Installation and Operating Instructions

Series AVI-PDU

RF DRIVEN SHIELD LEVEL SWITCH

General Safety Notes

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. **Be aware of the power and relay wiring when doing calibration or maintenance as high voltage can exist on these connections.**

3. **Pay attention to unsafe conditions when installing the equipment in the field.**

SECTION 1 INTRODUCTION

1.1 System Description

This instruction manual is for the AVI-PDU Series smart two wire RF admittance level limit switch, which is used for most level measurements and control and 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 equipment 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-PDU series integral system scheme.

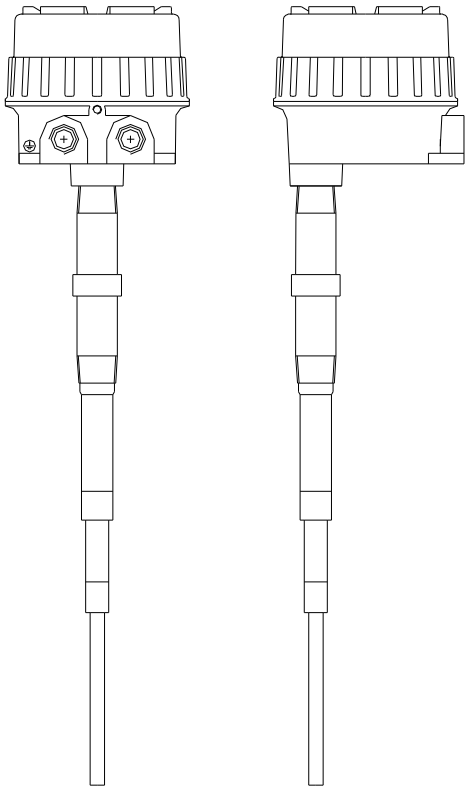


Figure 1.1 AVI-PDU series RF level switch

The AVI-PDU series RF level switch is strictly followed the International/Chinese standards which list 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 employs 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.

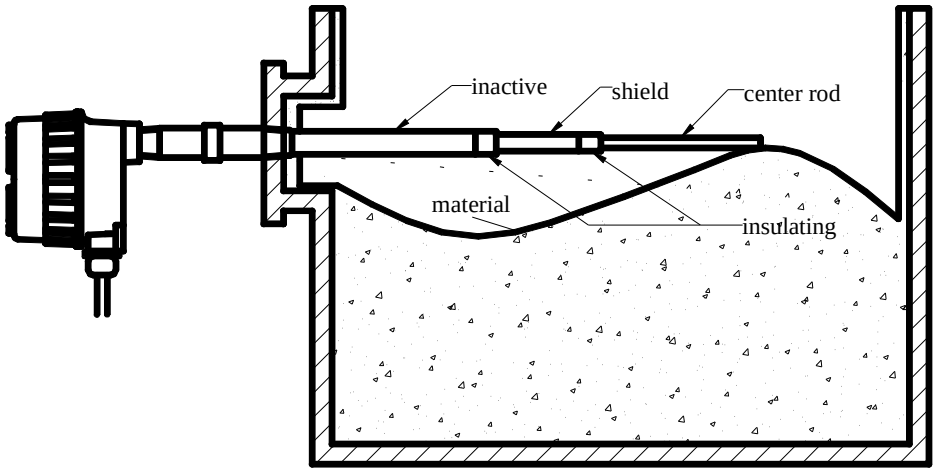
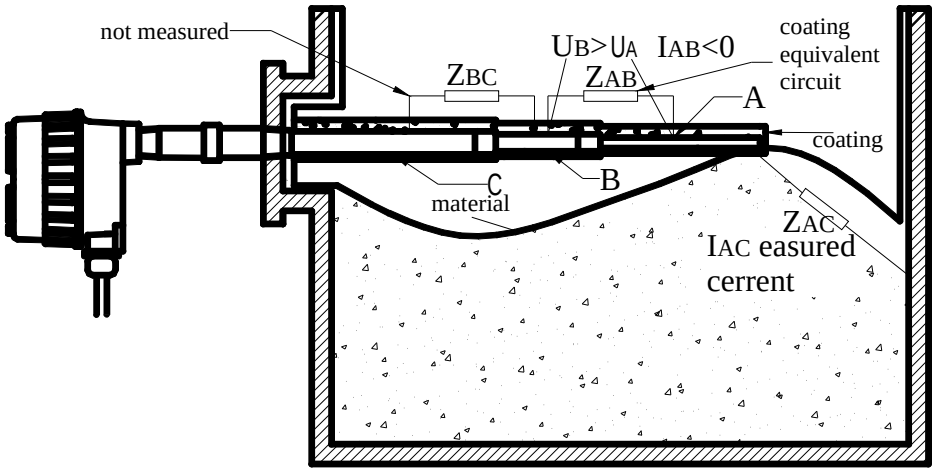


Figure 1.2 Sensing element construction

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.

We put a special circuit to keep no potential difference between the measuring element & shield element. When there is some coating on the probe, the impedance of the build-up is low and measurable current will not pass from the measuring element to the shield or ground, i.e. $U_A=U_B$, $I_{AB}=(U_A-U_B)*Y_L=0$. The electronic unit so only measures the current between the sensing element & probe ground (vessel wall). 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 circuit terminals: measurement category II, only use the equipment for measurements within measurement category I and II, transient over voltage is 2500V.

