DRANETZ™
THE STANDARD FOR ENERGY & POWER MEASUREMENT

TECH TIP

PQ Monitoring Standards – What You Need To Know

Description

There's an age-old problem in the Power Quality (PQ) monitoring industry – measure the same circuit with instruments from different manufactures at the same time, and you could get different results! Which one do you believe? Do you trust any of them?

There have been electrical energy monitoring standards for many years that define the methods, accuracies and other aspects to accurately measuring energy, especially when billing is involved. However, standards that define PQ monitoring methods have been slower to follow and have been inconsistent from region to region.

PQ monitoring standards have evolved significantly since they first arrived in the 1990's. There have been some very important changes recently that could affect how you monitor for PQ, and the instrumentation that you should use. This TechTip will update you on the current PQ standards, which ones may apply to you, and also help you determine the appropriate monitoring tools needed going forward.

PQ Standards Bodies

There are two major organizations that have published the PQ monitoring standards that we tend to follow:

- *Institute of Electrical & Electronic Engineers (IEEE). US based*
- *International Electrotechnical Commission (IEC). European based*

There are others who have published related standards, but they are usually for national or regional use and tend to follow the major methods from the IEC or IEEE, and sometimes both.

PQ Compliance vs. Monitoring Standards

Industry standards cover many topics. For PQ, there can be both compliance and monitoring standards. Sometimes both topics are covered in the same document. Below is a summary of each as they pertain to this TechTip:

- PQ compliance: Are the measured parameters within the limits defined by the standard for the application.
- PQ monitoring: The measurement methods and accuracies to properly measure PQ parameters. Note that accuracy alone is not enough and the methods (i.e. algorithms) used to measure/compute the required parameters are just as important.

There is an important distinction between compliance and monitoring standards. Simply stated, monitoring standards describe how to properly measure the parameters in order to determine if they are within the pass/fail limits defined in the compliance standards.

Again, sometimes measurement and compliance are covered in the same document, such as in IEEE 519-2014 (below). In other cases they are separate, such as IEC 61000-4-30 (below) defining the measurements and other IEC/EN standards defining compliance limits.

Which PQ Standards Apply To Me?

Generally speaking, geography usually determines the standards that you should follow.

- **IEEE:** The IEEE recommended practices for PQ are primarily followed in North America, but are also referenced in other parts of the world.
- **IEC:** The IEC standards for PQ are followed in Europe, parts of Asia, and other regions of the world.

If you're monitoring in Europe, then the IEC standards, specifically IEC 61000-4-30 should be followed. See below for details

However, for other parts of the world, including the USA, it may not be as simple as geography. A main reason is that the IEC standards have advanced more quickly than the equivalent IEEE recommended practices. As a result, the IEC is ahead of the IEEE in many areas, and the IEEE has used some of the IEC's measurement methods in some of its more recent revisions.

Further complicating matters are national and regional standards that adopt all, or part of these standards, and make their own requirements. These are mostly in regions outside of the USA.

IEEE Recommended Practices

The IEEE has several recommended practices that apply to PQ monitoring:

- IEEE 1159 - Recommended Practice for Monitoring Electric Power Quality: Describes nominal conditions, deviations in power, categorises PQ events and defines PQ data formats, but does not define the measurement methods for PQ.
- IEEE 519 - Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. The most recent revision was in 2014 which adopted IEC 61000-4-7

measurement methods, but added compliance parameters and limits.
- IEEE 1459 - Recommended Practice for the Analysis of Fluctuating Installations on Power Systems: Defines the measurement and limits for voltage flicker. Adopted IEC 61000-4-15 methods.

The recommended practices listed above are all important, and are very relevant, and the IEEE adopted the IEC's methods for harmonics and voltage flicker measurements. So what's the concern? There is no top down reference from the IEEE for the measurement of other common PQ issues, such as sags (dips), swells, and others. The IEEE is working on this, but an IEC standard called IEC 61000-4-30 addresses these concerns, and has become the worldwide reference for PQ monitoring methods. IEC 61000-4-30 is quite applicable in the USA and other regions that typically follow the IEEE's recommended practices.

