# ST5700 - Steam Trap Monitor - Theory of Operation

Armstrong Intelligent Monitoring Model ST5700 is wireless monitoring technology that efficiently monitors and evaluates steam trap operation. The AIM™ ST5700 identifies the conditions of a steam trap to determine significant problems that could put your operation at risk. The AIM™ ST5700 can accurately detect potential issues such as plugged and blow-through steam traps, which can cause a range of issues including, but not limited to failed equipment, loss of product, and safety concerns. Immediate failure notification from the AIM™ ST5700 helps identify the root cause while minimizing production losses and reducing energy consumption. Using nonintrusive technology combined with WirelessHART, the AIM™ ST5700 is the ideal solution for any temporary or permanent 24/7 steam trap monitoring.

## Theory of Operation

The Armstrong ST5700 AIM™ transmitter is designed to continuously monitor any type of steam trap.  It utilizes a combination of hardware and integrated algorithms to accurately detect steam trap conditions.  The hardware consists of an acoustic sensor (Piezo) and a temperature sensor (Thermistor). The integrated algorithms are patented, proprietary code designed by Armstrong to provide actual steam trap conditions based on inputs from the hardware.  When applied to a steam trap, the device will display and/or wirelessly transmit the current condition of the steam trap. The device is mounted onto the inlet pipe of the steam trap (≤ 6") by an Armstrong designed waveguide (saddle style pipe clamp).



Ultrasonic and temperature sensors

Waveguide mounting hardware
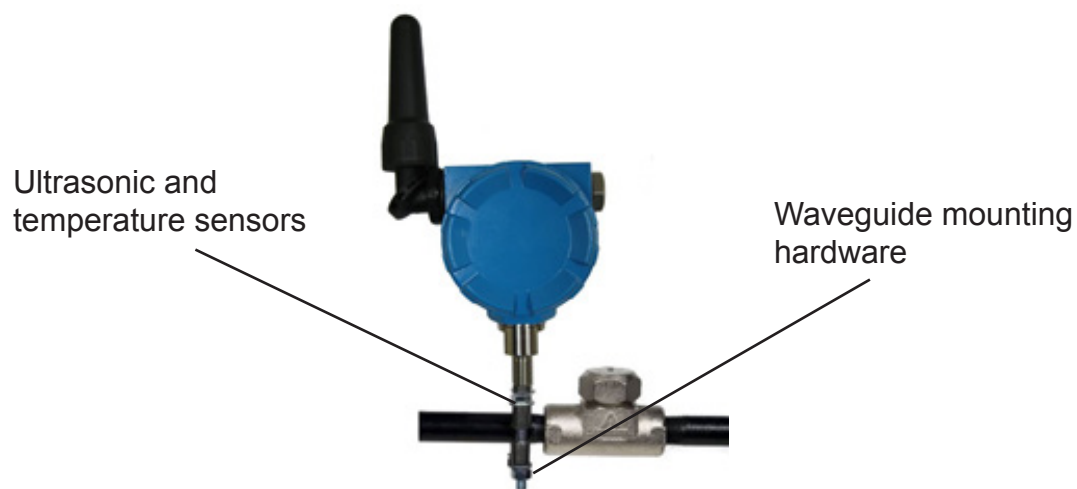
The ST5700 has built-in algorithms, which perform a series of diagnostic checks in order to determine the condition of the steam trap.

The first stage validates the surface temperature of the steam line and compares it with the configurable set temperature point. The temperature sensor detects the skin temperature at the inlet of the steam trap and is displayed as the secondary variable (SV).  The SV is compared to the configurable set temperature, which is displayed as the tertiary variable (TV).

| SV | TV |
|---|---|
| 86.000 DegF ● | 125.000 DegF ● |

If the SV is less than the TV, then the steam trap is cold. This could be due to a failed plugged steam trap, or there is no steam distributed to the steam trap. If this is the case, the transmitter will return a primary variable (PV) of 2.  A PV of "2" means the steam trap is in a cold condition.

| HART Tag | PV |
|---|---|
| ST 1321 | 2.000 User Defined (249) ● |

If the SV is greater than the TV, there is steam being distributed to the trap causing the device to go into the second stage of diagnostics.

| SV | TV |
|---|---|
| 213.800 DegF ● | 125.000 DegF ● |

In the second stage, the ST5700 listens to the operation of the trap to determine if there is steam loss through the steam trap's internal orifice. The Piezo sensor has been tuned to a frequency range of 37 KHz – 43 KHz.  Through extensive lab and field testing by Armstrong, this range has been determined to be the optimal frequency range to detect a trap passing live steam while filtering out background noise. This acoustic signature is analyzed by Armstrong's patented algorithm to determine if the steam trap is in a blow-thru condition (i.e. - losing live steam).

