Controls & Surge Protection

The term "controls" can mean anything from a simple on/off switch used to control a light bulb, or a computer controlled, variable speed motor controller or drive controller. A Control can be as basic as the tuner on your radio (variable capacitor) or as intricate as a SCR switch assembly in a robotics arm.

For our purposes, a control is considered a manual or an electronic switch and it can be a set of contacts or a variable control. The control in our example runs or acts as the "switch" for some device or equipment.

A basic example would be a wall switch used to control a single light bulb. This 120 volt AC wall mounted light switch can produce transient energy that is damaging to microprocessors. This 120 volt AC switch is a pair of contacts used to control the phase or hot leg of electrical power. (Remember 120 VAC power is comprised of three wires if you include phase, neutral and life safety ground.) The contacts "make" or "break" the connection between a light and the 120 VAC 60Hz electrical power source and in doing so turn on or off the light bulb. When they are making this contact it is common to have an arc before the connection is made. The reason for the arc is the relationship of the contacts (distance from each other) and the amount of voltage (potential) that is at the line side of the contacts. If you consider how the gap between the contacts is reduced as the switch is in the process of closing (before they make physical connection) you will understand that at some point, the voltage can jump or bridge the open gap. A spark will result and a spike (transient voltage) is created. This action is part of the switching of this control.

This very simple example is what action occurs and what happens as contacts make in a switch. If you expand this to the scale of a high voltage welding machine (Robotic welder), controlled by a computer commonly found in industry, you will have some idea of the effect of surges and spikes. Think about the design problem of a device making its own surges & spikes that are thousands of volts as part of its normal operation when this device is controlled by a computer upset by a spike or surge of less than 10 volts. Ford motor company and General Motors can tell you all about the problems associated with this equipment. It cost these companies millions of dollars learning and it was a lesson not soon to be forgotten.

Most elevators are controlled by relays. If you were to be in the elevator "dog house" or control room and turn off the lights with the control panel open you would see what looks like a fireworks display. When the elevators go up and down, their motion, doors, etc. are all controlled by relays. When these relays open and close, they arc. This causes the relay to erode and it also sends spikes and surges into the electrical system of the elevators and all devices that share the same electrical service.

If you think of a control as a power valve, you will understand it is much like a valve in your own home. The water valve controls the flow of water just like the wall switch controls the flow of electrical power. The switch can be a simple on/off type, or it could be a dimmer control and use a variable resistor or SCR. The dimmer (SCR) will cause surges, spikes and electrical noise and distortion of the 60 Hz sine wave.

Controls such as relays are often a low voltage used to control a very high voltage. Motor relays on a well are such an example. In the most simple form a 240 VAC single phase well motor, common in home water wells, uses a pressure sensitive relay to control the pump action. As the pressure drops, a sensor tells the relay to turn on the pump. The voltage used to "switch" the pump on is low voltage, "24-48 volts or less" and it is normally a DC voltage. The control in this case is a DC voltage. The voltage turned on is 240 Single phase. When the pressure reaches a preset level, the pump is turned off by the relay.