Output:DPDT reply (double pole double throw)

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

Power requirement:Universal Power supply 30~265VAC, 50/60Hz & 21~27VDC

Power consumption:2W

Resolution:0.2 pF or lower

Repeatability : <1mm (conductive)

<20mm (insulating)

Load resistance:Center wire to shield 500Ω, Shield to ground 50Ω

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

Indicators:Red- level alarm ;Green-system normal ;Yellow-instrument failure

Ambient Operating Temp.(electronics) :-40~+75℃(-40~167℉)

Storage Temp.:-40~+85℃(-40~185℉)

Response time:0.5second

Time delay:2~25seconds (continuously adjustable)

Barrier:Built-in limiting current、three-limiting voltage barrier

ESD protection (for unit): 4KV/8KV

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,0.1m(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 Thread, NPT and Flanges optional

Mounting: vertical, horizontal or any angle

Ingress Protection:accord with IP67 requirements

Explosion-proof rating:Exd[ia]iaIICT4

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

SECTION 3 MODEL NUMBER

Probe (sensing element) specifications S.E. Mounting

Probes Number	IL	SHD L/INACT L	Wetted Material	Insula-tion	Weight /Anchor	S.E. Mounting	S.E. Type	S.E. Temp. &Press	Application
18	St.500mm(19.7") /250mm(9.8")	250mm(9.8")/180mm (7"); 80mm(3.1") /0mm(0")	304SS (st.)other optional	PPS	NO	3/4"BSPT; 3/4"NPT optional	OD 9mm(0.35") Three terminal rod	100℃/1.0MPa （212℉/145psi） 25℃/1.6MPa （77℉/232psi）	Normal temp. & pressure
19	St. 500mm(19.7") /250mm(9.8")	250mm(9.8")/180mm (7"); 80mm(3.1") /0mm(0")	316SS	PEEK	NO	3/4"BSPT; 3/4"NPT optional	OD 9mm(0.35") Three terminal rod	230℃/1.6MPa （446℉/232psi） 25℃/4MPa （77℉/580psi）	Mid-Temperature & pressure
20	St. 500(19.7") Max 2m(78.7")	250mm(9.8")/ 180mm(7") other optional	304ss(st.) other optional	PTFE	NO	2"BSPT; 2"NPT optional	OD22mm(0.87") Three terminal rod	100℃/1.0MPa （212℉/145psi） 25℃/1.6MPa （77℉/232psi）	Heavy duty anti-agitation
21			04ss(st.) other optional	UR	NO	170mm* 170mm (6.7"*6.7")	205mm(8")* 205mm(8") Three terminal flush mounting	82℃/0.2MPa （180℉/29psi） 25℃/0.5MPa （77℉/73psi）	Heavy duty anti-dash
22	St. 500mm(19.7") Max. 2m(78.7") rod;6m(236") cable	250mm(9.8")/180mm (7") other optional	304SS(st) other optional	Ceramic & copper	NO	1 1/4" BSPT; 1 1/4"NPT optional	OD 9mm(0.35") Three terminal	815℃/0.1MPa （1500℉/15psi） 25℃/2.0MPa （77℉/290psi）	High temperature
23	st. 2m(787") Max. 8m(315") cable	250mm(9.8") / 180mm(7")	304SS(st.) other optional	PPS	Yes	3/4"BSPT; 3/4"NPT optional	OD 9mm(0.35") Three terminal cable	100℃/1.0MPa （212℉/145psi） 25℃/1.6MPa （77℉/232psi）	
24	Max. 3m(118")		304SS(st.) other optional	FEP	Yes	3/4"BSPT; 3/4"NPT optional	OD 12mm(0.47") Two terminal rod	150℃/2.5MPa （302℉/363psi） 25℃/4.0MPa （77℉/580psi）	Small range corrosive liquid

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. According to the packing list without destroying any packing materials. If there is any shortage or damage, contact us or local agent, packing material needn't recycle.

4.2 General requirements

The AVI-PDU series 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.

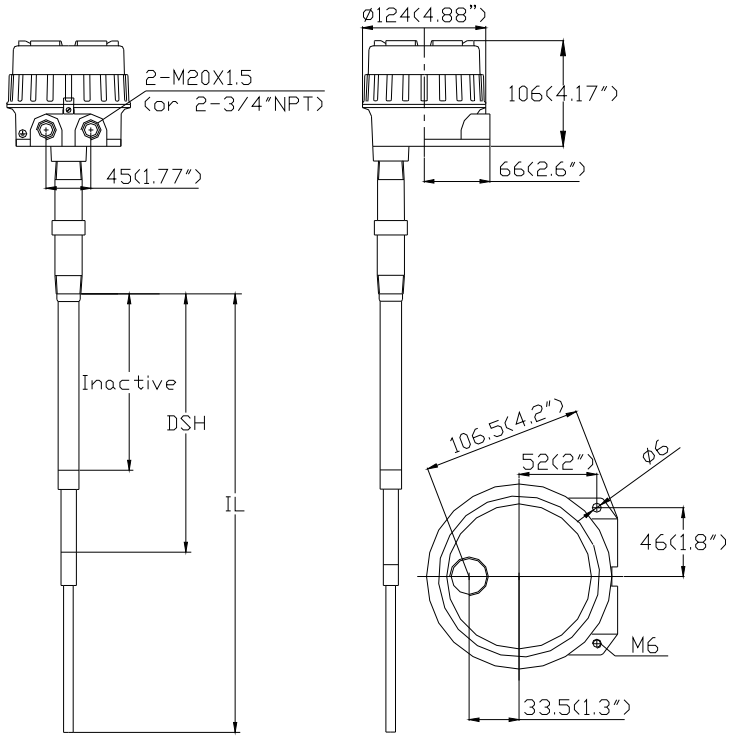


Figure 4.1 AVI-PDU integral system mounting

Power wire should be 3 terminal armature cable, cable O.D. should less than 12mm, conductor material of the cable is copper, section area should between 0.13 –2.1 mm^2(AWG14-26), insulating capability 1500V. And should meet IEC60245/60227 standard requirements. Associated switch should meet IEC60947 requirements.

