Six Types of Internal Surges

When people say "surges," they often picture lightning, although among the most destructive, lightning accounts for less than 5% of all surges. More common are the damaging surges that originate within homes and facilities generated from equipment within. These internal mechanisms will create, during normal operation, microsecond voltage surge spikes which are responsible for 80-90% of all equipment/system disruptions (flicker, lockups, glitches, etc.) and failures. With TPD SPDs they are easy to control/eliminate.

There are several major categories of internally generated surges. The following describes how to diagnose and solve problems originating from these internally generated sources:

1. **Motor-Generated Surges (Inductive Kickback)**
Consider amongst the most common source of internal surges. When motors start or stop, they build and collapse an electromagnetic field. This simple process creates a sharp voltage spike back onto the site's electrical wiring system.
This can be caused by the following:

- HVAC Systems
- Pumps (Well, Pool, irrigation etc.)
- Refrigeration/Frezer Equipment
- Elevators
- Fans (microwave, ovens, blow dryers, air fryers, etc.)
- Garage door motors
- Any large inductive load

Symptoms that suggest a system may be experiencing motor-generated surges:

- LED flicker
- Processor lockups
- Audio pops
- Networking glitches
- Random device resets
- Premature failure of electronics

2. **Solenoid/Relay/Contactor Surges (Switching Transients)**
Solenoids are like tiny inductors. When they release, they generate a high-frequency microsecond spike.

This can be caused by the following:

- Door strikes
- Irrigation valves
- HVAC solenoids
- Control relays and contactors
- Gate operators

Symptoms that suggest a system may be experiencing solenoid/relay surges:

- System resets
- Packet loss
- Flickering lights
- AV failures
- Intermittent, unexplained issues

3. **Utility/Facility Capacitor Switching Surges**

Creates severe oscillatory transients, typically in the kilohertz range, which travel deep into the building. These are extremely destructive if not filtered.

This can be caused by the following:

- Utility capacitor bank switching
- Large HVAC capacitor banks

Symptoms that suggest a system may be experiencing bank switching surges:

- Bright flash flicker
- Lighting dimmer dropout
- Equipment nuisance resets
- Voltage swells paired with the surge

4. **Load Switching/Contact Bounce/SMPS Noise**

Load connection/disconnection creates arcing and contact bounce every time a load connects/disconnects from a line, producing fast transient spikes and noise bursts.

This can be caused by the following:

- Any device turning on/off.
- Power strips
- Lighting loads
- Cheap chargers
- Switch-mode power supplies

Symptoms that suggest a system may be experiencing load-switching surges:

- AV dropouts
- Data errors
- LED instability
- Buzzing or humming in audio systems

5. **Back-EMF From Inductive Loads**

Back-EMF occurs when stored magnetic energy discharges back into the system as sharp, repetitive microsecond spikes.

This can be caused by the following:

- Transformers
- Ballasts
- Coils
- Older fluorescent lighting

Symptoms that suggest a system may be experiencing back-EMF:

- Flicker
- Noise
- Processor resets
- Premature failure

6**. Lightning-Induced Surges (External)**

Although lightning-induced surges originate outside, they appear inside as high-energy, surges capable of creating massive damage.

This can be caused by the following:

- Direct lightning
- Capacitive Coupled
- Resistive Coupled
- Inductive Coupled

Symptoms that suggest a system may have experienced a lightning-induced surge:

- Damage beyond repair
- Melted electronics
- Burned circuit boards
- Complete system loss