CHAUVIN ARNOUX

IEC 61000-4-30 STANDARD

Homogenizing measurement

Electrical appliances are designed to function optimally with a constant voltage level as close as possible to the rated value.

Furthermore, industrial equipment operating with a three-phase power supply requires equal (balanced) three-phase voltage levels. A poor-quality power supply leads to inefficient dangerous operation of the electrical systems powered and may cause damage to the equipment connected, while increasing the risks of fire or electrocution, production losses and direct financial cost overruns.

This means it is increasingly important to monitor electricity quality for modern electrical systems, making it a key element of tomorrow's smart networks. The standards impose specific requirements in terms of power quality. Power quality is a broad term which traditionally covers the voltage from an electrical power supply system, as well as the frequency and the waveform, including their compliance with the specifications defined.

But the measurements performed for these diagnostics must also be perfectly comparable, whatever the equipment manufacturer and whatever the country involved.

The International Electrotechnical Commission (IEC) has drawn up the IEC 61000-4-30 international standard. This standard defines the methods for measuring the quality of the current supplied to electrical power networks at a specified fundamental frequency and describes how to interpret the results. Measurement methods are described for each applicable parameter in terms which reliable, repetitive results however the method is implemented.

The power quality parameters taken into account in this standard are the industrial frequency, the amplitude of the supply voltage, the "flicker", temporary voltage dips and swells, voltage outages, transient voltages, supply voltage unbalance, voltage harmonics and interharmonics, signals transmitted on the power supply voltage, fast voltage variations and current measurements.

Some other parameters are only defined in the Appendix to the standard.

Electricity

Quality

Comparability

QUALISTAR Class A

Measure up

IEC 61000-4-30 defines 3 performance classes, as follows:

- **Class A** - must comply with the highest performance and accuracy levels to obtain reproducible, comparable results.
- **Class S** - the accuracy levels are less strict. Class S power quality analysers can be used for statistical surveys and contractual applications for which comparable measurements are not required.
- **Class B** - this class was introduced in the 1st and 2nd editions of the standard to avoid making instruments obsolete. In this class, the standard required the measurement method and the accuracy to be specified by the manufacturer in the instrument's technical data sheet. In edition 3 of the standard, this performance class has been moved to an appendix.

Users should choose an instrument in the class they require, based on their application(s) and according to the issues encountered.

Power quality parameters defined in the standard

- Network frequency
- Amplitude of the supply voltage
- Amplitude of the current
- The Flicker (as per IEC 61000-4-15)
- Dips and swells
- Voltage interruptions
- Voltage unbalance
- Current unbalance
- Voltage harmonics (as per IEC 61000-4-7)
- Current harmonics (as per IEC 61000-4-7)
- Voltage interharmonics (as per IEC 61000-4-7)
- Current interharmonics (as per IEC 61000-4-7)
- Mains signals
- Rapid voltage changes (RVC)
- Current and voltage recording during events

The RMS values are measured and calculated using several methods and durations.

RMS values refreshed every half-period

This involves voltage (or current) values measured over one period, beginning with a zero crossing of the fundamental component and refreshed every half-period.

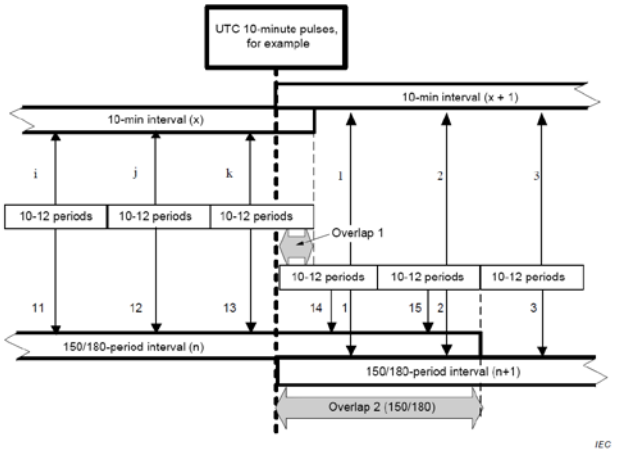
This technique is independent on each measurement channel and will produce RMS values at successive instants on each channel in the event of polyphase networks.

This value is only used for detecting and assessing voltage dips, temporary overvoltages at industrial frequency, outages and rapid voltage changes (RVC).

Measurement over 10/12 periods corresponds to an aggregation of the measurement time intervals.

The values over 10/12 periods are then aggregated on three additional intervals

- Intervals of 150/180 periods, or 3 seconds,
- Intervals of 10 minutes,
- Intervals of 2 hours for Plt measurements, which are aggregated from twelve 10-minute intervals.



Synchronization of the aggregation intervals for Class A,
Source: IEC 61000-4-30

Harmonics and interharmonics

IEC 61000-4-7 completes IEC 61000-4-30 concerning harmonics. They are calculated on 10/12-period windows, with a resolution (bins) of 5Hz. These are called harmonic subgroups.

And between 2 harmonic subgroups, there is an interharmonic subgroup.

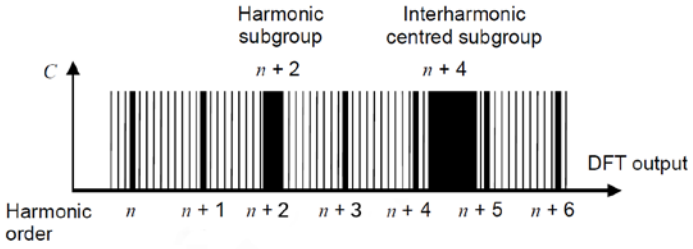


Illustration of subgroups

Source: IEC 61000-4-7

The measurements must be performed at least once up to the 50th order.