Please consider double power voltage capacitance since the instrument consumption is 2W.

Very Important information for Installation: For Explosive proof and safety reason, the system housing should be connect to the earth reliably.

4.3 Integral Installation

The AVI-PDU series level switch is designed and suitable for most industrial applications. The mounting location of the electronic unit should free of vibration, corrosive atmospheres, or any possibility of mechanical damage for maximum service life. If this is not possible, consider a remote electronic system. Most integral systems can be field converted to remote electronic system. Consult your local rep of factory for a conversion parts list.

For convenience when adjusting electronic controls, place the electronic unit in a reasonably accessible location. Ambient temperature should be between -40 ~70^{o}C (-40 ~158^{o}F). See figure 4.1 integral system mounting.

4.4 Remote Installation

A remote system 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 coax cable. Connect the Center wire of the cable to the center wire terminal of the unit (CW), connect the coaxial cable shield to the driven shield terminal (SHD), and the ground wire to the GND terminal. The ground wire is usually an independent wire pulled with the coax cable. See figure 4.2 UFI 7P01 Remote mounting.

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

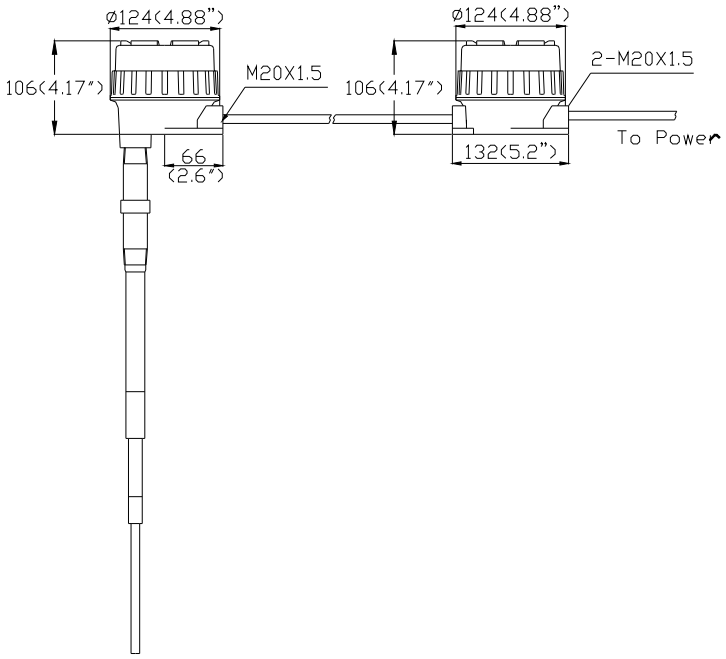
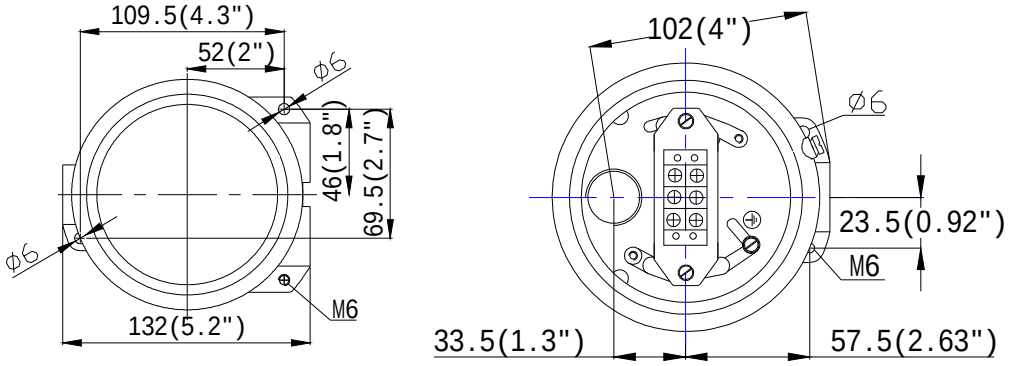


Figure 4.2 AVI-PDU remote system mounting



Electronic unit Probe

Figure 4.3 XP housing installation

4.5 Sensing Element Installation

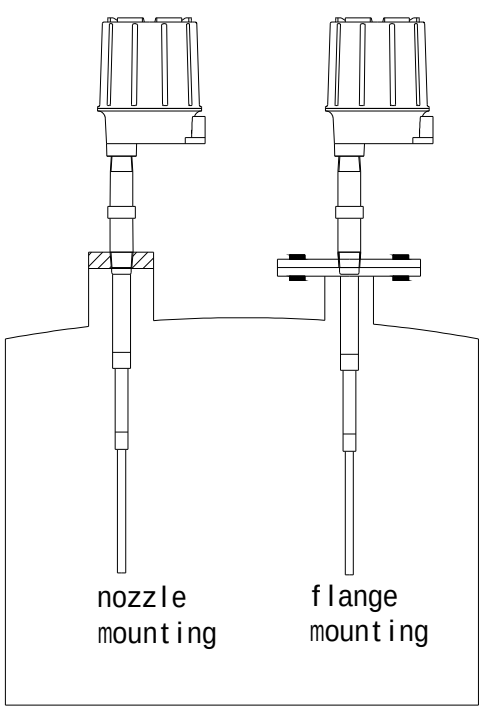
When selecting an installation point, be sure the measuring element will contact the material at the point the alarm should be initiated. Do not install directly under a flow stream or feed line. Be aware of the angle of repose in granular bins and silos, the level must reach the probe. If a suitable place inside the vessel cannot be found, consider an external chamber for liquid measurements. Be sure the level in the external bridle tracks the level in the vessel. Pay attention to the amount of space above the vessel, rigid probes must have adequate head-room to install the probe.

