



# ***TEK-WAVE 4300A***

## ***Radar Level Transmitter***

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### **Instruction Manual**

Document Number: IM-4300A



[www.tek-trol.com](http://www.tek-trol.com)

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#### **NOTICE**

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

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## Table of Contents

<b>1</b>	<b>Safety Instructions .....</b>	<b>2</b>
1.1	Intended Use .....	2
1.2	Safety Instructions from the Manufacturer .....	2
1.2.1	Disclaimer.....	2
1.2.2	Product Liability and Warranty .....	2
1.2.3	Information Concerning the Documentation.....	2
1.3	Safety Precautions .....	2
1.4	Packaging, Transportation and Storage.....	4
1.4.1	Packaging.....	4
1.4.2	Transportation.....	4
1.4.3	Storage .....	4
1.4.4	Nameplate.....	5
<b>2</b>	<b>Product Description .....</b>	<b>6</b>
2.1	Introduction .....	6
2.2	Measuring Principle .....	6
2.3	Specifications.....	7
2.4	Dimensional Drawing .....	9
<b>3</b>	<b>Installation.....</b>	<b>10</b>
3.1	Mounting.....	10
3.2	Distance from Tank's Wall.....	11
3.3	Installation on Tanks with Domed Top.....	12
3.4	Installation on Tanks with Obstruction .....	12
3.5	Installation on Stilling Well and Stand Pipe .....	13
<b>4</b>	<b>Electrical Installation.....</b>	<b>15</b>
4.1	Wiring Information .....	16
4.2	2-Wire Sensor Wiring Connection .....	16
<b>5</b>	<b>Configuration.....</b>	<b>17</b>
5.1	Inside Tank Calibration.....	17
5.2	Outside Tank Calibration .....	19
<b>6</b>	<b>Maintenance.....</b>	<b>20</b>
<b>7</b>	<b>Troubleshooting.....</b>	<b>21</b>
7.1	Metal Stand Pipe Mounting.....	21
7.2	Multiple Reflections.....	21
7.3	False Level of Low Dielectric Materials.....	22
7.4	Empty Tank with Coned Bottom .....	22
7.5	Low Output Current and No Communication to PC.....	23
7.6	Two Radar Units Close to Each Other .....	23
7.7	Loss of Calibration.....	24

## 1 Safety Instructions

### 1.1 Intended Use

Tek-Wave 4300A is a radar level transmitter used for continuous and contactless level measurement of liquids. The device can only be mounted on closed metal tanks.

### 1.2 Safety Instructions from the Manufacturer

#### 1.2.1 Disclaimer

The manufacturer will not be held accountable for any damage that happens by using its product, including, but not limited to direct, indirect, or incidental and consequential damages.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer has the right to modify the content of this document, including the disclaimer, at any time for any reason without prior notice, and will not be answerable in any way for the possible consequence of such changes

#### 1.2.2 Product Liability and Warranty

The operator shall bear authority for the suitability of the device for the specific application. The manufacturer accepts no liability for the consequences of misuse by the operator. Wrong installation or operation of the devices (systems) will cause the warranty to be void. The respective Terms and Conditions of Sale, which forms the basis for the sales contract shall also apply.

#### 1.2.3 Information Concerning the Documentation

To prevent any injury to the operator or damage to the device it is essential to read the information in this document and the applicable national standard safety instructions. This operating manual contain all the information that is required in various stages, such as product identification, incoming acceptance and storage, mounting, connection, operation and commissioning, troubleshooting, maintenance, and disposal.

### 1.3 Safety Precautions

You must read these instructions carefully prior to installing and commissioning the device. These instructions are an important part of the product and must be kept for future reference. Only by observing these instructions, optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device can be ensured.

For additional information that are not discussed in this manual, contact the manufacturer

### **Warnings and Symbols Used**

The following safety symbol marks are used in this operation manual and on the instrument.



#### **WARNING**

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Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury

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#### **CAUTION**

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Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

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#### **NOTE**

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Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

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## 1.4 Packaging, Transportation and Storage

### 1.4.1 Packaging

The original package consists of

1. Tek-Wave 4300A Radar level transmitter
2. Documentation



#### NOTE

Unpack and check the contents for damages or signs of rough handling. Report damage to the manufacturer immediately. Check the contents against the packing list provided.

### 1.4.2 Transportation

- Avoid impact shocks to the device and prevent it from getting wet during transportation.
- Verify local safety regulations, directives, and company procedures with respect to hoisting, rigging, and transportation of heavy equipment.
- Transport the product to the installation site using the original manufacturer's packing whenever possible.

### 1.4.3 Storage

If this product is to be stored for a long period of time before installation, take the following precautions:

- Store your product in the manufacturer's original packing used for shipping.
- Storage location should conform to the following requirements:
  - Free from rain and water
  - Free from vibration and impact shock
  - At room temperature with minimal temperature and humidity variation

- Before storing a used flowmeter remove any fluid from the flowmeter line completely. Properties of the instrument can change when stored outdoors.


#### 1.4.4 Nameplate

The nameplate lists the order number and other important information, such as design details and technical data.



#### NOTE

Check the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

		<b>Tek-Wave</b>	
Model No.	<input type="text"/>		
Supply Voltage	<input type="text"/>	Range	<input type="text"/>
SN	<input type="text"/>	IP Class	<input type="text"/>
<a href="http://www.tek-trol.com">www.tek-trol.com</a>			

## 2 Product Description

This section covers the reference and specification data, as well as ordering information.

