# Power Quality Solutions Matrix

## Power FactorCorrection

**Causes**
- Increase of nonlinear loads like AC motors, solenoid valves, lighting ballast, arc welders, furnaces, rectifiers, variable frequency drives, power supplies, computer equipment or TVs

**Effects**
- Improve service or load power factor
- Reduce line losses
- Eliminate utility penalties and surcharges

**Solutions:**
- Power Factor Correction Capacitor
- Power Survey
- Myron Zucker

## Electrical Noise

Electrical noise is a low amplitude, low current, high-frequency disturbance.

**Causes**
- High frequency generator
- Static electricity
- Electromechanical interface
- Poor grounding or bonding
- Poor wiring practices
- Lightning strikes
- Poor brush contacts

**Effects**
- Computer or process control glitches
- Downtime

**Solutions:**
- Active Tracking® Filters
- EMI/RFI Filters
- Isolation Transformers

**Manufacturers:**
- Acme
- MTE
- Sola HD
- TCI

## Harmonic Distortion

This disturbance is a sine wave distortion of the voltage and current waveforms. Usually generated from internal nonlinear devices like power supplies, variable frequency drives (VFDs) and solid state electronics.

**Causes**
- Computers
- Office equipment
- Electronic ballast
- Variable Frequency Drives (VFDs)
- Electric furnaces and welders
- Any device with a power supply

**Effects**
- Electrical terminations
- Overheating neutral conductors
- High neutral currents
- Overheating transformers
- Inadvertent tripping of breakers

**Solutions:**
- Harmonic Filters
- Harmonic Mitigation Transformers

**Manufacturers:**
- Acme
- Myron Zucker
- Power Survey
- TCI

## Frequency Variations

While rare in utility power, frequency variations are most common with back-up power systems such as standby generators.

**Causes**
- Usually internally generated by onsite generation equipment
- Out of frequency sequence
- Disconnection of large loads and source generation
- Computers
- Office equipment

**Effects**
- Equipment failure, crashes or lockups
- Loss of data

**Solutions:**
- Power Conditioners
- UPS

**Manufacturers:**
- APC by Schneider Electric
- Sola HD

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**Experience the Difference!**
Power Quality Solutions

At Schaedler Yesco we recognized the importance of using our technical expertise and resources to develop awareness around power quality and disturbances. This subject is continuing to change with technology advancements in the smart utility grid and the further use of electronic equipment or smart devices in power distribution systems. Some of the key factors of implementing a good platform and sound power quality plan include:

- Understanding of the symptoms
- Field measurements and surveys to pin point the problem
- Corrective action plan with the right solution
- End goal in mind; develop and maintain a “Pure Sine Wave”

Power Quality Solutions

Power quality, simply stated, determines the health and stability of electrical distribution systems in residential, commercial and industrial facilities. These electrical variables are found both inside and outside the facility and comprise of anything that affects the pure sine waveforms—variation in voltage, current and frequency. Even though utilities cause many power quality problems, such as voltage sags, recent studies by research organizations, like the Electric Power Research Institute (EPRI), have found that utility users cause 70 to 90 percent of their own power quality problems. Users are faced with numerous challenges to prevent these various electrical or power disturbances.

- Voltage Sags
- Voltage Swells
- Power Loss and Interruption
- Surge or Transients
- Poor Power Factor
- Electrical Noise
- Harmonics
- Frequency Variations

From an economic and operational standpoint, we realize end users are faced with multiple challenges in trying to mitigate these unwanted power disturbances. For these main reasons, the Schaedler Yesco team is in position to show the value of various power quality solutions.

Overview of Power Quality Issues (Utility and End User Side)

Impact of Power Disturbances

Poor power quality can negatively impact both the performance and the life expectancy of power distribution systems and electrical equipment. One of the challenges is trying to identify the cost impact of these disturbances and ensuring you have consistent and stable power for your operation. Part of the power assessment or return on investment is to evaluate the economics of the various power quality solutions.

Some of these impact areas and potential cost saving measures include:

- Loss of Power – Critical Loads
- Equipment Deterioration and Failures
- Equipment and Production Downtime – Cost Implications

Power Quality Solutions Matrix

<table>
<thead>
<tr>
<th>Voltage Sags</th>
<th>Causes</th>
<th>Effects</th>
<th>Solutions / Manufacturers</th>
</tr>
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<tbody>
<tr>
<td>Voltage Sags</td>
<td>Loads with large inrush currents</td>
<td>Equipment overheating</td>
<td>Solutions: Ferroresonant transformers</td>
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<tr>
<td>Voltage Swells</td>
<td>Large load shut downs</td>
<td>Nuisance overvoltage limit trips</td>
<td>Power Conditioners</td>
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<tr>
<td>Power Loss and Interruption</td>
<td>Arc furnaces and welders</td>
<td>Surge or Transients Waveform</td>
<td>Surge Controllers</td>
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<tr>
<td>Electrical Noise</td>
<td>Utility switching equipment</td>
<td>Surge or Transients Waveform</td>
<td>UPS</td>
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<tr>
<td>Harmonics</td>
<td>Reduce equipment efficiency and reliability</td>
<td>Surge or Transients Waveform</td>
<td>Voltage Regulators</td>
</tr>
<tr>
<td>Frequency Variations</td>
<td>Surge or Transients</td>
<td>Power Loss Waveform</td>
<td>Manufacturers: Acme</td>
</tr>
</tbody>
</table>

Power Quality Measurement

One of the first steps in solving any power quality issue or disturbance is to determine the cause of the problem. Other than a visual inspection, making the proper power measurements is the key in coming up with the next action steps and possible solution. Schaedler Yesco has a wide range of power loggers, portable and fixed power quality meters.

- Power Loggers / Portable Meters: Amprobe, Dent Instruments, Fluke and Rockwell Automation
- Fixed Meters: Eaton, E-Mon D-Mon, Leviton, National Meter and Siemens

Electronic Disturbance

- Voltage Sags
- Voltage Swells
- Power Loss and Interruption
- Surge or Transients
- Poor Power Factor
- Electrical Noise
- Harmonics
- Frequency Variations

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