Protecting Honeywell ST3000 Field Transmitters Against Lightning Induced Damage
- Pressure, level, flow measurement in all industries

Problem: How to protect field transmitters from damage induced by lightning or power surges.

Lightning is a very fast, high electrical energy transfer between earth and the sky. The lightning strike seeks out the lowest impedance path and normally strikes tall trees, power pylons or lightning rods on buildings or structures. The likelihood of a direct strike on filed mounted transmitters is normally very low, but if the strike to ground is in the proximity of the transmitter wiring, then the high electrical field strengths involved are likely to induce high electrical surges in the wiring. Equipment at both ends of the wiring will be exposed to the lightning induced surge.

Description of the Lightning Phenomena:

Lightning strikes can vary widely in total energy contained and in duration. When this is converted to an induced strike to local transmitter 2-wires, it changes into a lower energy but increases in duration. There is no ‘typical’ lightning strike but data suggests a ‘typical’ induced strike as having a peak amplitude of 800 Volts, a rise time of 15 to 600 μSec and a decay time of 40 to 3000 μSec as shown:

Lightning Protection Solutions for ST3000 Transmitters:

Honeywell’s ST3000 transmitters can be supplied with a ‘Lightning Protection’ option, or more correctly Surge Protector. Basically, this consists of adding surge protectors at the entry point of the 2-wire power connection, which is normally passive, but acts quickly to prevent excessive energy from being passed onto the electronic components. The ‘Lightning Protection’ option is part of the terminal block. The Lighting Protection (LP) option terminal block is clearly identifiable by its RED color. When this option is ordered, the components in the figure below are added to the transmitter:

The spark gap tube T1 will fire and conduct to ground any voltage appearing across the input terminals in excess of 300 volts. The time the tube takes to fire is less than 1 μSec. For the short time before the tube fires, the standard surge protector Transorb (T2) limits the voltage to which the main electronics are exposed. The two resistors ensure that the Transorb (T2) is not ‘blasted’ by excessive energy during this initial time.
The rated specifications of the surge protection cater to the wide variety of forms that the induced surge can appear as. It covers two different wave forms A and B, each with two different peak currents amplitudes and number of repeated strikes that it is required to withstand.

The diagram below shows some typical waveforms that correspond to Impulse Discharge Current and the number of repeated strikes:

### Installation Considerations:

The detailed installation of the Lightning Protection Option is covered in the ST3000 Installation Guide. In the event that an optional Smart Indicating meter is used in combination with the ST3000 transmitter, the surge protector also gives protection to the meter.

It is very important that an external ground wire is connected between the transmitter housing and a secure local grounding point. This connection should be as short and as direct as possible to ensure a low impedance discharge path.

The resistance of the ground point should be 1Ω or less in order to make the lightning protection effective. The Lightning Protection (LP) option is included in the various safety approvals/certificates that apply to the transmitter.

### Other Equipment

It should be noted that separate surge protection of the receiving instruments is required if they also are prone to damage from electrical surges. Several suppliers (e.g. MTL) have suitable protection devices, packaged like safety barriers, which can be installed at the cable termination area for the receiving instruments. In addition, the Total Plant Solution (TPS) have Field Termination Assemblies (FTA) that have built-in surge protectors for transmitters operating in DE mode.

### Upgrading the ST3000 to Include Lightning Protection

If the original transmitter did not include the Lightning Protection (LP) option and it is later considered desirable to add it, the protection can be easily added on. A conversion kit is available for all ST3000 series 900 and 100e transmitters. This kit includes the mounting screws, cover and terminal block. The part number for this kit is: 51197425-002.

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
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<tbody>
<tr>
<td>ST3000 Transmitter with integral Lightening Protection option, mounting bracket, FM approval</td>
<td>STD924-E1G-00000-1C,LP,MB</td>
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<tr>
<td>Lighting Protection Kit</td>
<td>51197425-002</td>
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