); 50m(1968.5") ~100m(3937") consult factory

Cable length: 5m(197") standard; 0.1(3.9") ~50m(1968.5") optional; >50m(1968.5")~100m(3937") consult factory

Electrical Connection: Double M20\*1.5 (cable diameter less than 12mm, 0.47"), 3/4" NPT optional

Process Connection: Standard: BSPT(R) Thread, Optional: NPT or flange

Mounting: Vertical, horizontal or any angle

Ingress Protection: Meets IP67 requirements

Explosion-proof rating: Ex ia IIC T4

Designed elevation altitude: Lower than 2000m (6562ft)

Wire requirement: Power & relay output wire is armoured & explosion-proof three terminal cable, cable O.D. less than 12mm, conducting material is copper. The section area of wires should be between 0.13-2.1mm<sup>2</sup>(AWG14-26), insulation rating over 1500V, meet IEC60245/60227 standard requirement. Associated switch meet IEC60947 standard requirements.

## SECTION 4 INSTALLATION

### 4.1 Unpacking

Carefully remove the contents of the shipping carton and check each item such as model number, serial number of electronic unit & sensing element, accessory, instruction manual etc. against the packing list before destroying any packing materials. If there is any shortage or damage, report it to the factory or local representative.

### 4.2 General requirements

The AVI-PSM series smart level system can be mounted vertically, horizontally or at an angle. Be certain that neither the measuring element nor the driven shield element contact the vessel wall, nozzle or any obstruction in the vessel.

The sensing element should be installed using a proper thread sealant and tightened using the hex wrench flats on the inactive (ground) portion of the probe. Do not try to tighten the probe by using leverage on the probe housing. The housing or probe seals may be damaged. For long rigid sensing elements in agitated vessels a support should be affixed to the inactive section of the probe to prevent damage. Long fully insulated sensors may be anchored in the vessel. Consult either the factory or local representative for specific recommendations.

Electrical connections should conform to plant and national standards. For horizontal mounting, instrument wire entries should be pointed downward to the vessel so moisture is not carried into the electrical housing through the conduit.

For explosion-proof installations each wiring entry must have an appropriate gas seal device. Consult factory or local rep for such fitting.

Instruments installed outdoors in areas of lightning strikes should be installed with lightning protection.

24VDC Instrument power noise should be lower than 200mV.

Ground wire should be connected to standard ground or instrument ground, mustn't be connected to dynamic ground.

### 4.3 Integral Installation

The AVI-PSM series smart level system is designed and is suitable for industrial, municipal and process applications. It should be mounted in a location as free as possible from vibration, corrosive atmospheres, the possibility of mechanical damage or limited accessibility. If these conditions cannot be avoided consider a system with remote electronics.

For the safety and convenience of operation and maintenance personnel place the electronic unit in a reasonably accessible location. Ambient temperature should be between  $-40\sim 70^{\circ}\text{C}$  ( $-40\sim 158^{\circ}\text{F}$ ). See figure 4.1 AVI-PSM integral mounting.

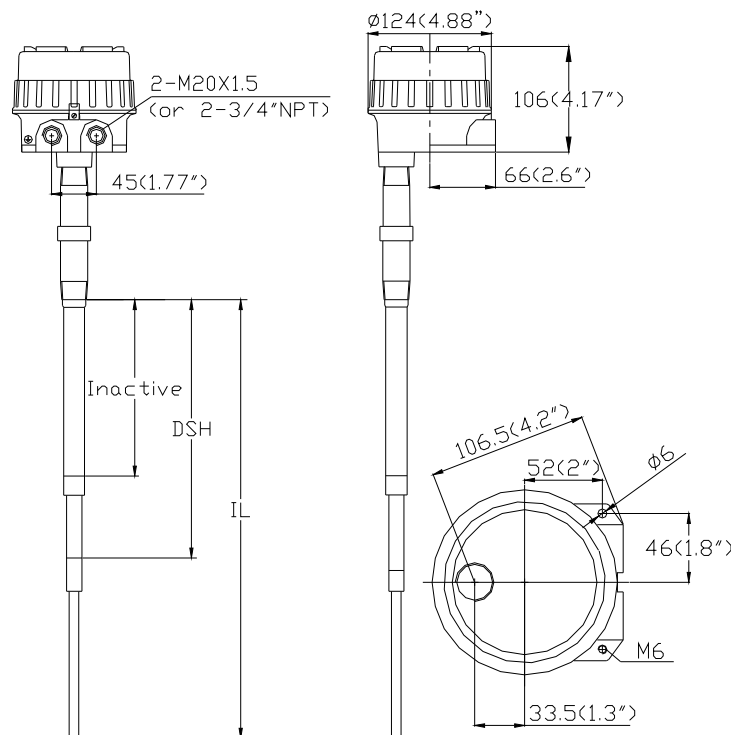


Figure 4.1 AVI-PSM Integral system mounting

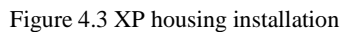
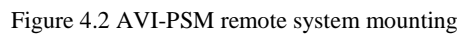
Carefully remove the contents of the shipping carton and check each item such as model number, serial number of electronic unit & sensing element, accessory, instruction manual etc. against the packing list before destroying any packing materials. If there is any shortage or damage, report it to the factory or local rep, packing material needn't recycle.

Power cable O.D. should be less than 12mm, conductor material of the cable is copper, section area should be between  $0.13\sim 2.1\text{mm}^2$  (AWG14-26), insulating capability 1500V.