IEC 61000-4-30 and Its Importance

In 2003, the IEC release the first edition of an important standard called IEC 61000-4-30. This was an all-encompassing standard that defined measurement methods for most of the important PQ parameters, including sags/dips, inerruptions, harmonics, flicker, frequency, etc. IEC 61000-4-30 defined several classes of monitoring devices, with Class A meeting the most stringent requirements. The intent of this standard was to define the methods for instruments to measure PQ parameters, accuracies, etc. The objective being to achieve consistent and repeatable measurements from all compliant manufacturers, addressing the age old problem referred to above…

Since its introduction, there have been two subsequent revisions to IEC 61000-4-30, with the most recent being Edition 3 that was released in 2014. Edition 3 added the measurement of current and Rapid Voltage Changes (RVC). With the release of Edition 3, a parallel compliance testing standard called IEC 62586 was also introduced that defines the test procedures and requirements to certify compliance to IEC 61000-4-30 (see below).

In Europe and other regions, IEC 61000-4-30 Class A instruments are required for many types of PQ monitoring applications. Examples are in compliance monitoring applications and those where you are questioning the reliability of the utility or energy supplier. In such cases you must prove that the instrument is reliably measuring the parameters being questions.

IEC 62586 – IEC 61000-4-30 Compliance Testing

IEC 62856 defines the testing methods and procedures to certify compliance of an instrument to IEC 61000-4-30 Edition 3. Prior to IEC 62586 there were no defined techniques to test to IEC 61000-4-30, and laboratories and instrument manufacturers created their own guidelines and certification processes. This resulted in inconstancies and the actual compliance of some products being questioned. IEC 62586 addresses this concern, and puts everyone on equal footing by defining the requirements in advance for consistent testing and certification.

Below is a portion of the IEC 61000-4-30 Class A Edition 3 compliance test certificate for our Dranetz HDPQ Plus family showing the required tests that were performed. Click here for the full compliance certificate.

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IEC 61000-4-30 Edition 3 (2015)

Power Quality Class A Functions Tested:
The equipment under test conforms to the requirements for a Class A instrument.

IEC 62586-2 Clause	Test Description
6.1	Power Frequency – 50 Hz
6.2	Magnitude of supply voltage
6.3	Flicker - Class F3, 120V & 230V, 50 Hz
6.4	Supply Voltage Interruptions – dips & swells, 50 Hz
6.5	Supply Voltage Unbalance
6.6	Voltage Harmonics
6.7	Voltage Interharmonics
6.8	Mains Signaling Voltages on the supply voltage - Method 1
6.10	Flagging
6.11	Clock Uncertainty Testing
6.12	Variations of External Influence Quantities
6.13	Rapid Voltage Changes (RVC)
6.14	Magnitude of Current
6.15	Harmonic Current
6.16	Interharmonic Current
6.17	Current Unbalance

How To Choose the Right PQ Monitoring Instrument

IEC 61000-4-30 has become the worldwide benchmark for PQ monitoring methods. It is appropriate for use in most parts of the world, and it can also be used in conjunction with local standards. Case in point is the USA where IEC 61000-4-30 fills in the areas missing in IEEE recommended practices.

By choosing an IEC 61000-4-30 Class A Edition 3 compliant instrument, you can be assured that it has reliable and repeatable measurements, and comes from a reputable manufacturer.

Being a global leader in power quality monitoring instrumentation, Dranetz was the first manufacturer to conform to the requirements of IEC 61000-4-30 Class A. Most of our current PQ monitoring instruments, including our HDPQ Plus family, are fully compliant with the requirements of IEC 61000-4-30 Class A Edition 3, and compliance has been verified to IEC 62586. The HDPQ Plus family is also fully compliant with the latest IEEE standards, including IEEE 519-2014 for harmonics measurements.