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Interested committees:

Title: Draft IEC 61000-4-30 Electromagnetic compatibility (EMC)

Part 4-30: Testing and measurement techniques - Power quality measurement methods

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



77A/1178/CD

COMMITTEE DRAFT (CD)

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SECRETARIAT:

France

SECRETARY:

Mr Cédric LAVENU

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 8

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☒ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

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TITLE:

Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-30: Testing and measurement techniques –
Power quality measurement methods

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- International Standard IEC 61000-4-30 has been prepared by subcommittee 77A: EMC – Low-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

This standard forms part 4-30 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This fourth edition cancels and replaces the third edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) The measurement method for RVC (rapid voltage change) has been corrected and extended.
- b) Annex C from Ed. 3 was divided into 2 parts:

- Annex C: The measurement method from IEC 61000-4-7 Annex B for conducted emissions in the 2 kHz to 9 kHz range has been separated.

- Annex D: A new measurement method for conducted emissions in the 9 kHz to 150 kHz range has been added.

c) Informative Annex D (underdeviation and overdeviation parameters) was removed.

d) Informative Annex E (Class B) was removed.

a) Corrigendum 1 and Amendment 1 of IEC 61000-4-30 Ed. 3 were included.

The text of this standard is based on the following documents:

FDIS	Report on voting
77A/XX/FDIS	77A/XX/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The National Committees are requested to note that for this publication the stability date is 2025?

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 61000 is published in separate parts according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (in so far as they do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as International Standards or as Technical Specifications or Technical Reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and completed by a second number identifying the subdivision (example: 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-30: Testing and measurement techniques – Power quality measurement methods

1 Scope

This part of IEC 61000-4 defines the methods for measurement and interpretation of results for power quality parameters in a.c. power supply systems with a declared fundamental frequency of 50 Hz or 60 Hz.

Measurement methods are described for each relevant parameter in terms that give reliable and repeatable results, regardless of the method's implementation. This standard addresses measurement methods for in-situ measurements.

This standard covers two classes of measurement methods (Class A and Class S). The classes of measurement are specified in Clause 4.

NOTE 1 In this standard, "A" stands for "Advanced", and "S" stands for "Surveys".

Measurement of parameters covered by this standard is limited to conducted phenomena in power systems. The power quality parameters considered in this standard are power frequency, magnitude of the supply voltage, flicker, supply voltage dips and swells, voltage interruptions, transient voltages, supply voltage unbalance, voltage harmonics and interharmonics, rapid voltage changes and current measurements.

Mains communicating system (MCS) voltage on the supply voltage is a special case of injected distortions.

Emissions in the 2 kHz to 150 kHz range are considered in Annex C, D and E (informative).

Depending on the purpose of the measurement all or a subset of the phenomena on this list may be measured.

NOTE 2 Test methods for verifying compliance with this standard can be found in IEC 62586-2.

NOTE 3 The effects of transducers inserted between the power system and the instrument are acknowledged but not addressed in detail in this standard. Guidance about effects of transducers can be found IEC TR 61869-103.

NOTE 4 Measurements of voltage signals associated with MCS are also in the scope of this standard.

2 Normative References and Bibliography

2.1 Normative References

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)

IEC 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61000-3-8, *Electromagnetic compatibility (EMC) – Part 3: Limits – Section 8: Signalling on low-voltage electrical installations – Emission levels, frequency bands and electromagnetic disturbance levels*

IEC 61000-4-7 ed2.1 Consol. with am1, *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 61000-4-15:2010, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications*

IEC 61180 (all parts), *High-voltage test techniques for low voltage equipment*

IEC 62586-1, *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*

ISO/IEC Guide 99:2007

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161, as well as the following apply.

3.1 channel

individual measurement path through an instrument

Note 1 to entry: “Channel” and “phase” are not the same. A voltage channel is by definition the difference in potential between 2 conductors. Phase refers to a single conductor. On polyphase systems, a channel may be between 2 phases, or between a phase and neutral, or between a phase and earth, or between neutral and earth.

3.2 declared input voltage

U_{din}

value obtained from the declared supply voltage by a transducer ratio

3.3 declared supply voltage

U_{c}

normally the nominal voltage U_{n} of the system.

Note 1 to entry: If by agreement between the supplier and the customer a voltage different from the nominal voltage is applied to the terminals, then this voltage is the declared supply voltage U_{c} .