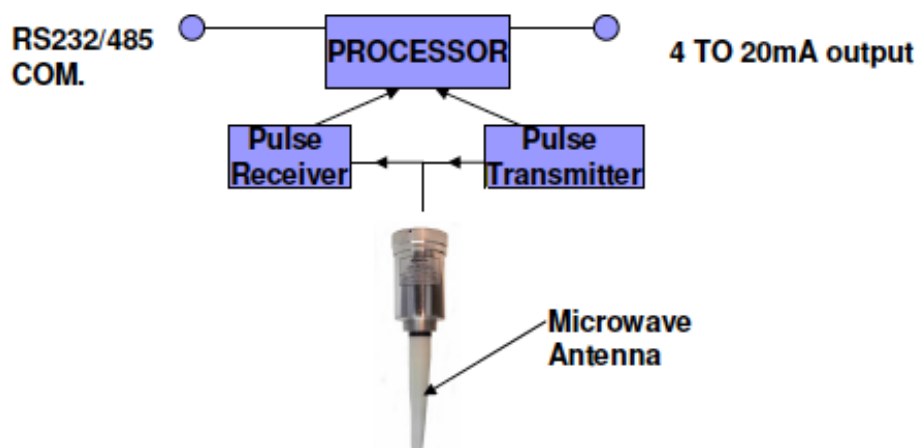
### 2.1 Introduction

Tek-Wave 4300A Radar level transmitter is a device for continuous level measurement that uses radar technology to measure the level of different types of media. The key advantage of this device is its ability to take reliable and accurate measurements even under extreme temperature and pressure conditions. It is not affected by the density, viscosity or the conductivity of the medium. Furthermore, since it does not come in contact with the media, it can also be used to measure levels of corrosive, viscous and abrasive materials without any damage.

### 2.2 Measuring Principle

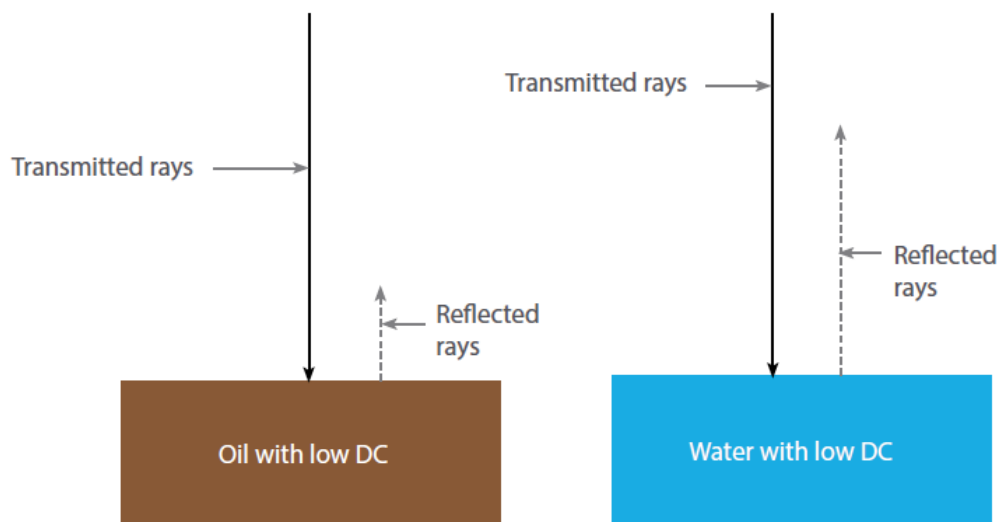
Tek-Wave 4300A uses the Time of Flight method to measure the level of the medium. The radar transmits a signal containing short-duration radar pulses via the antenna towards the surface of the medium. When the signal reaches the surface, a part of it is reflected back to the antenna. The transmitter calculates the time between the transmission of the signal to the reception of the reflected signal (also called the echo) by the antenna. This is called as the Time of Flight and is used to calculate the distance to the surface of the medium. The level measurement of any medium depends on the strength of the reflected signal which in turn is influenced by factors such as the Dielectric Constant (DC) of the medium, the distance from the antenna, and the turbulence on the surface of the medium. Every medium has a Dielectric Constant (DC).

The higher the Dielectric Constant (DC) of a medium, the stronger the reflected signal is and the range measure can be longer.





For example, vacuum has a Dielectric Constant (DC) of 0 and does not generate any reflection. The approximate Dielectric Constant (DC) of oil and water are 2 and 80 respectively; the signal strength of oil is therefore weaker than that of water. The intensity of the reflected signal also decreases as the distance between the antenna and the medium surface increases.



The above figure shows the transmitted and the reflected rays from Oil and Water with low Dielectric Constant (DC).

## 2.3 Specifications

OPERATIONAL SPECIFICATIONS	
Operation	Pulse Radar
Accuracy	±0.25% of max. range
Response Time	Standard Unit 2 - 3 echoes per sec. Std. with less damping 6 echoes / sec. Fast Protocol Unit 10 - 30 echoes / sec
Frequency	6.3 GHz
Transmit Power	50 $\mu$ W average
Calibration	Via communications port (required)
Diagnostics	(Echo Profile) via communications port
Antenna	PTFE
Power Input	20-35VDC
Current	Default 22mA, or 3.5mA
Agency Approvals	FM for Can. & US Explosion Proof Class I, Div.1, Groups B, C, D: Dust-Ignition Proof Enclosure for Class II/III Div. 1, Groups E, F, G.

PROCESS SPECIFICATIONS	
Temperature PP Rod	-40°F to 176°F (- 40°C to 80°C)
De-coupler & PTFE Rod	-40°F to 350°F (- 40°C to 177°C)
Material Dielectric	Er >2
Max. Pressure	5 bars (without De-coupler)

MECHANICAL SPECIFICATIONS	
Conduit Entry	1/2" NPT Two
Enclosure	Aluminium
Ingress Protection	NEMA 4X (IP66)

