

# **BABBITT SMART WAVE PULSE RADAR TRANSMITTER**

## **INSTRUCTION MANUAL**



**NOTICE**

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure that you thoroughly understand the contents before installing, using or maintaining this product.

For equipment service or support needs:

**Customer Service:** 1-800-835-8012 or 713-467-4438 (8:00 a.m. to 5:00 p.m. CST US)

**WARNING**

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.
- Do not perform any services other than those contained in this manual unless you are qualified.

Explosions could result in death or serious injury.

- Verify the operating environment of the Babbitt Radar is consistent with the appropriate location certifications.
- Do not remove the housing cover in explosive atmospheres when the circuit is alive.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.



High voltage that may be present on leads could cause electrical shock.

Make sure the main power to the Radar is off and the lines to any other external power source are disconnected or not powered while wiring the instrument.

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## RADAR LEVEL TRANSMITTER

### 1. DESCRIPTION

Babbitt Pulse Radar Transmitters allow simple and reliable non-contact level measurement of liquids inside metal tanks. The Radar is designed to “see through” environments such as foam, fumes and vapor that would normally interfere with ultrasonic sensors. The SmartWave technology automatically adjust the microwave pulse amplitude and its width to a target distance and target reflection properties. The receiver changes its sensitivity with the amplitude of received echoes. In addition, the unit analyzes the shapes of the received echoes and eliminates the ones coming from the tank walls, standpipes and other obstructions. These features allow the Radar to track targets from the tip of the rod antenna to the tank bottom in most tank shapes and environmental conditions. The Radar also features a low dielectric mode. In this mode, the unit will ignore echoes from the tank bottom with material present and it will increase the transmit energy and sensitivity of the receiver until it detects echoes from the surface of the low dielectric material. In short, the Radar will ignore the first echo (tank bottom) and instead lock onto to the second strongest echo, which would be the fluid surface. In this mode, the Radar will work with dielectrics of 2 or greater.

The transmitter can be programmed to send a 4/20mA analog output signal directly to an existing control system or to send data by RS-232, RS-485 or HART (2 Wire Units) to a PC running calibration/data logging software program.

### FCC Information To SmartWave Pulse Radar Users

**Note:** This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operating in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case, the user will be required to correct.

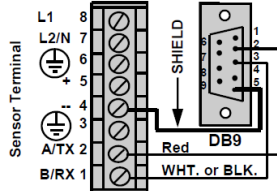
**2. GENERAL SPECIFICATIONS**

<b>Conduit Entry:</b>	1/2" NPT
<b>Enclosure:</b>	Aluminum (Standard)      Stainless Steel (Optional)
<b>Enclosure Rating:</b>	NEMA 6 (IP 68)
<b>Antenna:</b>	Standard – Teflon PTFE
<b>Electronics Operating Temperature:</b>	-40° to 140° F (-40° to 60° C)
<b>Process Operating Temperature:</b>	Standard -40° to 266° F (-40° to 130° C) Optional - High Temp Teflon De-Coupler -40° to + 350° F (- 40° to 176° C)
<b>Pressure:</b>	Standard – 1-5 bar / 15-75 psi Optional - High Pressure 70 bar / 1000 psi
<b>Approvals:</b>	FCC Part 15—Low Power Communication Device; General Approvals for FM and CSA  Optional - Explosion Proof - FM and CSA for Can. & US Class 1, Div. 1 Groups B, C & D
<b>Accuracy:</b>	+/- 0.25% of maximum target range (In Air)
<b>Loss of Echo:</b>	Hold 30 seconds, 22 mA Output
<b>Calibration:</b>	Push-button or programmable via optional communication port
<b>Diagnostics:</b>	Via communication port (echo profile, echo stability, operation errors)
<b>Power AC:</b>	AC units 115 VAC 60Hz or 230 VAC 50Hz, 1.7 VA
<b>Power DC:</b>	DC units 12 to 30 VDC, 0.07 A max @ 24 VDC
<b>Output:</b>	4-20 mA, optional RS-232, RS-485, Modbus or HART (2 Wire Only)
<b>4 to 20 mA Max. Loop Resistance</b>	110 VAC @ 750 Ohms (isolated) 12 VDC @ 250 Ohms 24 VDC @ 750 Ohms
<b>Frequency:</b>	6.3 GHz (Standard)                      5.8 GHz (Optional)