3.4 dip threshold

voltage magnitude specified for the purpose of detecting the start and the end of a voltage dip

3.5 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

Note 1 to entry: For some applications, this ‘marked’ or ‘flagged’ data may be excluded from further analysis, for example. See 4.7 for further explanation.

3.6 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]

3.6.1 **P_{st}**

short-term flicker evaluation based on an observation period of 10 minutes

SEE: IEC 61000-4-15.

3.6.2 **P_{lt}**

long-term flicker evaluation

SEE: IEC 61000-4-15.

3.7**fundamental component**

component whose frequency is the fundamental frequency

3.8**fundamental frequency**

frequency in the spectrum obtained from a Fourier transform of a time function, to which all the frequencies of the spectrum are referred

Note 1 to entry: In case of any remaining risk of ambiguity, the fundamental frequency may be derived from the number of poles and speed of rotation of the synchronous generator(s) feeding the system.

3.9**harmonic component**

any of the components having a harmonic frequency

Note 1 to entry: Its value is normally expressed as an r.m.s. value. For brevity, such component may be referred to simply as a harmonic.

[SOURCE: IEC 61000-2-2:2002, 3.2.4,]

3.10**harmonic frequency**

frequency which is an integer multiple of the fundamental frequency

Note 1 to entry: The ratio of the harmonic frequency to the fundamental frequency is the harmonic order (recommended notation: n) (IEC 61000-2-2:2002, 3.2.3).**3.11****hysteresis**

difference in magnitude between the start and end thresholds

Note 1 to entry: This definition of hysteresis is relevant to PQ measurement parameters and is different from the IEC 60050 definition which is relevant to iron core saturation.

Note 2 to entry: The purpose of hysteresis in the context of PQ measurements is to avoid counting multiple events when the magnitude of the parameter oscillates about the threshold level.

3.12**influence quantity**

any quantity which may affect the working performance of a measuring equipment

Note 1 to entry: This quantity is generally external to the measurement equipment.

[SOURCE: IEC 60050-311:2001, 311-06-01–]

3.13**interharmonic component**

a spectral component with a frequency between two consecutive harmonic frequencies

Note 1 to entry: The definition is derived from IEC 61000-4-7.

Note 2 to entry: Its value is normally expressed as an r.m.s. value. For brevity, such a component may be referred to simply as an interharmonic.

3.14

interharmonic frequency

any frequency which is not an integer multiple of the fundamental frequency

Note 1 to entry: By extension from harmonic order, the interharmonic order is the ratio of an interharmonic frequency to the fundamental frequency. This ratio is not an integer (recommended notation m).

Note 2 to entry: In the case where $m < 1$ the term subharmonic frequency may be used.

[SOURCE: IEC 61000-2-2:2002, 3.2.5]

3.15

interruption

reduction of the voltage at a point in the electrical system below the interruption threshold

3.16

interruption threshold

voltage magnitude specified for the purpose of detecting the start and the end of a voltage interruption

3.17

mains communicating system

MCS

electrical system using mains power lines to transmit information signals, either on the power supply system or within installations of network users

3.18

maximum permissible measurement error

maximum permissible error

limit of error

extreme value of measurement error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system

Note 1 to entry: Usually, the term "maximum permissible errors" or "limits of error" is used where there are two extreme values.

Note 2 to entry: The term "tolerance" should not be used to designate 'maximum permissible error'.

[ISO/IEC Guide 99:2007, 4.26]

3.19

nominal voltage

U_n

voltage by which a power supply system is designated or identified

3.20

power quality

characteristics of the electricity at a given point on an electrical 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 on a network and the loads connected to that network.

3.21**root-mean-square value****r.m.s. value**

square root of the arithmetic mean of the squares of the instantaneous values of a quantity taken over a specified time interval and a specified bandwidth

[SOURCE: IEC 60050-103:2009, 103-02-03,]

3.22**r.m.s. voltage refreshed each half-cycle** **$U_{\text{rms}(\frac{1}{2})}$**

value of the r.m.s. voltage measured over 1 cycle, commencing at a fundamental zero crossing, and refreshed each half-cycle

Note 1 to entry: This technique is independent for each channel and will produce r.m.s. values at successive times on different channels for polyphase systems.

Note 2 to entry: This value is used only for voltage dip, voltage swell, interruption, and RVC detection and evaluation, in Class A.

Note 3 to entry: This r.m.s. voltage value may be a phase-to-phase value or a phase-to-neutral value.