If the algorithm determines that the trap is in normal operation, then the ST5700 will publish a PV of 1. A PV of "1" means the trap is in a good condition.
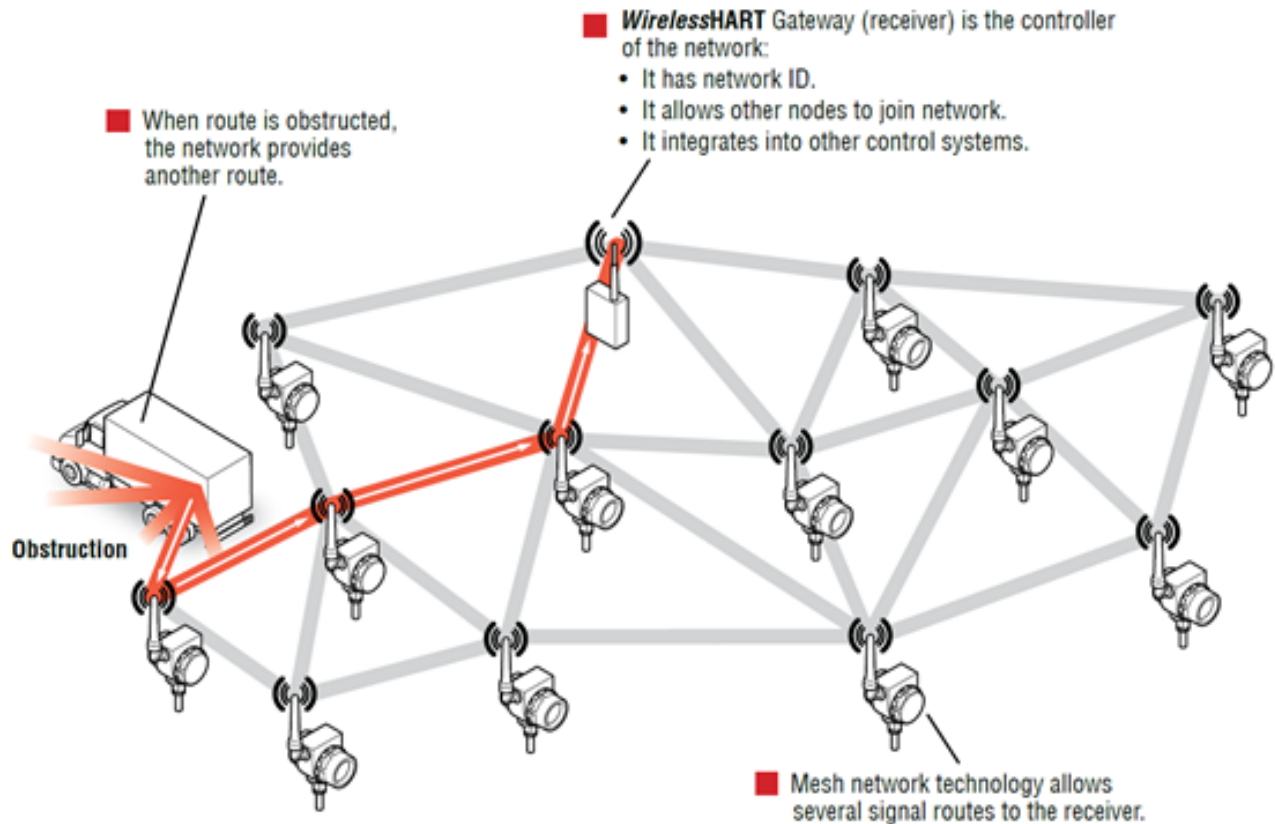
| HART Tag | PV |
|---|---|
| ST 1321 | 1.000 User Defined (249) ● |

If the algorithm determines that the trap is losing live steam, the ST5700 will publish a PV of 3. A PV of "3" means the trap is in a blow-thru condition.

| HART Tag | PV |
|---|---|
| ST 1321 | 3.000 User Defined (249) ● |

# Wireless Communication

Armstrong's ST5700 uses WirelessHart for its communication protocol. WirelessHart is a robust wireless protocol that allows communication amongst other transmitters, while maintaining compatibility with existing devices, tools, and systems. WirelessHart uses a mesh technology for developing wireless networks. It allows devices to communicate with each other, repeating the signals back to the gateway. This network is also self healing; if a device loses its path back to the gateway it will automatically find the next best route.



■ **WirelessHART** Gateway (receiver) is the controller of the network:
- It has network ID.
- It allows other nodes to join network.
- It integrates into other control systems.

■ When route is obstructed, the network provides another route.

**Obstruction**

■ Mesh network technology allows several signal routes to the receiver.

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