### 3. COMMUNICATION WIRING

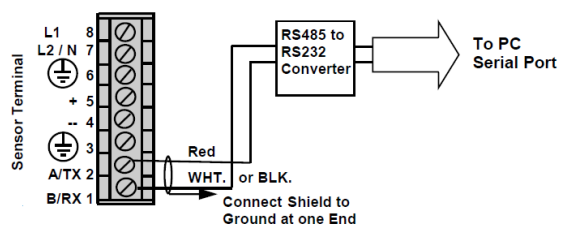
#### 3 & 4 Wire Radars

**Fig. 1 RS232 Connection**



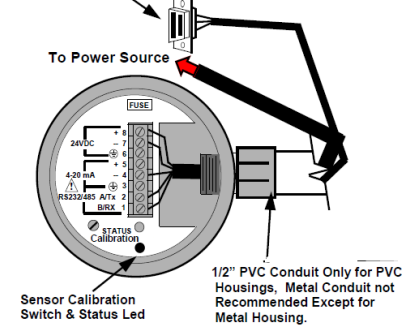
Note – Connect the shield to Terminal #4.

**Fig. 2 RS485 Connection**

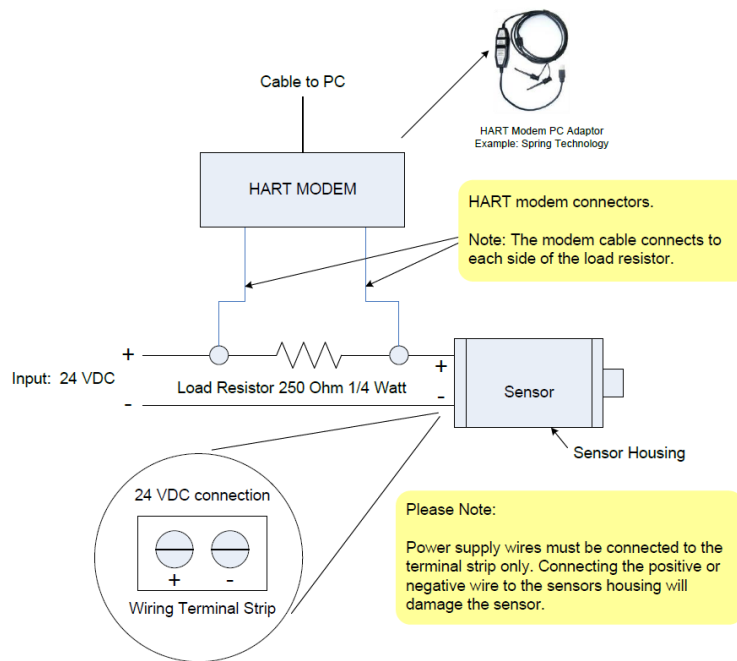


Note – Connect the shield to Terminal #3.

Connect to Serial Port of PC ,use Extension Cable length as required ,Refer to Fig.# 1 or # 2 For Wiring Dtl.



#### 2 Wire Radars



PDF 2 Wire HART Software Instruction Manual can be downloaded from the bottom of webpage:  
<https://www.babbittinternational.com/radar-level-transmitters.html>

#### 4. COMMUNICATION SOFTWARE

Communication software is provided with all Radar orders. It is important to note that 3 & 4 Wire Units use a different software than 2 Wire Loop Power Units.

If lost or not found, software for each can be downloaded from the bottom of webpage:

<https://www.babbittinternational.com/radar-level-transmitters.html>

The instructions below are for 3 & 4 Wire Radars units. For 2 Wire Radars, users should follow the instructions located in the 2 Wire HART Instruction Manual PDF, which can be downloaded from the bottom of webpage:

<https://www.babbittinternational.com/radar-level-transmitters.html>

#### HOW TO START THE GATEWAY PC COMMUNICATION PROGRAM – 3 & 4 WIRE ULTRASONIC

- 1.) Install Level device Gateway PC by selecting SETUP.EXE from the factory provided disc or by downloading the software from the webpage.
- 2.) Click on START Windows button and select “probe\_GatewayPC”
- 3.) Choose save an available serial communication port; Click on Select\_COM\_Port (Click STOP data link)
- 4.) After selection of communication port, save port number to avoid going through the same process next time.
- 5.) Click on Start data link, you will see two bar graphs that display last 8 echoes and tank level in %.
- 6.) When communication is working, you should see a smiling face and green light at the bottom of screen.
- 7.) 4mA and 20mA distance calibration, go to TOOLS and click on 4mA Distance Calib. and 20mA Distance Calib. In the 4mA (20mA) dialog box, click OK and in the next box enter distances.
- 8.) For low dielectric materials, turn ON this parameter in the TOOLS menu.