### 4.4 Remote Installation

Remote configuration separates the probe from the electronics with a special coaxial cable (provided by factory). The cable can be field shortened and re-terminated as required. Do not coil excess cable. Connect the Center wire of the unit (CW)

The XP housing of electronic unit could be installed on a bracket or wall using the mounting holes provided. See figure 4.3electronic unit XP housing installation.



Selecting the correct installation point can be critical to the success of the measurement.

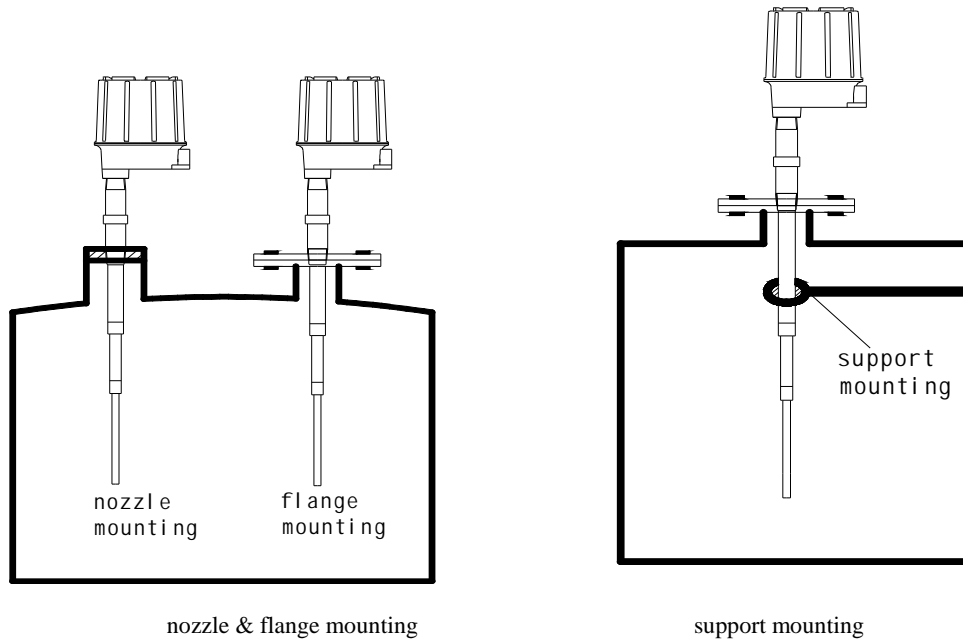
The measurement can also be done with a flexible sensing element. The probe can be weighted on the bottom with an IL keeping the weight out of the discharge section of the bin. The probe can also be supplied with a flexible bottom anchor.

To insure a successful measurement and long-term reliability note the following:

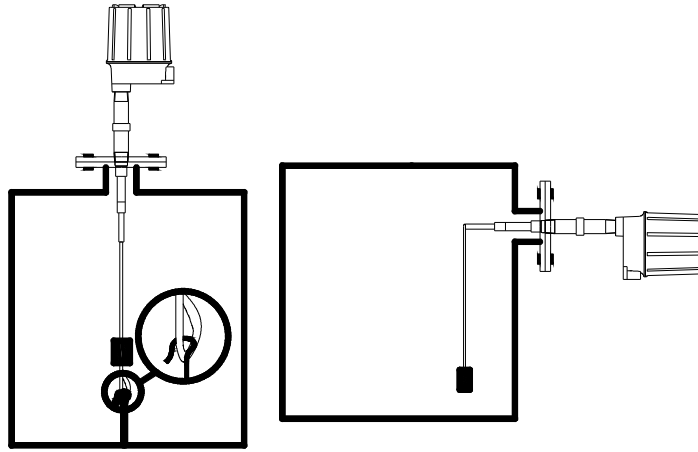
1. When installing the instrument/ sensing element in the vessel do not damage or modify the probe insulators or insulation. Be sure measuring & shield elements do not touch the nozzle or vessel wall.
2. Do not install the sensing element directly under a flow stream or feed line. If this is the only position available use a baffle or shield above the probe to keep it out of the flow stream.
3. Do not open sensing element or loosen sealed gland.
4. Use open-end wrench on the wrench flat to tighten sensing element.
5. Review the installation distance when mounting rigid probe. Keep cable probe as straight as possible to avoid hitting the vessel wall.
6. Long rigid probes in agitated vessels or where excess force is placed on the element should be supported using a bracket from the vessel wall to the inactive section of the probe. Long flexible probes should be anchored using the factory supplied anchor assembly.
7. Pay attention to moisture or condensation in the conduit it will cause damage to electronic unit.
8. Connect the ground of sensing element to field equipment securely, less than 1 ohm resistance Consult factory or representative for non-metallic vessel grounding recommendations.

