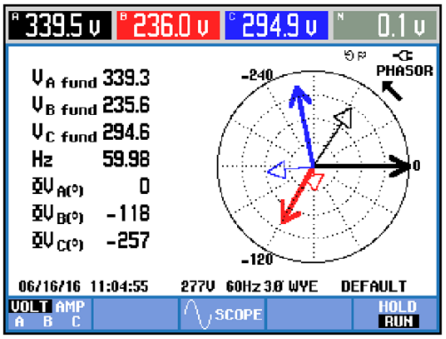
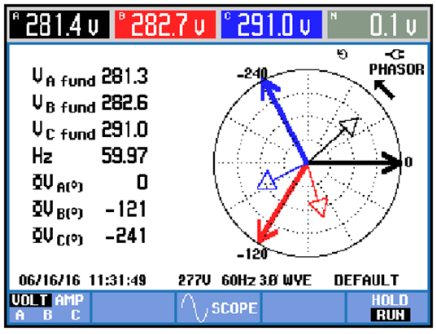


Power Quality

Worst Case Scenario

Before and After

issues causing excessive downtime & the fix



Summary of a Crop Processing Facility's Problems, diagnosis, and results, from June 2016.

Power problems that the Utility said may be related to being at the end of the distribution line, more likely was an old system with new electronic loads that brought the problems to light. Regardless, ***Phaseback VSGR*** solved the problems without a protracted study, without changing out the existing system components, and with little inconvenience.

Before It was reported that drive faults were occurring as a result of voltage imbalance issues. Variable frequency drives (VFDs) will fault if voltages become unbalanced beyond 10%, or if the phase voltage differential distortion exceeds 6°. Another common cause of VFD faults is overvoltage.

In the data we gathered, we saw a voltage imbalance exceeding 21%, a phase differential distortion of 17°, and a line voltage as high as 503 volts. These statistics create a situation where unreliable operation, lockups, and failures are likely to occur. Additionally, we studied the magnitude of harmonics in the facility. We found that the harmonic distortion was below the nominal threshold of 5% Voltage THD. This value may change depending on the amount of equipment operating, but is presently not the source of the power issues described above.

A ***Phaseback*** Voltage Stabilizing Ground Reference ***(VSGR)*** was temporarily installed at a welding outlet in the store room, then later in the machine shop, in order to test the VSGR's effectiveness in solving the power quality issues mentioned above. Voltage imbalance was reduced by a factor of 15 (from 21.3% to 1.4%), and phase voltage differential distortion was reduced by a factor of 16 (Phase C from 257° to 241°). This simple solution will eliminate drive failures, and prevent them from returning, in this extreme case.

With line voltage 5% above nominal, it is recommended to change the drive settings to a higher input voltage. Changing the incoming taps at the Utility transformer may create issues on UPS and other devices, but something to consider.

Adding a Phaseback VSGR to the 480V side of each power transformer will provide the benefits shown below to all equipment in the facility.

- Arcing ground faults
- Voltage spikes from internal or external sources
- Phase voltage imbalance
- Phase loss due to high impedance grounds
- Phase angle differential distortion
- Phase voltage instability
- Phase voltage harmonics
- Waveform distortion
- Noisy ground reference and frequency instability
- Operational efficiency increases
- Insulation monitor
- Ground detection
- Local ground indication
- Remote ground alarm/shunt trip signal
- Lifetime warranty