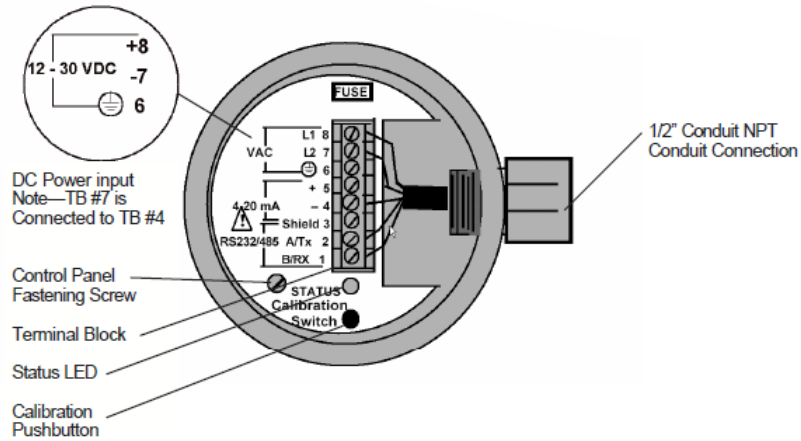
For information about the communication program, please go to **HELP** and click on **OPERATING INSTRUCTIONS**.

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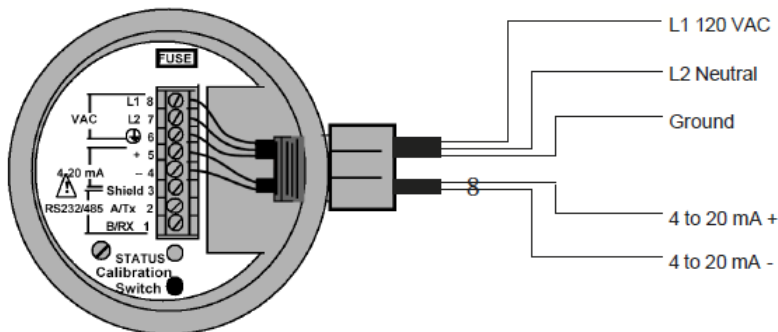
#### IMPORTANT NOTE:

Radars with RS-485 communication ports can be used in Daisy Chain Network. BEFORE INSTALLATION, please assign new sensor ID to each sensor starting from 4 and up. The default ID for a single sensor is 2. Please read HELP file in the Gateway PC Software. In points 20-22 you will learn how to change the sensors ID.

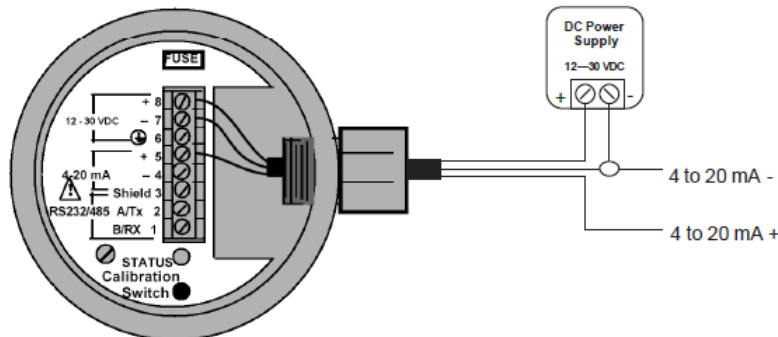
5. INTERCONNECTING WIRE DIAGRAM



**AC Wire Diagram**



**DC 3—Wire Diagram**



**Wire/Cable for A/C Units**

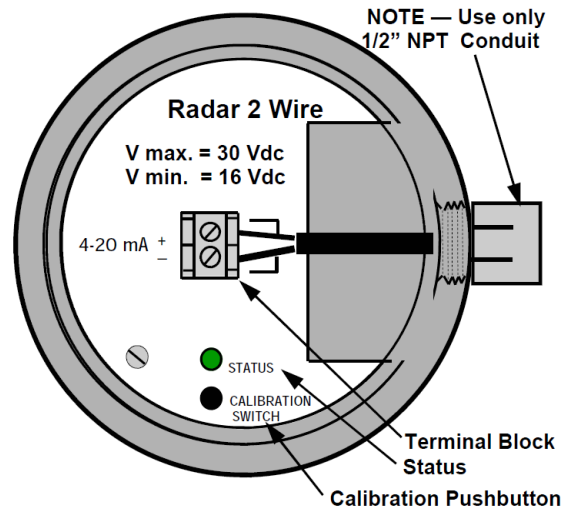
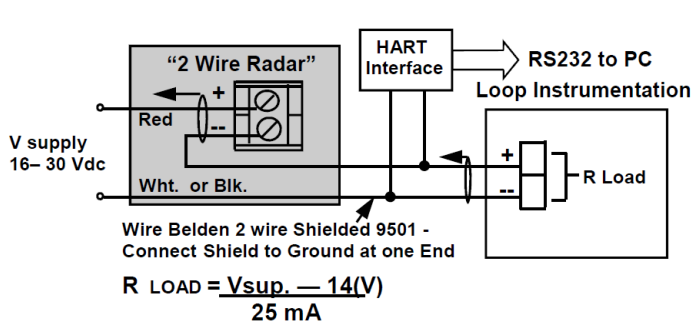
- 115/230 VAC..... 3 wire unshielded, 22AWG (7X30), 300V
- 4/20mA..... 1 pair shielded, 24AWG (7X32), 300V

