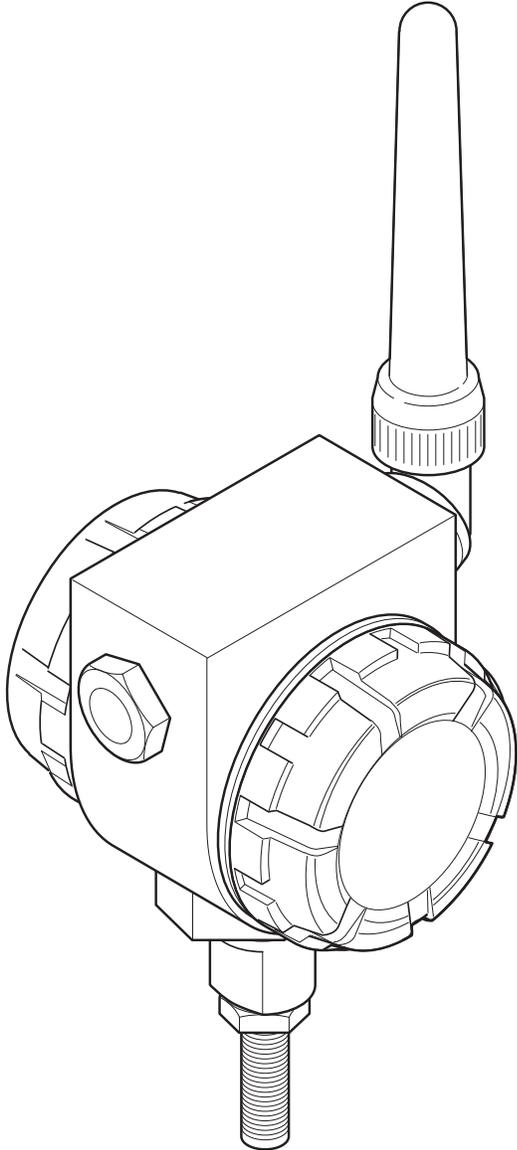


Armstrong Intelligent Monitoring Installation and Operation Manual

Models: AD5000, ST5700, TD5100



Please read and save
these instructions

Installation and Set Up Overview



Warning: Lithium Batteries and Shipping

Armstrong Intelligent Monitoring™ products use lithium batteries as power source. Lithium batteries are regulated in transportation by the U.S. Department of Transportation and are also covered by IATA (International Air Transportation Association), ICAO (International Civil Aviation Organization), and ADR (2009 European agreement concerning International Carriage of Dangerous Goods). Confirm transmitters are packaged and shipped in accordance with all shipping regulations.



Warning: Explosion Hazard

Please review product certifications when installing transmitter in explosive or potentially explosive atmospheres. This transmitter must be installed in accordance with appropriate local, national and international standards, codes and practices.



Warning: Damaged Transmitter

If the transmitter becomes damaged, immediately remove from service. Do not attempt repair or maintenance. Contact Armstrong Smart Services Group at:

+12692731415
Armstrong International, Inc.
816 Maple St.
Three Rivers, MI 49093



Warning: Maintenance (Battery)

Authorized maintenance to the transmitter(s) is limited to replacing the battery. All other maintenance should be performed only by Armstrong Smart Services Group. Do not attempt any other maintenance aside from changing the battery and contact Armstrong Smart Services Group for repair:

+12692731415
Armstrong International, Inc.
816 Maple St.
Three Rivers, MI 49093



Warning: Compliance

This transmitter complies with Part 15 of the FCC Rules. Operation is subject to the following condition:

- This transmitter may not cause harmful interference.
- This transmitter must accept any interference received, including interference that may cause undesired operations.



Warning: Sparking Hazard

Risk of electrostatic sparking when installed in explosive atmosphere, clean only with a damp cloth.



Warning: Usage

This manual should be used by experienced personnel as a guide to the installation of the Models AD5000, ST5700, and TD5100 Armstrong Intelligent Monitoring™ System. Selection or installation of equipment should always be accompanied by competent technical assistance. You are encouraged to contact Armstrong International or its local sales representative for additional information.



Warning: Environment

It is the responsibility of the end user to verify that the process and environment that the transmitter is placed in is free of hazards that will damage the transmitter. Proper conditions are outlined in this document and should be followed to ensure the transmitter does not sustain damage.



Warning: Maintenance Safety

Use industrial standard safety protocol when installing, removing, or performing authorized maintenance procedures on Armstrong Intelligent Monitoring™ transmitter on, or near, process equipment (This includes, but is not limited to, steam traps, relief valves, hot pipes, and equipment).

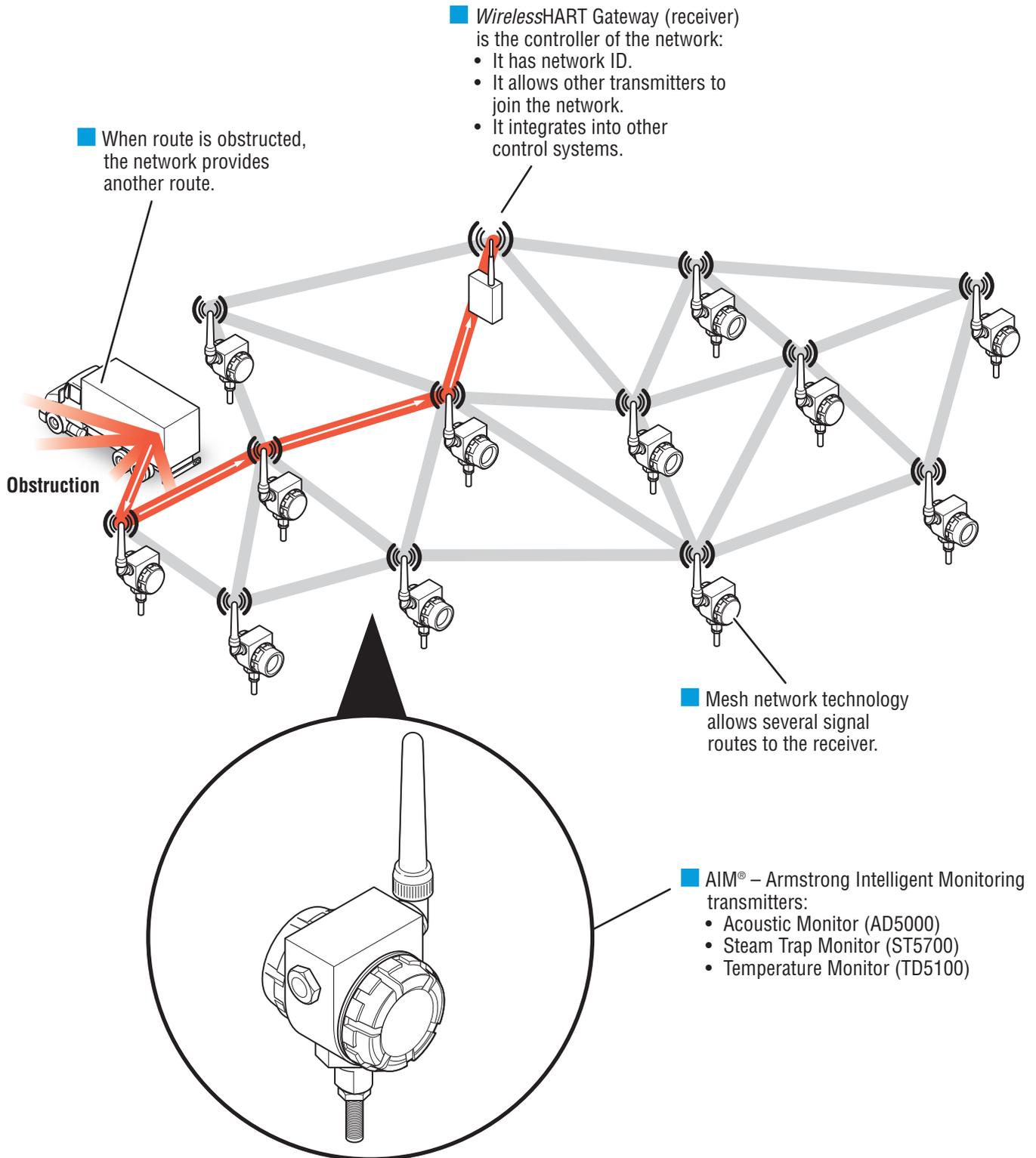
Installation and Set Up Overview

Table of Contents

WirelessHART Overview	1
Designing a WirelessHART Network	2
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Installing Waveguide™ and Transmitter	
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WirelessHART Overview

WirelessHART is a simple, reliable, and secure industrial wireless communications protocol.