For reliable and trouble free installation and operation:

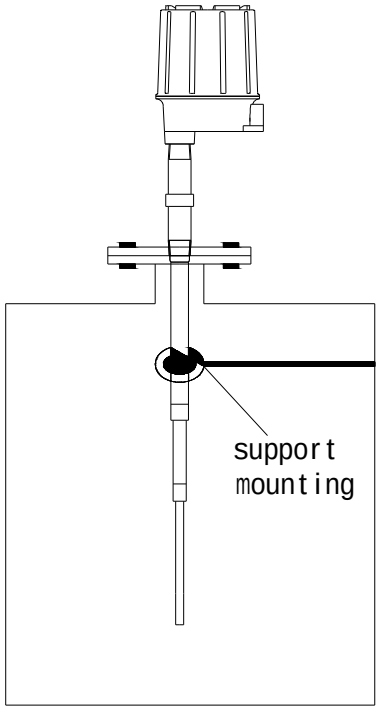
1. Do not damage or modify the probe insulators when installing the instrument/ sensing element in the vessel. Be sure the measuring & shield elements do not touch the nozzle or vessel wall.
2. Do not install the sensing element directly under a flow stream or feed line. If this is the only position 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. Do Not use the housing as a source of leverage.
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 the sensing element to field equipment securely, less than 1 ohm resistance. Consult factory or representative for non-metallic vessel grounding recommendations.**

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.