**Wire/Cable Recommendation for 3 Wire 24VDC Units**

- 24 VDC + 4/20mA ..... 3 wire shielded, 24AWG (7X32), 300V



**DC 2 Wire Diagram**



**Wiring Information**

- Ground shield at one end only.
- All terminal block wiring must be rated for 250V.
- Terminal is for use only with equipment which has no live parts that are accessible.
- Terminal is for use with equipment which maintains basic insulation from hazardous voltage under normal and single fault conditions.
- Connection used at the remote end of external circuit.

**Recommended Wiring**

AC Sensor

- Power 3 Wire unshielded 22 AWG, 300V
- Current Output 1 Pair shielded 24 AWG, 300V
- Communication 1 Pair shielded 24 AWG, 300 V

DC Sensor

- Power 3 Wire shielded 24 AWG, 300V
- Current Output 3 Wire shielded 24 AWG, 300V
- Communication 1 Pair shielded 24 AWG, 300 V

2 Wire Sensor

- 2 Wire shielded 24 AWG, 300 V

**FCC Information To SmartWave Pulse Radar Users**

**Note:** This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operating in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case, the user will be required to correct.

## 6. CALIBRATION (4/20mA or 20/4mA Output) AND LOW DIELECTRIC MODE

All Babbitt Radars feature single push button calibration, allowing the user to manually calibrate the unit inside the tank or off a flat metal surface. The Radar can also be calibrated using the factory provided software. In addition, the factory software provides access to advanced features, settings and diagnostics.

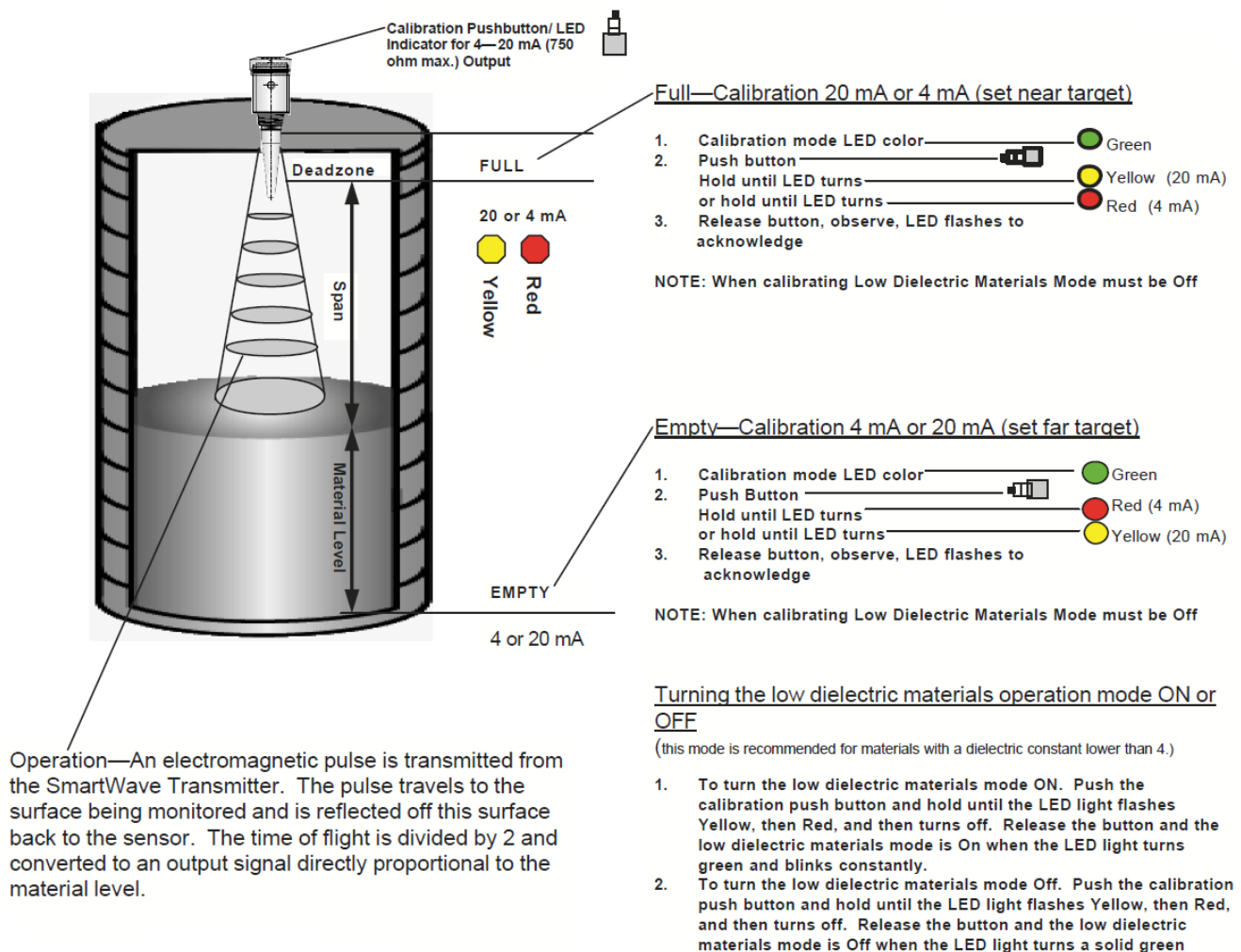
NOTE: 3 & 4 Wire Radars use a different software than 2 Wire Loop Power Radars.