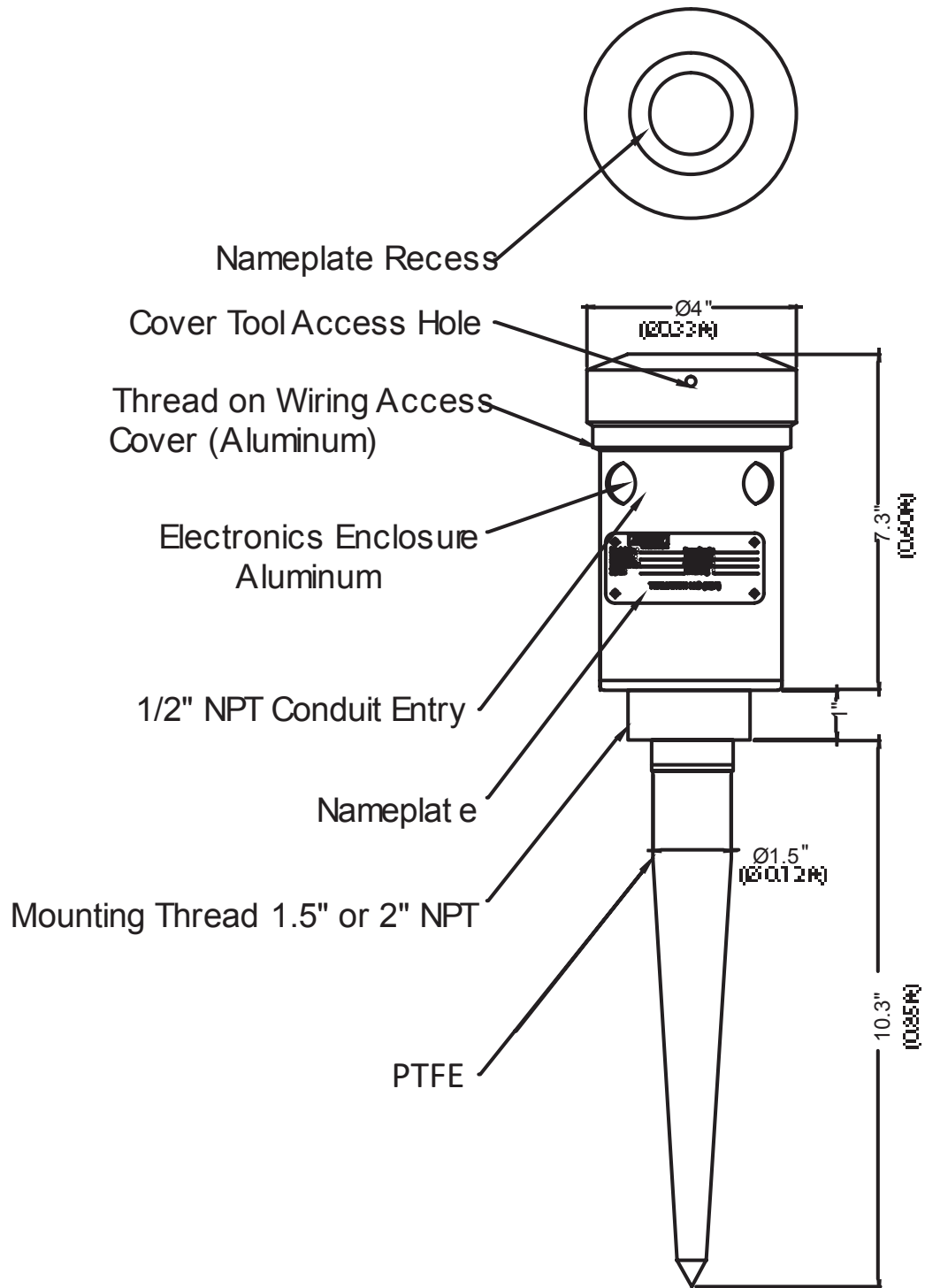
TEMPERATURE SPECIFICATIONS	
Temperature	- 40°F to 140°F (- 40°C to 60°C)

TECHNICAL SPECIFICATIONS			
Radar Range Code	Range in Liquids	Resolution	Mounting
017	(204") *17ft	0.08" (0.006 ft)	**2", 1 1/2" NPT
033	(396") *33ft	0.15" (0.012 ft)	**2", 1 1/2" NPT
050	(600") *50ft	0.22" (0.018 ft)	**2", 1 1/2" NPT
100	(1200") *100ft	0.44" (0.036 ft)	**2", 1 1/2" NPT

\* Minimum Range starts at the lower tip of the antenna for high dielectric material (water).  
For low dielectric materials allow longer Minimum Range.

\*\*Only 2" and 3" NPT Mtg. Connection Available on High Temperature Radar.

## 2.4 Dimensional Drawing



### 3 Installation

This section covers instructions on installation and commissioning. Installation of the device must be carried out by trained, qualified specialists authorized to perform such works.



#### CAUTION

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- When removing the instrument from hazardous processes, avoid direct contact with the fluid and the meter
  - All installation must comply with local installation requirements and local electrical code
- 

#### 3.1 Mounting

- The Tek-Wave 4300A has to be directed straight down to a discharge hole, even if the material is not flat (sloped). This is typical for pellets/powder applications; the devices will still receive an echo.
- When installed properly, the Tek-Wave 4300A transmit electromagnetic pulses down to the material (liquids or solids).
- During installation make sure that you do not have any large objects in front of transducer or antenna.
- Reflected pulses from materials are received and processed to obtain correct distances.
- Due to very narrow and uniform polar patterns (directivity) and signal processing of ultrasonic/ microwave devices, small unwanted echoes from tanks walls, ladders, filling pipes, etc. can be ignored or cancelled.