3.23**r.m.s. current refreshed each half-cycle** **$I_{\text{rms}(\frac{1}{2})}$**

value of the r.m.s. current measured over 1 cycle, commencing at a fundamental zero crossing on an associated voltage channel, and refreshed each half-cycle

Note 1 to entry: For guidance, the associated voltage channel might be the corresponding phase-to-neutral channel on single-phase or star networks. If there is no corresponding voltage channel, for example on delta network currents, or earth current or neutral current measurements, then the reference channel (see 5.1.3) used for frequency measurements might be used.

3.24**r.m.s. voltage refreshed each cycle** **$U_{\text{rms}(1)}$**

value of the r.m.s. voltage measured over 1 cycle and refreshed each cycle

Note 1 to entry: In contrast to $U_{\text{rms}(\frac{1}{2})}$, this technique does not define when a cycle commences.

Note 2 to entry: This value is used only in Class S, and is used for voltage dip, voltage swell, and interruption detection and evaluation.

Note 3 to entry: This r.m.s. voltage value can be a phase-to-phase value or a phase-to-neutral value.

3.25**range of influence quantities**

range of values of a single influence quantity

3.26**rapid voltage change****RVC**

a quick transition in r.m.s. voltage occurring between two steady-state conditions, and during which the r.m.s. voltage does not exceed the dip/swell thresholds

Note 1 to entry: This note applies to the French language only.

3.27**reference channel**

one of the voltage measurement channels designated as the reference channel for polyphase measurements

Note 1 to entry: In the case of a single-phase measurement, the voltage measuring channel is also the reference channel.

3.28 residual voltage

U_{res}

minimum value of $U_{\text{rms}(\frac{1}{2})}$ recorded during a voltage dip or interruption

Note 1 to entry: The residual voltage is expressed as a value in volts, or as a percentage or per unit value of the declared input voltage.

3.29 sliding reference voltage

U_{sr}

voltage magnitude averaged over one minute, representing the voltage preceding a voltage dip or swell

Note 1 to entry: It is precisely defined in 5.4.4 .

Note 2 to entry: The sliding reference voltage may be used to determine the voltage change during a dip or a swell, typically for medium-voltage or high-voltage systems.

3.30 swell threshold

voltage magnitude specified for the purpose of detecting the start and the end of a **voltage swell**

3.31 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

Note 1 to entry: Aggregation in this document always refers to time aggregation.

3.32 UTC (Universal Time Coordinated) (abbreviation)

Time scale which forms the basis of a coordinated radio dissemination of standard frequencies and time signals. It corresponds exactly in rate with international atomic time, but differs from it by an integral number of seconds

Note 1 to entry: Coordinated universal time is established by the International Bureau of Weights and Measures (BIPM) and the International Earth Rotation Service (IERS).

Note 2 to entry: The UTC scale is adjusted by the insertion or deletion of seconds, so called positive or negative leap seconds, to ensure approximate agreement with **Universal Time** UT1.

[SOURCE: ITU-R Rec. 686, modified]

3.33 voltage dip

temporary reduction of the voltage magnitude at a point in the electrical system below a threshold

Note 1 to entry: Interruptions are a special case of a voltage dip. Post-processing may be used to distinguish between voltage dips and interruptions.

Note 2 to entry: A voltage dip is also referred to as sag. The two terms are considered interchangeable; however, this standard will only use the term voltage dip.

3.34 voltage swell

temporary increase of the voltage magnitude at a point in the electrical system above a threshold

3.35 voltage unbalance

condition in a polyphase system in which the r.m.s. values of the phase voltages (fundamental component), and / or the phase angles between consecutive phase voltages, are not all equal

Note 1 to entry: The degree of the inequality is usually expressed as the ratios of the negative- and zero-sequence components to the positive-sequence component.

Note 2 to entry: In this standard, voltage unbalance is considered in relation to 3-phase systems.

[SOURCE: IEC 60050-161:2002, 161-08-09, modified]

4 General

4.1 Classes of measurement

For each parameter measured, two classes, A and S, are defined in this standard. For each class, measurement methods and appropriate performance requirements are included.

– Class A

This class is used where precise measurements are necessary, for example, for contractual applications that may require resolving disputes, verifying compliance with standards, etc. Any measurements of a parameter carried out with two different instruments complying with the requirements of Class A, when measuring the same signals, will produce matching results within the specified [maximum permissible measurement error](#) for that parameter.

NOTE 1: Class A measurements produce matching results only if the user-selected parameters (thresholds, hysteresis, etc.) match.