Software for each can be downloaded from the bottom of webpage:

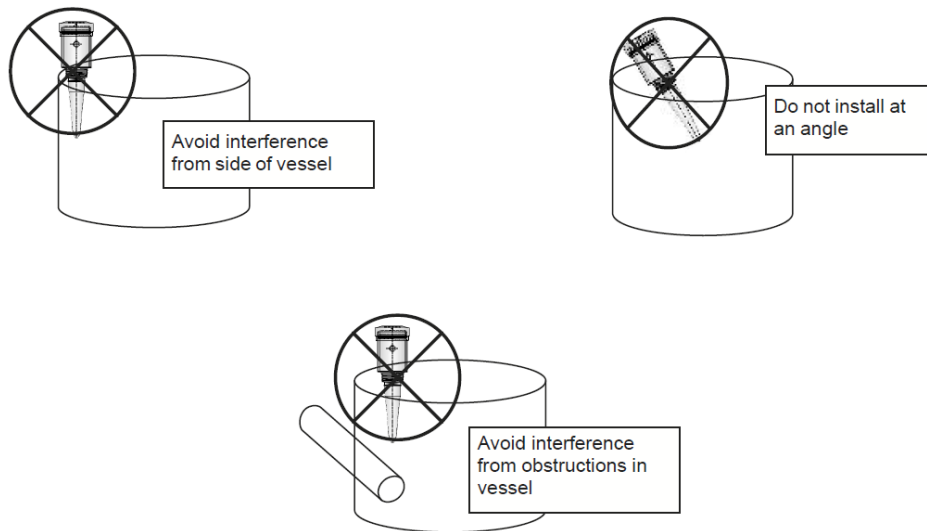
<https://www.babbittinternational.com/radar-level-transmitters.html>

PDF 2 Wire HART Software Instruction Manual can be downloaded from the bottom of webpage:

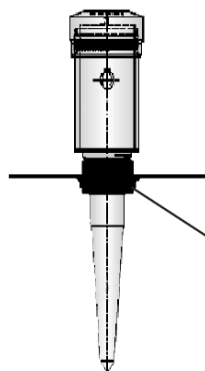
<https://www.babbittinternational.com/radar-level-transmitters.html>



**7. POSITIONING**



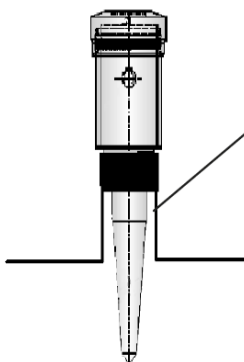
**8. MOUNTING**



Standard Mounting:

Mounting the SmartWave Transmitter is critical to the proper operation of the unit. The unit can be directly mounted by simply threading the sensor directly into a 2" NPT metal mounting flange with the antenna pointing down. The SmartWave Transmitter must be installed in a metal flange. If an extended standpipe is used for mounting, please consult the factory for assistance.

