



## Eaton helps industrial manufacturer prolong the life and operation of mission-critical equipment

**Location:**

Burnsville, Minn.

**Problem:**

Prevent costly repairs and intermittent failure of critical machining equipment

**Solution:**

Expert electrical system analysis leading to the application of an Eaton Innovative Technology surge protection device solution

**Results:**

Eaton helped eliminate costly equipment repair and increased production availability

*By adopting the series connected SPD solutions we could quickly and cost-effectively protect not only the critical machining equipment which had faced the original intermittent operation problem, but also the total investment of all our electrical equipment used on-site.*

*Mike Bartizal, Chief Operating Officer,  
Permac Industries*

**Background**

Permac Industries is a small part machining company with the vision of providing precision machining services for global aerospace, medical, industrial and commercial customers. The company manufactures critical parts ranging from unique prototypes to high-volume production machined parts.

During a production run, a critical precision machine at Permac Industries' Burnsville, Minn., site experienced intermittent operation failures. At the time, the issue was traced to a production microprocessor board failure that resulted in a costly repair and replacement expense of more than \$2,000. However, the larger issue was the significant loss in production time. The transients caused the machine performing the last operational step to a high-precision part to fail.

When the intermittent operation failure resurfaced on the same critical machine only a year later, Permac's Chief Operating Officer, Mike Bartizal, contacted the local utility company to troubleshoot the problem. Bartizal also noticed other power quality effects occurring on-site, including high-frequency failures of the facility's fluorescent lighting and ballasts. Concerned by the repeat failures, Bartizal wondered if the utility electric service supply was the source of the power quality problems.

Permac and the local utility agreed to pursue a power quality analysis to investigate, identify and remedy the problem. The customer sought out Eaton's team of power quality experts to determine whether the power quality disturbances were being generated within the facility or by the utility.



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## Challenge

To identify the source of Permac's power quality problem, expert analysis would need to be completed at two locations within the facility: at the main service entry and at the critical machine panelboard. Eaton recorded data and power quality waveforms with high-speed transient detection and power quality metering equipment.

An evaluation of the voltage supply was completed to rule out any utility supply compliance issues. The nominal voltage readings were well within the standard of  $\pm 10$  percent of nominal ranges. In addition, no events were found for voltage sags, swells, interruptions or abnormal utility supply transients. Based on the analysis, it was clear that the local utility was fully compliant with all of the required standards.

To locate the origin of the failure, Eaton analyzed the 200 A panelboard feeding the critical precision equipment. The meter was connected to the panelboard over a five-hour period to capture any anomalies. Power quality anomalies were detected indicating the presence of internally generated voltage transients. In total, 322 transient events were recorded, not an unusual number of events originating from within a manufacturing facility. The recorded voltage sine waves exhibited notches and multiple zero crossing events.

The Eaton team concluded the distorted voltage waveform was impacting the logic signals of the critical machinery, causing 60 Hz timing issues. Furthermore, the transients had impulses measuring 228 percent above the nominal voltage, contributing to microprocessor board failure.

## Solution

Manufacturing facilities can generate as much as 80 percent of all voltage transients internal to their facility and this can often affect the reliability and operational integrity of critical process machinery. Consequently, manufacturing facilities may periodically experience large, incoming transients from lightning, utility switching and other sources. As a result, IEEE recommends a multi-stage surge protection system to protect from internal and external sources.

Eaton recommended a cascaded surge protection approach (as recommended by IEEE C62.42) for the facility. Cascading is a term used to describe the application of surge protection devices installed at the main service to protect the electrical system from incoming transient surge activity. Secondary surge devices are used downstream of the incoming service to further reduce surge magnitudes and protect sensitive equipment from internally generated surge activity. This solution assures protection from the service entrance to the distribution panels feeding sensitive plant floor electronics.

A cascaded solution implementing Eaton's Innovative Technology (IT) surge products was employed. An IT Equilizer Series surge device with line filtration was connected at the panelboard feeding the critical equipment. Downstream a series connected, IT Critical Line Filter was installed at the main terminal block of the precision machining equipment to provide uncompromising protection from any voltage transients and eliminate zero crossing issues.

## Results

With the installation of the cascaded Eaton Innovative Technology surge solution, a significant power quality improvement was immediately observed. A test at the critical precision machine location indicated a reduction in transient voltage magnitude by nearly 75 percent and a reduction in transient activity from more than 300 events to 75 in the same time period. Testing at the panelboard location showed similar reductions in surge activity and magnitude. Surge magnitudes at the panelboard were reduced by 75 percent with the number of events reduced by 65 percent.

"We were relieved to find such a simple and reliable solution in the highly recommended Eaton SPD product suite," said Bartizal. "By adopting the series connected SPD solutions we could quickly and cost effectively protect not only the critical machining equipment which had faced the original intermittent operation problem, but also the total investment of all our electrical equipment used on-site."

To further safeguard the machine facility, Permac Industries is reviewing plans to install larger surge units at the main service entry to protect from incoming transients and adding several more IT Critical Line Filters to protect other sensitive electronic loads inside the facility.



For technical assistance with surge applications, contact the Eaton Technical Resource Center: 1-800-468-1705, option 4, option 2 [spd@eaton.com](mailto:spd@eaton.com) [Eaton.com/spd](http://Eaton.com/spd)

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