– Class S

This class is used for statistical applications such as surveys or power quality assessment, possibly with a limited subset of parameters. Although it uses equivalent intervals of measurement as Class A, the Class S processing requirements are much lower. Some surveys may assess power quality parameters of several measurement sites on a network; other surveys assess power quality parameters at a single site over a period of time, or at locations within a building or even within a single large piece of equipment.

Users shall select the class that they require, based on their application(s). For troubleshooting applications, depending on the type of problem either Class A or Class S methods may be selected by the user.

The instrument manufacturer should declare influence quantities which are not expressly given and which may degrade performance of the instrument.

An instrument may measure some or all of the parameters identified in this standard, and preferably uses the same Class for all parameters. For guidance, see IEC 62586.

The instrument manufacturer shall declare which parameters are measured, which class is used for each parameter, the range of U_{din} for which each class is fulfilled, and all the necessary requirements and accessories (synchronization, probes, calibration period, temperature ranges, etc.) to meet each class.

4.2 Organization of the measurements

The electrical quantity to be measured may be either directly accessible, as is generally the case in low-voltage systems, or accessible via measurement transducers.

The whole measurement chain is shown in Figure 4.1.

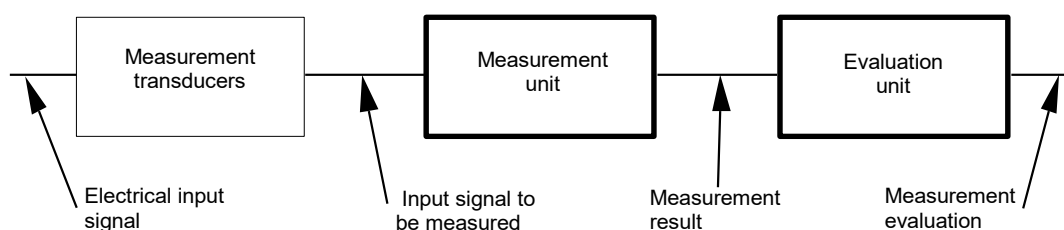


Figure 4.1 – Measurement chain

An "instrument" may include the whole measurement chain (see Figure 4.1). In this standard, the normative part does not consider any possible measurement transducers external to the instrument and their associated **maximum permissible measurement error**, but Clause A.2 gives guidance.

4.3 Electrical values to be measured

Measurements can be performed on single-phase or polyphase supply systems. Depending on the context, it may be necessary to measure voltages between phase conductors and neutral (phase-to-neutral) or between phase conductors (phase-to-phase) or between phase conductors or neutral and earth (phase-to-earth, neutral-to-earth). It is not the purpose of this standard to impose the choice of the electrical values to be measured. Moreover, except for the measurement of voltage unbalance, which is intrinsically polyphase, the measurement methods specified in this document are such that independent results can be produced on each measurement channel.

NOTE Phase-to-phase instantaneous values can be measured directly or can be derived from instantaneous phase-to-neutral measured values or from phase-to-earth measured values.

Current measurements may be performed on each conductor of supply systems, including the neutral conductor and the protective earth conductor. See 5.13

4.4 Measurement aggregation over time intervals

– Class A

The basic measurement time interval for parameter magnitudes (supply voltage, harmonics, interharmonics and unbalance) shall be a 10-cycle time interval for a 50 Hz power system or a 12-cycle time interval for a 60 Hz power system.

The 10/12-cycle measurement shall be resynchronized at every UTC (Universal Time Coordinated) 10-min tick. See Figure 2.

NOTE 1 The uncertainty of this measurement is included in the uncertainty measurement protocol of each parameter.

The 10/12-cycle values are then aggregated over 3 additional intervals:

- 150/180-cycle interval (150 cycles for 50 Hz **power systems** or 180 cycles for 60 Hz **power systems**),
- 10-min interval,
- 2-hour interval for P_{lt} flicker.

NOTE 2 A 2-hour aggregation interval is optional for all parameters, **except for** flicker measurements which require a 2-hour aggregation interval for P_{lt} . This 2-hour aggregation interval may possibly be useful in some applications and may possibly be necessary for measuring compliance with some national or international standards.

NOTE 3 Clauses B.1 and B.2 discuss some applications of these aggregation time intervals.

– Class S

Same time intervals as Class A.

4.5 Measurement aggregation algorithm

4.5.1 Requirements

Aggregations shall be performed using the square root of the arithmetic mean of the squared input values.

For flicker measurements, a different aggregation algorithm is used (see IEC 61000 4-15).