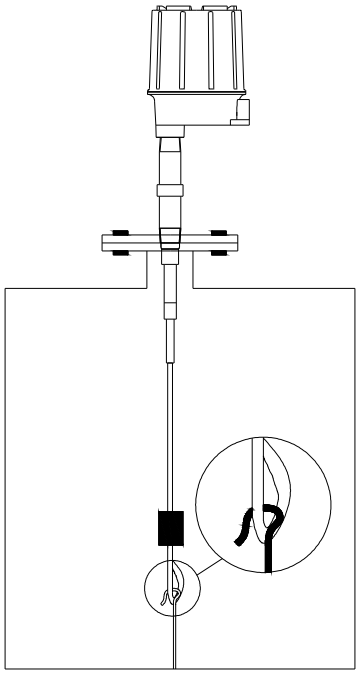
4.6 Typical mounting



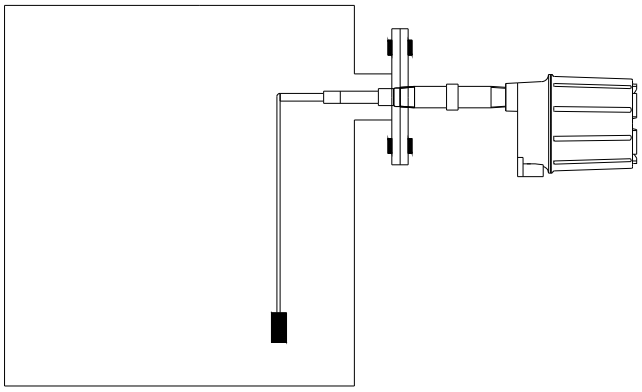
Nozzle/Flange mounting



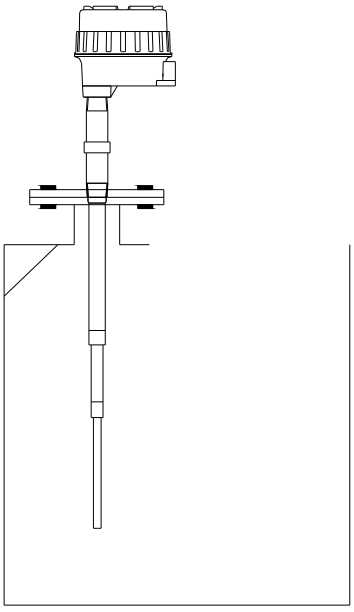
Insulation Support mounting



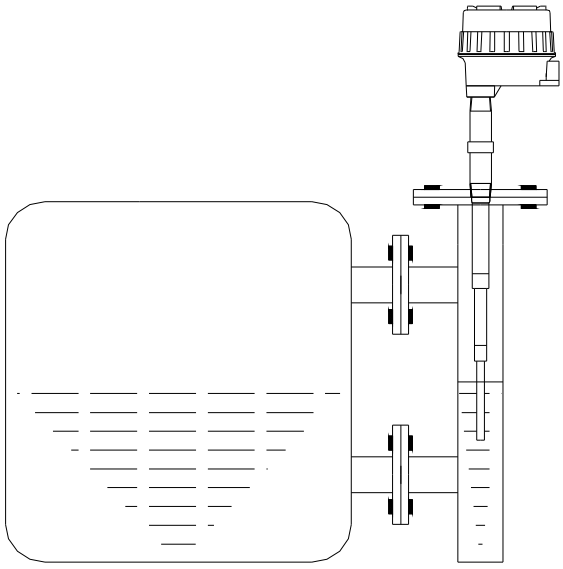
Anchor mounting



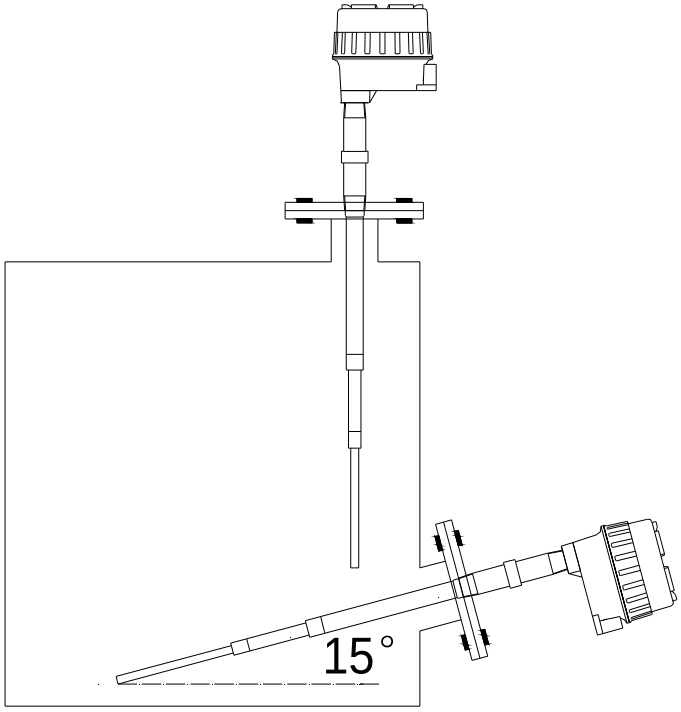
Bent mounting



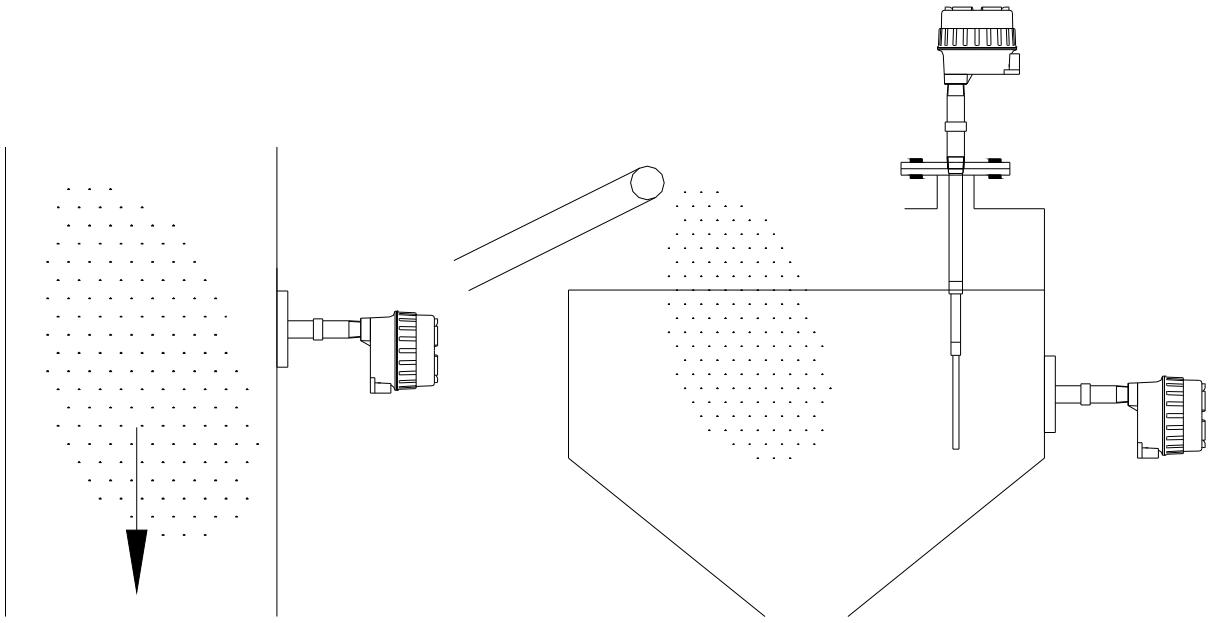
Bracket mounting in open vessel



External side arm mounting



Different Mounting Angle



Flushing Mounting

Silo Application

4.7 System wiring

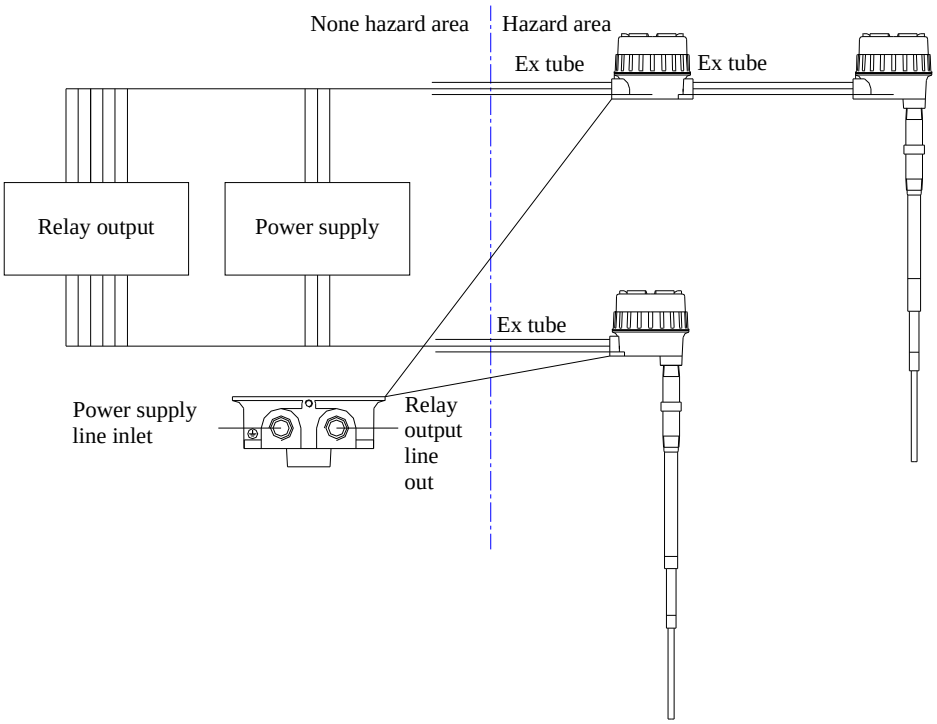


Figure 4.4 System wiring

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.