Designing a WirelessHART Network

WirelessHART Best Practices

■ Obstructions affect transmission distance:

Level of Obstruction	Typical Transmission Distance feet (meters)
None (line of sight)	Up to 1000 ft. (300 m)
Light	Up to 500 ft. (150 m)
Medium (can drive a vehicle through it)	Up to 200 ft. (60 m)
Heavy (can only walk through it)	Up to 100 ft. (30 m)

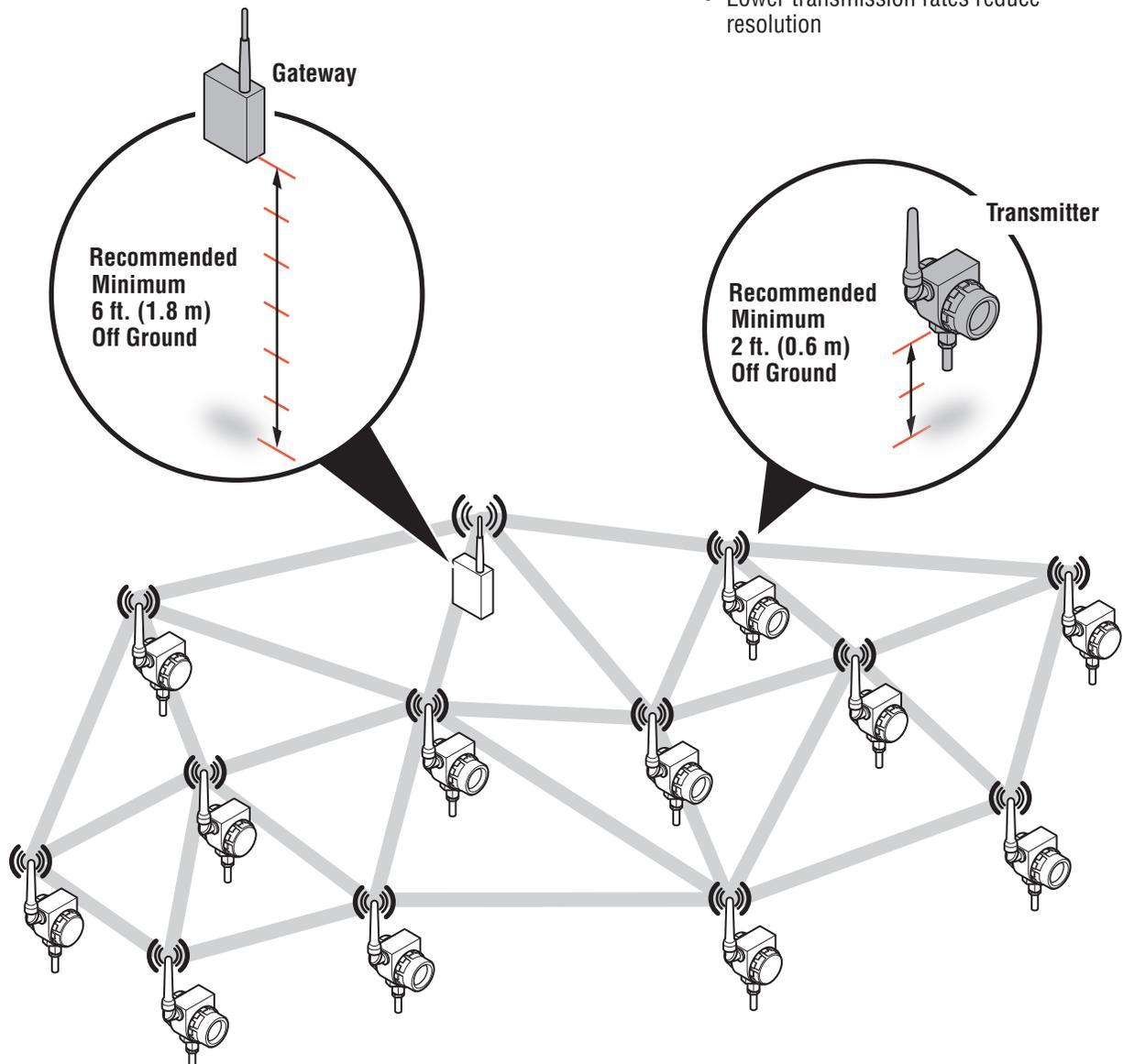
■ Each transmitter should have three neighbors minimum.

■ 25% of the transmitters should report directly to *WirelessHART* Gateway.

Note: Allowable minimum is 10% or five *WirelessHART* transmitters.

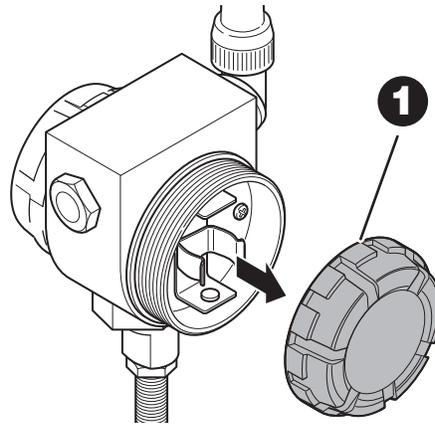
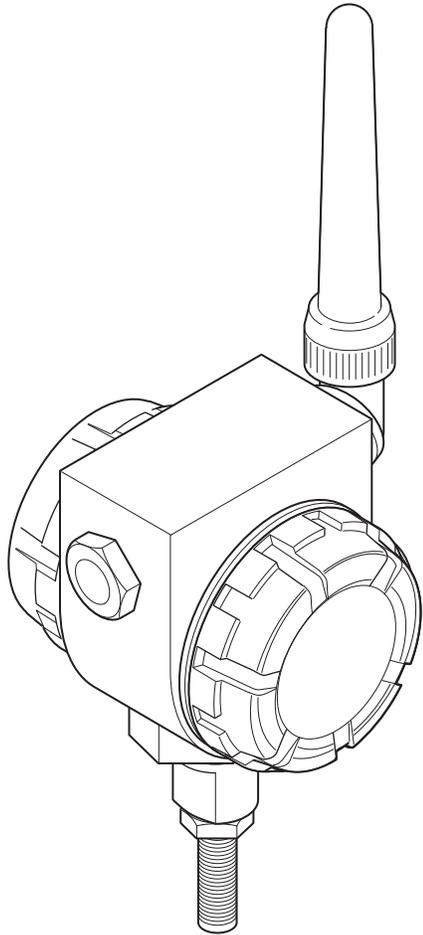
■ Transmission rate affects network:

- Higher/frequent transmission rates reduce the number of transmitters allowed on network
- Higher transmission rates reduce battery life
- Lower transmission rates reduce resolution

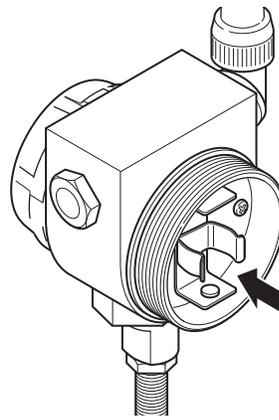


Installing Battery

Recommendation: Install battery at monitoring location to help transmitter learn network neighbors.