#### NOTE

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The Tek-Wave 4300A can be used only in metal tanks

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### 3.2 Distance from Tank's Wall

The distance from the wall is the minimum allowable distance from the side wall based on the height of the tank. It can be found out by using the formula:

$$x = \tan\left(\frac{\alpha}{2}\right) \times h$$

Where,

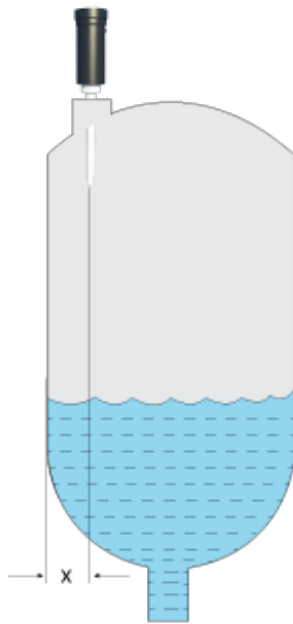
X = distance from wall

h = height of the tank

$\alpha$  = radiation beam angle

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

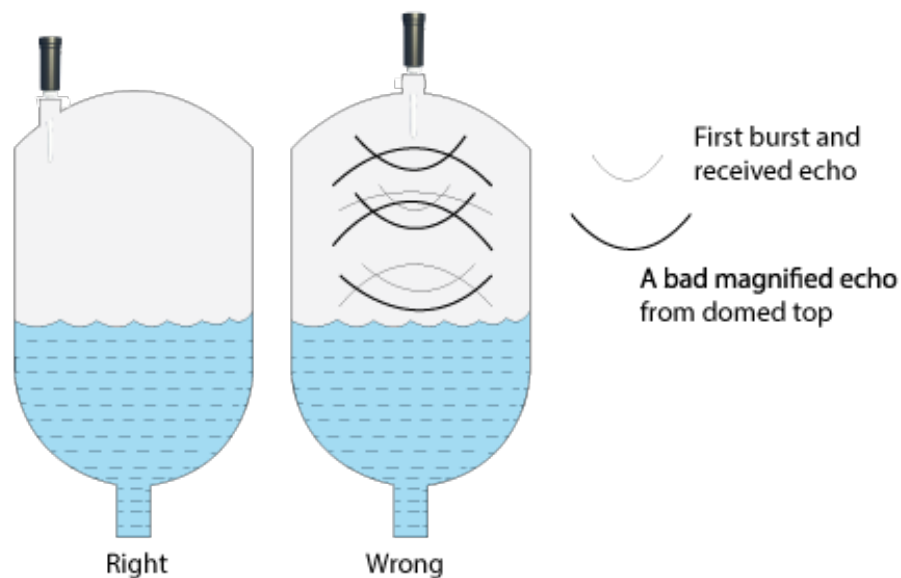
If it's not possible to have a minimum level in a tank, then you can use the Loss Of Echo function found in the TOOLS menu. Either set the Loss of Echo for 2 mA or 22 mA depending on the full tank calibration setting.



Distance from the tank's wall (x)

### 3.3 Installation on Tanks with Domed Top

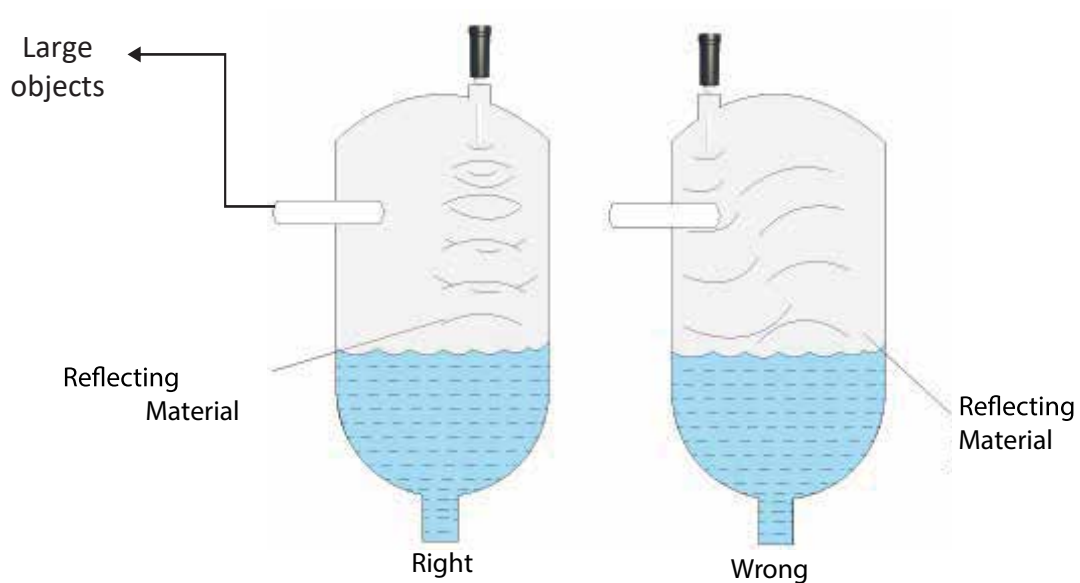
When mounting Tek-Wave 4300A on a tank that has a domed top, the mounting cannot be at the centre. The domed top works like a satellite dish and magnifies the first receiving echo. This echo actually gets stronger than the first received echo. This creates a false echo which the software locks onto. This echo is typically twice the distance of where the material actually is.