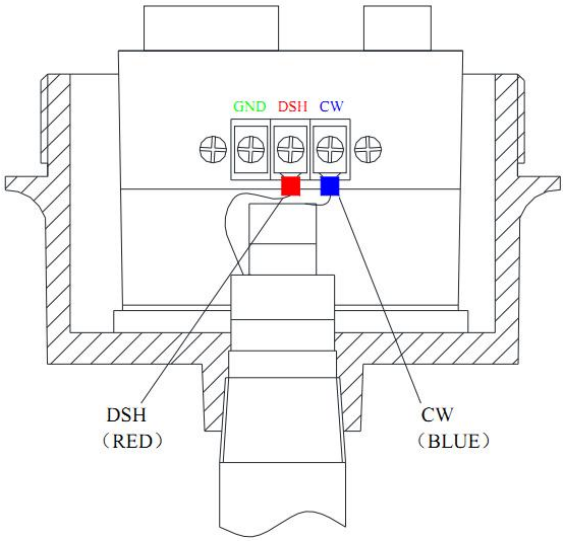


Figure 4.5 Integral System wiring

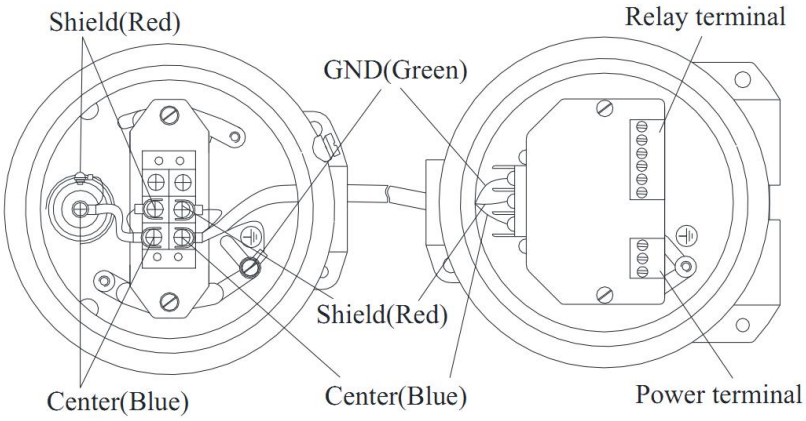


Figure 4.6 Remote System wiring

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 0.13-2.1mm^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 annunciator 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.

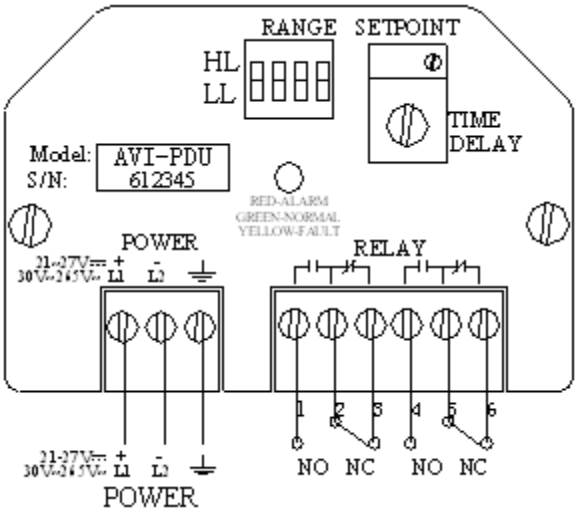
A red LED indicates that the relay is de-energized (reset), normally this is the alarm condition. A yellow LED indicates that the relay is de-energized (reset) and there is an electronic unit failure. A green LED indicates the unit is in the "normal position" and the relay coil energized.

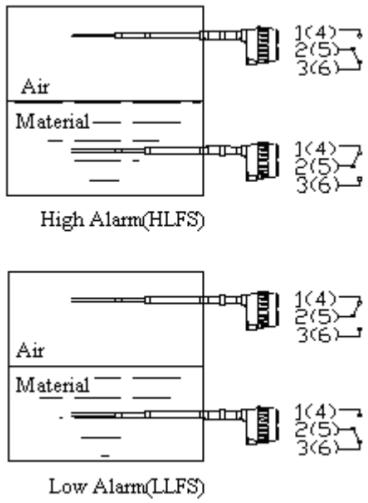
High level Fail Safe (alarm) means that the relay will de-energize when level is high. These contacts also de-energize indicating high level upon loss of power.

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 contact position in normal status

4.10 Power 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!!

The cross section area of wires should be between 0.13-2.1mm^2(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 wiring.

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.

