Electrical Noise

System wiring is divided into two main areas--signal wiring and power wiring. Signal wiring deals with input signals (generated by the temperature sensor) and output signals (generated by the temperature controller). Power wiring deals with supply power to the temperature and power controllers and the current that's ultimately delivered to the heating element. Signal wiring is less straight forward than power wiring. Not only does it have to conform to circuit design, but must also be installed in such a way as to minimize the negative effects of electrical noise present in any thermal system.

What is Electrical Noise? It is electrical signals, which produce undesirable effects in the electronic circuits of the control system. The term "electrical noise" originated with AM radios when the extraneous "noise" heard in the speaker was caused by lighting or other sources of electrical arching. Electrical noise from all sources and its effects on controllers are very difficult to define, let alone give exact rules on how to prevent. Noise sensitivity is a function of more recent electronic controller designs. However, the majority of noise problems stem from crude wiring practices and techniques, which allow "coupling" or the transfer of electrical noise into the control circuit.

When is Electrical Noise a Problem? Symptoms resulting from an electrically noisy environment are difficult to predict. One common symptom is an erratic system, with no evidence of a problem appearing consistently. Even worse, the system may exhibit several different symptoms. Some other commonplace symptoms are fluctuating digital indicators, blanked digital indicators, control instability about set point, and outputs turning ON or OFF unexpectedly. Another "red flag" of electrical noise raises when high or low limits trip with no limit fault condition.

Why is Electrical Noise Sensitivity a Problem? How accurately a controller can differentiate between desired system signals and electrical noise is a good indicator of its sensitivity to noise. In general, high power controllers such as mechanical relays or mercury displacement replays have a low noise sensitivity, while low power controllers that use electronic logic, especially those using integrated circuits, are more sensitive to noise. The development of all electronic solid state controllers has improved the accuracy of control and expanded immensely their capabilities, but they are more complex and operate at very low power levels. Electrical noise is more likely to affect them because of their lower operating power levels.

Where Does Electrical Noise Come From? Our industrial world is full of equipment capable of generating many types of electrical noise. A typical noise source is any piece of equipment that can cause or produce very rapid or large amplitude changes in voltage or current when turned on and off.

Noise Sources:

- Switches and relay contacts operating inductive loads such as motors, coils, solenoids, and relays
- Thyristors or other semiconductor devices which are not burst fired (randomly-fired or phase angle)
- All welding machinery
- Heavy current carrying conductors
- Fluorescent and neon lights
- Thermal voltages between dissimilar metals that influence the low voltage thermocouple input signal
- Chemical voltage produced by electrolyte action between poorly connected leads and interconnect cables
- Thermal noise from increased ambient temperatures around the circuit electronics
- Noise could be introduced if the control circuit includes the option of a mechanical relay output and is used to switch high load currents over two or three amps. This presents a significant source for noise, including inductive noise from the coil and contact arcing, depending on how much power is brought inside the controller.

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