Installation on tanks with domed tops

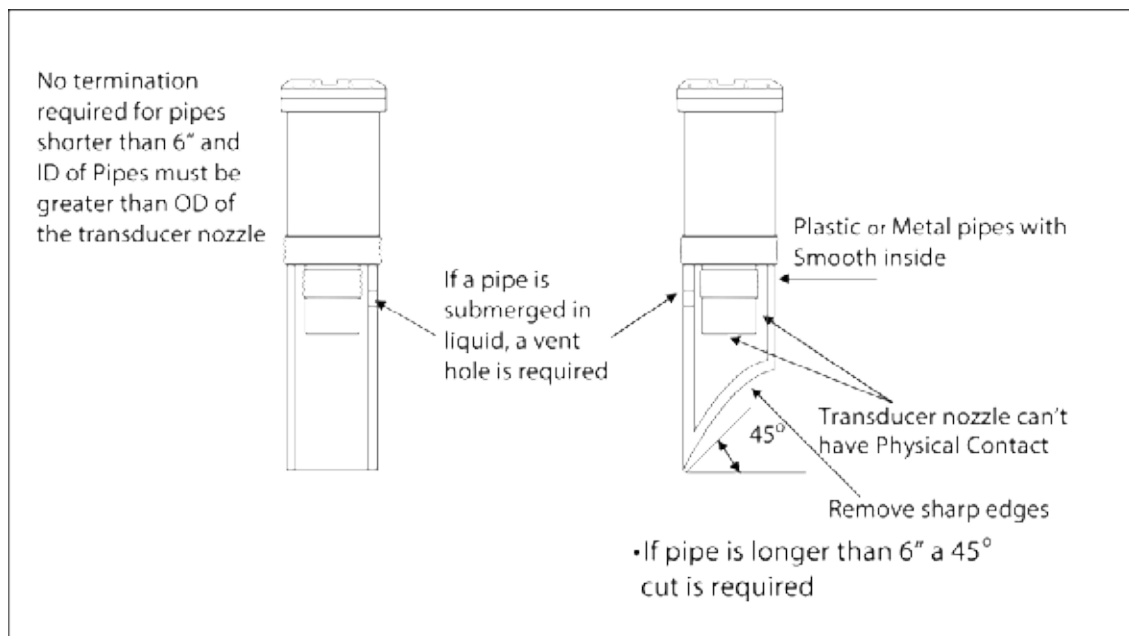
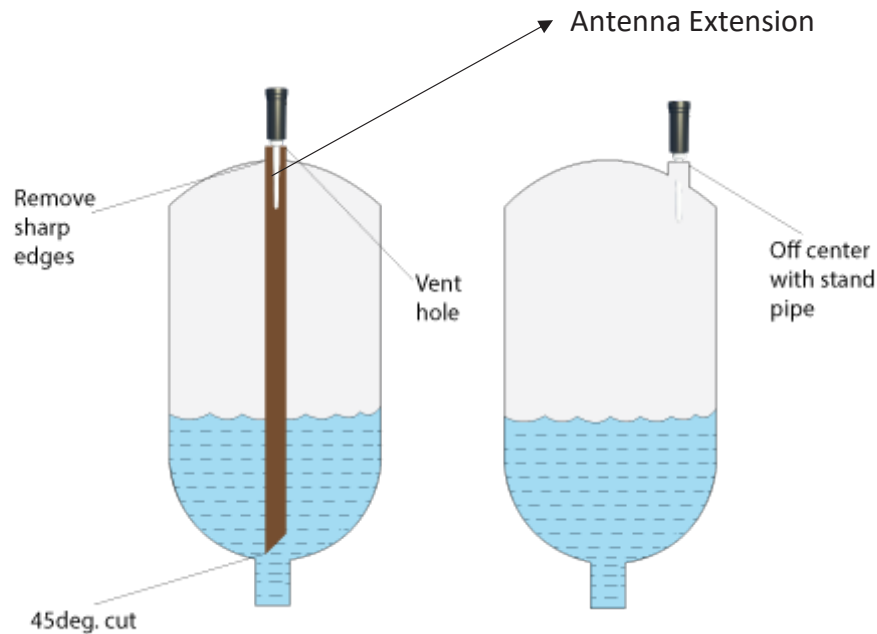
### 3.4 Installation on Tanks with Obstruction

During installation make sure that you do not have any large objects in front of transducer or antenna.



### 3.5 Installation on Stilling Well and Stand Pipe

Radar must be mounted off center or in a stilling well because multiple reflections can occur. The rounded bottom of the tank can gain our radar signal and cause false readings.



Stilling Well must be within 5" of the bottom of the tank with 45° cut.



#### CAUTION

- 
- Never mount the sensor at the center without stilling well. The stilling well must be within 5" of the bottom of the tank with 45° cut
  - Stilling well must be made up of metal pipes
  - The sensor can't have a physical contact with the stilling well
  - No metal caps should be there at the end of stilling well
  - The antenna extension is to ensure that the antenna exceeds the mounting
  - Match extensions with Teflon antenna only
  - 45° cut helps medium to make it into the stilling well
  - A vent hole is required at the top of the pipe
- 

## 4 Electrical Installation

This section covers the all electrical connection requirement. Electrical connection of the device must be carried out by trained, qualified specialists authorized to perform such work by the installation site.



#### WARNING

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- Connect all electrical cables when the power is switched off. If the device does not have switch-off elements, then, overcurrent protection devices, lightning protection and/or energy isolating devices must be provided by the customer.
  - The device must be grounded to a spot in accordance with regulations in order to protect personnel against electric shocks.
- 



#### NOTE

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- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
-

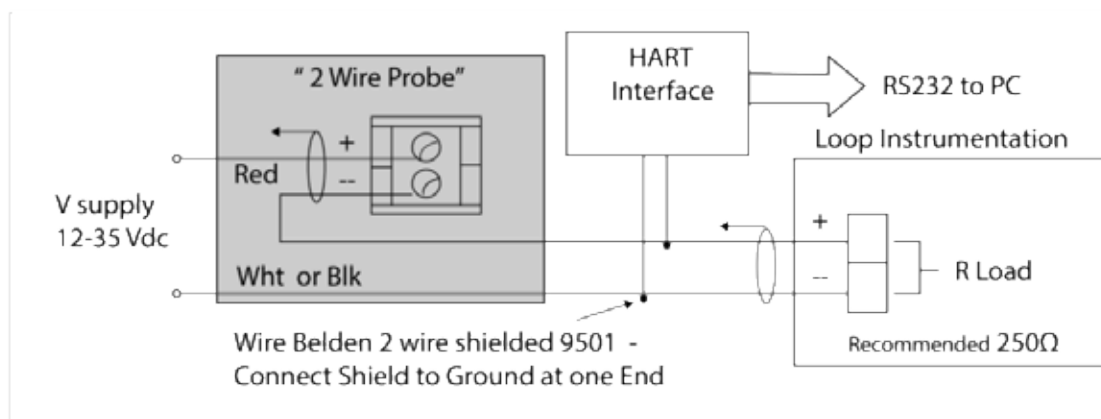


#### 4.1 Wiring Information

- 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 which are accessible.
- Terminal is for use with equipment which maintains basic insulation from hazardous voltage under normal and signal fault conditions.
- **Recommended wiring:** 2 Wire shielded 24AWG, 300V