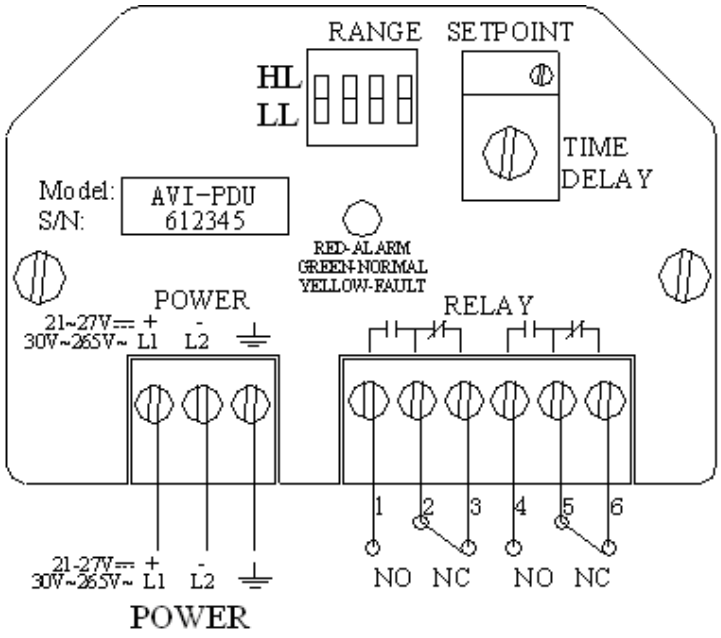


Figure 4.9 power wiring

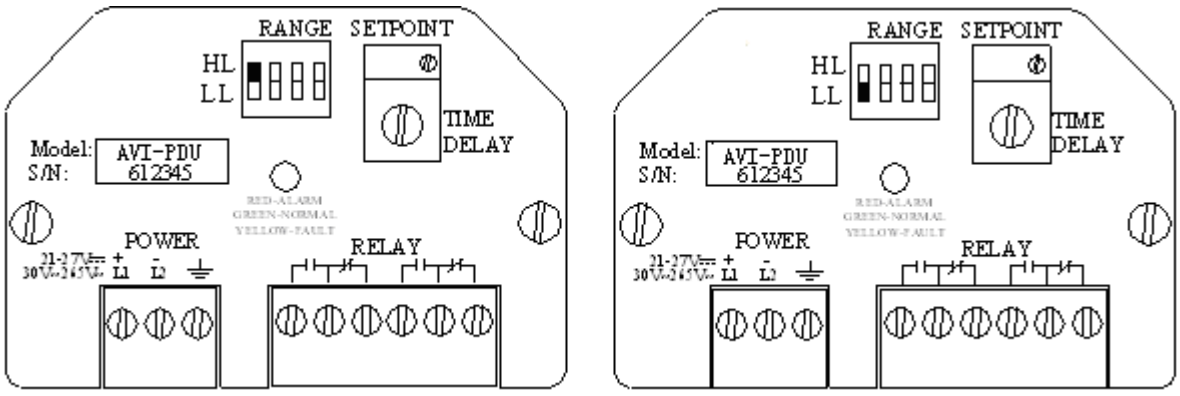
SECTION 5 FUNCTION SETTING

5.1 Process material setting

See figure 4.9 power wiring, the "SETPOINT " is the operating control used to control the switch point at which the relay changes state. Turning the switch point adjustment clockwise increases the amount of sensed capacitance required (less sensitive) to change the relay state. Counter clockwise reduces the amount of sensed capacitance required (more sensitive) to change the relay state. A Green LED indicates that the electronic unit is in the normal state and the relay is energized. A Red LED indicates that the electronic unit is in alarm and the relay is de-energized.

5.2 HLFS/LLFS setting

The High Level Fail Safe (HLFS) / Low Level Fail Safe (LLFS) jumper determines whether the relay will de-energize when material is higher or lower than the set point. HLFS means the relay will de-energize (alarm) when sensed capacitance (level) is higher than the set point. LLFS means relay will de-energize (alarm) when sensed capacitance (level) lower than the set point. The instrument is supplied in the failsafe mode requested when the order is placed (HLFS, if not specified.) The HLFS/LLFS jumper is located on the side of the unit. See figure 5.1 Electronic Unit Sketch



High alarm Low alarm

Figure 5.1 HLFS/LLFS

5.3 Time delay setting

The time delay adjustment is a potentiometer located on the top of the unit "TIME DELAY". It could adjust the reset time of the relay when an alarm condition ceases to exist. Clockwise the adjustment could increasing the time delay.

If the unit without "TIMA DELAY" adjustment, then no time delay option available.

5.4 Range setting

Range setting normally be adjust at span 2 (i.e. the second place is at "ON", following is same),factory setting always also at that position.

Range setting at on the top of the unit --"RANGE", change the switch No.2、3、4position,could measure different process material through different sensing element IL. While one position at "ON", the other twos should at "off" position.

Relationship between material conductivity and span position:

Span 2:Sensing element length less than 300mm or high insulating material such as: plastic powder/granular or foam;

Span 3:Sensing element length less than 3000mm or general insulating/conductive material;

Span 4:Sensing element length over 3000mm or semi-conductive/conductive material.

SECTION 6 CALIBRATION

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 and control elements are in manual.

6.1 Start Up

The AVI-PDU is ready for operation when the system is installed and wired in accordance with previous instructions. The area should be evaluated, and if found safe, the housing cover should be removed for start-up. It is advisable at this time to disable control elements until proper operation is verified.

6.2 Factory Calibration

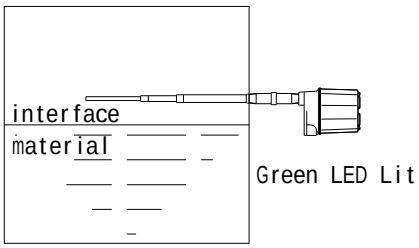
All AVI-PDU series products are factory configured to switch on water based conducting materials (set point adjustment is set to full clockwise position) and sealed with a paper seal.