Threaded Mounting Flange (2" NPT)

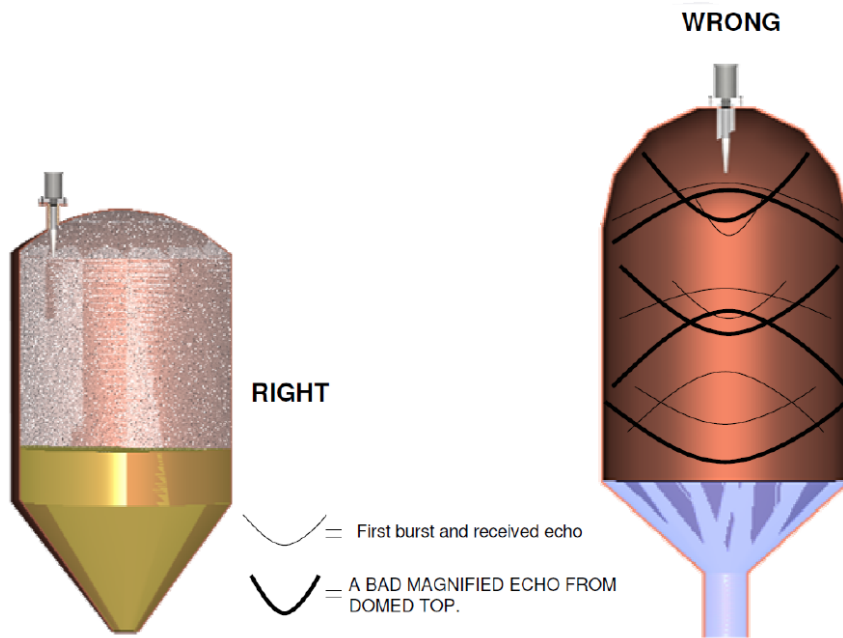


Metal Standpipe Mounting:

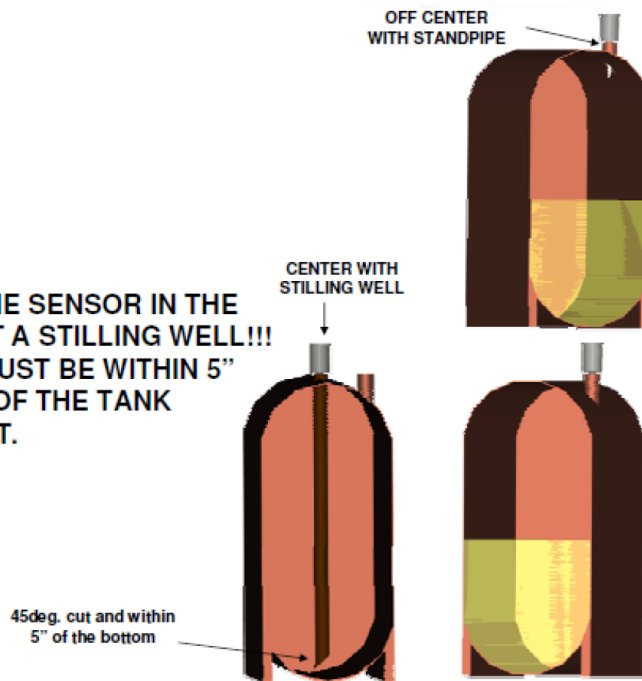
Pipe Diameter	Max. Length
2.5"	2"
3.0"	4"
3.5"	4"
4.0"	11" & Longer

The Radar should not be mounted in the center of a tank that has a domed top. The domed top acts like a satellite dish and magnifies the first echo. This echo becomes stronger than the first received echo, creating a false echo that the software locks onto. This echo is typically twice the distance of the actual level.

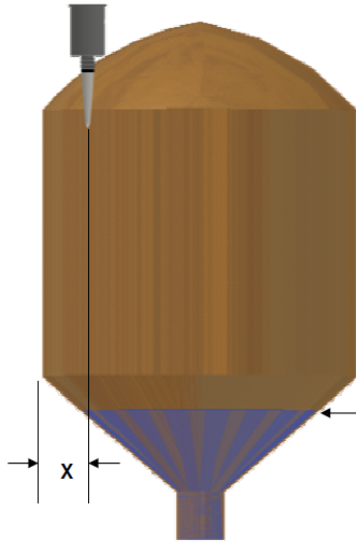
Radar must be mounted off center or in a stilling well.



**NEVER MOUNT THE SENSOR IN THE CENTER WITHOUT A STILLING WELL!!! STILLING WELL MUST BE WITHIN 5" OF THE BOTTOM OF THE TANK WITH A 45deg. CUT.**



### 9. DISTANCE FROM TANK WALL



The distance from the wall after using the formula is the minimum distance allowable from the side wall based on the height of the tank.