#### 4.2 2-Wire Sensor Wiring Connection



## 5 Configuration

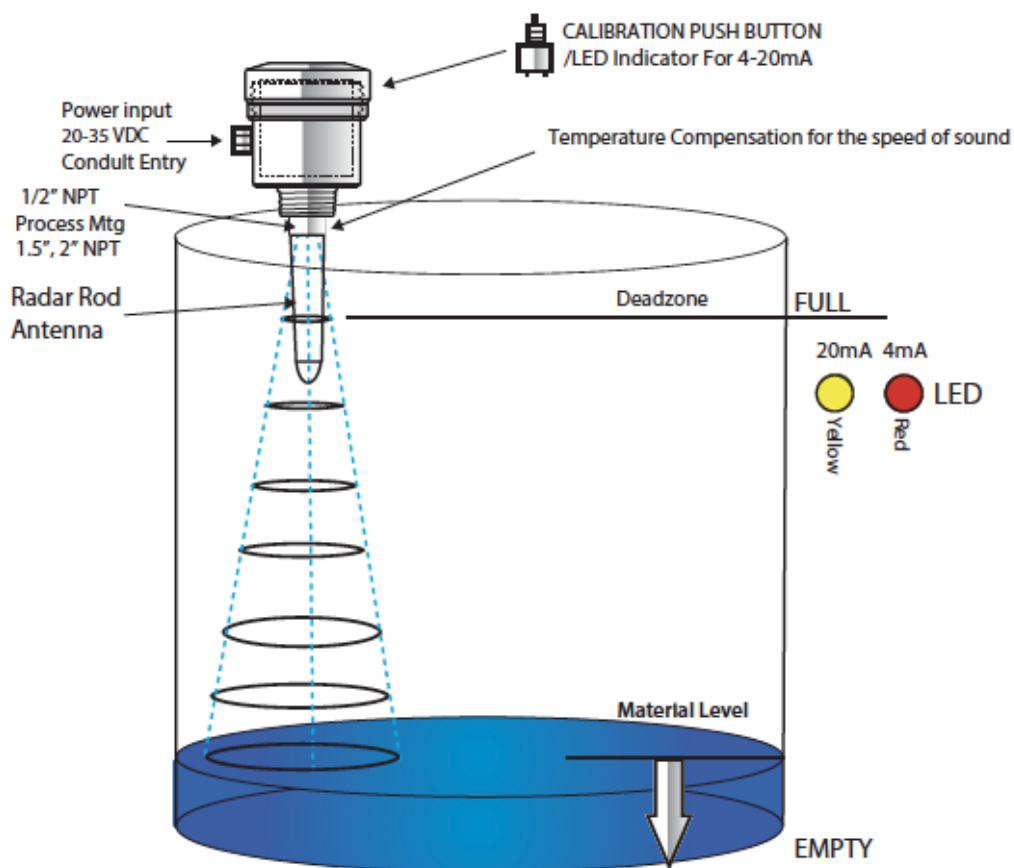
This section covers the configuration and calibration of Tek-Wave 4300A Radar Level Transmitter.

### **i** NOTE

Calibrate the instrument according to the instructions given in this section, otherwise there would be a measurement error

### 5.1 Inside Tank Calibration

Follow the following guidelines for calibrating a tank using 4 mA to 20 mA or 20 mA to 4 mA output.



**FULL — Calibrate 20 mA or 4mA (Set Near Target)**

1. Calibration mode LED color is blinking Green (for Radar, Low Dielectric Materials has to be off).
2. Push button and hold until LED turns Yellow (20 mA) or push button and hold until LED turns Red (4 mA).
3. Release button at Yellow or Red and observe LED flashes to acknowledge the calibration.

**EMPTY— Calibrate 4 mA or 20 mA (Set Far Target)**

1. Calibration mode LED color is blinking Green (for Radar Low Dielectric Materials has to be off).
2. Push button and hold until LED turns Red (4 mA) or push button and hold until LED turns Yellow (20 mA).
3. Release button at Yellow or Red and observe LED flashes to acknowledge the calibration.

**For Radar in order to turn the low dielectric materials operation mode ON and OFF follow the following instructions**

1. To turn the Low Dielectric Materials ON. Push button and hold until LED goes OFF after the sequence of Yellow, Red and turns Off. The Low Dielectric Material operation is on when the LED'S Green light gives two short blinks.
2. To turn the Low Dielectric Materials OFF. Push button and hold until LED goes OFF after the sequence of Yellow, Red and Turns OFF. The Low Dielectric Material operation is OFF when LED is blinking Green.
3. Or use HART 7 communication software



**NOTE**

This mode is recommended for materials with dielectric materials lower than 4 and also to eliminate multiple reflections

## 5.2 Outside Tank Calibration

- For calibration of an Empty Tank (4 mA calibration), position the level device at a distance to a target equal to your empty tank level.
- For Full Tank Calibration (20mA Calibration) place the level device at a distance equal to a full tank.
- In case of the radar do the positioning for a full tank when the radar is off. Make sure the antenna is perpendicular to the metal target. After that, turn the unit on and wait a few seconds until the GREEN light is ON.
- The push button operation is explained in the **Inside Tank Calibration (Section 5.1)**.