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USE SPECIAL DOUBLE-COMPOSITION ENCAPSULAN (non-erosive), please consult factory for the type of this material.**

#### 4.6 Typical mounting

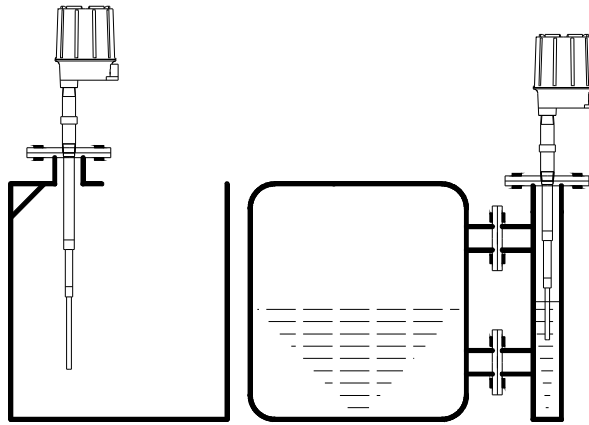






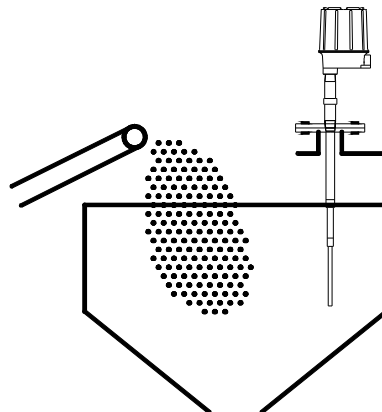
Anchor mounting

Bent mounting



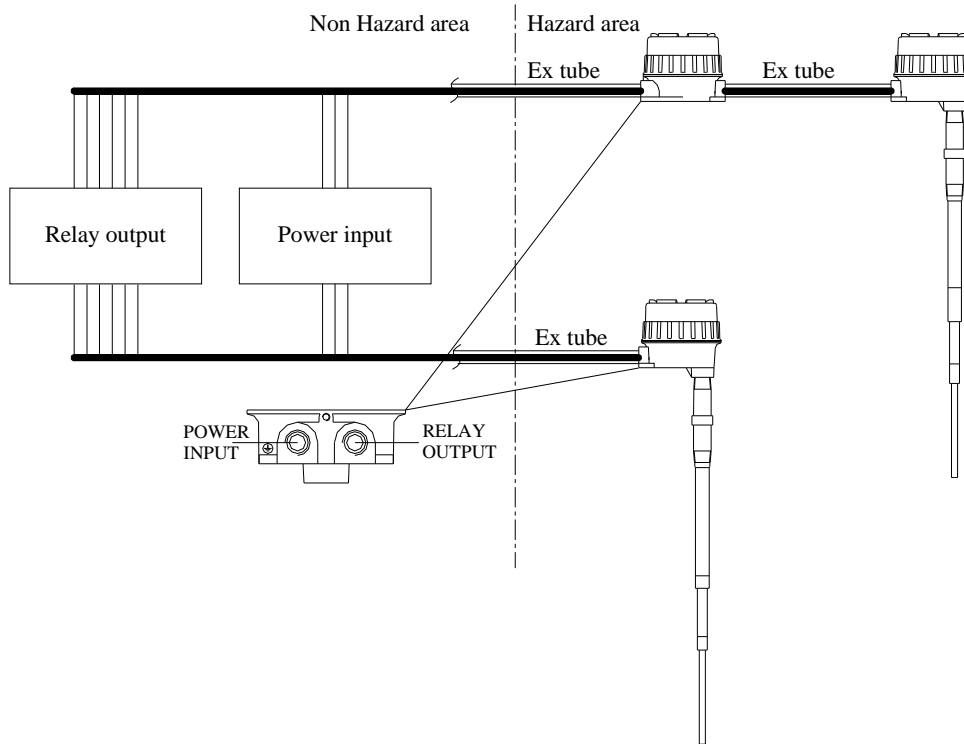
Bracket mounting in open vessel

External side arm mounting



Silo application

## 4.7 System wiring



4.4 System wiring

## 4.8 Sensing Element Wiring



**Assure power to the equipment has been turned off before opening the explosion-proof housing. Also make sure relay power has been turned off more than ten minutes !!**

For integral mounting, the sensing element is usually pre-wired at the factory. If the system were shipped unassembled or you want to replace the cable see figure 4.5 below. All of the sensing element connections are made to the terminals on the opposite side of the power and relay connections. The shield wire (red) and the center wire (blue) are twisted, be sure the shield wire connects to the electronic unit shield terminal (DSH), the center wire connects to the center terminal (CW) . Since a metal housing is used the electronic unit ground does not have to be connected. At the probe end, connect the Center wire (blue) to the center rod of probe and the shield wire (red) to the shield of probe. See figure 4.6 system wiring. Remote wiring connections are the same as integral except the ground wire is connected at both the probe and electronic units.