4.5.2 150/180-cycle aggregation

– Class A

The data for the 150/180-cycle time interval shall be aggregated without gap from fifteen 10/12-cycle time intervals.

The 150/180-cycle time interval is resynchronized at the UTC 10-min tick as shown in Figure 2.

When a 10-min tick occurs, a new 150/180-cycle time interval begins, and the pending 150/180-cycle time interval also continues until it is completed. This may create an overlap between these two 150/180-cycle intervals (overlap 2 in Figure 4.2).

– Class S

The data for the 150/180-cycle time interval shall be aggregated from 10/12-cycle time intervals. Resynchronization at the UTC 10-min tick is permitted but not mandatory. (See Figure 4.3.)

Gaps are permitted but not mandatory for harmonics, interharmonics, MCS voltage and unbalance. A minimum of three 10/12-cycle values shall be used each 150/180-cycle time interval, i.e. at least one 10/12-cycle value shall be used each 50/60 cycles (see Figure 4.4). For all other parameters, the data for the 150/180-cycle time interval shall be aggregated without gap from fifteen 10/12-cycle time intervals.

4.5.3 10-min aggregation

– Class A

The 10-min aggregated value shall be tagged with the UTC time (for example, 01H10.00,000) at the conclusion of the 10-min aggregation interval, rounded to the nearest second.

NOTE: In some circumstances, it can be useful to use local time, which can differ from UTC by a fixed offset, or an offset that can vary based on time of year. This type of time stamp often includes both a time and a date. This type of time stamp can be referred to as “absolute time”.

The data for the 10-min time interval shall be aggregated from 10/12-cycle time intervals.

Each 10-minute interval shall begin on a UTC 10-min tick. The 10-min tick is also used to resynchronize the 10/12-cycle intervals and the 150/180-cycle intervals. See Figure 4.2.

The final 10/12-cycle interval(s) in a 10-min aggregation period will typically overlap in time with the UTC 10-min clock tick. Any overlapping 10/12-cycle interval (overlap 1 in Figure 4.2) is included in the aggregation of the previous 10-min interval.