### NOTE

For Radar, use a conductive (metallic) surface. Use 3 ft. x 3 ft. or larger target

## 6 Maintenance

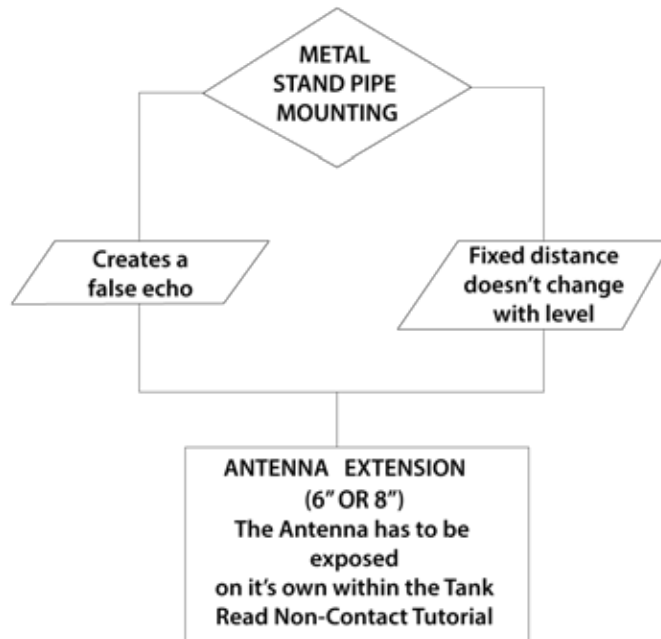
This section covers maintenance techniques and guidelines.

Occasionally check the transmitter face to ensure it remains clean and check that the cover seal, wiring, and cable glands are in good condition.

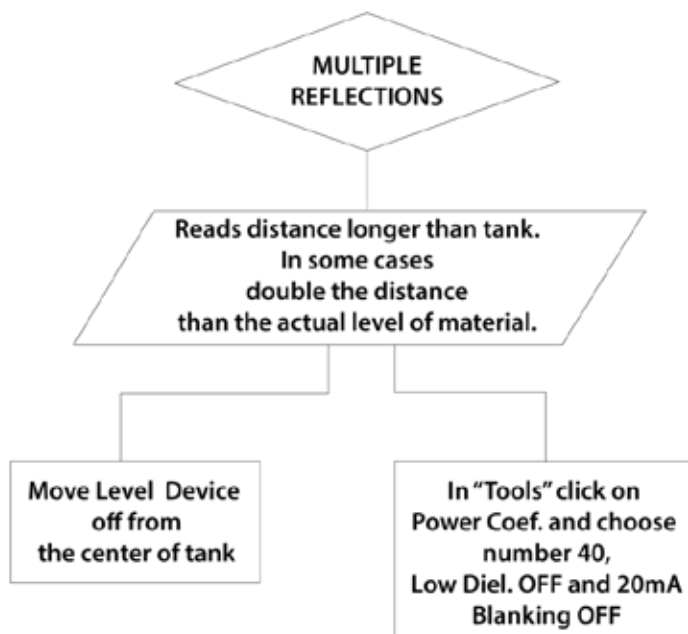
## 7 Troubleshooting

This section provides troubleshooting techniques for most common operating problems.