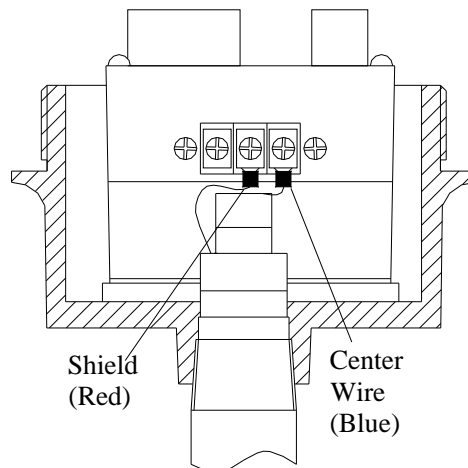


Fig4.5 Integral probe wiring

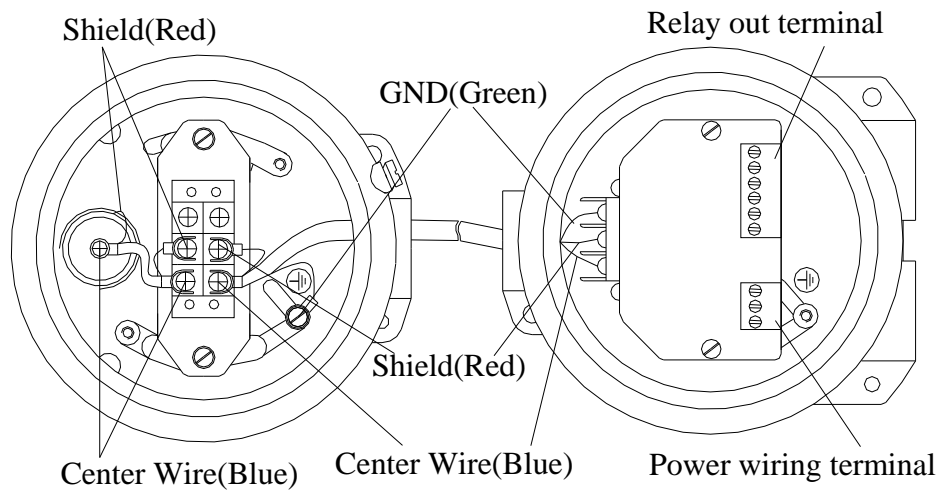
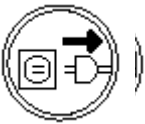


Fig4.6 Remote system probe wiring

#### 4.9 Relay wiring



**Assure power to the equipment has been turned off before opening the explosion-proof housing. Also make sure relay power has been turned off over ten minutes!! Be sure all power and relay wires do NOT have power!**

The section area of wires should between  $0.13\text{-}2.1\text{mm}^2$  (AWG14-26), insulation rating over 1500V.

Use approved sealed fitting in the conduit entrances of the explosion-proof housing in hazardous areas.

The relay is a double-pole, double-throw (DPDT) dry contact relay. The relay serves as a switch and does not provide the power to operate an indicator or other equipment. All relay connections are made to the right hand terminal strips on the power side of electronic unit. See figure 4.7 as relay contacts.

##### Terminal Connection Procedure

- 1、 Open upper lid of the housing,
- 2、 Feed the relay contact wires through the right hand entrance fitting into housing.
- 3、 Adjust the cable for suitable length,
- 4、 Connect the wires to the proper terminals and verify it is correct.
- 5、 Tighten the upper lid again.

Instrument uses normal relay logic; the relay fails safe and contacts are de-energized in alarm. This is also the no power state.

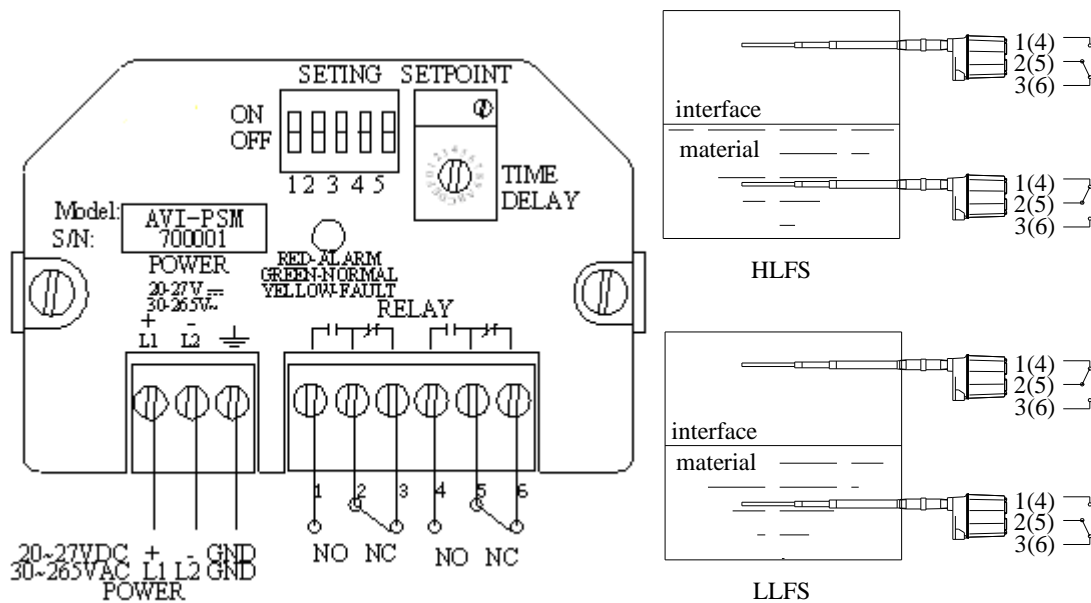
A red LED indicates that the relay is de-energized (reset), normally this is the alarm condition. A yellow LED indicates that the relay is de-energized (reset) and there is an electronic unit failure. A green LED indicates the unit is in the “normal position” and the relay coil energized.

High level Fail Safe (alarm) means that the relay will de-energize when level is high. These contacts also de-energize indicating high level upon loss of power.

Low-level Alarm Fail Safe (alarm) means that the relay will de-energize when level is low. These contacts also de-energize indicating low level upon loss of power.

See figure 4.8 relay contacts in normal condition.

**Remark: There is no absolute fail-safe device made. Critical applications should have redundant or back-up devices.**



4.7 relay contacts

4.8 Relay contact position in normal status

#### 4.10 Power wiring



Assure power to the equipment and its relay has been turned off before opening the explosion-proof housing. Also make sure these power had been turned off over for ten minutes !!

