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TECHNICAL SPECIFICATION

colour inside

Power quality management –
Part 2: Power Quality Monitoring System

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FOREWORD

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IEC TS 63222-2 has been prepared by IEC technical committee 8: System aspects of electrical energy supply. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
8/1658/DTS	8/1674/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at http://www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 63222 series, published under the general title *Power quality management*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- withdrawn,
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POWER QUALITY MANAGEMENT –

Part 2: Power Quality Monitoring System

1 Scope

This part of IEC 63222 defines technical requirements for designing a power quality monitoring system for public power supply networks. It is applicable for LV, MV and HV public power supply networks.

The design procedure of a power quality monitoring system (PQMS) generally includes the following four steps:

- Step 1: purpose and application analysis

  Analyse power quality monitoring (PQM) demand and define the purpose of PQM.
- Step 2: preliminary study

  Collect background information such as network configuration, the parameters of instrument transformers, e.g. the output levels and performance capabilities, attributes of loads or distributed generations (DG), communication conditions, budgets, and other restrictive conditions, and select the parameters to be monitored and monitoring sites according to corresponding principles.
- Step 3: system structure design

  Design the overall structure of the monitoring system according to the monitoring purpose based on the analysis of the advantages and disadvantages of various system structures.
- Step 4: detailed design of functional modules

  Design the function modules of data collection, communication, data storage, data processing and analysis in detail according to the functional requirements.

This document defines the main purposes of PQM and gives recommendations for preliminary study, such as how to select monitoring sites and monitoring parameters and whether the instrument transformer is suitable for monitoring. This document also classifies the PQMS structure and specifies the functional requirements of the modules such as data collection, communication, data storage, data processing and analysis.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61000-2-2:2002, *Electromagnetic compatibility (EMC) – Part 2-2: Environment − Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC TR 61000-3-6, *Electromagnetic compatibility (EMC) – Part 3-6: Limits – Assessment of harmonic emission limits for the connection of distorting installations to MV, HV and EHV power systems*

IEC TR 61000-3-7:2008, *Electromagnetic compatibility (EMC) – Part 3-7: Limits − Assessment of emission limits for the connection of fluctuating load installations to MV, HV and EHV power systems*

IEC TR 61000-3-13, *Electromagnetic compatibility (EMC) – Part 3-13: Limits − Assessment of emission limits for the connection of unbalanced installations to MV, HV and EHV power systems*

IEC 61000-4-7, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques − General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

IEC 61000-4-30:2015, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques − Power quality measurement methods*

IEC TR 61850-90-17:2017, *Communication networks and systems for power utility automation - Part 90-17: Using IEC 61850 to transmit power quality data*

IEC 61869-6:2016, *Instrument transformers – Part 6: Additional general requirements for low power instrument transformers*

IEC 61869-11, *Instrument transformers – Part 11: Additional requirements for low power passive voltage transformers*

IEC TR 61869-103, *Instrument transformers – Part 103: The use of instrument transformers for power quality measurement*

IEC 62443 (all parts), *Industrial communication networks − Network and system security*

IEC 62586-1:2017, *Power quality measurement in power supply systems – Part 1: Power quality Instruments (PQI)*

IEC 62586-2, *Power quality measurement in power supply systems – Part 2: Functional tests and uncertainty requirements*

IEC TS 62749:2020, *Assessment of power quality − Characteristics of electricity supplied by public networks*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

NOTE Terms are listed in alphabetical order.

3.1
flagged data
for any measurement time interval in which interruptions, dips or swells occur, the marked measurement results of all other parameters made during this time interval

[SOURCE: IEC 61000-4-30:2021, 3.5]

3.2
flicker
impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time

[SOURCE: IEC 60050-161:1990, 161-08-13]

3.3
point of common coupling
PCC
point in an electric power system, electrically nearest to a particular load, at which other loads are, or may be, connected

Note 1 to entry: These loads can be either devices, equipment or systems, or distinct network user's installations.

[SOURCE: IEC TS 62749:2020, 3.25, modified – "network" has been replaced by "system"]

3.4
point of connection
POC
reference point on the electric power system where the user's electrical facility is connected

[SOURCE: IEC 60050-617:2009, 617-04-01]

3.5
power quality
PQ
characteristics of the electric current, voltage and frequencies at a given point in an electric power system, evaluated against a set of reference technical parameters

Note 1 to entry: These parameters might, in some cases, relate to the compatibility between electricity supplied in an electric power system and the loads connected to that electric power system.