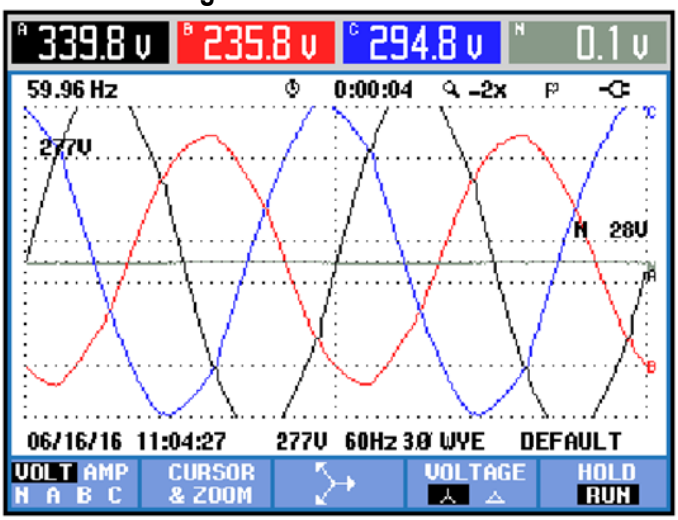
After The facility has (5) 480 volt, 2,500 kVA 3-phase 3-wire delta power transformers. We asked them for their worst problem so we could show how well the power system will function with the addition of a ***Phaseback VSGR***. After the results were shared with the operations and maintenance manager they ordered and installed (5) ***Phaseback VSGR*** units. A follow-up visit 6 months after the installation the electrical people explained that this has been the best the power system has ever operated. The year before they had 35 drives fail which shut the facility down. After the ***Phaseback VSGR*** installation, they did not have any downtime for drive faults or equipment failure. More charts and data on the following pages.

William Hinton Director of Engineering Applied Energy LLC www.phaseback.com

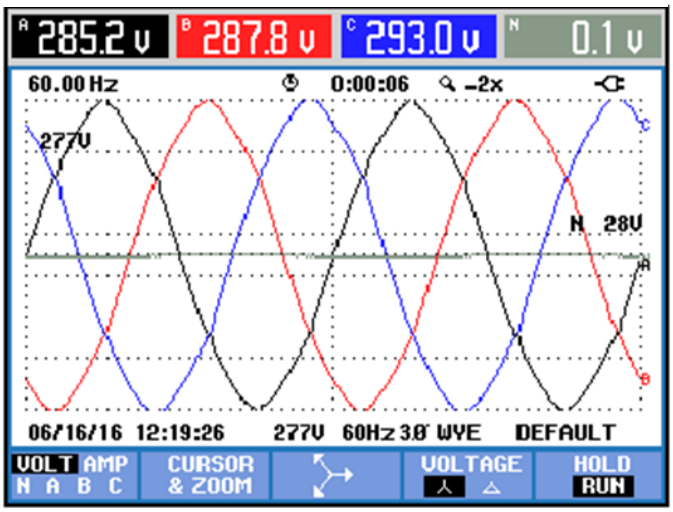
Let us help you with your Power issues and Transformers. Begin saving money and saving lives now.