The cross section area of wires should be between 0.13-2.1mm<sup>2</sup>(AWG14-26), insulation rating over 1500V. Use approved sealed fitting for any connections to the explosion-proof housing in hazard area.

All power connections are made to the terminal strip on the left side of electronic unit. See figure 4.9 power connection.

1. Open upper lid of the housing,
2. Feed the power wires through the left hand entrance fitting into housing.
3. Adjust the cable for suitable length,
4. Connect the wires to the proper terminals on the left side of the unit and verify it is correct.
5. Tighten the upper lid again.

## SECTION 5 Function configuration

### 5.1 Set point selected

The RF switch set point could be calibrated automatically or manual.

#### 5.1.1 Auto calibration mode

When the RF switch working under this mode, when the first time the switch was powered on, the switch would search the set point step by step controlled by its software, find it and output, do not need the operator to do anything, this work needs about 50 to 80 second. Because normally, most application the vessel is empty, so the switch software would record the current status as the process material did not touch the probe, and give out the “normal” status. Now, the switch begins to work. When then if the process material touched the probe, the software would record the signal changing and complete the calibration process.

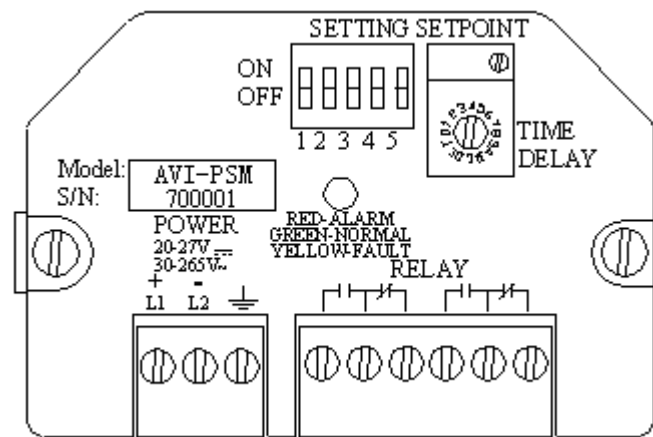


Fig 5.1 AVI-PSM electronic unit calibration

#### 5.1.2 Manual mode

If the operator wants to calibrate the switch himself, he could just change the switch into manual mode and adjust the set point POT to find the right set point. Please see fig5.1, on the top of the electronic unit right side, there is the POT. Turn the POT clock wise would increase the set point.

### 5.2 Working statue indicate LED

On the top of the unit, there is a working status indicate LED, in green color means NORMAL and red means ALARM. And if it was in yellow, that means there is something wrong in the system could be wrong wire connection, something shortage to the probe or even electronic unit failure.

When the switch system power on, self checking program needs some time, and the LED status could be changed as the self checking program running.

### 5.3 Damping time adjustment

On the top of the unit, up and right side there is a damping time control knob, it could control the delay time when the system from alarm status changes to normal status, delay time range is from 1 to 70 seconds, 16 position could be selected which listed below.

Position	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Delay time	1	2	4	6	8	10	12	14	16	18	20	30	40	50	60	70

## 5.4 Working mode setting

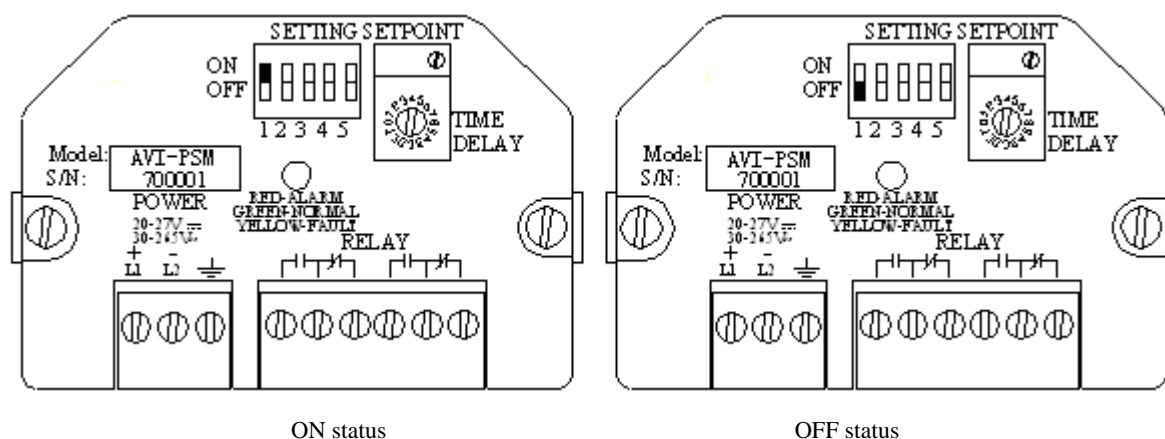


Fig 5.2 System working status setting

Please see the fig5.2, there are 5 switches in the upper of the panel, push up is ON position and push down is OFF position, except the 5<sup>th</sup> one is working for the 'position changing reset switch', the others are for working status setting, their detail is listed below. All these setting and we also suggested to be and could be selected before power on. Please pay attention wrong setting could bring wrong output.

Position and function	When in ON	When in OFF
1: Calibration mode	Manual calibration	Auto calibrating mode
2: High or low alarm	High alarm	Low alarm
3: Material setting	Conductive material	Insolating material
4: Range setting	Long range application	Short range application

### 5.4.1 Calibrating mode

The switch system could be set into manual or auto calibrating mode, for the auto mode it is required when it first time to power on is in empty vessel status.