1 Remove back housing cap.

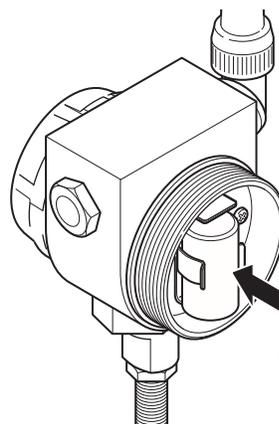


2 Inspect O-ring:
• Replace if worn or damaged.
• Lubricate if necessary.



3 Install battery with positive side down.

Note: Use only TADIRAN model TLH-5920 lithium ion battery. Use caution when installing battery not to damage or bend any components.



4 Reinstall back housing cap – torque 25 ft-lb (34 N-m).

Note: Properly tighten cap to avoid water leakage into housing.

Rules and Regulations

This transmitter is designed for live maintenance in hazardous environments. All maintenance should be performed by experienced personnel in accordance with local, national, and international standards and codes.



Warning: Explosion Hazard

Do not place conductive objects or materials within battery compartment.



Warning: Explosion Hazard

Do not open when dust atmosphere is present.

Programming

Obtain Network ID and Join Key

Note: The Network ID tells the transmitter what network to talk on. The Join Key is the password to talk on that network. Both are necessary for the transmitter to communicate on the network and must be programmed into the transmitter to match the Gateway.

1 Select Setup—Network—Settings.

2 Select Yes to show the Join Key.

The screenshot shows the 'Network Settings' page in the Armstrong Intelligent System Solutions web interface. The left sidebar contains a tree view with 'Setup' > 'Network' > 'Settings' highlighted. The main content area displays the following settings:

- Network name: AIM
- Network ID: 12345
- Security mode: Common join key, Access control list
- Join key: 1234567890
- Show join key: Yes, No
- Generate random join key:
- Rotate network key?: Yes, No
- Key rotation period (days): 90
- Change network key now?: Yes, No

A 'Submit' button is located at the bottom of the settings form.

Enable Active Advertising

Note: The transmitters will initiate communication with the Gateway automatically. To speed up the process, it is recommended that the Active Advertising be turned on in the Gateway.

1 Login to Gateway.

2 Select Setup—Network—Speed.

3 Select Activate.

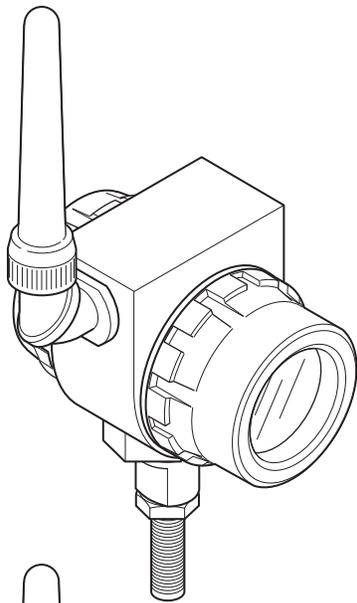
Note: Transmitter should check into Gateway within 30 minutes.

The screenshot shows the 'Network Speed' page in the Armstrong Intelligent System Solutions web interface. The left sidebar contains a tree view with 'Setup' > 'Network' > 'Speed' highlighted. The main content area displays the following settings:

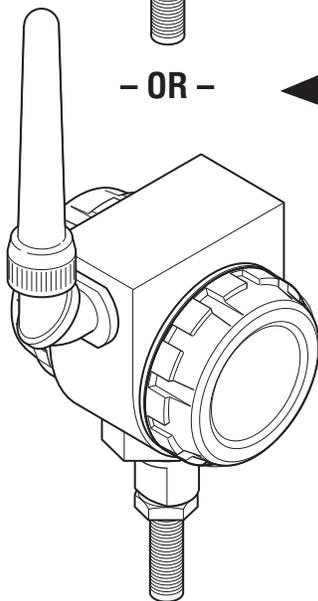
- Active advertising: Deactivated
- Duration (minutes): 60

An 'Activate' button is located below the settings form.

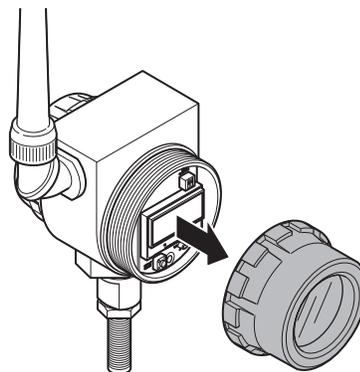
Programming (continued)



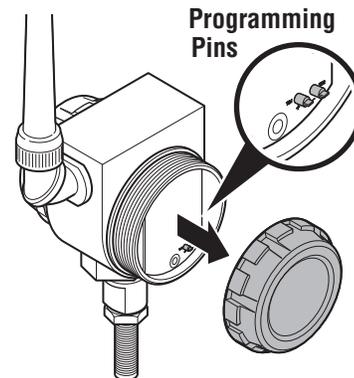
- OR -



- 1 Remove front housing cap.



(with display)



(without display)

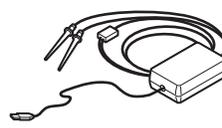
- 2 Use HART communicator to program (see page 4) the following:
 - Transmitter ID
 - Network ID
 - Join key
 - Temperature setting
 - Temperature units
 - HART tag



Note: If programming in hazardous environment, confirm programming transmitter is classified for that location. See page 15 for Entity Parameters.



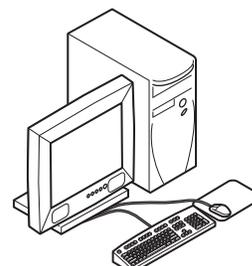
HART Communicator Options



USB Modem



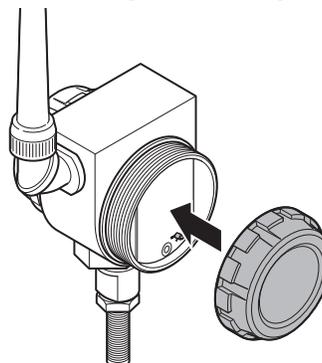
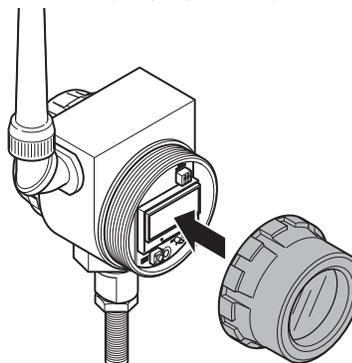
Handheld Communicator



Software

- 3 Reinstall front housing cap – torque 25 ft-lb (34 N-m).

Note: Properly tighten cap to avoid water leakage into housing.



Verifying Operations

Verify Transmitter is Checking in Properly

1 Select Explorer.

2 View HART status.
 • Green = activated
 • Red = not activated

Note: Repeat steps as needed to activate transmitter.

HART Tag	HART status	Last update	PV	SV	TV	QV	Bu	ra
--- UNKNOWN --- (00-1B-1E-E0-E3-00-00-13)	🔴							
AD_1	🟢	08/23/10 16:30:42	16.852	3.330 V	0.000	0.000	00:0	
AD_18	🟢	08/23/10 16:30:42	5.247	3.262 V	0.000	0.000	00:0	
AD_20	🟢	08/23/10 16:31:16	24.895	3.394 V	0.000	0.000	00:0	
AD_21	🟢	08/23/10 16:30:18	9.739	3.311 V	0.000	0.000	00:0	
AD_22	🟢	08/23/10 16:30:59	20.637	3.364 V	0.000	0.000	00:0	
AD_7	🟢	08/23/10 16:30:27	0.150	2.891 V	0.000	0.000	00:0	
ST_42	🟢	08/23/10 16:31:00	2.000	57.000 DegC	893.000 days	3.472 V	00:0	
ST_45	🟢	08/23/10 16:30:19	1.000	31.000 DegC	1778.000 days	3.354 V	00:0	
TD_648_1	🟢	08/23/10 16:31:02	85.183 DegF	85.738 DegF	84.200 DegF	7.189 V	00:0	
TD_648_2	🟢	08/23/10 16:31:11	302.266 K	303.002 K	30.500 DegC	7.151 V	00:0	

Available Information through Local Display

Network and Transmitter Information

DEVICE ID:
36

TRANSMITTER ID: Unique ID specific to transmitter

NETWORK ID:
36863

NETWORK ID: Network ID of Gateway and Transmitter(s)

NETWORK STATUS:
OPERATIONAL

NETWORK STATUS: OPERATIONAL or SEARCHING; reflects if transmitter is communicating on network

BATTERY VOLTAGE:
3.1

BATTERY VOLTAGE: Current voltage available in battery

For Transmitter Monitoring Condition Displays, refer to Transmitted Information Chart on page 12.