To prevent the bouncing of the echo from the tapered bottom a **Minimum Level** can be set so there is a perpendicular reflection.

If it's not possible to have a minimum level in a tank then you can use the **Loss Of Echo** function found in the **TOOLS** menu. Either set the Loss of Echo for 2 mA or 22 mA depending on the full tank calibration setting.

← **Minimum Level**

Minimum distance to Wall can be calculated from the equation:

$$X = \tan(\text{ALFA}/2) \times \text{height}$$

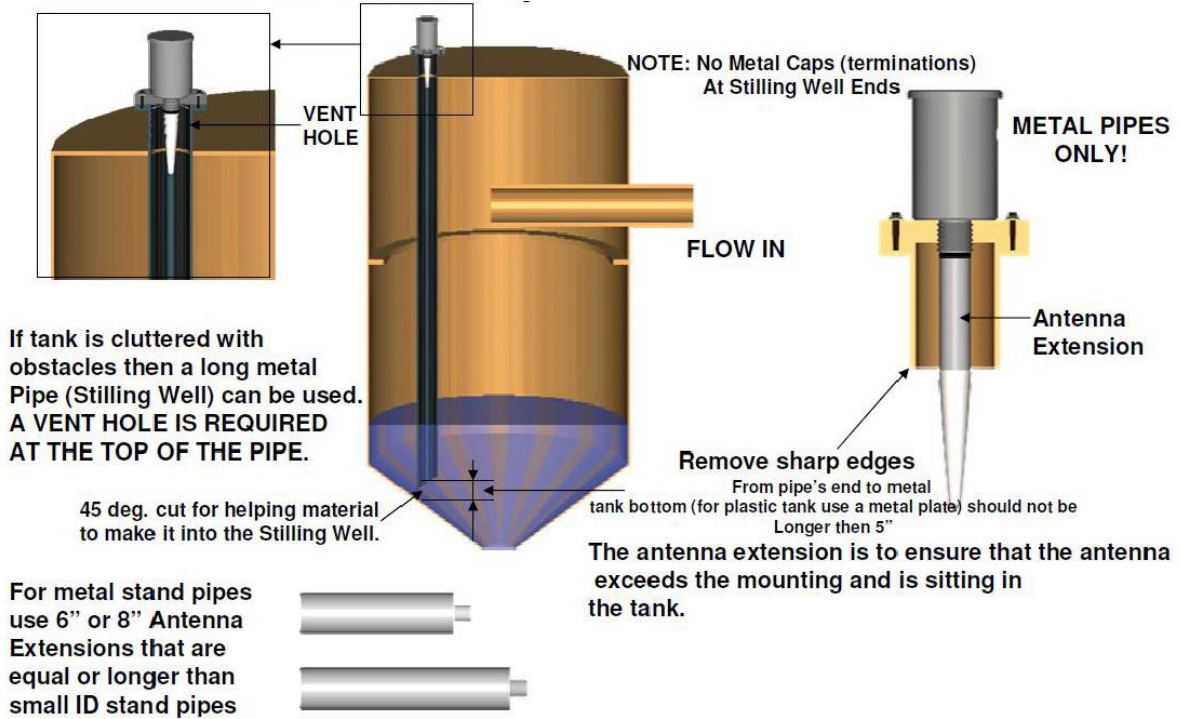
Where: ALFA is a radiation beam angle

→ For Radar with rod:  $\tan(20/2) = 0.18$

For Radar with Horn:  $\tan(16/2) = 0.14$

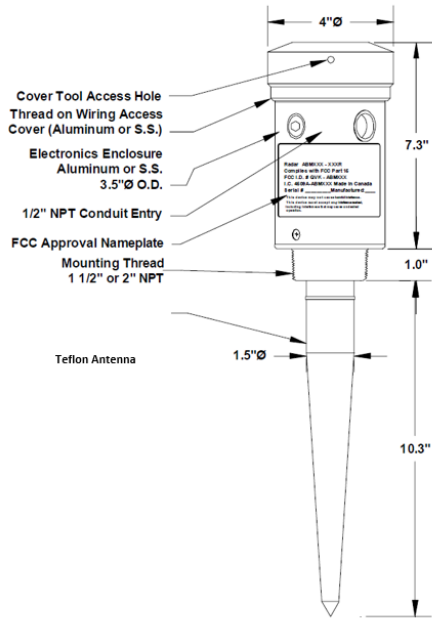
### 10. METAL STAND PIPE AND STILLING WELL MOUNTING

NOTE: Depending on model, PIPE ON may need to be enabled in TOOLS section of software.