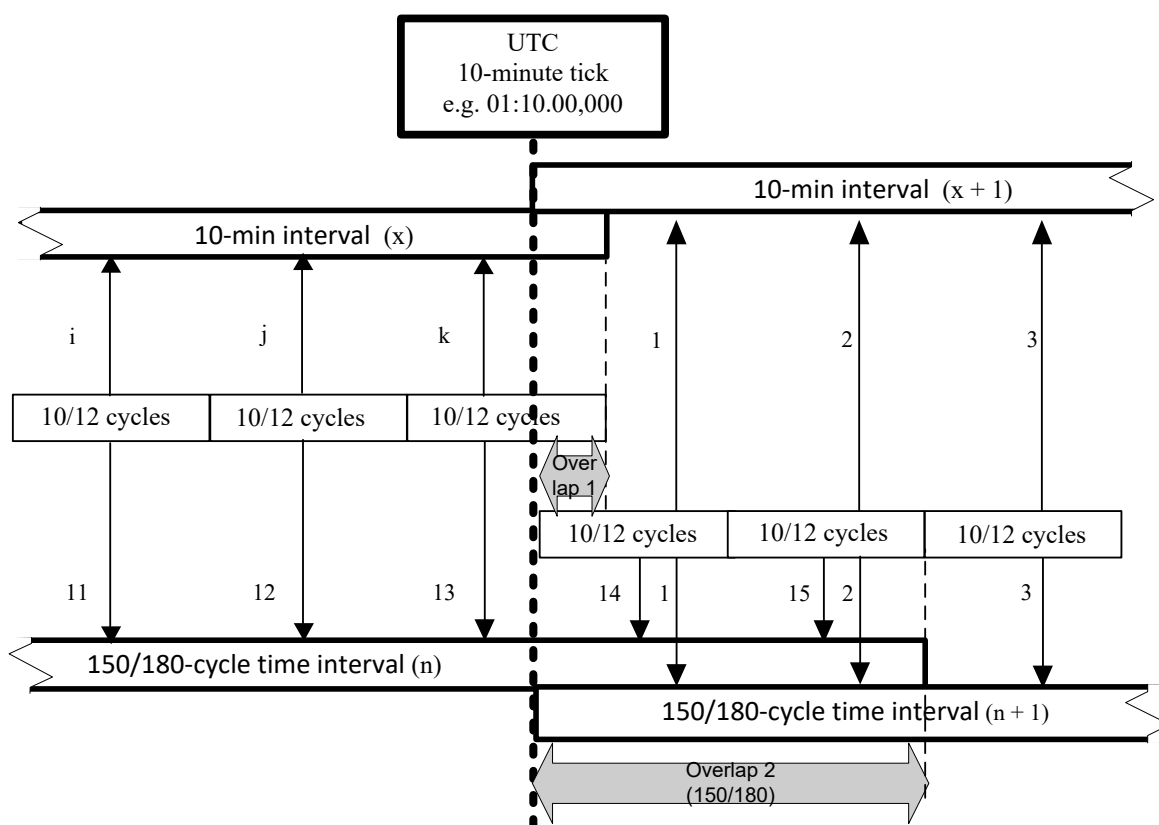


Figure 4.2 – Synchronization of aggregation intervals for Class A

– **Class S**

The 10-min aggregation method used for Class S shall be either the Class A method, or the following simplified method:

The data for the 10-min time interval shall be aggregated from 10/12-cycle time intervals. There is no resynchronization on the UTC 10-min tick. The 10-min intervals are free running.

The 10-min aggregated value shall be tagged with the time at the conclusion of the 10-min aggregation interval (e.g. 01h10.00,040).

There will be no overlap, as illustrated in Figure 4.3 and Figure 4.4.

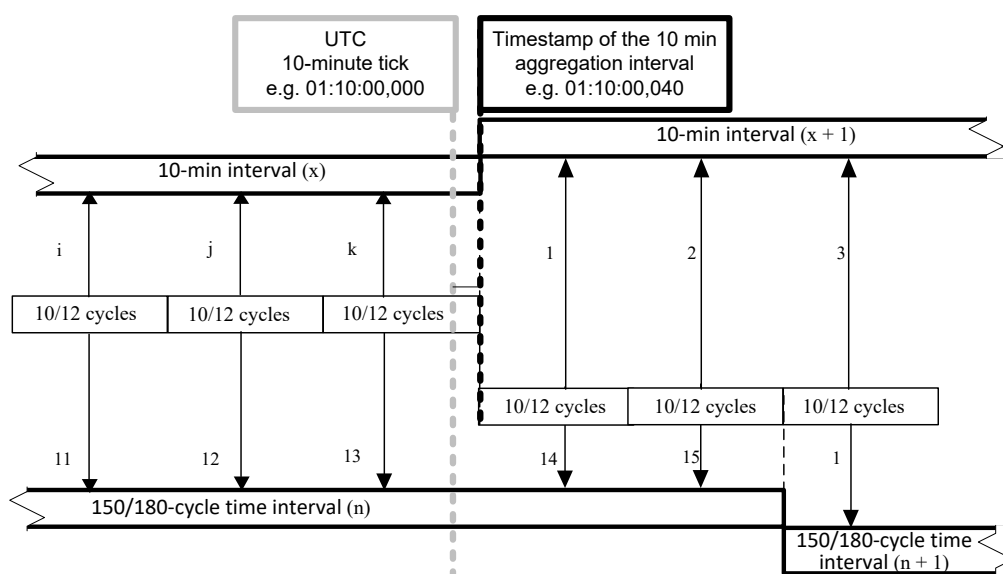


Figure 4.3 – Synchronization of aggregation intervals for Class S: parameters for which gaps are not permitted

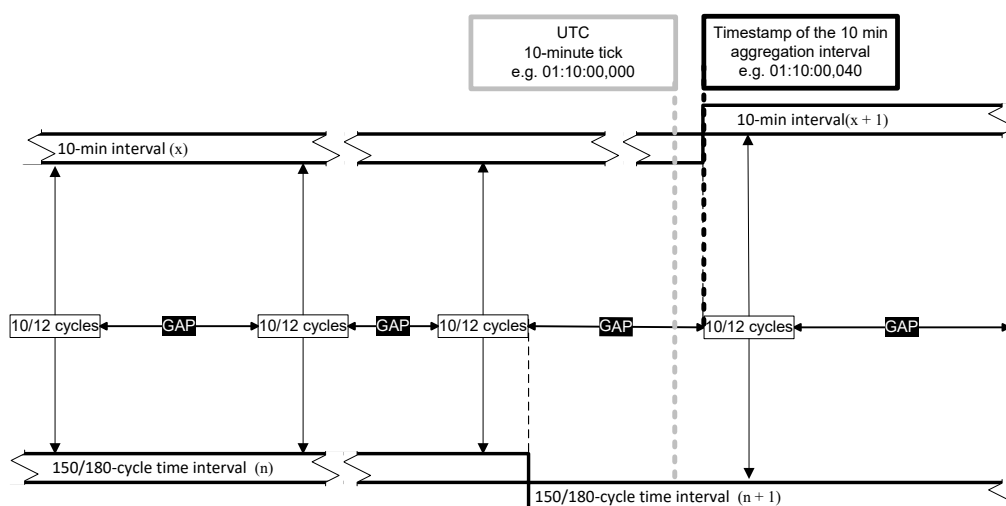


Figure 4.4 – Synchronization of aggregation intervals for Class S: parameters for which gaps are permitted (see 4.5.2)