[SOURCE: IEC 60050-617:2009, 617-01-05]

3.6
power quality instrument
PQI
instrument whose main function is to measure, record and possibly monitor power quality parameters in power supply systems, and whose measuring methods (class A or class S) are defined in IEC 61000-4-30

[SOURCE: IEC 62586-1:2017, 3.1.1]

3.7
residual voltage
minimum value of $U_{\text{rms(½)}}$ recorded during a voltage dip or interruption

[SOURCE: IEC 61000-4-30:2021, 3.28]

3.8
time aggregation
combination of several sequential values of a given parameter (each determined over identical time intervals) to provide a value for a longer time interval

[SOURCE: IEC 61000-4-30:2021, 3.31]

3.9
voltage deviation
difference between the supply voltage at a given instant and the declared supply voltage

3.10
voltage dip
sudden reduction of the voltage at a point in an electrical system followed by voltage recovery after a short period of time from a few cycles to a few seconds

[SOURCE: IEC 60050-161:1990, 161-08-10]

3.11
voltage unbalance
in a polyphase system, a condition in which the magnitudes of the phase voltages or the phase angles between consecutive phases are not all equal (fundamental component)

[SOURCE: IEC TS 62749:2020, 3.47]

4 Purposes and applications analysis

The most important step in the design of a PQ monitoring system is clear identification of the purpose for PQ monitoring, which is crucial for the selection of monitoring sites, the selection of monitoring parameters, monitoring system structure and requirements of functional modules, etc.

The following main purposes for PQ monitoring can be distinguished from the present PQM practices:

- Compliance verification

  Compliance verification compares a defined set of power quality parameters with limits given by standards, contracts or regulatory specifications. The verification results are reported externally to promote power quality management. It includes typical tasks such as verification of compliance with the connection contracts for a connected user, or verification of compliance with regulatory specification for a system operator. Compliance verification is usually done for individual sites and provides qualitative results. It can also be applied to multiple sites by using appropriate aggregation.

- Performance analysis

  Performance analysis is mainly undertaken by system operators to assess average power quality levels in a grid. The analysis results can be used to determine long term trends by system operators and provide support for strategic planning, asset management and benchmarking, etc. Performance analysis is usually done for multiple sites but can be applied to single sites as well. It provides quantitative results (indices), which can be selected flexibly and it is not mandatory to follow specific standards. Benchmarking compares one or more indices for different sets of sites and is part of performance analysis.

- Site characterization

  Site characterization is used to describe PQ at a specific site in a detailed way. It includes typical tasks such as to predefine the expected power quality for a potential customer or to assess and verify power quality once the customer is already connected to the grid. It is important to know the power quality at a particular site, in particular to predict the effect of a new non-linear, unbalanced or intermittent load, and subsequently survey the ability of the site to comply with the contractual constraints.

- Troubleshooting

  Troubleshooting is used to diagnose power quality related problems such as system harmonic resonance, the abnormal interruption of the customer production process, equipment malfunction, etc. A long term PQM campaign by permanent monitoring equipment can provide more useful information for troubleshooting, especially for process interruptions caused by voltage dips. Typically, raw unaggregated power quality measurement data are most useful for troubleshooting, as they permit any type of post-processing preferred.

- Advanced applications and studies

  Advanced applications and studies are relevant for purposes of different aspects from both system operator's side and end user's side, e.g. how to improve the efficiency of system operation, how to promote end user's immunity capability, etc., it includes more specific measurements and deep analyses that are often not part of the daily business. Typical applications and studies include fault location, signature analysis and studies of propagation of power quality phenomena.

5 Preliminary study

5.1 Background information collection

The following background information should be collected before the design of the PQMS:

- Power supply network configuration to be monitored

  The configuration of the power supply network to be monitored such as power grid topological structure (e.g. radial or meshed networks), three-phase or single-phase, short-circuit powers, the categories of feeders available for monitoring (e.g. urban, semi urban or semi-rural, rural), and the parameters of instrument transformers, e.g. the output levels and performance capabilities, should be collected, which can be used for the selection of monitoring sites.