Interpretation of power quality measurements made easy

Vision Power Quality transforms voltage quality measurement data into useful information. This is achieved by means of smart processing, aggregation and visualisation. The application uses a classification system to report the PQ levels in a uniform way and makes comparison easy.

Power quality
Our modern society is more and more sensitive to power quality problems. Therefore, a kind of PQ regulation is needed. Such regulation asks for reliable and transparent tools for monitoring and reporting the PQ levels. Besides using these levels for regulatory issues, they can be used for coordination between the manufacturers of electrical equipment, the customers and the transmission and distribution companies.

Development
At the beginning of the development of the application, it has been recognized that the user interfaces and the related visualization techniques are equally important as the underlying data acquisition and processing algorithms. Therefore, from scratch much effort has been put to the development of the interface. This has been achieved by good communication between end-users, utility engineers and the developers of the application.

PQ overview: harmonics from several LV locations during 10 years
Classification
The Vision Power Quality application is based on the classification methodology introduced by Dr. J.F.G. Cobben.

This classification technique is analogous to the one already in use to classify the energy efficiency of household appliances such as washing machines. This ABC classification uses letters combined with colours to label the various levels of quality. The same format is adapted for voltage quality, where A stands for a very good quality (green) and F stands for a very poor quality (red). The voltage quality is divided into six aspects:

- voltage variations;
- voltage dips;
- frequency variations;
- flicker Plt;
- THD;
- unbalance.

The classification method for this voltage quality is based on the Standard deviation, Average Value (STAV) method. This means that for a week of measurements the average ($m$) and standard deviation ($\sigma$) are calculated for every aspect. So each aspect is represented by a single point on the $(m, \sigma)$ plane. Dips are handled in an alternative way. The different classes are set as lines in the $(m, \sigma)$ plane which represents a fixed probability of (not) exceeding a certain $m$.

The limits sets by the Dutch national regulator (mainly based on the European standard EN50160) are incorporated in the classification. These limits are set as the boundary between the classes C and D.

User interface
The Vision Power Quality application presents the information in different overviews to its users. In the main screen the PQ levels of each aspect for the measurements locations are shown in separate bars. In the left part of the main screen, the names of the measurements are shown in a tree. This tree allows for grouping different voltage levels, years, weeks or locations. For instance, MV and LV measurements. User can navigate into the tree: accordingly to the selected node the aggregation and visualisation is performed over all underlying nodes.
Example
In the figure on the left it is seen that the quality level is mostly of class A and B, which is good, except for flicker (4th bar from the left) in a certain location and period where only class F is met.

The user can now decide to get more detail, and look only to the classification of the aspect of flicker. In the figure below, the graph of the classification results are shown for the aspect of flicker. It is shown that the PQ level of phase L3 in some locations in week 15 is located near the F class outside boundary. If the user still wants more detail the

Configuration settings of classification

Classification results of the PQ flicker aspect

10-minute average measurements of the selected week for a single measurement location can be plotted into a chart (see the graph above).

From this chart it is clearly seen that for the L3 phase the limit set by the Dutch national regulator of 1% Plt is exceeded for the first half of the week.

J.F.G. Cobben, 2007
Power Quality, Implications at the Point of Connection
ISBN: 978-90-386-1030-6
Alessandro Giuseppe Antonio Anastasio Volta (1745-1827)

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Overview

- Read PQ measurements directly from a SASensor™ webserver.
- Import PQ data from Microsoft Excel files.
- Easy to interpret classification of PQ data over 6 aspects: voltage variations, dips, frequency, flicker, THD and unbalance.
- User configurable limits for classification scheme.

- PQ presentation: according to voltage level, year, week or location.
- Detailed chart per classificated PQ aspect.
- Charts of yearly trends for each PQ aspect class.
- Weekly chart of 10 min. measurement data per location and per PQ aspect.
- User configurable colors of classes and charts.

- Configuration of measurement locations and automatic loading of data.
- Zooming and panning of charts.
- Export PQ data to ASCII or Microsoft Excel files.

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Phase to Phase

Phase to Phase focuses on software development for transmission and distribution network analysis. The vision is to introduce and enhance the network analysis for a broad range of engineers by means of innovative products.

The fulfilment of this vision is supported by the growing sense of cost in planning, development and management of the electrical infrastructure. The products are used by electricity companies, industry and consultants for network development and analysis.

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Weekly measurements of fifth harmonic on specific location

Harmonic spectrum over a week on specific location

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