Contact Cy Cates 832 647 4606 cell www.cycates.com cycates@cycates.com

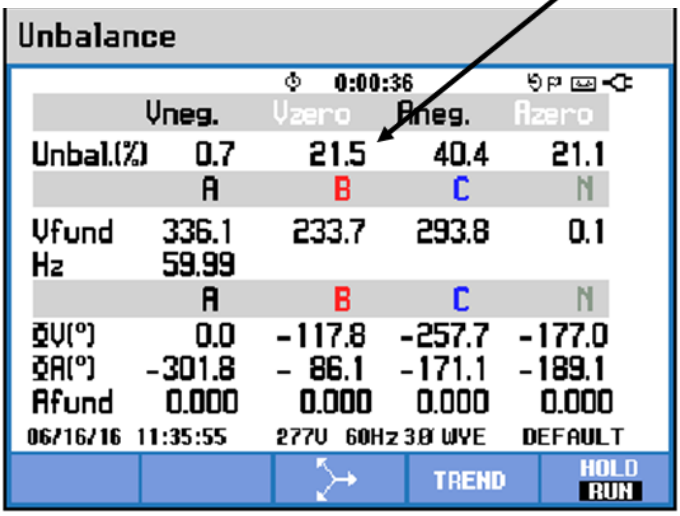
Phase Voltage Imbalance Phaseback OFF



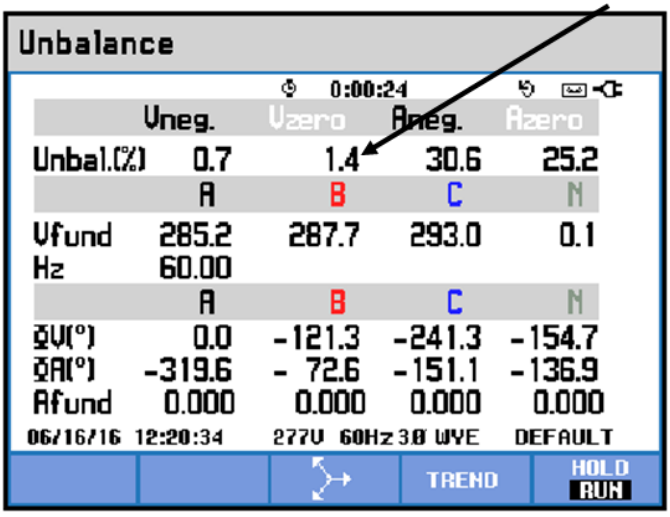
Phase Voltage Imbalance Phaseback ON



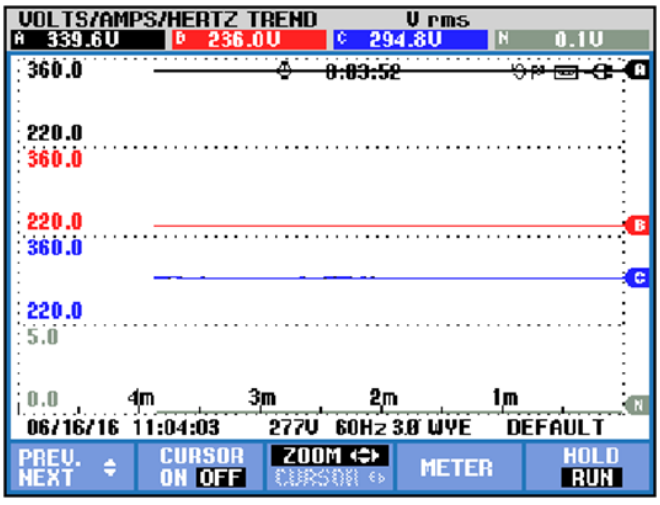
Phase Voltage Unbalanced by 21.5% (Phaseback OFF)



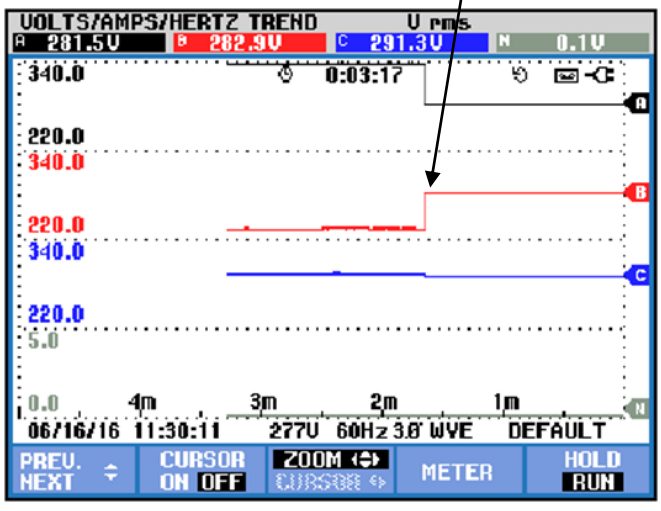
Voltages Balanced Within 1.4% (Phaseback ON)



