

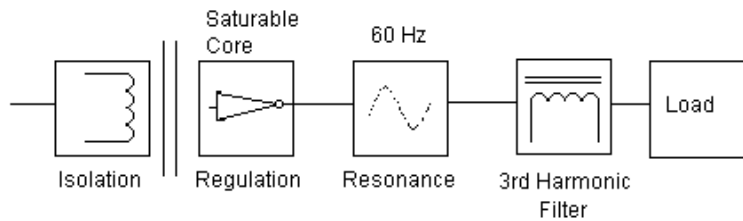
# HOW THE DOUBLE MAGNETIC CONVERSION POWER PURIFIER WORKS

## General

The Controlled Power Company's *Power Purifier* is a double magnetic conversion line interactive power conditioning system which provides constant voltage, elect-

rical noise attenuation, harmonic attenuation, and power factor correction by using advanced ferroresonant technology in its electromagnetic operation. The block

diagram below shows the operation of the *Power Purifier* through the functions of each block.

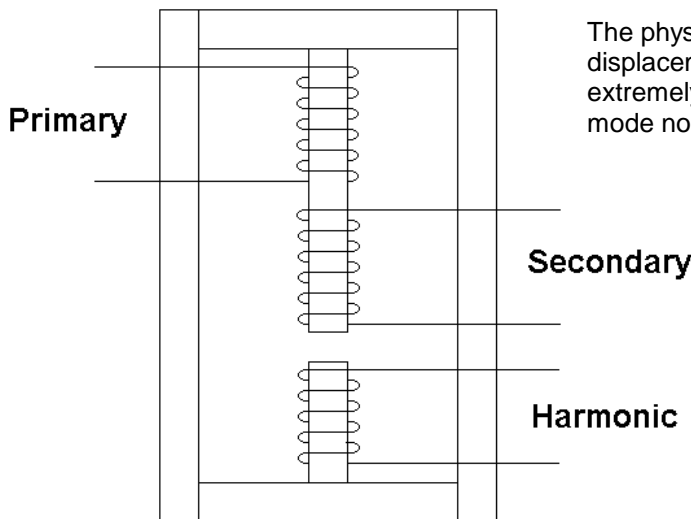


## Isolation

The primary, secondary, and harmonic windings are three separate windings. They are placed apart from each other and create a resonance in the circuit to provide

the ferroresonant transformer with its basic features, such as, voltage regulation, harmonic attenuation, and noise attenuation. The primary and secondary wind-

ings are wound and magnetically coupled on a common core in the ferroresonant transformer as shown in the figure below.



The physical displacement provides extremely high common mode noise attenuation.

When a voltage is applied across the primary winding, the induced current establishes a primary magnetic flux in the core. The primary magnetic flux interacts with the secondary winding

accordingly. When a load is connected across the secondary, the secondary current establishes a magnetic flux which tends to cancel the primary flux. The primary current increases to maintain the

original flux level. This is known as isolation. Isolation attenuates the common mode and transverse mode noise, protecting the load from transients and electrical spikes.

## Line Voltage Regulation

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The definition of line voltage regulation is: as the input voltage changes, the output voltage tends to remain constant. To regulate voltage, a transformer must operate as a nonlinear device. For a transformer to become nonlinear, it must operate in the saturation region. This is where an increase in magnetizing force no longer

increases the magnetic flux. As a result there is no change in the secondary core flux when the input voltage changes. Regulation action exists because changes in the applied voltage is rerouted by the electromagnetic force. Ferroresonant transformers use this concept to obtain regulation.

Based upon the design and operating point within the saturation region, regulation performance will vary. The *Power Purifier* operates deeper in the saturation region than most generic ferro-resonant systems. This permits the widest input voltage operating range in the industry.

## Resonance

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A resonant circuit contains both inductance and capacitance. Their values are chosen to resonate at a certain frequency. A resonant condition exists when an inductor and capacitor store

energy and pass the same energy back and forth. The rate at which this occurs is called the resonant frequency. Resonance is an inherent part of a ferroresonant transformer. It provides the load

with a regulated output voltage and immunity to input distorted power. The stored energy delivers power to the load during short term outages up to one cycle.

## Harmonic Filter

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The neutralizing coil (harmonic winding) is connected to the secondary (output winding). Voltage is induced in this harmonic winding when magnetic flux passes through the center leg of the core. The magnetic flux links the primary, secondary, and harmonic windings. This voltage in the neutralizing winding has a high odd-harmonic content due to leakage flux from the secondary winding. The harmonics are still

present in the secondary winding and also in the harmonic winding. Since those harmonics present in the harmonic winding are induced by the flux from the secondary winding, the harmonics in each coil are approximately 180 degree out of phase, so they cancel. Thus, the secondary winding maintains a constant voltage with a waveform nearly void of harmonics. The proper turns ratio and magnetic path gives rise to a sinusoidal

waveform. The major advantage of this technique is that it attenuates odd ordered harmonics and provides a continuous harmonic free sinusoidal voltage to the load. By canceling the load generated harmonics, there are no significant harmonics reflected to the primary. The *Power Purifier* rids the primary current of harmonics, thus also improving the power factor.

## Summary

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The *Power Purifier* uses isolation, line voltage regulation, resonance, and a harmonic filter to provide mission critical equipment with constant voltage, electrical noise attenuation, harmonic attenuation,

and power factor correction. The *Power Purifier* will also provide up to 1 cycle of ride-through for short duration blackouts (all of these features are covered in later application notes). The *Power*

*Purifier* will protect your sensitive electronics from 99.95% of all electrical anomaly occurrences, which is better than any other line conditioner on the market.

