Power Quality Measurement Equipment I

Solving any diagnostic problem requires the right tools and the ability to use them. Like doctors trying to solve a health problem, power quality engineers and technicians need meters and other measurement tools to solve electrical facility health problems. The first step in solving a power quality problem is to determine the cause of the problem. Making either visual inspections or electrical measurements of the electrical distribution system can do this. –Power Quality Surveys,‖ shows how to make visual inspections of a facility's electrical distribution system. –Power Quality Measurement Tools,‖ explains how to perform and analyze power quality measurements using power quality measurement tools.

There are a myriad of power quality measurement tools available today. They include instruments that measure and display the basic electrical parameters of voltage, current, frequency, and impedance of an electrical distribution system. These tools include ammeters, voltmeters, multimeters, oscilloscopes, flicker meters, electrostatic voltmeters, infrared detectors, radio-frequency interference and electromagnetic interference meters, harmonic and spectrum analyzers, power quality monitors, and various types of wiring and grounding testers. These instruments measure, display, and store electrical parameters for the purpose of helping solve power quality problems. In addition to these electrical measurement tools, there are devices, such as video cameras and audiotape recorders, for recording the effects of power quality problems. With all these choices, power quality experts as well as novices must know how to choose and use the right instrument.

It is clear that power quality phenomena cover a wide range of frequencies. They include everything from very fast transient overvoltages (microsecond time frame) to long-duration outages (hours or days time frame). Power quality problems also include steady-state phenomena, such as harmonic distortion, and intermittent phenomena, such as voltage flicker.

There are other instruments that can be used to help solve power quality problems by measuring ambient conditions:

- Infrared meters can be very valuable in detecting loose connections and overheating conductors. An annual procedure of checking the system in this manner can help prevent power quality problems due to arcing, bad connections, and overloaded conductors.
- Noise problems related to electromagnetic radiation may require measurement of field strengths in the vicinity of affected equipment. Magnetic gauss meters are used to measure magnetic field strengths for inductive coupling concerns. Electric field meters can measure the strength of electric fields for electrostatic coupling concerns.
- Static electricity meters are special-purpose devices used to measure static electricity in the vicinity of sensitive equipment. Electrostatic discharge (ESD) can be an important cause of power quality problems in some types of electronic equipment.

5.3.1 Selection of Instruments

There are a number of important factors that should be considered when selecting the instrument. Some of the more important factors include

- Number of channels (voltage and/or current)
- Temperature specifications of the instrument
- Ruggedness of the instrument
- Input voltage range (e.g., 0 to 600 V)
- Power requirements
- Ability to measure three-phase voltages
- Input isolation (isolation between input channels and from each input to ground)
- Ability to measure currents
- Housing of the instrument (portable, rack-mount, etc.)
- Ease of use (user interface, graphics capability, etc.)
- Documentation
- Communication capability (modem, network interface)
- Analysis software

Figure 5.1 Measurement tools

5.3.2 Wiring and grounding testers

Many power quality problems reported by end users are caused by problems with wiring and/or grounding within the facility. These problems can be identified by visual inspection of wiring, connections, and panel boxes and also with special test devices for detecting wiring and grounding problems.

Important capabilities for a wiring and grounding test device include

- Detection of isolated ground shorts and neutral-ground bonds
- Ground impedance and neutral impedance measurement or indication
- Detection of open grounds, open neutrals, or open hot wires
- Detection of hot/neutral reversals or neutral/ground reversals

Three-phase wiring testers should also test for phase rotation and phase-to-phase voltages. These test devices can be quite simple and provide an excellent initial test for circuit integrity. Many problems can be detected without the requirement for detailed monitoring using expensive instrumentation.

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