Installing Waveguide™ and Transmitter

Preparation

Clearance

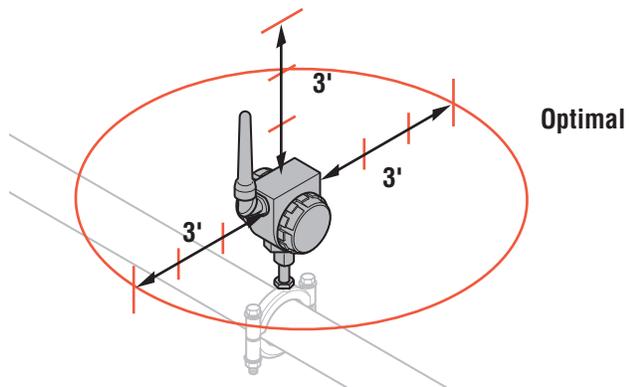
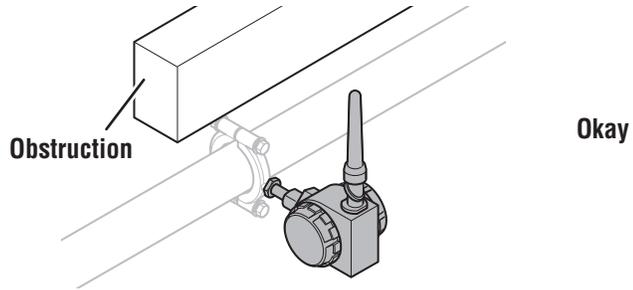
- Make sure Waveguide is oriented so that enough clearance is available to install transmitter.

Note: Install antenna in vertical position for optimal performance.

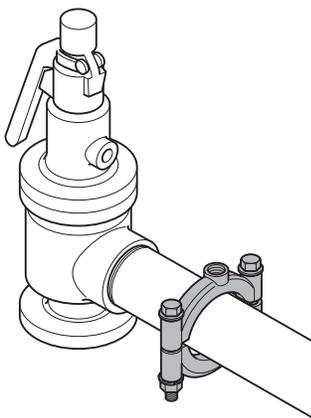
- ⚠ **Important:** To prevent damage, do not rotate antenna more than 180 degrees.

- **Recommendation:** Install transmitter at least 3 ft. (1 m) from any large structure for optimal performance.

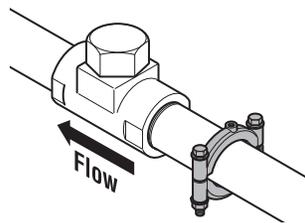
Note: Install the transmitter so that hazards do not interfere with or damage the transmitter. Examples of physical hazards include, but are not limited to: blowing steam or condensate directly onto the transmitter, high temperature pipes, installation in pathways where the transmitter could be struck by personnel or vehicles, etc.



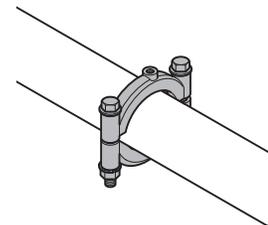
Installation Choice



Acoustic (AD5000)
Go to page 9.



Steam Trap (ST5700)
Go to page 10.



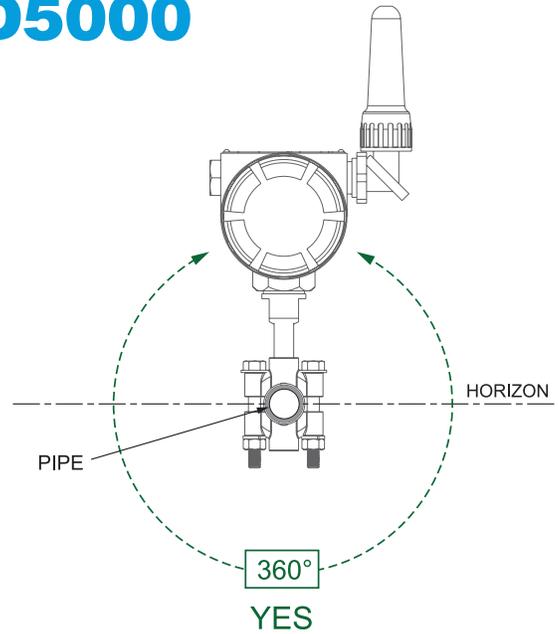
Temperature (TD5100)
Go to page 11.



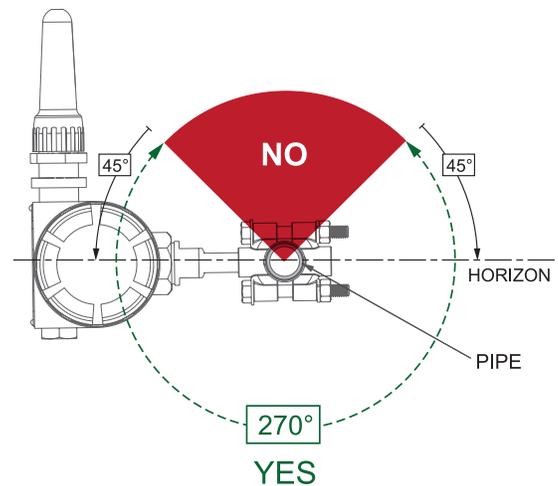
Proper Transmitter Positioning for Models ST5700 & AD5000

Transmitter should be mounted as depicted in the illustration based on the pipe temperature.

Pipe Temperature	0-185 °C / 32-365 °F
Saturated Steam Pressure	0-150 PSI / 0-10 BAR

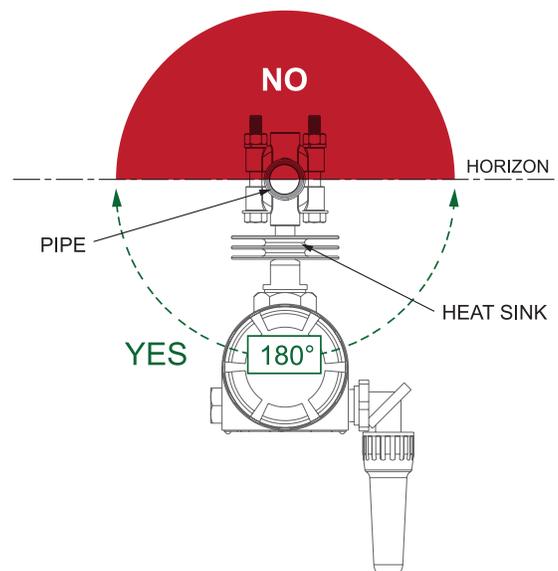


Pipe Temperature	186-231 °C / 366-448 °F
Saturated Steam Pressure	151-400 PSI / 11-27 BAR



Pipe Temperature	232-313 °C / 449-596 °F
Saturated Steam Pressure	401-1500 PSI / 28-103 BAR