### 5.4.2 High or low alarm mode

The switch system could be set into high or low alarm mode, high alarm means when the material position is higher than the setting point in the vessel, it would give alarm status output, and also with its failsafe function. Low alarm mode means when the material position is lower than the setting point in the vessel, it would give alarm status output, and also with its failsafe function. High alarm mode is default when it comes from the factory.

### 5.4.3 Process material selection

The process material were just simply divided into conductive material and insolating material, it could be selected by client intend to help the software get a good performance in the field, there is some process material list below:

- Conductive material : coal, mud, sand, water, and other water base liquid
- Insolating material: powder, ash, oil, hot and dry coal, plastic chips.

### 5.4.4: Probe range setting

For our experience almost 98% applications were belong to long range applications. We could inspect the range according these below:

- Short range: Normally the probe is shorter than 500mm(about 9 feet).
- Long range: Normally the probe is longer than 500mm(about 9 feet).

### 5.4.5 Position changing reset switch

That is a switch which could let the software knows the above setting(5.4.1 to 5.4.4) had been changed, we need to let the software to do our work according the new setting when next power on, that means the software would initial the old calibration datum and recalibrate the set point according the new setting. So, normally, this switch is ideal to recalibrate the system, if you had finished calibration, you could fix it with a label in case wrong operation erasing the set point.

- a. When the switch just comes from the factory, you could just change the above setting (5.4.1 to 5.4.4) before power on, do not need to change this reset switch position, because we had changed it to the new position in the factory already.
- b. If you had power the switch system on, and changed the any above 4 setting, you could just change this reset switch to the other position and turn off the power, next time when the switch system power on, the software would work according your new setting.

## SECTION 6 CALIBRATION



**Assure power to the equipment and its relay has been turned off before opening the explosion-proof housing. Also make sure these power had been turned off over for ten minutes!!**

### 6.1 Start up

Before power on the system, please check the wiring of probe, power and relay.

If you want auto calibration, please see Chapter 6.2 and 6.7, if you want Manual mode, just push the 1<sup>st</sup> setting switch on, and please see Chapter 6.3, 6.4, 6.5 and 6.6.

When the calibration had been finished, be sure the housing also had been put together and fixed well.

**Attention:** For explosion-proof installations each wiring entry must have an appropriate gas seal device. Consult factory or local rep for such fitting.

### 6.2 Calibration in factory

All AVI-PSM series products, in factory, had been setting for insulating material auto calibrating mode, and also the 5<sup>th</sup> position switch had been a new position, that means for client just get ready for installation and then turn on the power to the switch system, the software would calibrate itself as empty status for insulating applications.

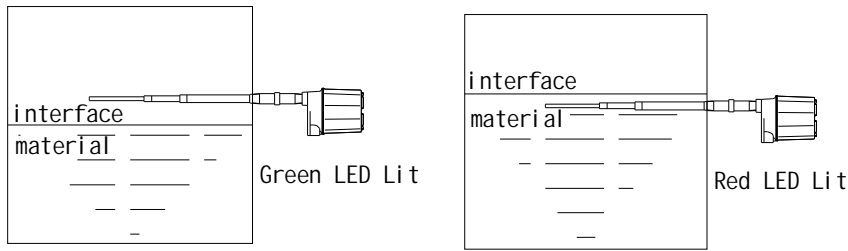
If client did want to change setting, just do it before power on, then get ready for the installation, software would do the other calibration steps.

If the switch system had be power, for example had been tested or some other similar power on, please turn off and directly do all setting and move the 5<sup>th</sup> switch to new position.

If you could not sure if it was powered on, no problem, just power on for two minutes, please turn off and directly do all setting and move the 5<sup>th</sup> switch to new position.

### 6.3 Manual Calibration for Insulating Materials (HLFS) Horizontal mount.

- A. First of all, finish the installation work in the field, push the 1<sup>st</sup> setting switch on.
- B. Be sure the material level is well below the sensing element.
- C. Turn the set point adjustment to the full counterclockwise (CCW) position. The red alarm light will light.
- D. Turn set point adjustment slowly clockwise (CW) until the relay just changes state. (LED changes color to GREEN). Make a pencil mark on the label at one of the screwdriver slot ends. See figure 6.1 Calibration in Insulating Material 1
- E. Increase the material level until it is just well above the sensing element. (RED LED turns on). See figure 6.2 Calibration in Insulating Material 2.
- F. Turn the set point adjustment slowly clockwise (CW) until relay once again just operates (LED change to GREEN) counting the number of revolutions required to change states, or you come to the end of the adjustment travel.
- G. Turn the adjustment back counterclockwise (CCW) one half the number of turns that was counted.
- H. Record number of turns and save for future calibration reference. Calibration is now complete..



#### 6.1 Calibration in Insulating material 1

#### 6.2 Calibration in Insulating material 2

**Caution!** If the set point status change less than one turn or the relay does not change state, consult factory.

#### 6.4 Manual Calibration for Conducting Materials (HLFS)

- A. First of all, finish the installation work in the field, push the 1<sup>st</sup> setting switch on.
- B. Be sure the material level is well below the sensing element
- C. Turn the set point adjustment to the full counterclockwise (CCW) position. The LED will be red.
- D. Turn set point adjustment slowly clockwise (CW) until the relay just changes state. (LED changes color to GREEN).
- E. Turn the set point adjustment slowly clockwise (CW) at least 2~5 turns, it would depends on the process material's conductivity,
  - 2~5 turns for conductivities <0.5 micro mhos( $\mu\text{S}/\text{cm}$ ) .(Conductive material)
  - Full clockwise for conductivities over 100 micro mhos( $\mu\text{S}/\text{cm}$ ). (For example: water base solution.)