4.5.4 2-hour aggregation

– Class A

The data for the 2-hour interval shall be aggregated from twelve 10-min intervals. The 2-hour interval shall be gapless and not overlapping. **2 h intervals commence at even numbered 2 h time clock intervals.**

NOTE 1 As an option to provide a more frequent update rate, sliding 2 h intervals could also be provided by an instrument at the end of 10-minute intervals.

– Class S

Same as Class A.

4.6 Time clock uncertainty

Time clock uncertainty is defined relative to Universal Time Coordinated (UTC), which is continuously incrementing and available world-wide.

NOTE 1 The time clock may move forward or backward under certain circumstances, such as daylight savings time, external synchronization updates, etc. When the clock moves forward in time, there may be gaps in the data. When the clock moves backwards in time, data may overlap in time.

– **Class A**

The time clock uncertainty shall not exceed ± 20 ms for 50 Hz or $\pm 16,7$ ms for 60 Hz, regardless of the total time interval.

NOTE 2 This performance can be achieved, for example, through a synchronization procedure applied periodically during a measurement campaign, or through a GPS receiver, or through reception of transmitted radio timing signals or by using network timing signals.

When synchronization by an external signal becomes unavailable, the time tagging tolerance shall be better than ± 1 sec per 24-hour period; however, this exception does not eliminate the requirement for compliance with the first part of this paragraph.

NOTE 3 This performance is necessary to ensure that two instruments using Class A methods produce the same 10-min aggregation results when connected to the same signal.

– **Class S**

The time clock uncertainty shall not exceed ± 5 sec per 24-hour period.

4.7 Flagging concept

During a dip, swell, or interruption, the measurement algorithm for other parameters (for example, frequency measurement) might produce an unreliable value. The flagging concept avoids counting a single event more than once in different parameters (for example, counting a single dip as both a dip and a frequency variation), and indicates that an aggregated value might be unreliable.

Flagging is only triggered by **supply voltage events (dips and swells)** and interruptions. The detection of **supply voltage events** is dependent on the thresholds selected by the user, and this selection will influence which data are "flagged".

The flagging concept is applicable for Class A and Class S during measurement of power frequency, voltage magnitude, flicker, supply voltage unbalance, voltage harmonics, voltage interharmonics, and **MCS voltage** parameters.

If during a given time interval any value is flagged, the aggregated value which includes that value shall also be flagged. The flagged value shall be stored and also included in the aggregation process. For example, if during a given time interval any value is flagged, then the aggregated value that includes this value shall also be flagged and stored.

The flag on the aggregated value shall differentiate the cause of the flag and can include multiple causes if it includes values that have been flagged due to different causes. For example, a 10-min. mean value of the voltage, wherein both a dip and a swell occurred should be flagged as being caused by both a dip and a swell.

NOTE 1 Information about other types of flagging, or data marking, can be found in IEC 62586-1.

NOTE 2 The user can decide how to evaluate flagged data.

5 Power quality parameters

5.1 Power frequency

5.1.1 Measurement method

– **Class A**

The frequency reading shall be obtained every 10-s. As power frequency may not be exactly 50 Hz or 60 Hz within the 10-s time clock interval, the number of cycles may not be an integer number. The fundamental frequency output is the ratio of the number of integral cycles counted during the 10-s time clock interval, divided by the cumulative duration of the integer cycles.

When a zero-crossing method is used for frequency calculation, then before assessment, harmonics and interharmonics shall be attenuated to minimize the effects of multiple zero crossings.

The measurement time intervals shall be non-overlapping. Individual cycles that overlap the 10-s time clock are discarded. Each 10-s interval shall begin on an absolute 10-s time clock, with uncertainty as defined in 4.6.

Other techniques that provide equivalent results, such as convolution, are acceptable.

NOTE For some applications, the use of time intervals shorter than 10 s may possibly be useful, such as 10/12 cycles (wind turbines), 1 s (national standards), etc.