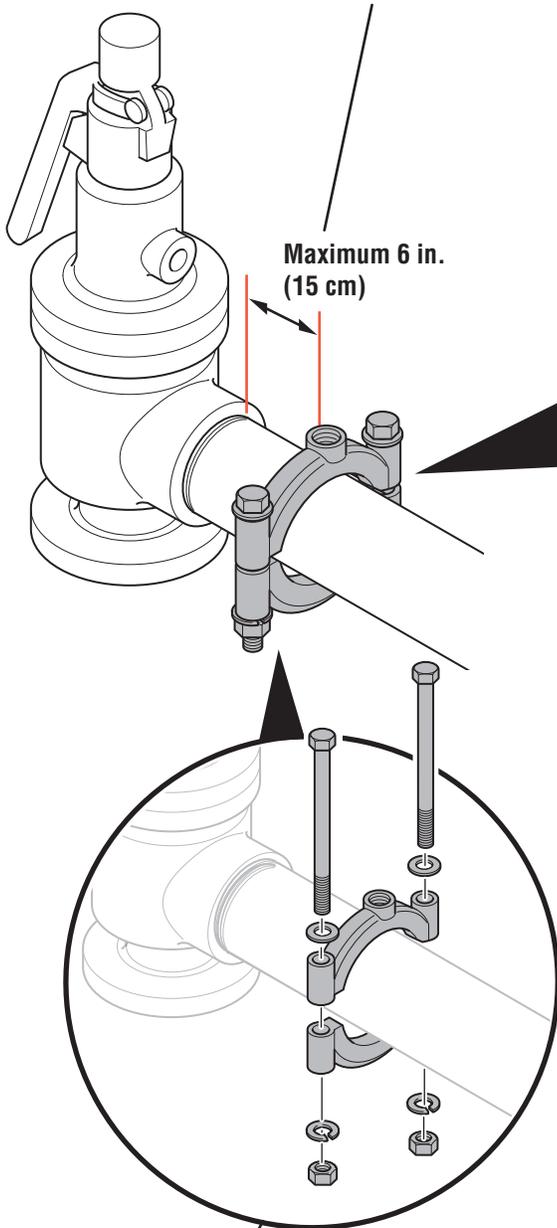
Note: Heat Sink Required.



Install Acoustic Transmitter—Model AD5000

Note: Make sure transmitter is programmed (see page 4) and preparation is completed (see page 6).

- 1** Position Waveguide no greater than 6 in. (15 cm) from body valve.



- 2** Install Waveguide:
- Assemble Waveguide around discharge pipe.
 - Torque Waveguide bolts to 25 ft-lb (34 N-m).

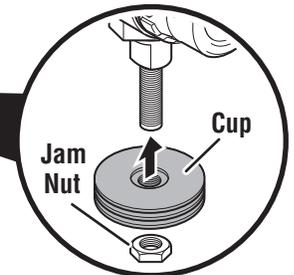


- 3** Refer to page 8 to determine the proper installation orientation for pipe temperature/steam pressure.



Note: If heat sink required, make sure cup side of heat sink is up.

Note: Thread heat sink to the top.



- 4** Carefully thread acoustic transmitter stem into Waveguide.

Note: Do not cross-thread stem.

- 5** Torque transmitter to 20 ft-lb (27 N-m).

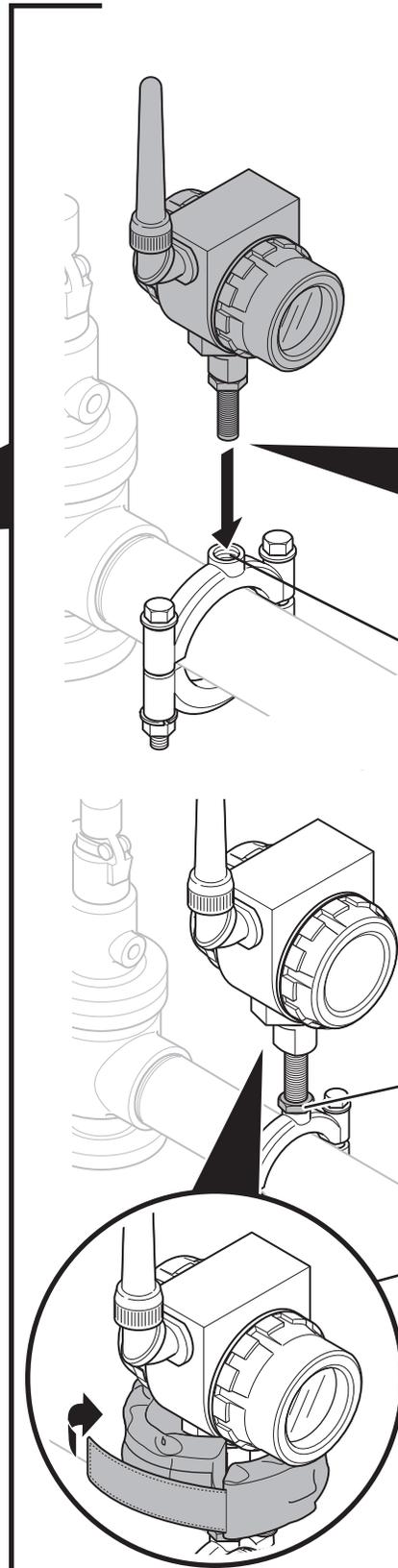


- 6** Tighten jam nut to 20 ft-lb (27 N-m).



- 7** Install insulation jacket on transmitter(s) where accelerated heat loss may occur. Consult Factory if needed.

- 8** Confirm caps are tightened to 25 ft-lb (34 N-m).

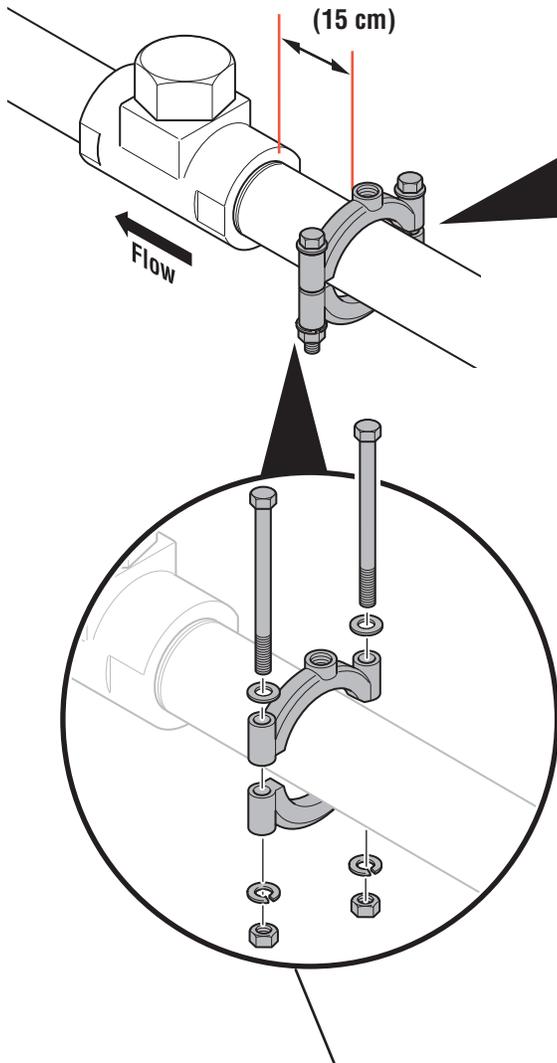


Install Steam Trap Transmitter—Model ST5700

Note: Make sure transmitter is programmed (see page 4) and preparation is completed (see page 6).

- 1** Position Waveguide no greater than 6 in. (15 cm) from inlet.

Maximum 6 in. (15 cm)



- 2** Install Waveguide:
- Assemble Waveguide around pipe.
 - Torque Waveguide bolts to 25 ft-lb (34 N-m).

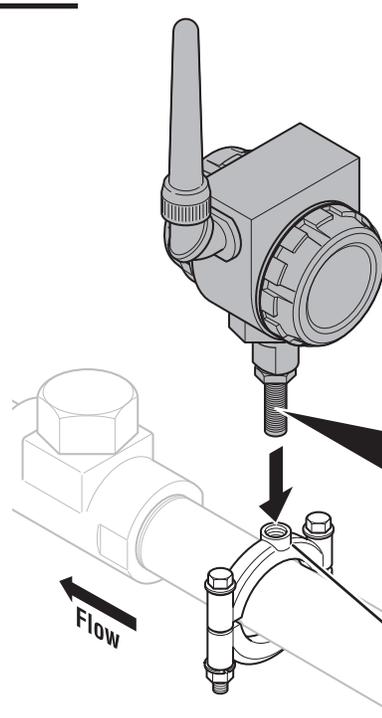


- 3** Refer to page 8 to determine the proper installation orientation for pipe temperature/steam pressure.