Note: The AVI-PSM-1119 will detect any interface where there is a significant electrical difference between these materials, that means not only air/material interface, but also liquid/liquid interface. The AVI-PSM-1119 can only be calibrated to detect ONLY one interface. The manual calibration process is almost the same, now we explain it as a oil/water interface

- Be sure the probe is in the insulating phase of the interface.
- Turn the set point adjustment to the full counterclockwise (CCW) position. The LED will be red.
- Turn set point adjustment slowly clockwise (CW) until the relay just changes state. (LED changes color to GREEN).
- Increase the material level until the sensing element is in the conducting phase. (RED LED turns on). See drawing 6.Y
- Turn the set point adjustment slowly clockwise (CW) until relay once again just operates (LED change to GREEN) counting the number of revolutions required to change states, or you come to the end of the adjustment travel.
- Turn the adjustment back counterclockwise (CCW) one half the number of turns that was counted.
- Record number of turns and save for future calibration reference. Calibration is now complete for that interface.

#### 6.5 Manual Pre-calibration or empty calibration for START-UP (HLFS)

- A. First of all, finish the installation work in the field, push the 1<sup>st</sup> setting switch on.
- B. Insure vessel is empty or material is well below probe.
- C. Turn the set point adjustment to the full counterclockwise (CCW) to position. (LED will be red) Turn the set point adjustment slowly clockwise (CW) until the relay just changes state (LED changes color to GREEN).
- D. Turn the set point adjustment slowly clockwise (CW) 1/2 turn as a pre-turn for granular materials and organic liquids, this is a good initial set up.
- E. If the material is conductive, you may use 2 or 3 turns as a pre-turn initially. For very conducting material, turn the adjustment full clockwise.
- F. Some other material pre-calibration
  - 1/4~1/2 turns for dielectric constant (K) less than 2. (Insulating material)
  - 1/2~1 turns for dielectric constant (K) between 2~ 10. (Insulating material)
  - 1~2 turns for dielectric constant (K) between 10~80. (Insulating material)
  - 2~5 turns for conductivities <0.5 micro mhos( $\mu\text{S}/\text{cm}$ ) .(Conductive material)
  - Full clockwise for conductivities over 100 micro mhos ( $\mu\text{S}/\text{cm}$ ). (For example: water base solution.)

#### 6.6 Manual Calibration for Low Level Fail Safe (LLFS)

Calibration for low level applications is the same as for high level applications except the normal state is with the probe covered and the alarm state is with the probe uncovered. Select the configuration from 6.3, 6.4, 6.5 and lower the material instead of raising the material.

#### 6.7 Auto calibration

- A. Turn off power, finish the installing, and make sure the process material did not reach the probe.
- B. Select auto calibration for the 1<sup>st</sup> setting switch.
- C. Select the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> in the setting switch.
- D. Push the 5<sup>th</sup> setting switch to a new position.



E. Turn on the power, wait about 80 seconds, and then finished.

## SECTION 7 TROUBLESHOOTING

### 7.1 Introduction

AVI-PSM series is a solid-state device with no moving parts except the alarm relay. Neither the probe nor the electronics require routine maintenance or periodic adjustments. All components are tested and inspected during manufacture and then as a complete system. The systems are designed to give years of unattended service.

A spare electronic chassis is recommended for every 25 units so that, in case of a failed unit, a critical application will not be delayed while the unit is returned to the rep or factory for repair or replacement. A complete system is recommended for critical applications or for project start-up where additional applications may be required.

No SPECIAL tools are required for servicing the AVI-PSM product line except a digital or analog multi-meter for measuring the resistance of the probe and cable and checking the relay contacts.

Use the following troubleshooting procedures to check out the AVI-PSM level control. If attempts to locate the difficulty fail, notify your local FIT representative or call the factory directly.

### 7.2 Testing the electronic unit

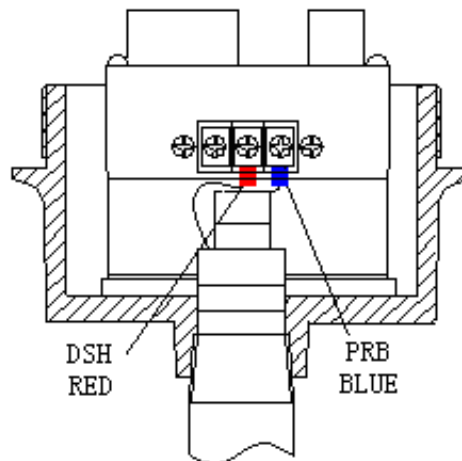


**Assure power to the equipment and to the relay had been turned off at least 10 minutes before opening the explosion-proof housing.**

We take the manual calibration mode as a example.

- Disconnect the sensing element wires from the instrument by removing the blue wire from the center terminal and the red wire from shield terminal. Leave the power connected.
- Connect a 5 to 10pF fixed capacitor between center wire and ground.
- Starting with the set point adjustment in the extreme counterclockwise (CCW) position, turn the screwdriver clockwise (CW) until the relay just operates.
- Rotate the set point adjustment back and forth about this point, observing the travel of the screwdriver between the relay pull-in and relay drop-out. If the instrument is working properly, the screwdriver should travel less than 1/4 turn to operate the relay.