Phase Voltage Imbalance Phaseback OFF



Phase Voltages Balanced Phaseback ON



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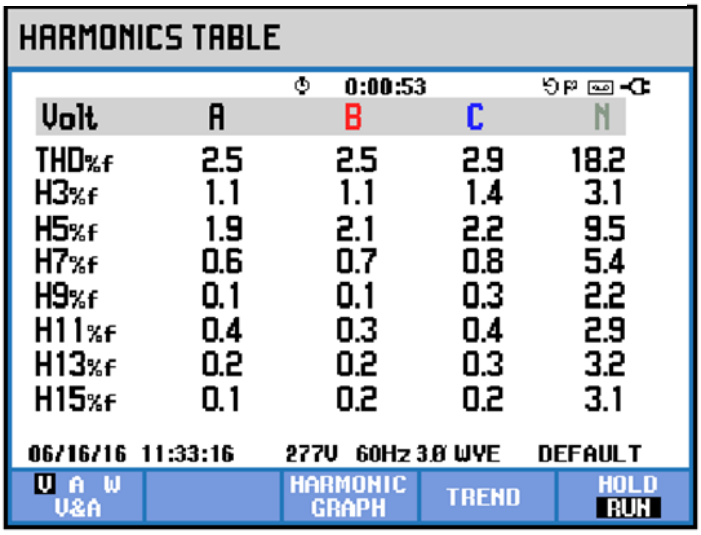
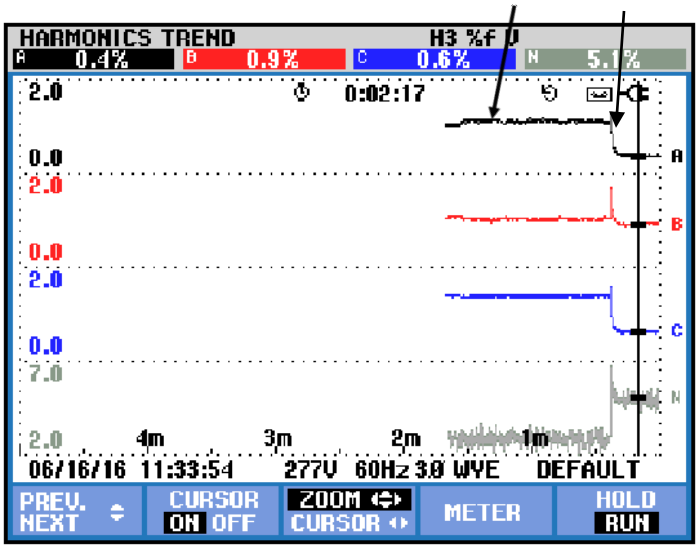
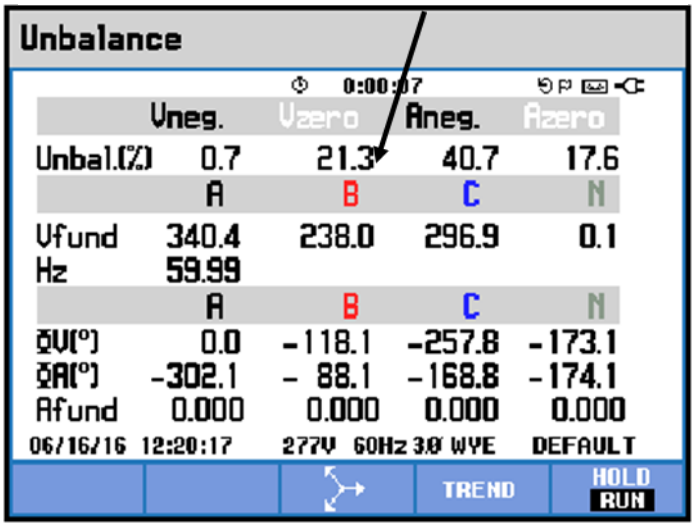
Harmonic Distortion Phaseback OFF
(*No substantial harmonics*)