Note: If heat sink required, make sure cup side of heat sink is up.

Note: Thread heat sink to the top.



- 4** Carefully thread steam trap transmitter stem into Waveguide.

Note: Do not cross-thread stem.

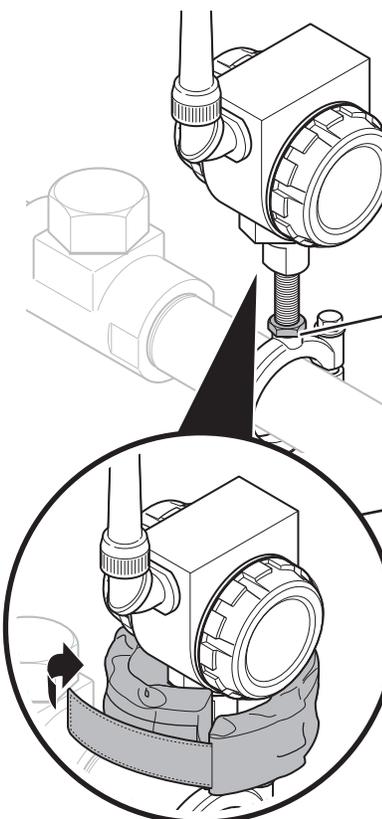
- 5** Torque transmitter to 20 ft-lb (27 N-m).



- 6** Tighten jam nut to 20 ft-lb (27 N-m).



- 7** Install insulation jacket on transmitter(s) where accelerated heat loss may occur. Consult Factory if needed.



- 8** Confirm caps are tightened to 25 ft-lb (34 N-m).

Install Temperature Transmitter—Model TD5100

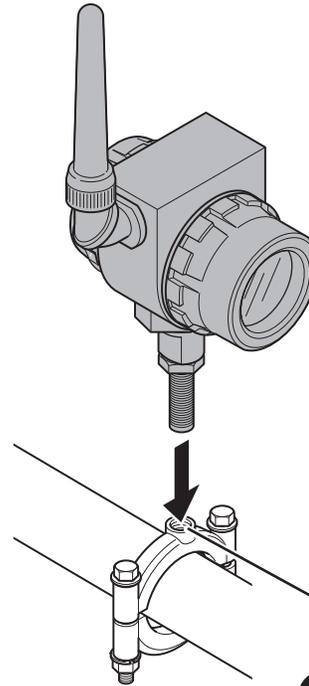
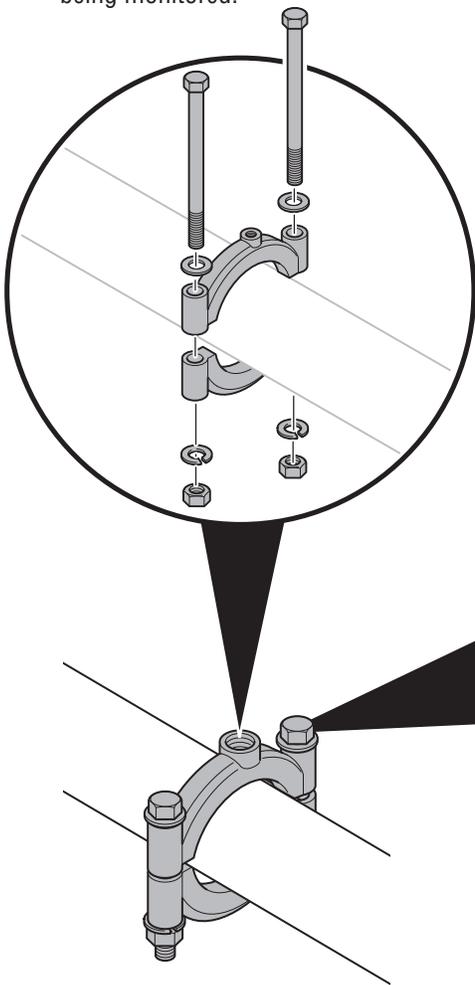
Note: Make sure transmitter is programmed (see page 4) and preparation is completed (see page 6).

⚠ Important: The model TD5100 should not be installed on surfaces in excess of 200°C (398°F).

- 1** Install Waveguide:
- Assemble Waveguide around pipe.
 - Torque Waveguide bolts to 25 ft-lb (34 N-m).



Note: If alternate mounting bracket is used, the stem of the TD5100 transmitter must touch surface that is being monitored.



- 2** Carefully thread temperature transmitter stem into Waveguide.

Note: Do not cross-thread stem.

- 3** Torque transmitter to 20 ft-lb (27 N-m).

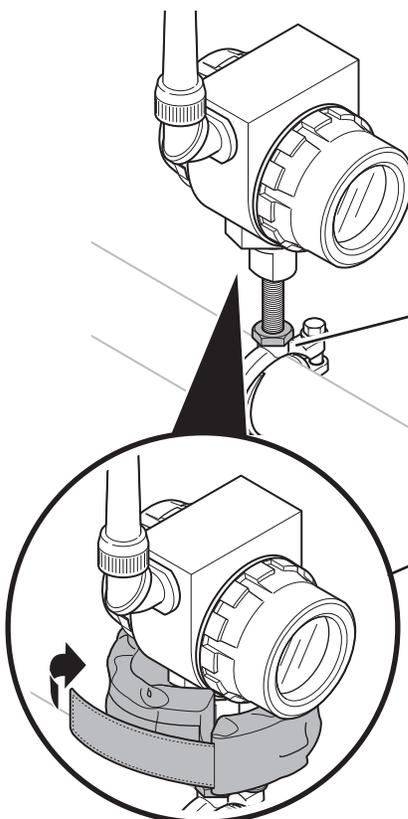


- 4** Tighten Tighten jam nut to 20 ft-lb (27 N-m).



- 5** Install insulation jacket on transmitter(s) where accelerated heat loss may occur. Consult Factory if needed.

- 6** Confirm caps are tightened to 25 ft-lb (34 N-m).



Operation

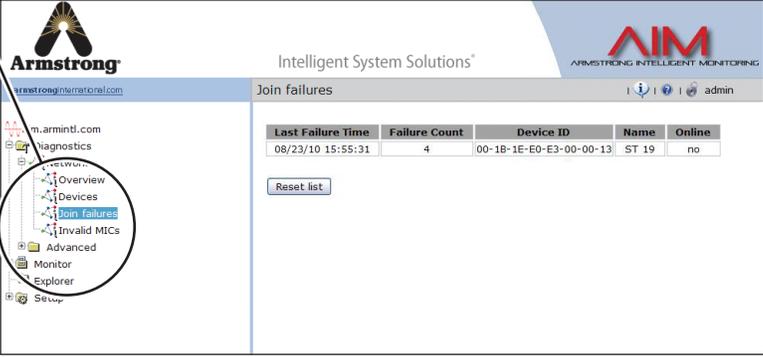
Transmitted Information

The following information is sent from the transmitters:

Information	Transmitter ID	HART Tag	Primary Variable (PV)	Secondary Variable (SV)	Tertiary Variable (TV)	Quaternary Variable (QV)
Acoustic— Model AD5000	✓	✓	Counts (0-255)	Current temperature reading (°F or °C)	Alarm Setting (default 0)	Estimated Battery Life (Days)
Steam Trap— Model ST5700	✓	✓	Trap Condition <ul style="list-style-type: none"> • 1 – OK = no alarm; steam trap is functioning properly. • 2 – CD = alarm; steam trap plugged/locked or steam supply valve off. • 3 – BT = alarm; steam trap failed to open, experiencing steam loss. 	Current temperature reading (°F or °C)	Temperature Setting*	Estimated Battery Life (Days)
Temperature— Model TD5100	✓	✓	Temperature (°F or °C)	Status Bit <ul style="list-style-type: none"> • 1 – Temp. above setting • 2 – Temp. below setting 	Temperature Setting	Estimated Battery Life (Days)

