Typical Causes and Effects of Electrical Transients, and Potential Solutions

Voltage spike

The example waveform shown in Figure 8 is a 2000V voltage spike with duration of ~0.2 milli-seconds. This voltage spike will only show up in high-speed capture using event triggers. RMS trend data for this event will show only a ~0.8V increase because of the 2000V spike.

Causes: Lightning strikes, power factor correction (PFC) capacitor switching, fault clearing (the end of a short circuit condition), or inductive kick (turning off a large inductive load). Ungrounded electrical systems are more prone to voltage spikes, especially line-to-ground voltages.

Effects: High voltage magnitude causes stress on insulating materials, such as wire insulation, motor windings, cable harnesses, and circuit boards. Most circuit boards include features to absorb some voltage spikes. If the spike is severe enough, it may exceed the component limits, resulting in failure. Short duration spikes often go undetected by the controls because they occur too quickly. Variable-frequency drives (VFDs) are susceptible to voltage spikes, but they typically protect motors from being affected.

Potential solutions: If possible, identify the source of voltage spikes and suppress the transient at the source. Surge protection devices (SPD) or metal oxide varistors (MOV) can be used to shunt voltage spikes away from sensitive equipment. Isolation transformers can be installed for sensitive equipment. For ungrounded systems, consider converting to center grounded, or create a local grounded network with an isolation transformer.

Figure 8. Example of a voltage spike waveform