Transient Surge Protection for Agricultural Facilities

Protection from electrical surges is receiving more attention with the widespread adoption of electronic devices in agricultural facilities ranging from personal computers to environmental control systems and computerized feed mills. Incorporation of surge protection is advised as the cost of surge protection equipment drops and the potential cost due to a single failure of electronic equipment increases.

Transient surges arise from many sources. Common sources include lightning and load switching that induce transients which enter through the electrical or telephone utility service. Load switching from other users on the electrical power grid and other facilities on a user's premises also are surge sources. While the massive energy of a direct lightning strike can clearly cause extensive damage, smaller transients from remote strikes and other sources also can create severe upsets in digital electronics without any outward sign of damage. In fact, most transient surges have voltage magnitudes under 6000 volts (6 kV). Protection against these surges is important and cost effective.

A properly installed transient surge suppression system includes several levels of protection. The system starts at the utility service and progresses to each building's service panels, sub-panels and particular circuits with sensitive electronic equipment. Each protective level is designed to remove a portion of the surge that survived a preceding level. These levels of protection are classified by Standards Organizations (ANSI, IEEE, NEC) by their location within the site as Category C (service entrance panel), Category B (panel boards and large sub-panels) and Category A (branch panels). Protection for individual circuits and for the utility service also are recommended.

Figure 1 is a schematic of this cascade approach. This idealized representation illustrates all five levels of protection which are numbered in ascending order for reference. In practice, many agricultural installations do not need all levels. It is important to note, however, that providing surge suppression only at the circuit to which sensitive electronic equipment is connected generally is insufficient for high-energy transients. These surges can destroy this low level protection and still have sufficient energy remaining to damage electronic equipment.

A good grounding system for the building is essential for correct operation of surge arrestors due to how surge arrestors work. Once a transient is detected, the arrester short-circuits (shunts) the transient to the ground. If the ground is poorly established, the effectiveness of the surge arrestors is greatly diminished. Your electrical utility can test the adequacy of your grounding by measuring the resistance between the ground rod and earth nearby.

Most surge suppressors are made of either gas discharge tubes or solid state components called metal oxide varistors (MOVs). While both functionally provide similar capabilities, MOVs are becoming more prevalent.

Beware of imitations, such as silicon oxide varistors, when selecting surge suppression devices. Look for ratings from an independent laboratory (e.g., Underwriter's Laboratory) that certify the equipment to meet or exceed the ANSI/IEEE C62.41 transient over-voltage test waveforms.

Lightning protection for buildings also is important if sensitive electronic or life-supporting equipment, such as ventilation systems, are installed in the building. The National Fire Protection Agency (Batterymark Park, Quincy, Massachusetts) and the Farm Building Wiring Handbook (published by Midwest Plan Service and available through county Extension offices) are excellent sources of information on lightning protection.

The following minimum surge suppression equipment is recommended for agricultural facilities such as livestock buildings containing electronic controls.

- Lightning arrester on main service pole.
- Adequate ground for service entrance and main service pole.
- Category A or B arrester for the building service panel.
- Secondary arrester (or Category A) for the individual circuit to which the electronic controls are attached.
Certainly more surge protection is helpful, but this minimum level is practical to install and should protect equipment against most surges. Remember, no amount of surge protection can guarantee absolute reliability. Thus, equipment that performs critical functions should also have an appropriate back-up system in addition to surge suppression.

Manufacturers of Surge Suppressors

This is a partial list of transient surge suppression device manufacturers. The University of Kentucky does not in any way endorse a manufacturer or product at the exclusion of other manufacturers or products; the intent is only to provide a reference for interested parties.

General Electric Capacitor
Customer Service
 Ft. Edward, NY
(518) 746-5750
Lexington, KY distributor (606) 278-8402
Secondary Arrestor: Model 9L15EC — C001

Joslyn Electronic Systems Corporation
Santa Barbara Research Park
P.O. Box 817
Goleta, CA 93116
(805) 968-3551
Wide range of primary and secondary arrestors.

Joslyn Manufacturing Co.
9200 W. Fullerton Avenue
Franklin Park, IL 60131
(312) 625-1500
Surge/Tec Model Z2-175 secondary arrestor
Lexington, KY Distributor: Westinghouse (606) 293-2647

Kal glo Electronics Co., Inc.
6584 Ruck Road
E. Allentownship
Bethlehem, PA 18017-9359
(215) 837-0700
Wide range of telephone and data arrestors.

MCG Electronics, Inc.
12 Burt Drive
Deer Park, NY 11729
(516) 586-5125
Wide range of telephone and data arrestors.

Schematic of a protected building electrical service using the recommended cascaded system. Although not shown, telephone service is protected in a similar fashion. Electrical utility service arrestor and ground are intended to absorb large transients that originate from other sources on the power grid. Category C and B protection levels are designed to further dissipate outside transients as well as those generated from within the facility (motor switching, for example). For very sensitive electronic equipment, surge suppressor strips are recommended as a sixth level of protection.