*Transmitter temperatures measuring less than user-defined set point will trigger COLD alarm. Default value = 51°C (125°F)

Troubleshooting

Condition	Possible Cause(s)	Action
Temperature reading incorrect	External environmental conditions (wind, rain, cold)	Wrap insulation around stem of transmitter. Note: For continued incorrect readings, contact factory.
Transmitter stopped communicating	Battery needs replacement	1. Wipe unit with damp cloth to remove potential electrical discharge. 2. Install TADIRAN model TLH-5920 lithium ion battery. See Installing Battery, page 3.  3
	Transmitter out of range	Install additional Armstrong Intelligent Monitoring™ transmitters to extend network range.
Transmitter not displaying on Explorer page	Join key failure	Check the "Join failures" screen: 1. Select Diagnostics—Network—Join failures  2. Verify transmitter connection. If transmitter is not connected, reprogram transmitter with network ID and join key that matches information key in Gateway: <ul style="list-style-type: none"> • Select Setup—Network—Settings. • Select Yes to show join key. 3. See Programming, page 4.  4
Steam trap monitor alternating between CD and OK or reading a constant CD	Temperature setting too high	1. Verify steam is on to the steam trap. 2. Investigate and adjust temperature setting to a more appropriate value using web interface.
"Deep Sleep" stated on handheld	Transmitter has not joined network	Re-join the transmitter to the network
"Critical Power Failure" on handheld	Battery is very low or installed wrong	Replace Battery

Product Specifications and Certifications

Factory Mutual (FM) Approval	
	  
<i>United States</i>	Intrinsic Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G Zone Rating: Zone 0, AEx ia IIC Temperature Code: T3 Ambient Temperature Range: T _{amb} -40°C to 90°C (-40°F to 194°F) For use with TADIRAN model TLH-5920 lithium ion battery only Standards used for Certification: FM3600, FM3610, FM3810, ANSI/ISA 60079-0, ANSI/ISA 60079-11
<i>Canada</i>	Intrinsic Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G Zone Rating: Zone 0, Ex ia IIC Temperature Code: T3 Ambient Temperature Range: T _{amb} -40°C to 90°C (-40°F to 194°F) For use with TADIRAN model TLH-5920 lithium ion battery only Standards used for Certification: CSA 1010.1, CSAC22.2No.157, CSAC22.2No.25,CAN/CSAE60079-0, CAN/CSA60079-11
<i>European Certification</i>	ATEX Intrinsic Safety Ex ia IIC T3 Ambient Temperature Range: T _{amb} -40°C to 90°C (-40°F to 194°F) For use with TADIRAN model TLH-5920 lithium ion battery only Standards used for Certification: EN60079-0,EN60079-11, EN 60079-26
<i>IECEx Certification</i>	Equipment Protection Level: Ga Gas/Vapour: EX ia IIC T3 Ambient Temperature Range: T _{amb} -40°C to 90°C (-40°F to 194°F) For use with TADIRAN model TLH-5920 lithium ion battery only Standards used for Certification: IEC 60079-0, IEC 60079-11, IEC 60079-26

Ingress Protection Rating	IP66
Output	WirelessHART 2.4 GHz
Local Display (if applicable)	Liquid Crystal Display Viewing Area: 1.34" x 0.55" (34 mm x 14 mm)
Temperature Operating Range	With display: -30°C to 80°C (-22°F to 176°F) Without display: -40°C to 90°C (-40°F to 194°F)
Materials of Construction	Housing – Aluminum Paint – Powder Coat O-ring – Nitrile Stem – 304 SS Antenna – Nylon 6,6 Nampelate – 304 SS
Battery Type	Tadiran Lithium Ion Model – TLH-5920
Weight	2.2 lbs (1 Kg)

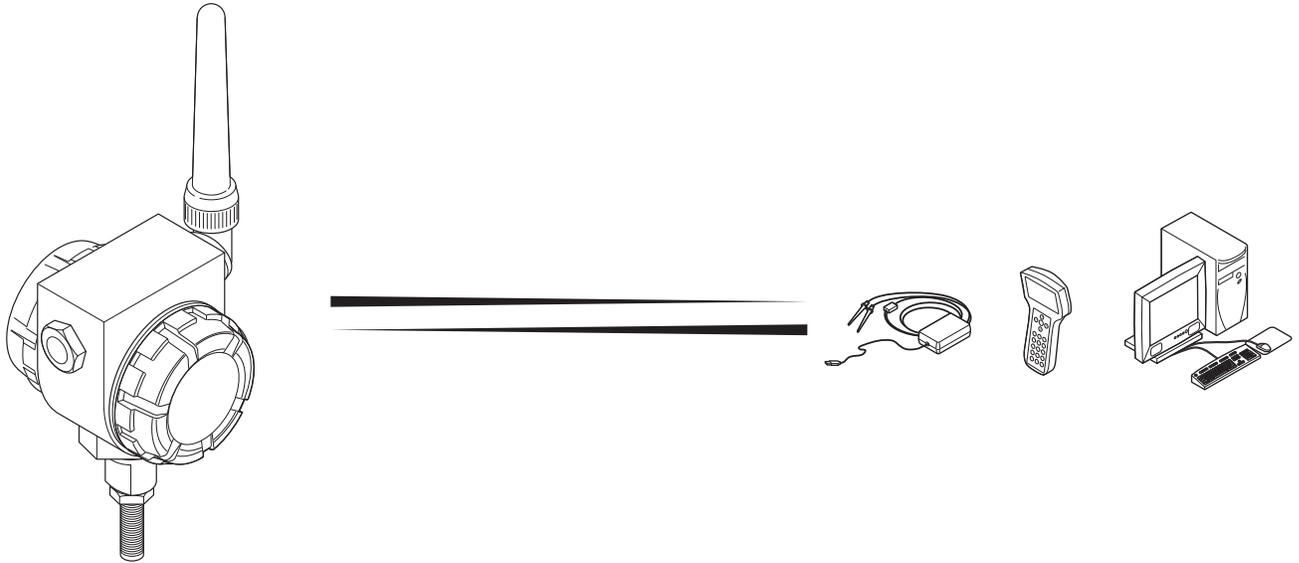
Product Certifications

Hazardous Location / Explosive Atmosphere

Class I, II, III, Division 1, Group A,B,C,D,E,F,G

Zone 0, Group IIC, IIB, IIA

T3 at T ambient = -40°C to 90°C (-40°F to 194°F)



Armstrong Int'l ST5700, AD5000 or TD5100

Entity Parameters for HART Modem Port,
TB1, TB2: $U_i = 1.9V$, $I_{sc} = 32 \mu A$, $P_i = 61 \mu W$, $C_i = 5.64 \mu F$, $L_i = 0 \mu H$

Entity Approved/Certified HART Programming Transmitter

Entity Parameters: $U_o \leq 1.9V$, $I_{sc} \leq 32 \mu A$,
 $P_o \leq 61 \mu W$, $C_a \geq 0.5.64 \mu F + C_{cable}$
 $L_a \geq 0 \mu H + L_{cable}$

Notes:

1. Install per the National Electrical Code, ANSI/ISA-RP12.06.01, the Canadian Electrical Code, and applicable European or other international installation codes, including EN / IEC 60079-14, as applicable.
2. **WARNING – Explosion hazard** - Do not place conductive objects or materials within battery compartment
3. **WARNING – Explosion hazard** - Do not open when explosive dust atmosphere is present
4. **WARNING – Explosion hazard** - Use only Tadiran type TLH-5920 cell
5. **WARNING – Explosion hazard** - To reduce risk of electrostatic sparking in explosive atmospheres, clean only with damp cloth
6. **WARNING – Explosion hazard** - Enclosure contains aluminium and is considered to present a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction