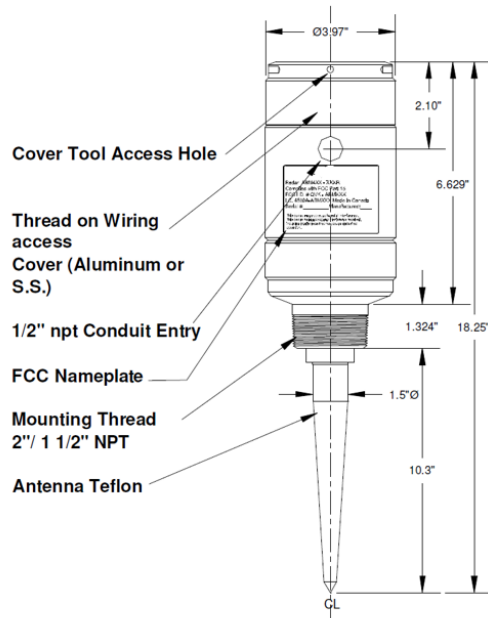


11. TECHNICAL SPECIFICATIONS

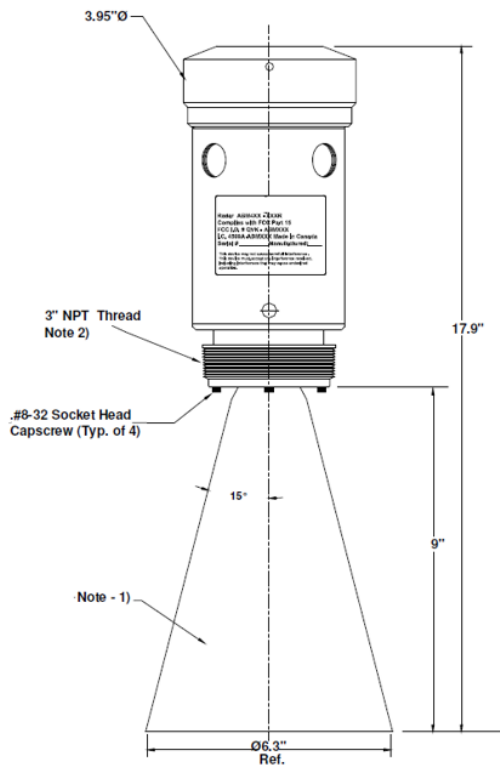
Standard Radar



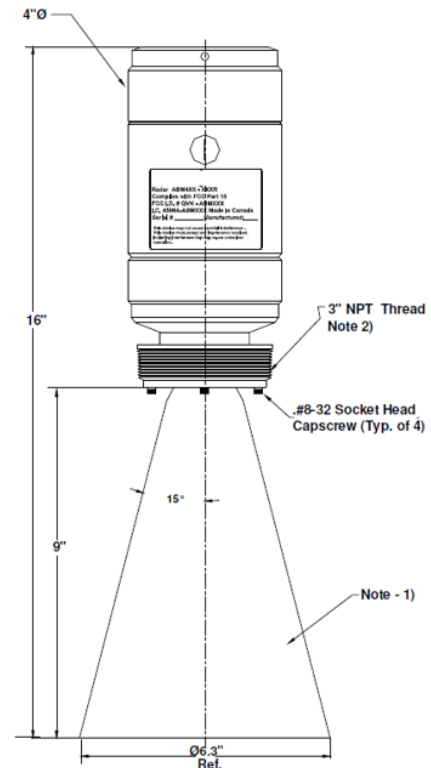
Explosion Proof Radar



Standard Radar w/ 6" Horn



Explosion Proof Radar w/ 6" Horn



Notes – 1) Material 316 SS, 21 Gauge Sheet  
2) Flange Size required to pass Horn thru ANSI 8" -150 lb

<b>MODEL</b>	<b>OPERATING RANGE</b>	<b>RESOLUTION</b>	<b>MOUNTING THREAD</b>
BAB200/300/400/430- <b>017R</b>	17'	0.08"	2" NPT
BAB200/300/400/430- <b>033R</b>	33'	0.15"	2" NPT
BAB200/300/400/430- <b>050R</b>	50'	0.022	2" NPT
BAB200/300/400/430- <b>100R</b>	100'	0.044"	2" NPT
BAB200/300/400/430- <b>140R</b>	140'	0.062"	2" NPT
BAB200/300/400/430- <b>240R</b>	240'	1.06"	2" NPT

Call one of the following numbers if you have installation or application questions.

1-800-835-8012            8:00 am – 5:00 pm CST  
 (713) 467-4438            Voice  
 (713) 467-8736            Fax  
 www.babbittinternational.com

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