

Lightning Protection of Ultrasonic Flow Meters by Eli Spalten

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Damage to instrumentation by lightning is a topic that is of great importance to many of our customers. Unfortunately, existence of this problem is usually not taken into consideration until a flow meter stops working. In many cases, a user does not suspect the cause of the damage to be lightning until the second event occurs. This document outlines important recommendations for all installations requiring protection from lightning damage. If the meter is already installed, modification to decrease susceptibility to lightning damage is easily done.

To avoid lightning damage, the first topic that one must understand is how the damage occurs. It is very seldom that lightning does its damage through a direct hit. This occurrence has a very clear symptom, a large blackened area.

In most instances, lightning damage is caused by the immense currents created by the discharge of lightning to earth ground. These flowing currents cause a magnetic field to be developed. The expansion and deflation of this magnetic field will incite a voltage to develop on any conductive material in the field. This means that any pipe or wire near the lightning strike will have a voltage generated by the initial lightning strike. These voltages will be enormous, but they will have a brief duration. Every structure in the lightning induced magnetic field will have a different voltage wave shape developed upon it. Any device in contact with multiple structures has the potential to be damaged. Lightning can damage flow meters located miles from the actual lightning strike.

Certain factors, which cannot be controlled, will determine the risk of damage by lightning. If the installation is at severe or critical risk levels, it is wise to provide protection against lightning. Many sources are commercially available for lightning protection devices and they will be effective. We are not recommending a particular device, but how to configure the protection scheme.

How To Determine An Application's Risk for Lightning Damage.

Check the conditions that apply.

- Electronic equipment in same general area has had previous lightning damage.
- Transducers or flow computer is located in an isolated, open area.
- Transducers or flow computer is located on top of a hill or prominent area
- Tall trees overhanging roof or standing nearby to flow structure with flow computer.
- A structure higher than surrounding elevation is nearby.
- Transducers or flow computer located in a structure that has a metal roof or ridge vent
- Flow computer mounted onto a structure with metal supports or siding
- No surge protection on electrical supply panel
- No surge protection on data output lines
- Transducers are mounted on a metallic pipe
- Location is in an area that has more than 30 thunderstorm days per year
- Pipe is above grade level and exposed

Count the boxes you checked to determine your risk:

- 3 or fewer - Low
- 4 to 6 - Moderate
- 7 to 8 - Severe
- 9 or more - Critical

Protection of Flow Computers

Modules constructed with electrical components that have an absolute maximum voltage level less than the voltage levels generated by the lightning strike are susceptible to lightning damage. An example of such components is the integrated circuits used in the flow display computer. Controlotron has taken care to use components with the highest breakdown voltage available. When either the transducers and outputs or power inputs are connected to different structures influenced by lightning, damage will be almost certain.

In most cases, damage will be limited to the circuits connected directly to the input or output wiring. It is not uncommon to have other circuits also damaged.