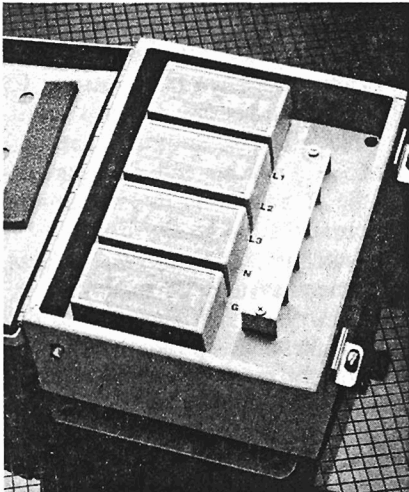


# Power spikes blocked from numerical control

## Suppressors aid computerized machines

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Four TVSS units are enclosed in a NEMA-12 case; this gives one module per phase and one spare.

### Problem

The compressor manufacturing facility of the Trane Company in LaCrosse, WI is heavily centered on precise, computerized numerical control machining. Two situations were developing simultaneously. The state of the art of transient voltage protective equipment had made substantial advances. Also, Trane was entering into the Just-in-Time, reduced inventory system for manufacturing, which increased its dependence on machine-tool reliability. Traditional transient voltage protection, which had been integral with existing machines, was not providing the necessary reliability. Trane engineers began a program to improve this protection.

### Solution

One project for the protection of numerical control machines along with other electronic equipment involved the installation of more than 70 transient voltage suppression systems (TVSS's). The first step was a survey conducted by a consultant specializing in transient effects and stresses on electrical electronic equipment.

This survey included operating history, uptime vs downtime and effects of self-generated voltage abnormalities. Recommendations were included regarding cabinet air-conditioning for temperature control, corrosion prevention and insuring a dust-free environment.

The final implementation was specific to each machine. However, a typical generalization shows a TVSS unit

placed at the circuit breaker box and at the AC entrance to control power feed. A suppression unit is comprised of a rugged 2 x 2 x 4" plastic-enclosed module, supplied in six variations for standard industrial voltages from 120 to 480 VAC. Clamping voltage ranges from 205 to 905 respectively. Transient peak amperes run from 6500 to 25,000. Response time is less than one nano-second.

In a compact assembly, 4 TVSS units are in plug-in placement in a NEMA-12 case. This gives one module per phase and one spare. A normal/fault indicator will show drop-out and exchange can be made by a plant electrician. The same module, which forms a building block for the system, can also be wired in individually, integral to equipment power circuits. Remote supervision of status, including audible alarm, is available.

Particularly for sub-systems and control components, Trane also employed TVSS power strips. The power strip features easy installation, removal of clamping harmonics, status light alarm and sturdy, fire-resistant construction. Six protected outlets allow plug-in connection. Amperage rating at 120 v, 60 Hz ranges from 10 to 15 amps. These have been installed in the present case where, for instance, specific internal control components were known to unaccountably drop elements of memory.

An important criterion in the choice of surge suppressors for Trane was the utilization of both metal-oxide varistors, cascaded diodes for fast response time and EMI/RFI filtering to smooth

out current discrepancies. The chosen TVSS employs all these systems, along with additional clamping and conditioning technologies, all integrated into one circuit for tight regulation. Present regulations from IEEE, UL and FCC were taken into consideration.

The danger from transient voltage aberration is in unpredictable power bumps to control circuits. Such bumps, or spikes usually result in unexpected shutdown, but can often lead to inappropriate response action. Damage to chips may be immediate or cumulative, resulting from the high transient amperage, or voltage.

Transients leave no record and maintenance time for "unexplained" machine shutdown is expensive. Current perturbations are not only from plant inlet services. Estimates are made that 65% of spiking and surges arise within the plant, caused by: switch and relay closures, contact bounce, motor switching, SCR drives, welders, and general system "cross-talk."

In 1986-1987 Plant No. 6 of Trane completed this project of TVSS protection for machine tools, robotic operations, stackers and welders.

### **Results**

Trane finds that the TVSS installation has increased machine reliability and uptime.

The facility had several machines that lost their memory at least once a month. Trane has not experienced this since the TVSS installation.

Also, the air-conditioning on electronic control cabinets has increased the up-time considerably.

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*Technical services and consulting for transient voltage and stress conditions for electronic equipment were carried out by Howard Cooper, Directing Engineer of Amemco Inc., P.O. Box 211, Kaysville, UT 84037.*

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