If instrument doesn't work properly, consult service department.



7.1 Testing electronic unit

### 7.3 Testing the sensing element

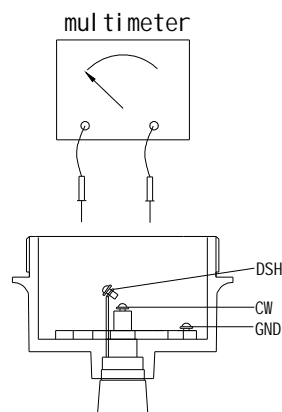
- A. See figure 7.1. Disconnect the sensing element wires from the instrument by removing the blue wire from the center terminal and the red wire from shield terminal.
- B. See figure 7.2. Using an analog ohmmeter, measuring the following values
- Center wire to ground \_\_\_\_\_ ohms
  - Center wire to shield \_\_\_\_\_ ohms
  - Shield to ground \_\_\_\_\_ ohms

Using the same analog ohmmeter on the DC voltage scale, measure following values:

- Center wire to ground \_\_\_\_\_ milli volts
  - Center wire to shield \_\_\_\_\_ milli volts
  - Shield to ground \_\_\_\_\_ milli volts
- C. Resistance result in item B should over following values:
- Center wire to ground \_\_\_\_\_ ohms
  - Center wire to shield 500ohms
  - Shield to ground 150ohms

Voltage result in item B should less than following value:

- Center wire to ground \_\_\_\_\_ mV
  - Center Wire to shield 100mV
  - Shield to ground 200mV
- D. If voltage results are over above values or resistance results are lower than above values, please clean the sensing element and do procedure B again.
- A new or clean Sensing element without build-up will have the following values:
- ü Resistance: higher than 1M at all test points, consult factory
  - ü Voltage: lower than 200mV at all test points, consult factory.



7.2 Testing sensing element

### 7.4 Testing the relay circuits



**Be careful during relay check since line power is present on power terminals.**

- A. The relay circuits consist of double-pole double-throw relay contact brought out to terminal strips.
- B. Adjust equipment per section 5.1.
- D. Relay operation may generally be heard as an audible click when the background noise is not too high. To be sure that the contacts actually change state, disconnect the wires to the relay contacts, use an ohmmeter to check if relay contacts work properly. In many cases, contacts can oxidize and not carry current.

### 7.5 Testing the coaxial cable

Disconnect all three spade lugs of the coaxial cable at the electronic unit and sensing element. Using an ohmmeter measure following value, check if the result meets the value in brackets.

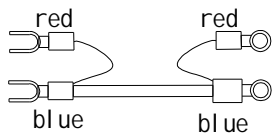
See figure 7.3 integral cable, figure 7.4 remote cable.

Integral cable:

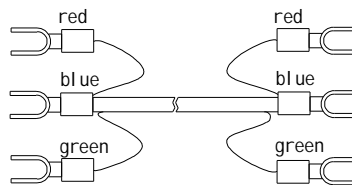
Resistance between the two blue spade lugs ( $< 2 \Omega$ )

Resistance between the two red spade lugs ( $< 2 \Omega$ )

Resistance between the red & blue spade lug ( $> 100M \Omega$ )



7.3 Integral cable



7.4 Remote cable

#### Remote Cable

Resistance between the two blue spade lugs ( $< 10 \Omega$ )

Resistance between the two red spade lugs ( $< 10 \Omega$ )

Resistance between the two green spade lugs ( $< 10 \Omega$ )

Resistance between the three different color lugs ( $> 100M \Omega$ )

#### 7.6 Possible Problem and Cause

Problem	Possible Cause	Solution
1. Instrument indicates alarm at all time	a. Severe coating build-up (HLFS)	a. Need Super Shield Barrier Potential technology Consult factory.
	b. Sensing Element always touch material (HLFS)	b. Need shorter insertion length. Consult factory.
	c. Defect in sensing element.	c. See section 7.3.
	d. Improper wiring	d. See section 4.6, 4.7.
	e. Improper calibration.	e. See section 6.3, 6.4.
	f. Electronic unit malfunction (Yellow LED)	f. Replace unit
	g. LED failed	g. Replace fuse of unit or turn power on again
2. Instrument never indicates alarm	a. Sensing element not “seeing” material (HLFS)	a. Need longer insertion length. Consult factory.
	b. Broken wiring	b. Replace signal cable
	c. Improper calibration	c. See section 6.3, 6.4
3. Instrument can't be calibrated	a. Improper wiring	a. See section 4.6, 4.7
	b. Sensing Element not “seeing” material (HLFS)	b. Need longer insertion length. Consult factory.
	c. High insulating material	c. Need high discrimination unit. Consult factory.
4. Instrument gives a false alarm	a. Improper Calibration.	a. See section 6.3, 6.4.
	b. Loose wiring	b. See section 4.6, 4.7, 4.8.
	c. Electronic unit malfunction.	c. See section 7.2.
5. Instrument operates intermittently.	a. Improper calibration.	a. See section 6.3, 6.4
	b. Loose wiring.	b. See section 4.6, 4.7, 4.8.
	c. High insulating material.	c. Need high discrimination unit. Consult factory.