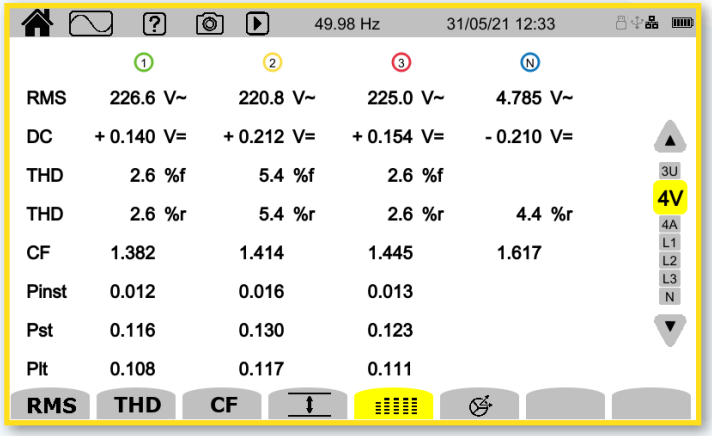
An interharmonic centred subgroup without discontinuities, called $Y_{isg,h.}$ must be measured over 10/12 periods.

Events

Swells, dips, outages, transients and RVCs must be measured in a sliding one-period window refreshed every half-period and synchronized at the zero crossing.

Each event is specified on the basis of the voltage and its duration. The instant when it starts must be time-stamped with the Urms start time on the channel where the event originated, and the instant when the dip ends must be stamped with the end time of the Urms value which terminated the event.

The duration of the event is the difference between the start time and the end time.



Voltage thresholds must be defined to capture events. In the same way, a cutoff threshold must also be defined.

In polyphase networks, a dip starts when the Urms voltage of one or more channels falls below the dip threshold and ends when the Urms voltage on all the channels measured is equal to or greater than the dip threshold plus the hysteresis voltage.

Flagged data

Throughout any measurement interval during which outages, voltage dips or temporary overvoltages occur, the results will be flagged with the measurements of all the other parameters made during the time interval in question.

Flicker

This involves network voltage modulation. In terms of lighting, it gives a visual impression of instability due to a light stimulus whose luminance or spectral distribution fluctuates over time.

There are 2 parameters calculated on the basis of the network voltage.

- P_{st} which is a short-term evaluation based on a 10-minute observation period
- P_{lt} which is a long-term evaluation, usually over a 2-hour observation period

Unbalance

Unbalance measurements apply only to three-phase networks. The power supply voltage unbalance is assessed using the symmetrical components method. In the event of unbalance, as well as the positive component U1, at least one of the following components is added: negative component U2 and/or zero sequence component U0.

Mains signalling voltages on the power supply voltage

The transmission voltage of the signals known as «centralized remote-control signals» in some applications, is a burst of signals, often applied to non-harmonic frequencies, which remotely controls industrial equipment, meters and other appliances.

The IEC 61000-4-30 standard defines the measurements defines the measurements for remote-control frequencies below 3 kHz. The signal transmission voltage measurement must be based on an RMS value of the corresponding ray of interharmonics over 10/12 periods.

Temporal accuracy or coordinated universal time (UTC)

This is the time scale used as the basis for coordinated radio distribution of the standard calibration frequencies and time signals, which advances at the same rate as international atomic time (TAI) but is deferred by a whole number of seconds.

The concept of flagging helps to avoid counting a given event several times in different parameters and indicates that the aggregated value may be doubtful. If a value is flagged during a given time interval, the aggregated values including this value must be flagged and recorded.

The standard therefore specifies the methods and accuracies for the measured parameters useful for correct qualification of the voltage. A measuring instrument can measure all or some of the parameters identified in the IEC 61000-4-30 standard, preferably using the same class for all the parameters.

Measuring instrument manufacturers must perform the tests indicated in the IEC 62586 standard before stating that its instrument complies with the IEC 61000-4-30 standard.

For full information, the texts can be obtained from Cenelec or other national standardization organizations.

With the CA 8345, Chauvin Arnoux is proposing a simple, reliable solution for checking your voltage and your overall power quality.

Reading this Case Study is not under any circumstances a substitute for carefully reading the whole standard.

FRANCE
CHAUVIN ARNOUX
12-16 rue Sarah Bernhardt
92600 Asnières-sur-Seine
Tél : +33 1 44 85 44 85
Fax : +33 1 46 27 73 89
info@chauvin-arnoux.fr
www.chauvin-arnoux.fr

UNITED KINGDOM
CHAUVIN ARNOUX LTD
Unit 1 Nelson Ct, Flagship Sq, Shaw Cross Business Pk
Dewsbury, West Yorkshire - WF12 7TH
Tel: +44 1924 460 494
Fax: +44 1924 455 328
info@chauvin-arnoux.co.uk
www.chauvin-arnoux.com

MIDDLE EAST
CHAUVIN ARNOUX MIDDLE EAST
P.O. BOX 60-154
1241 2020 JAL EL DIB -LEBANON
Tel: +961 1 890 425
Fax: +961 1 890 424
camie@chauvin-arnoux.com
www.chauvin-arnoux.com

CHAUVIN ARNOUX GROUP