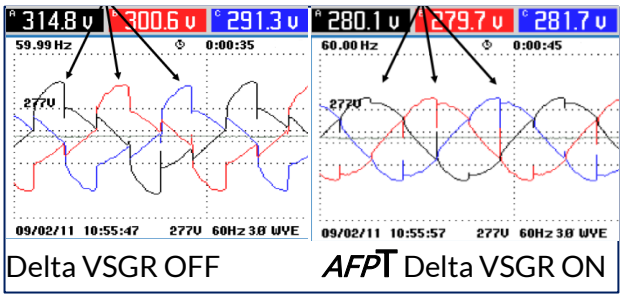

Harmonic Distortion: 3 Types of Current Correction or Voltage Correction Which type do you choose?

From Applied Energy's Critical Power Presentation June 12th, 2017

Common Solutions

For over 35 years, current correction has been the approach for reducing harmonic noise (or distortion) in Industrial facilities. Years ago, harmonic distortion and voltage imbalance were of a lesser concern.

Why is harmonic distortion and voltage imbalance more important now than before?

1. Electronics becoming smaller and more sensitive
2. The wide spread use of the Variable Frequency Drives
3. The wide spread use of the voltage-sensitive LED light bulb & other sensitive electronics
4. Heavy Concentration of Electronic Loads

Because current correction is commonly thought to be the only option for improving power quality, many organizations are unaware of the numerous pitfalls of this approach. Below are some examples of current correction your facility may be employing:

A. Current Correction: Passive Harmonic Filter

- Shunts harmonics to ground, only filtering specific harmonics (typically 5th and 7th)
- Must be applied individually to devices, to protect the system from the device and to isolate the device from the system.
- Minimal noise filtering, no voltage correction, no correction of phase angles.
- Uses excessive amount of energy to do its job. Most efficient at the highest load.

B. Current Correction: Active Harmonic Filter

- Senses harmonics, injects current to cancel out harmonics. In a noisy system, it can malfunction and cause problems.
- Each filter can be applied to one or several devices, but not all. Inter-harmonic noise can cause problems and malfunction.
- Can cause higher order harmonics which distort the voltage waveform.
- Consumes a large amount of energy.

C. Current Correction: Current Smoothing Reactor (or Line Reactor)

- Application is on a per-device basis, typically added before a drive to limit the current to the drive.
- Installation is cumbersome, requiring the reactor to be wired to the drive in series.
- Limits voltage to the drive, resulting in additional acceleration time and reduced torque, and may malfunction.
- Minimal noise filtering, no voltage protection, and no correction of phase angle.
- Consumes a large amount of energy.

In 2002, there became a new method of protecting the quality of power in Industrial facilities, when ***Phaseback VSGR*** with **voltage correction was introduced.**

D. Voltage Correction: Phaseback VSGR - *The Future-Proof Solution*

Because voltage correction targets the source of power quality issues, the voltage waveform, the result is that nearly all power quality issues are addressed automatically, economically, at the speed of current flow.

Voltage correction offers innumerable benefits. Compare the above offerings of current correction to the below table.

With *Phaseback VSGR*, get these benefits:

1. Arc Flash/Arc Fault Protection: Automatically prevent 85% of events	7. Eliminate Voltage Harmonic Noise on Ungrounded Systems. See Note 13 below.
2. Eliminate Voltage Spikes and single phase Voltage Sags	8. Correct Voltage Waveform Distortion
3. Correct Phase Voltage / Ground Imbalance	9. Correct Noisy Ground Reference & Frequency
4. Correct Phase Loss from High Impedance Grounds	10. Prevent Arcing Ground Faults and Alarm
5. Maintain Phase Angle Differential 120°	11. Increases Operational Efficiency- Reduce kW and Ground Current
6. Correct Phase Voltage Instability	12. ***AFP*T** = REMOVE Current & Voltage Harmonics plus the other 11 items above. Note 12.

12. ***AFP*T** (Arc Flash Preventing Transformer) provides the perfect Electrical System for today's loads, with Phaseback VSGR, will save more energy & eliminate the need for other Harmonic mitigating devices that use energy.

13. For Grounded WYE systems, Phaseback VSGR will provide all but 7 in the above table. Applied Energy also offers The Silencer for Grounded WYE systems to eliminate Harmonics.

Current correction is an inadequate solution, as it is a symptomatic approach to the problem. It is inefficient, offers few benefits, and is not an acceptable solution for the present industrial landscape. Its limitations are likely to become more obvious in the future.

There is only one device that provides effective Voltage Correction, Harmonic Mitigation, and all of the benefits above - Applied Energy LLC patented ***Phaseback VSGR*** in 2002, is all that is needed to resolve most if not all Power Quality issues on the electrical system! Let us help you with your Power Quality issues.

See yellow highlighted IEEE 142 Grounding table below for Voltage Stabilized Ground Reference.
Voltage Stabilizing Ground Reference (VSGR)

	Grounded				***Ungrounded***	
System Characteristics	Solid	Low Resistance	High Resistance	Reactance	Ungrounded	W/Voltage Stabilization
Continuity of Service on Ground Fault	No	No	Yes	No	Yes	Yes
Capability to Propagate Multiphase Fault	High	Medium	Low	High	Low	Lowest
Equipment Damage Potential	High	Low	Very Low	High	Very Low	Lowest
Ground Fault Current	High			High	Low	Lowest
Transient Over-Voltage Level	2.5X	2.5X	2.5X	2.5X	≥6X	1X
Cable Insulation Level	1.0X	1	1.73	1	1.73	1
Arc Flash Risk Level	High	Medium	Very Low	High	Very Low	Lowest

Table-1: Methods and Characteristics of Different Grounding Systems (Grounding options as applicable for specific installation requirements)

For more information, visit us at www.phaseback.com, and take a look at our ***Critical Power* Presentation**, where these topics, and many others, are described in detail. Applied Energy Critical Power Presentation (YouTube): **1.** 06:51min - Voltage Distortion: Without and With Correction, **2.** 21:04min - Voltage Waveform Correction: The Root Cause Solution, **3.** 22:30min - Correcting the Voltage Waveform: A Cause Solution, **4.** 30:19min- Phase Voltage Imbalances