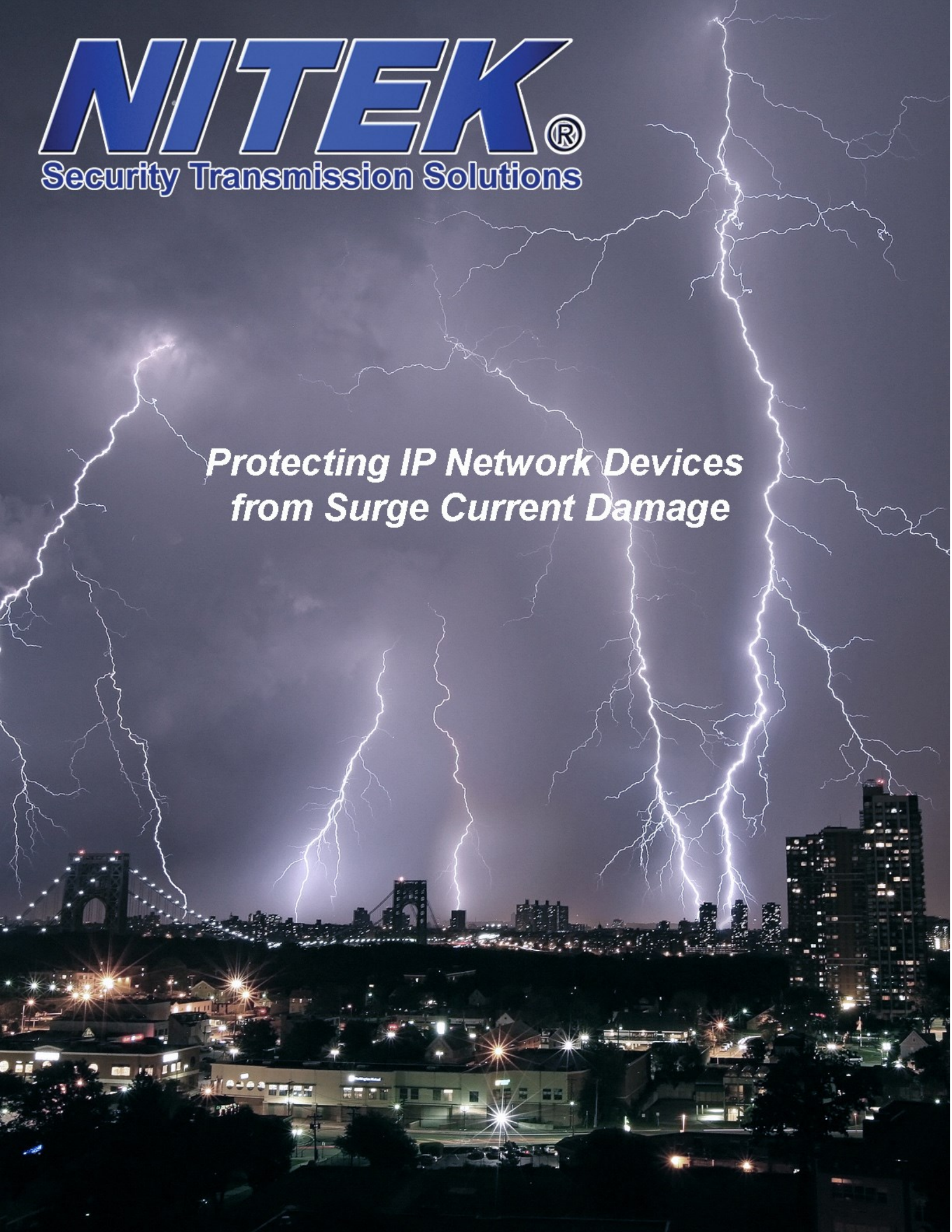
NITEK®

Security Transmission Solutions



Protecting IP Network Devices from Surge Current Damage

With 1,800 thunderstorms in progress at any given time on Earth, some of the most unpredictable disruptions to the proper operation of a security system are lightning strikes and electrical surges. Voltage surges have a huge destructive impact upon IP video and data systems each year. Many components such as IP cameras, VoIP emergency phones, LED illuminators, wireless access points along with other integrated security products are vulnerably mounted outdoors and exposed to the environment. The placement and location of these devices along with the continuity of service is essential to preserving safety and security, which is why it is crucial that these devices are protected against lightning and overvoltage. The vulnerability of electronic video systems to overvoltage is widely recognized by insurance companies and research institutes and supported in technical literature and different regulations along with standards which specify the need for lightning protection. This white paper explains the causes of overvoltage generated from surges, spikes and transients and how they damage electronic devices prematurely, or more importantly increase service interruption in life safety systems. It also covers the legal and regulatory framework governing protection, and proposes a solution to maximize protection performance and continuity of service.