– **Class S**

Same as Class A.

5.1.2 Maximum permissible measurement error and measuring range

– **Class A**

Under the conditions described in Clause 6, the maximum permissible measurement error shall not exceed ± 10 mHz over the measuring ranges 42,5 Hz to 57,5 Hz (50 Hz power system) / 51 Hz to 69 Hz (60 Hz power system).

– **Class S**

Under the conditions described in Clause 6, the maximum permissible measurement error shall not exceed ± 50 mHz over the measuring ranges 42,5 Hz to 57,5 Hz (50 Hz power system) / 51 Hz to 69 Hz (60 Hz power system).

5.1.3 Measurement evaluation

– **Class A**

The frequency measurement shall be made on the reference channel.

The manufacturer shall specify the behaviour of frequency measurement whenever the reference channel loses voltage.

– **Class S**

Same as Class A

5.1.4 Aggregation

Aggregation is not mandatory.

5.2 Magnitude of the supply voltage

5.2.1 Measurement method

– **Class A**

The measurement shall be the r.m.s. value of the voltage magnitude over a 10-cycle time interval for a 50 Hz power system or a 12-cycle time interval for a 60 Hz power system. Every 10/12-cycle interval shall be contiguous, and not overlapping with adjacent 10/12-cycle intervals except as shown in overlap 1 in Figure 4.2.

NOTE 1 This specific measurement method is used for quasi-stationary signals and is not used for the detection and measurement of disturbances: dips, swells, voltage interruptions and transients.

NOTE 2 The r.m.s. value includes, by definition, harmonics, interharmonics, MCS voltage, etc. The measurement bandwidth should be clarified by manufacturer, e.g. frequency components above 9 kHz or above 2,5 kHz should not be required.

– **Class S**

Same as Class A.

5.2.2 Maximum permissible measurement error and measuring range

– **Class A**

Under the conditions described in Clause 6, the maximum permissible measurement error shall not exceed $\pm 0,1$ % of U_{din} , over the range of 10 % to 150 % of U_{din} .

– **Class S**

Under the conditions described in Clause 6, the maximum permissible measurement error shall not exceed $\pm 0,5$ % of U_{din} , over the range of 20 % to 120 % of U_{din} .

5.2.3 Measurement evaluation

No requirements.

5.2.4 Aggregation

Aggregation shall be performed according to 4.4 and 4.5.

5.3 Flicker

5.3.1 Measurement method

– Class A

IEC 61000-4-15 Class F1 applies as the minimum requirement.

– Class S

IEC 61000-4-15 Class F3 applies as the minimum requirement.

5.3.2 Maximum permissible measurement error and measuring range

– Class A

See IEC 61000-4-15. Under the conditions described in Clause 6, the maximum permissible measurement error required by 61000-4-15 shall be met over the measuring range of 0,2 P_{st} to 10 P_{st} .

– Class S

See IEC 61000-4-15. Under the conditions described in Clause 6, twice the permitted maximum permissible measurement error required by 61000-4-15 shall be met over the measuring range of 0,4 P_{st} to 4 P_{st} .

5.3.3 Measurement evaluation

– Class A

IEC 61000-4-15 applies.

The 10-min time interval for P_{st} shall commence on a UTC 10-min tick, and shall be tagged with the time at the conclusion of the interval (see 4.5.3)

Voltage dips, swells, and interruptions shall cause P_{st} and P_{lt} output values (see IEC 61000-4-15) to be flagged.

– Class S

Same as Class A.

5.3.4 Aggregation

– Class A

Aggregation shall be performed according to IEC 61000-4-15.

– Class S

Same as Class A.

5.4 Supply voltage events

5.4.1 Measurement method

5.4.1.1 Basic r.m.s. voltage measurement

– Class A

The basic measurement U_{rms} of voltage events shall be the $U_{rms(1/2)}$ on each measurement channel (see 3.22).

– Class S

The basic measurement U_{rms} of voltage events shall be either the $U_{rms(1/2)}$ on each measurement channel (see 3.22) or the $U_{rms(1)}$ on each measurement channel (see 3.24).

The manufacturer shall specify which measurement is used.

The cycle duration for U_{rms} depends on the frequency. The frequency might be determined by the last non-flagged power frequency measurement (see 4.7 and 5.1), or by any other method that complies with the maximum permissible measurement error requirements of Clause 6.

NOTE 1 The U_{rms} value includes, by definition, harmonics, interharmonics, MCS voltage, etc.