



## 9 Power Problems and Their UPS Solutions

Power Problem	Definition*	Cause*	Solution
<b>1. Power Failure</b> 	A total loss of utility power.	Can be caused by a number of events: lightning strikes, downed power lines, grid over demands, accidents and natural disasters.	<div style="display: flex; flex-direction: column; align-items: center; justify-content: center;"> <div style="border-left: 1px solid red; border-right: 1px solid red; border-bottom: 1px solid red; padding: 5px;">Series 3 UPS</div> <div style="border-left: 1px solid red; border-right: 1px solid red; border-bottom: 1px solid red; padding: 5px;">Series 5 UPS</div> <div style="border-left: 1px solid red; border-right: 1px solid red; border-bottom: 1px solid red; padding: 5px;">Series 9 UPS</div> </div>
<b>2. Power Sag</b> 	Short-term low voltage.	Triggered by the startup of large loads, utility switching, utility equipment failure, lightning and power service that's too small for the demand. In addition to crashes, sags can damage hardware.	
<b>3. Power Surge (Spike)</b> 	Short-term high voltage above 110% nominal.	Can be caused by a lightning strike and can send line voltages to levels nominal in excess of 6,000 volts. A spike almost always results in data loss or hardware damage.	
<b>4. Undervoltage (Brownout)</b> 	Reduced line voltage for extended periods of a few minutes to a few days.	Can be caused by an intentional utility voltage reduction to conserve power during peak demand periods or other heavy loads that exceed supply capacity.	
<b>5. Overvoltage</b> 	Increased line voltage for extended periods of a few minutes to a few days.	Overvoltage can be triggered by a rapid reduction in power of a loads, heavy equipment being turned off, or by utility switching. The results can potentially damage hardware.	
<b>6. Electrical Line Noise</b> 	High frequency waveform caused by or EMI interference.	Can be caused by either RFI or EMI interference generated by transmitters, welding devices, SCR driven printers, lightning, etc.	
<b>7. Frequency Variation</b> 	A change in frequency stability.	Resulting from generator or small co-generation sites being loaded and unloaded. Frequency variation can cause erratic operation, data loss, system crashes and equipment damage.	
<b>8. Switching Transient</b> 	Instantaneous under-voltage (notch) in the range of nanoseconds.	Normal duration is shorter than a spike and generally falls in the range of nanoseconds.	
<b>9. Harmonic Distortion</b> 	Distortion of the normal line waveform, generally transmitted by nonlinear loads.	Switch mode power supplies, variable speed motors and drives, copiers and fax machines are examples of non-linear loads. Can cause communication errors, over heating and hardware damage.	

\*Reference IEEE E-050R & old FIPS PUB 94