What are transient or surge overvoltages?

Surge overvoltages are spikes that can reach tens of kilovolts but last for only a few microseconds. Despite their short duration, their high energy content may cause serious problems to connected electronics that are exposed to the surge overvoltage throughout the network. Most discussions surrounding surge protection originate from lightning discharges that directly strike the device, its mounting pole, the distribution lines or building infrastructure which can induce electromagnetic fields that generate voltage spikes throughout the network. Many CCTV systems incorporate very long outdoor cables either aerial, direct burial or routed through conduits which are highly susceptible to the direct effects of lightning strikes, with large currents from the lightning being conducted into the connecting cables. There is also a magnitude of ways electric surges and spikes are introduced into these networks which are commonly non-weather phenomena causing voltage spikes in adjacent lines — for instance, switching inside transformer cabinets, or the disconnection of motors and other inductive loads as shown in Figure 1.

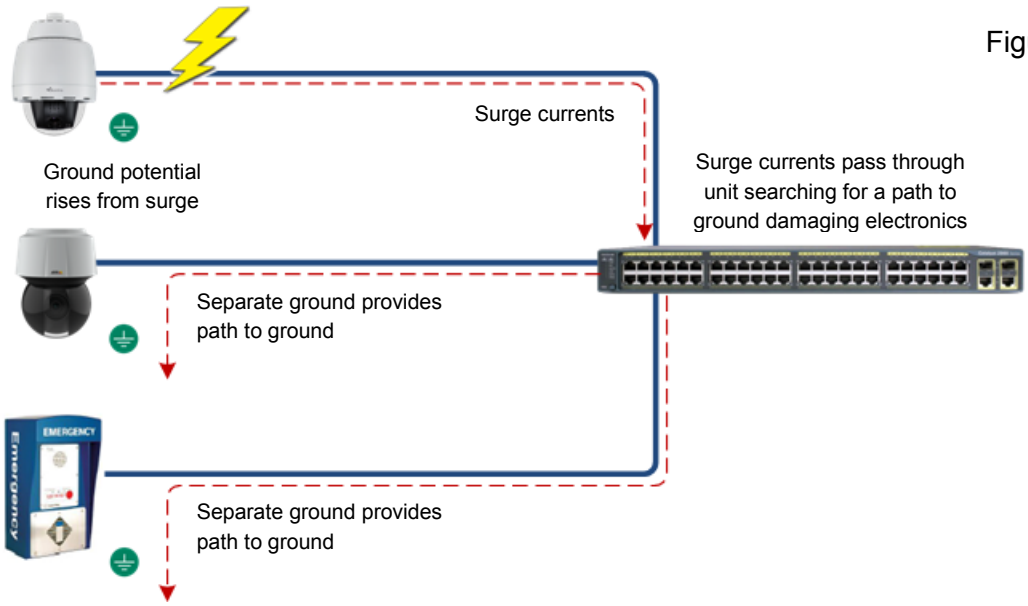
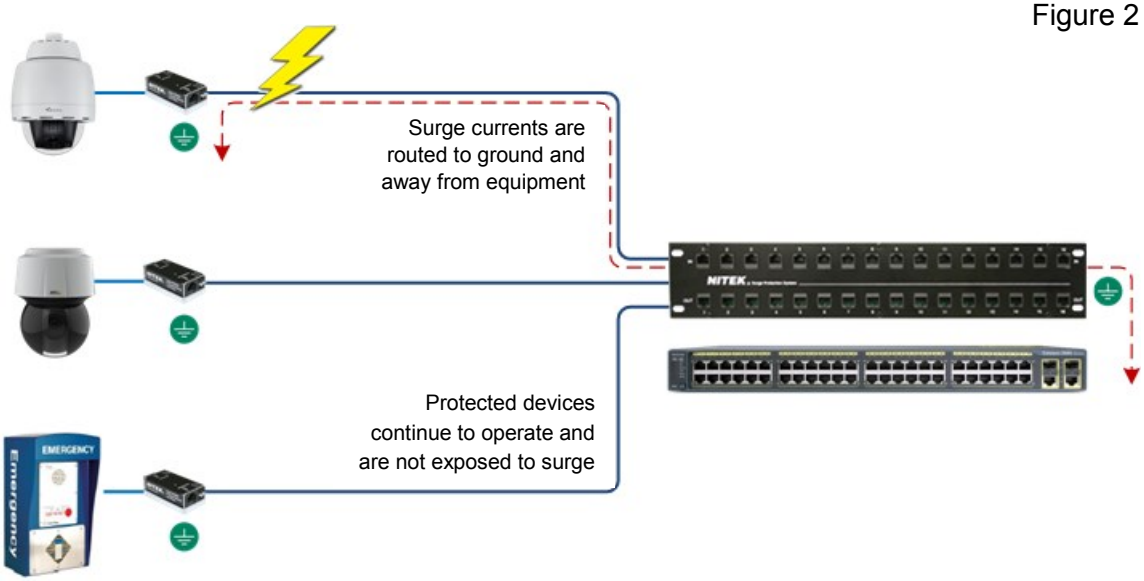