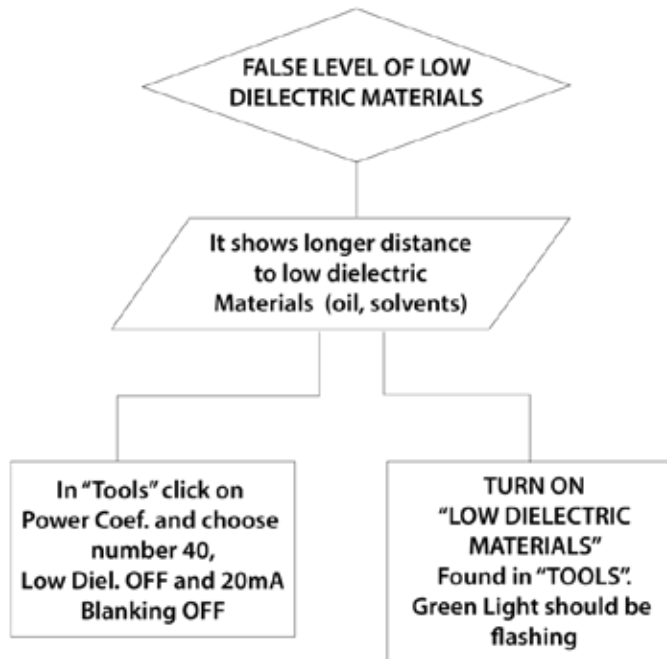
### 7.1 Metal Stand Pipe Mounting



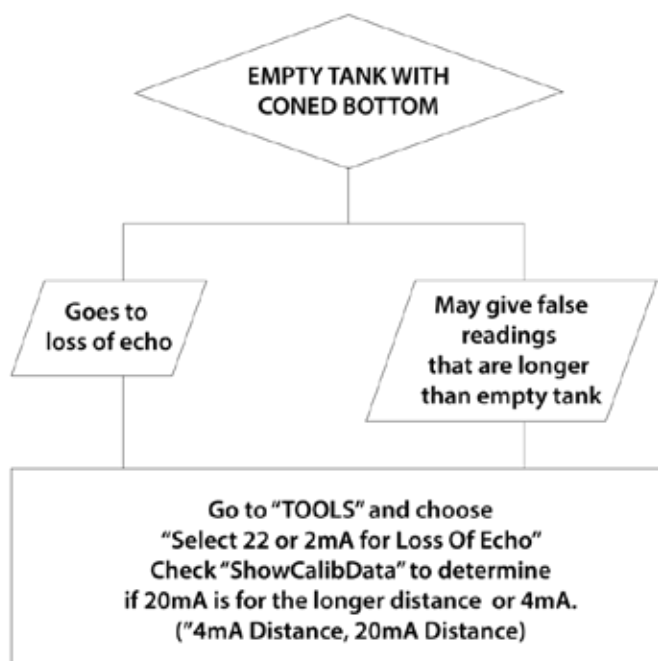
### 7.2 Multiple Reflections



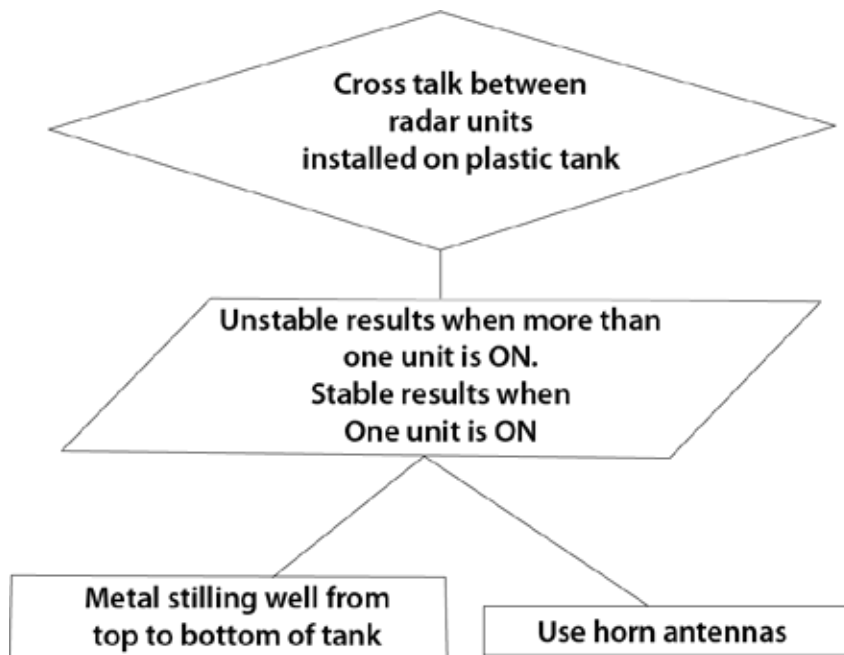
### 7.3 False Level of Low Dielectric Materials



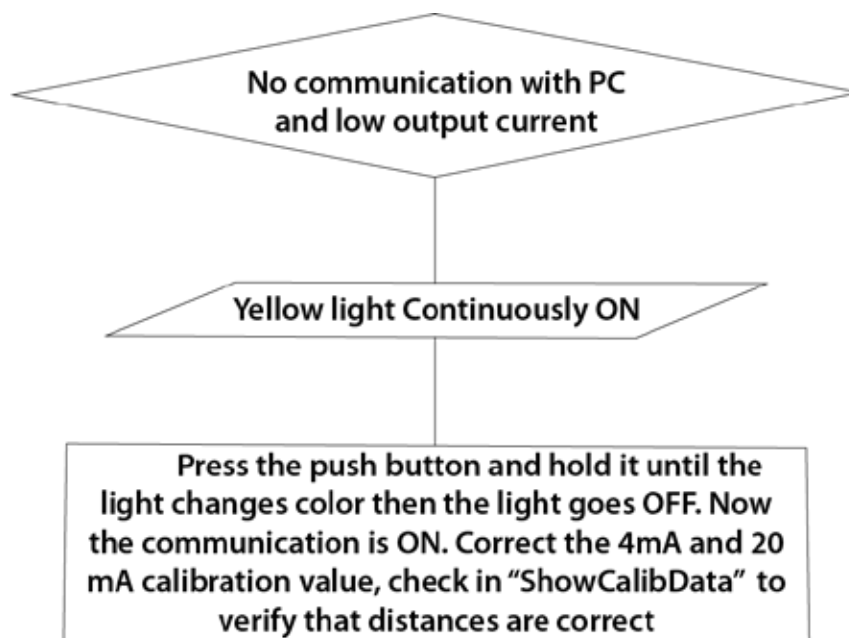
### 7.4 Empty Tank with Coned Bottom



### 7.5 Low Output Current and No Communication to PC

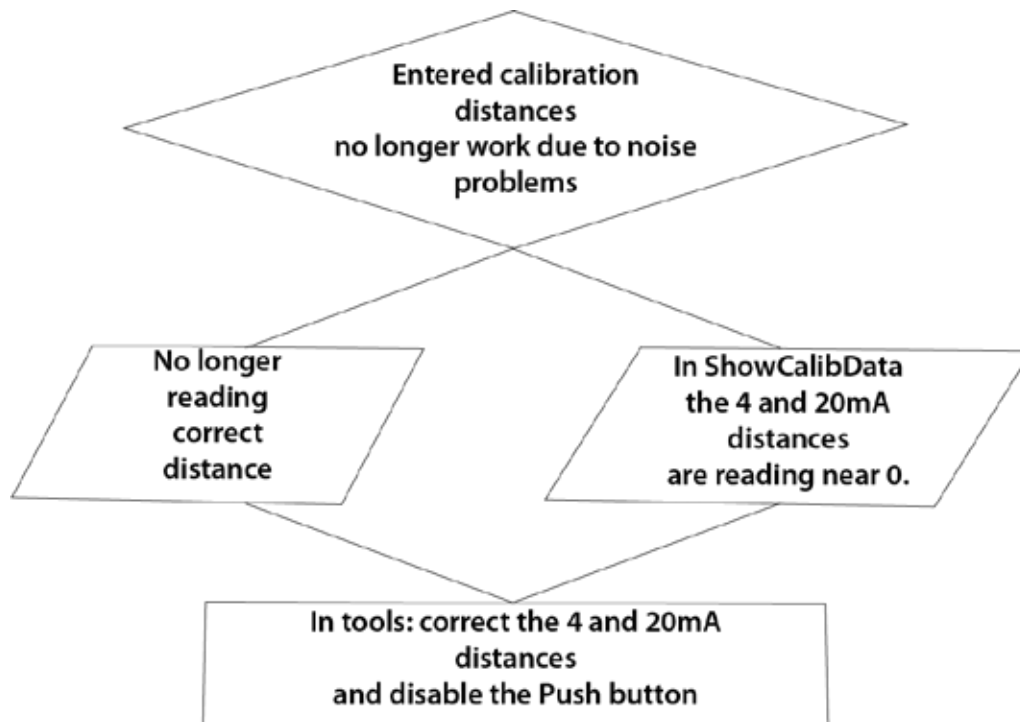


### 7.6 Two Radar Units Close to Each Other





## 7.7 Loss of Calibration





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