



# A CRASH COURSE IN POWER QUALITY ISSUES AND MONITORING



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# WHAT IS "POWER QUALITY"?

Power Quality refers to how well the Voltage,
 Frequency & Waveform match the established specifications.

• It can refer to compatibility load to the source.

• It can also used to describe how the utility customer feels their needs are being met



#### WHY IS IT IMPORTANT?

# **Poor Power Quality is expensive!**

- Damaged Equipment
- Unplanned Downtime
- Out of spec product
- Danger to personnel (elevator, fires etc.)
- Environmental Hazards



# WHERE DOES POOR PQ COME FROM?

- Utility Transformer
   You can start here
- Wiring inside the customer's house or building
   We have all see wiring that is more reminiscent of a bird's nest that professional, modern wiring.
- Devices/Equipment inside the building

Variable speed drives, computers, high-tech loads, and other internal loads cause disturbances & harmonics



# **KEY AREAS OF FOCUS**

- Sags
- Swells
- Harmonics
- Flicker
- Transients
- Grounding

#### **VOLTAGE SWELLS**



• a.k.a. Surges

 A temporary increase in voltage which lasts several cycles(1/2 cycle to 1 minute duration)

Caused by sudden changes in load or when a fault is cleared





A temporary reduction in voltage.

 Caused by an abrupt increase in load or a failure of utility equipment

#### **HARMONICS**



 Harmonics are defined as Sinusoidal Voltages or Currents having frequencies that are integer multiples of the frequency (fundamental frequency = 60 Hz for NA) at which the supply system is designed to operate

Results in a distorted Waveform

 Caused by VFD's, Switching Power Supplies & Damaged Equipment



#### HARMONICS PART DEUX

#### **Negative Sequence Harmonics**

- 5th, 11th, 17th, etc. are important to industrial environments
- They are caused by electronically controlled motors.
- Negative sequence harmonics counteract electrical power systems. (They make motors run backwards).
- These cause motor overheating and failure.



#### Zero Sequence & Triplen Harmonics

- Caused by computers and electronic equipment
- 3rd, 9th, 15th, etc. (div. by 3) are important to commercial environments.
- Triplen Harmonics cause a disruption in the balance of a 3-phase system and cause unusually high neutral current and
- causes overheating



# **HARMONICS PART QUATRO**

#### Harmonic THD or Total Harmonic Distortion

- Caused by computers and electronic equipment
- IEEE provides guidelines for acceptable harmonic current and voltage distortion levels.
- IEEE Standard 519-1992 states that THD for critical motors should be less than 5% Voltage THD & 20% Current THD
- Triplen Harmonics cause a disruption in the balance of a 3-phase system and cause unusually high neutral current and
- causes overheating



- A momentary or sustained fluctuation of Voltage that causes lighting to "Flicker"
- Short Term Flicker(PST) is measured over 10 minutes
- Long Term Flicker(PLT) is measured over 2 hours
- Can cause vision trouble, headaches, annoyance & distraction
- Mitigation focuses on reducing the amplitude of the voltage fluctuations

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 Sudden brief fluctuations of voltage or current lasting only milliseconds

Caused by lightning, switching operations or faults

Typically corrected by surge suppressors

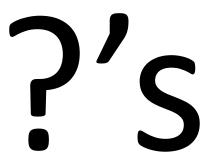


### **GROUNDING & BONDING**

- Grounding is not a problem
- Bonding is not a problem
- Lack of Grounding and/or Bonding is a Huge Problem!!
- Without proper Grounding & Bonding Measurement Results will be suspect & mitigation devices will not function properly
- Without proper Grounding & Bonding Safety will also be compromised as protection devices will not function properly







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#### Contact me anytime:

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