Figure 1

Protecting your IP video and data system against the effects of surge overvoltage

Nitek's surge protection devices act as a voltage-controlled switch. When the network voltage is lower than the activation voltage, the component is passive. On the other hand, when the network voltage exceeds the activation voltage, the surge protection device diverts the surge energy to ground and prevents it from destroying the equipment. In Figure 2 we illustrate how the surge current is led to ground away from the electronic devices and isolating the other network components.

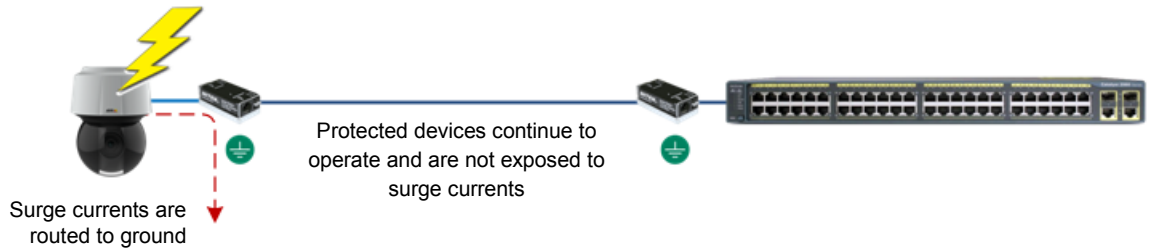
Figure 2



Nitek deploys the most effective approach to protect IP based life safety equipment against surge overvoltage by cascading multiple protective stages. Each stage combines the necessary balance between discharge capacity and voltage protection level. This way, a first stage provides robustness, thus diverting most of a spike's energy to ground, while a second stage provides a finer level of protection. Thus the peak voltage reaching the equipment always stays below the critical level.

Indirect lightning is defined as lightning that strikes one place but "induces consequences remotely". Many times in IP video systems the camera or the structure the camera is mounted to becomes exposed to indirect lightning. In these events the edge device(s) are usually sacrificed. With the proper surge protection, the surge currents are directed to ground protecting the electronics further down the line and limiting the damage to the edge device as illustrated in Figure 3.

Figure 3



Proper ground technique for IP surge protection devices

According to IEEE Std 142-2007, the definition of "ground" is "a conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some other body that serves in place of the earth."

Generally, for North America the following codes and standards will apply when installing surge protection devices:

- NFPA 70 – The National Electrical Code (NEC)
- NFPA 780 – Standard for the Installation of Lightning Protection Systems
- IEEE Std 142-2007 – IEEE Recommended Practice for Grounding of Industrial and Commercial Power System
- IEEE Std 1100TM – IEEE Recommended Practice for Powering and Grounding Electronic Equipment

The surge protection devices grounding lead should be as short as practical and installed in a straight and direct manner as feasible. Partial self-inductance of this lead will be the dominant impedance factor for the lead during a surge current event such as lightning – due to the relatively short rise time of the lightning current waveform.

Below is a chart which simplifies the product selection process

Model Number	When to use it
IPMRJ1	Single channel unit protects the 10/100/1000 network communication & PoE/PoE+ circuits. Typically installed at the IP edge device (IP Camera)
IPPWR1	Single channel unit protects the 10/100/1000 network communication, PoE/PoE+ circuits & two-wire auxiliary power connections. Typically installed at the IP edge device (IP Camera)
IPPTR12	Twelve port rack mounted unit protects the 10/100 network communications and PoE/PoE+ circuits
IPPWR16	Sixteen port rack mounted unit protects the 10/100/1000 network communications and PoE/PoE+ circuits
IPCOAX1	Single channel inline surge protection unit for use in IP over Coax installations. Protects the 10/100 communication, PoE/PoE+ circuits & two-wire auxiliary power connections
IPCOAX16	Sixteen port rack mounted unit for use in IP over Coax installations. Protects the10/100 network communications and PoE/PoE+ circuits

The following reference material was used in the creation of this document:

1. NEMA Surge Protection Institute
   1300 17th St N Suite 900, Arlington, VA 22209
   http://www.nemasurge.org
2. State Farm Insurance Company Learning Center
   "The Nuts and Bolts of Lightning Protection"
   https://learningcenter.statefarm.com/safety-2/the-nuts-and-bolts-of-lightning-protection/
3. NWS, National Weather Service, Office of Climate, Water, and Weather Services
   1325 East West Highway Silver Spring, MD 20910
   WWW.NWS.NOAA.GOV