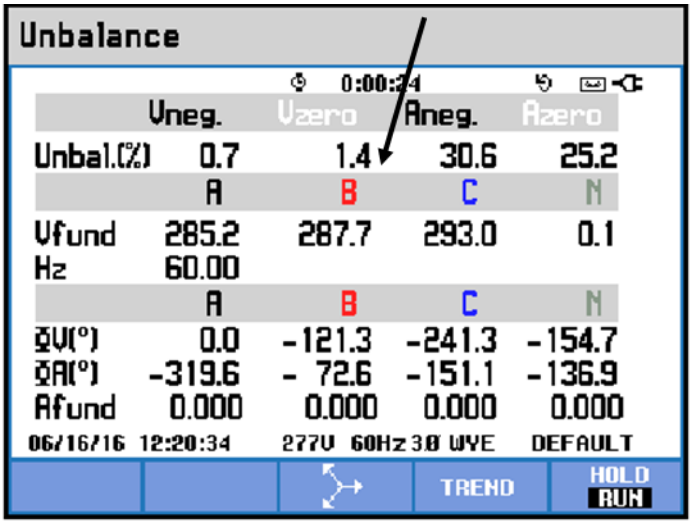
Harmonic Distortion Phaseback OFF and ON



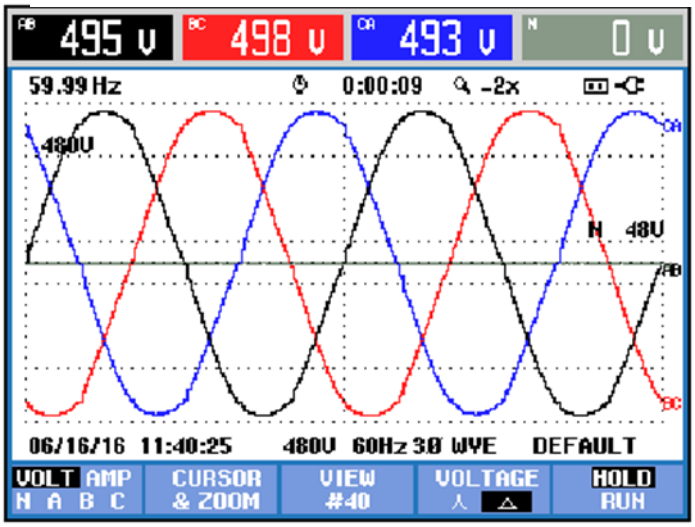
Voltage Imbalance of 21.3% (Phaseback OFF)



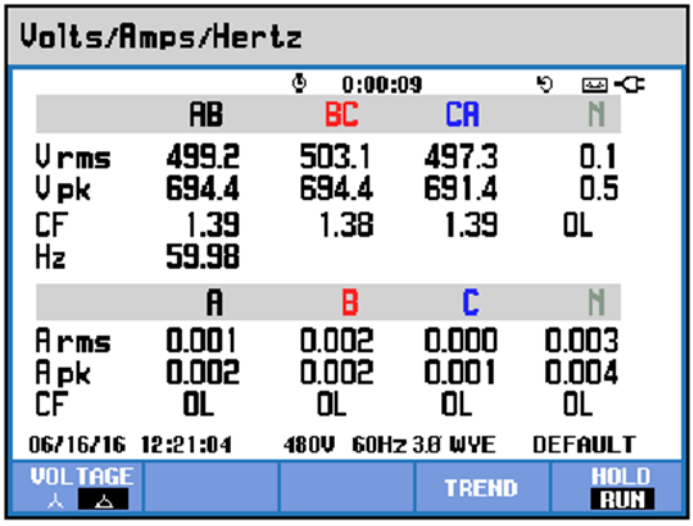
Voltages Balanced Within 1.4% (Phaseback ON)



Line Voltage Balanced Phaseback ON



Line Voltage Balanced Phaseback ON



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