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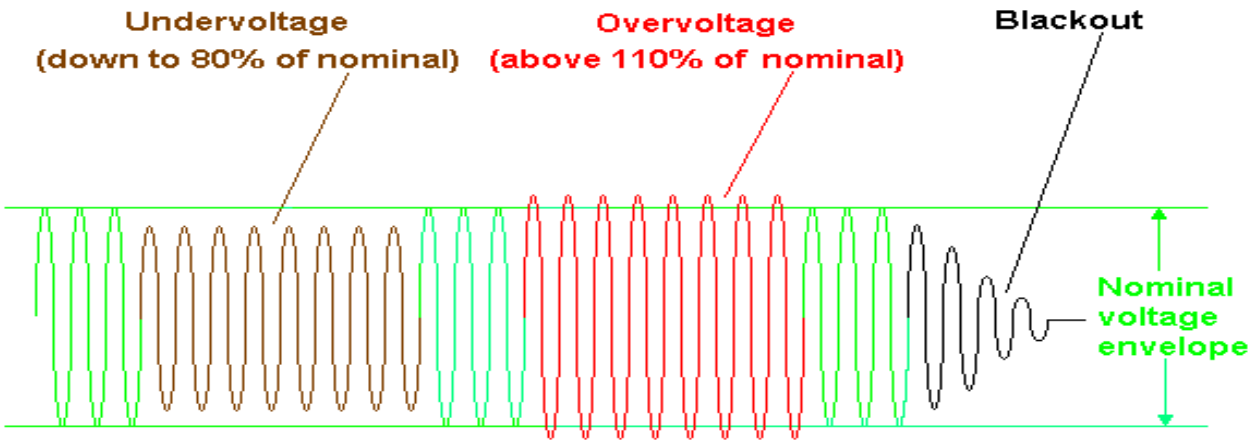
# LINE VOLTAGE REGULATION

## General

Computers, PLC's (programmable logic controllers), and other sensitive electronic systems require clean regulated power to perform to their specified standards. One element working against electronic equipment is fluctuating voltages. Fluctuating voltages are over-voltage and under-voltage power conditions that occur every day within facilities. To counteract the effects of fluctuating voltages, line voltage regulation is employed. Line voltage regulation is the process of maintaining constant output voltage to an electronic load despite a wide variation in input volt-age. Without line voltage regulation, sensitive electronic equipment will respond negatively to these over-voltage and under-voltage conditions, causing them to malfunction or cease operations altogether. The results are costly in terms of operation functionality, downtime, maintenance, and repair.

**Types of Voltage Fluctuations**




## Over and Under Voltage

The utility companies deliver clean regulated power to industrial facilities. Unfortunately over-voltage and under-voltage power problems, one of the biggest culprits of electrical anomalies in the industrial facility, are created within the facility by a number of different sources. The root causes of fluctuating voltages are ground faults; undersized power systems; and sudden start-up or switching of large loads such as an elevator, spot welder, photocopier, or a mainframe computer network.

Sensitive electronic equipment have tight voltage tolerances in which they are able to function properly. If voltages are allowed to fluctuate outside their toler-ances, the electronic components are prone to failure. Over-voltages and under-voltages are also known to be responsible for computer lock-up, robotic malfunction, and unexpected motor restart or failure. The net effect on a business with these conditions is devastating in the form of equipment damage, loss of production, and ultimately profit loss.

## Power Purifier

As devastating as over-voltages and under-voltages can be, there are solutions. The Controlled Power Company *Power Purifier* uses advanced ferroresonant technology to solve over-voltage and under-voltage conditions. To regulate the output voltage, the transformer is operated in it's natural saturation state. This means that when the transformer's saturation level is reached, the output voltage will not change, even when the input voltage varies. The *Power Purifier's* transformer is designed to start to saturate at least 35% below the nominal in-put voltage at full load. Therefore, when the *Power Purifier* is fully loaded, the input voltage can fluctuate between -35% to +15% of nominal indefinitely (up to +200% for a short period of time) and the output voltage is automatically regulated to within +/- 3% of nominal instantly. Add-itionally, at 75% load or less, the *Power Purifier* is still able to attain excellent voltage regulation even if the input voltage drops 45% from nominal. Therefore, the degree of voltage regulation the Controlled Power Company *Power Purifier* provides is much tighter than the tolerances of most sen-sitive electronic equipment. Em-ploying the *Power Purifier* in industrial applications will dras-tically reduce downtime, main-tenance, and equipment repair due to voltage fluctuation.

*Power Purifier*
Voltage Regulation Specifications

| Input Voltage Variation | Load | Output Voltage Regulation |
|---|---|---|
| +10% to -20% | 100% | +/- 2% |
| +10% to -35% | 75% | +/- 3% |
| +10% to -40% | 50% | +/- 3% |
| +10% to -45% | 25% | +/- 3% |

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## Other Technologies

Although not as encompassing as the *Power Purifier,* other options exist to solve over-voltages and under-voltages.

One option is a magnetically controlled voltage regulator that consists of an autotransformer with a buck-boost winding to control the output voltage. The buck-boost winding will either increase (boost) or decrease (buck) the voltage, whichever is necessary. The voltage level of the buck-boost winding is varied by a control winding that affects the saturation of the core. Response time to voltage variation in these systems is 3 to 6 cycles. An autotransformer provides no isolation between the input and output and therefore it's noise attenuation is not very good without additional conditioning devices.

Another option is an electronic tap-switching transformer. The tap-switching transformer regulates by switching a tapped coil winding that changes the turns ratio of the transformer. This action regulates the output voltage to the load. The switching is controlled by electronic circuits and its correction time is 1 to 3 cycles. The window of input voltage a tap-switching transformer will regulate is fairly tight, and once that window is exceeded the regulation ability starts to decline.

The Controlled Power Company *Power Purifier* regulates the output voltage for wider ranges of input voltage than either the autotransformer or the electronic tap-switching transformer. The *Power Purifier's* response time to input voltage variation is instantaneous and attenuates noise down to levels for the most sensitive equipment. The *Power Purifier* also provides a unique ride-through capability (see Application Note IPPS#12) which will deliver power to the load for up to 1 cycle in the event of a power loss.

## Summary

The Controlled Power Company *Power Purifier* provides excellent regulation that will keep your mission-critical operations functioning efficiently and without upset from over-voltages and under-voltages. The *Power Purifier* will also keep your operations free from transients, voltage surges, electrical noise, as well as, attenuate harmonics. In short, the *Power Purifier* will solve 99.95% of all power problem occurrences. The *Power Purifier* is excellent for the following applications: computerized industrial control systems, process-numerical control, audio-visual security systems, data acquisition, programmable logic controllers, automated manufacturing, robotics, test and measurement instrumentation, and sensitive electronic equipment, and more.



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