Product Labels



Armstrong
Three Rivers, Michigan, USA

WirelessHART™



FM
APPROVED



1725
FM10 ATEX 0062x

US/Canada: Intrinsically Safe, Exi, CL I, II, III, Div 1, Gp A-G T3
Class I, Zone 0, Ex ia / AEx ia IIC T3



II 1 G Ex ia IIC T3 Ga

IECEx FMG 10.0024X
Ex ia IIC T3 Ga
-40°C≤Ta≤90°C

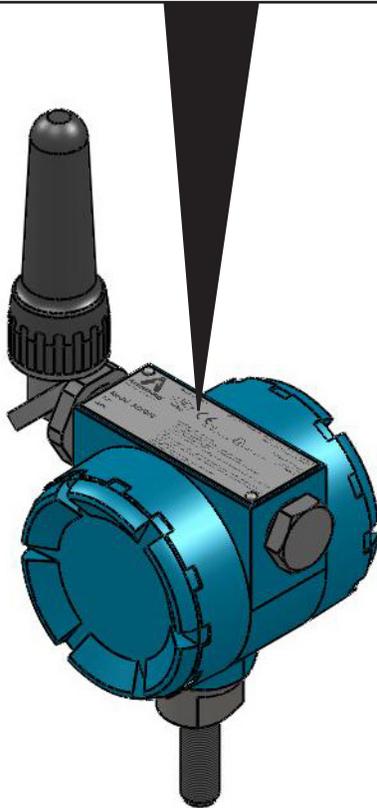
Model: AD5000

S/N:

Date:

WARNING - Explosion Hazard

- Do not open when explosive dust atmosphere is present
- Do not place conductive objects or materials within battery compartment
- Use only Tadiran type TLH-5920
- To reduce risk of electrostatic sparking in explosive atmospheres, clean only with damp cloth.
- Enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.
- Substitution of components may impair intrinsic safety.
- Install per control drawing IOM-256-A.





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Class I, Zone 0, Ex ia / AEx ia IIC T3



II 1 G Ex ia IIC T3 Ga

IECEx FMG 10.0024X
Ex ia IIC T3 Ga
-40°C≤Ta≤90°C

Model: ST5700

S/N:

Date:

WARNING - Explosion Hazard

- Do not open when explosive dust atmosphere is present
- Do not place conductive objects or materials within battery compartment
- Use only Tadiran type TLH-5920
- To reduce risk of electrostatic sparking in explosive atmospheres, clean only with damp cloth.
- Enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.
- Substitution of components may impair intrinsic safety.
- Install per control drawing IOM-256-A.



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1725
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Class I, Zone 0, Ex ia / AEx ia IIC T3



II 1 G Ex ia IIC T3 Ga

IECEx FMG 10.0024X
Ex ia IIC T3 Ga
-40°C≤Ta≤90°C

Model: TD5100

S/N:

Date:

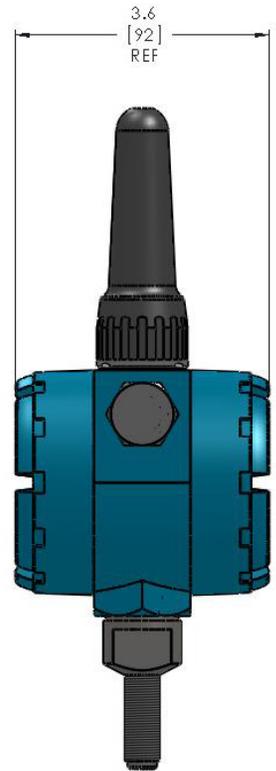
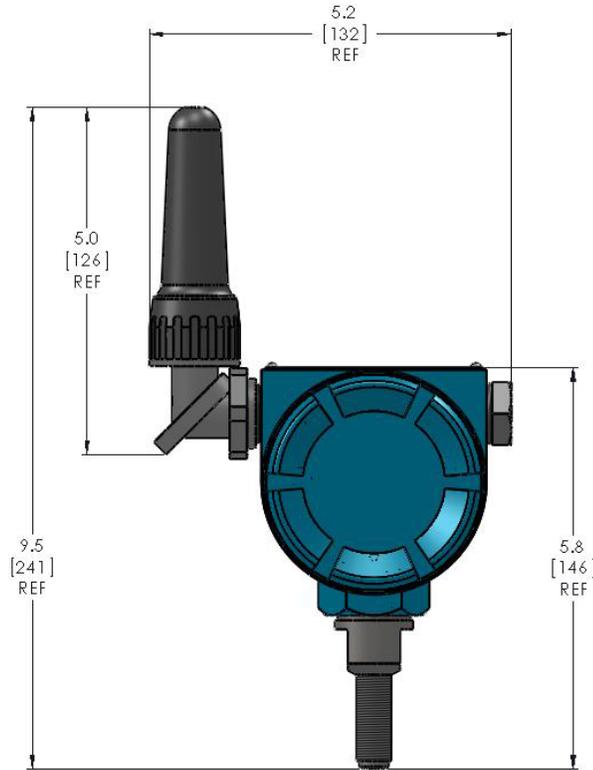
WARNING - Explosion Hazard

- Do not open when explosive dust atmosphere is present
- Do not place conductive objects or materials within battery compartment
- Use only Tadiran type TLH-5920
- To reduce risk of electrostatic sparking in explosive atmospheres, clean only with damp cloth.
- Enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.
- Substitution of components may impair intrinsic safety.
- Install per control drawing IOM-256-A.

Product Dimensions

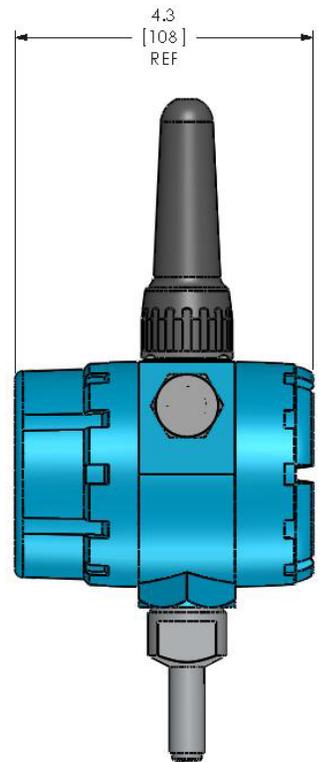
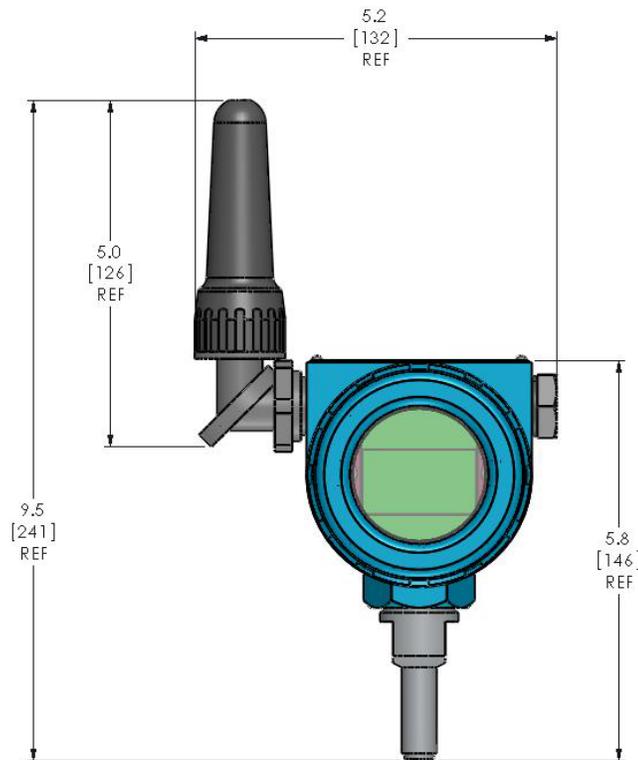
**Models AD500,
ST5700, and TD5100
without display screen**

inches
[mm]



**Models AD500,
ST5700, and TD5100
with display screen**

inches
[mm]



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