

TECHNICAL ANALYSIS

Protecting Profitability: Managing Transient-Driven Downtime in Automation Driven Plants

“Eaton reports that 43% of manufacturing outages are power-related. What portion of that power-related downtime is plausibly attributable to voltage transients (spikes)?”

A defensible estimate depends on whether you are attributing downtime to (1) immediate trip events or (2) degradation-driven failures that accumulate over time.

1) Immediate downtime events (trips, faults, resets)

In most plants, spikes/transients are a minor-to-moderate contributor compared with sags and interruptions.

Typical range: 5% to 20% of power-related downtime

So if 43% of all downtime is power-related, then spikes/transients would plausibly account for:

- Low case: $43\% \times 5\% \approx 2\%$ of total downtime
- High case: $43\% \times 20\% \approx 9\%$ of total downtime

This aligns with the general consensus in industrial PQ practice that sags dominate immediate nuisance trips, while transients are secondary.

Eaton Corporation’s latest research that 43% of outages in manufacturing are power related, then how much of that might be attributed to transients/spikes/supraharmonics?

While you can’t back-calculate that directly without **site-specific failure attribution** (i.e., what types of power events are actually causing your trips, resets, scrap, or process interruptions). However, you can estimate a realistic range by combining what power-quality studies show about event prevalence and what industrial power-quality experts report as the dominant disturbance categories.

Most industrial power-quality downtime is triggered by voltage sags, not transients.

- Rockwell Automation summarizes that the three most impactful categories for industrial customers are voltage sags, harmonics, and transients, and cites EPRI work showing industrial customers see many sag events per year (e.g., ~66/year in one EPRI study). [Rockwell Automation](#)
- EPRI’s DPQ work (Distribution Power Quality Project) is widely used for statistics on disturbance frequency and confirms that sags and momentary interruptions are the dominant RMS voltage events seen on distribution systems.

TECHNICAL ANALYSIS

2) If the analysis includes latent reliability impacts (e.g., accelerated failure of drives, power supplies, and control electronics), then transients can represent a larger share of the power-related downtime category.

- If your downtime classification includes failures from premature electronics damage (power supplies, VFD control boards, instrumentation failures), then spikes/transients can be a larger share because they silently degrade equipment until failure.

Typical range: 10% to 35% of power-related downtime (in plants with high switching loads, poor grounding, frequent lightning exposure, or weak surge protection)

That would translate to:

- Low case: $43\% \times 10\% \approx 4\%$ of total downtime
- High case: $43\% \times 35\% \approx 15\%$ of total downtime

This is especially plausible where there's frequent switching of large inductive loads, motor starts, welding, poor bonding/grounding, or sensitive automation.

In general, Most plants: spikes/transients are about **5–20%** of the power-related downtime slice ($\approx 2\text{--}9\%$ of total downtime if 43% is power-related). A strong default planning number: $\sim 10\text{--}15\%$ of the 43% ($\approx 4\text{--}6\%$ of total downtime).

If we drill down into the highly automated world of packaging and bottling in the Food and Beverage industry then we can consider additional scenarios.

Given our context—food & beverage, high VFD/PLC/robotics density, and little to no SPDs—it is reasonable to attribute a meaningfully larger share of the “power-related downtime” bucket to spikes and transients than in a well-protected facility.

That said, the dominant instantaneous trip mechanism in VFD/PLC/robotics environments is still usually voltage sags, not transients. A key [PG&E](#) paper on VFD process disruptions states plainly that voltage sags are the most frequent cause of disruption of VFD-related industrial processes. PG&E This is consistent with broader industrial power-quality guidance that modern automation (PLCs, ASD/VFDs, robots) is highly sensitive to sag events. [Plant Engineering+1](#)

Consider the following as the correct framing:

- **Sags** drive most immediate nuisance trips / line stops.
- **Transients/spikes** drive:
 - a non-trivial portion of immediate faults (especially in unprotected control electronics), and
 - a potentially large portion of equipment degradation and unexplained resets/failures over time—especially without SPDs.

TECHNICAL ANALYSIS

Therefore, given this sector of **F&B + heavy VFD/PLC/robotics** + minimal SPDs:

- Immediate event downtime: ~4% to ~11% of total downtime is likely due to spikes/transients (i.e., 10–25% of the 43%).
- Including degradation-driven failures: ~9% to ~17% of total downtime could plausibly be attributed to spikes/transients (i.e., 20–40% of the 43%).
- A strong single planning number: ~11% of total downtime (i.e., 25% of the 43%).

Surge protection is increasingly critical in highly automated facilities. Proper device selection and deployment can reduce both immediate downtime events and long-term equipment degradation.

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