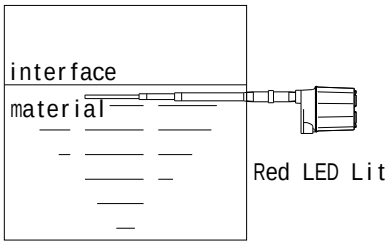
No calibration is required for conductive material applications.

If the calibration seal is broken or verification of the trip point is required turn the adjustment screw full clockwise for conductive applications. For insulating material applications, see section 6.3, for conducting material, see section 6.4

6.3 Calibration for Insulating Materials (HLFS) Horizontal mount.

A. Be sure the material level is well below the sensing element.
B. Turn the set point adjustment to the full counterclockwise (CCW) position. The red alarm light will light.
C. 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 screw driver slot ends. See figure 6.1Calibration in Insulating Material 1
D. Increase the material level until it is well above the sensing element. (RED LED turns on). See figure 6.2 Calibration in Insulating Material 2.
E. 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.
F. Turn the adjustment back counterclockwise (CCW) half of the number of turns that was counted.
G. 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 Calibration for Conducting Materials (HLFS)

A. Be sure the material level is well below the sensing element
B. Turn the set point adjustment to the full counterclockwise (CCW) position. The LED will be red.
C. Turn set point adjustment slowly clockwise (CW) until the relay just changes state. (LED changes color to GREEN).
D. Turn the set point adjustment slowly

- 1/4~1/2 turns for dielectric constant (K) less than 2.
- 1/2~1 turns for dielectric constant (K) between 2~ 10
- 1~2 turns for dielectric constant (K) between 10~80.
- 2~5 turns for conductivities <0.5 micro mhos (μS/cm)
- Full clockwise for conductivities over 100 micro mhos (μS/cm).

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

A. Insure vessel is empty or material is well below probe.
B. Turn the set point adjustment to the full counterclockwise (CCW) to position (LED will be red) .
C. 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) 3/4 turn, this is called as pre-load, if the material is high insulating one, then make it as 1/2 turn as a good initial set up. Normally 3/4 turn is for general

insulating/conductive material, for high conductive one, than make more turns.

SECTION 7 TROUBLESHOOTING

7.1 Introduction

AVI-PDU 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-PDU 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-PDU level control. If attempts to locate the difficulty fail, notify your local FITECHNIC® representative or call the factory directly.

Assure power to the equipment has been turned before opening the explosion-proof housing. Also make sure power to the relay contacts have been turned off over ten minutes and control devices are in manual.

7.2 Testing the electronic unit

During electronic unit testing , care should be taken as line power will be on the power terminals. Also assure relay power is off!

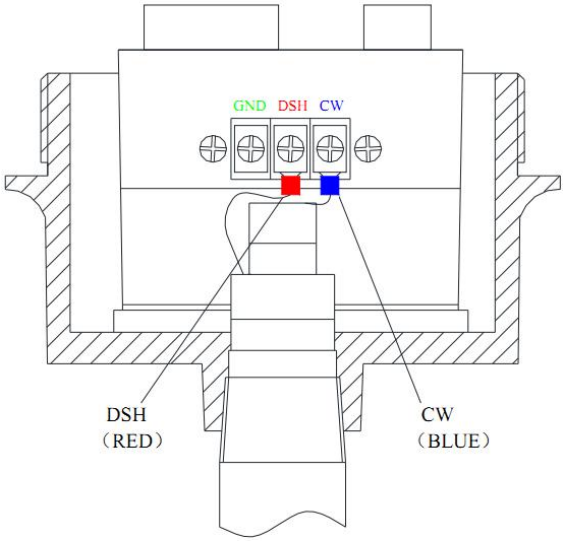
A. Disconnect the sensing element wires from the instrument by removing the blue wire from the center terminal and the red wire from shield terminal. Leave the power connected. See figure 7.1.

B. Connect a 1 to 10pF capacitor between center wire and ground.

C. Starting with the set point adjustment in the extreme counterclockwise (CCW) position, turn the screwdriver clockwise (CW) until the relay just operates.

D. 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 wok 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:

- o Center wire to ground _____milli-volts
- o Center wire to shield _____ milli-volts
- o 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

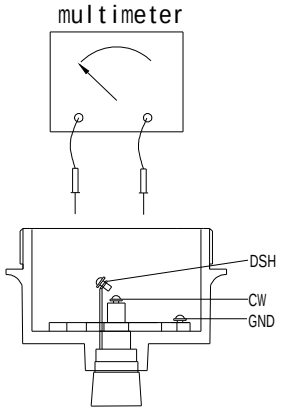
Voltage result in item B should less than following value:

- o Center wire to ground mV
- o Center Wire to shield 100mV
- o 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 than200mV 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 a 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.

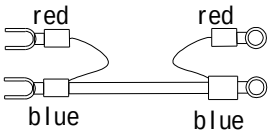
See figure 7.3 integral cable, figure 7.4 remote cable.

Integral cable:

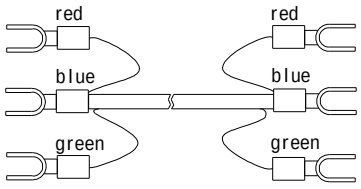
Resistance between the two blue spade lugs（< 2Ω）

Resistance between the two red spade lugs（< 2Ω）

Resistance between the red & blue spade lug（>100MΩ）



7.3 Integral cable



7.4 Remote cable

Remote Cable
Resistance between the two blue spade lugs（< 10Ω）
Resistance between the two red spade lugs（< 10Ω）
Resistance between the two green spade lugs（< 10Ω）
Resistance between the three different color lugs（>100MΩ）

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.