

Electromagnetic compatibility (EMC) —

Part 4-15: Testing and measurement techniques — Flickermeter — Functional and design specifications

The European Standard EN 61000-4-15:1998, with the incorporation of amendment A1:2003, has the status of a British Standard

ICS 33.100.20

National foreword

This British Standard is the English language version of EN 61000-4-15:1998. It is identical with IEC 61000-4-15:1997, Edition 1.1 which comprises Edition 1:1997 consolidated by the incorporation of amendment 1:2003.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, Electromagnetic compatibility, to Subcommittee GEL/210/8, EMC — Low frequency phenomena, which has the responsibility to:

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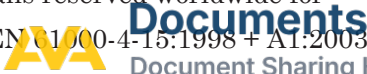
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European Committee for Electrotechnical Standardization
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Foreword

The text of document 77A/180/FDIS, future edition 1 of IEC 61000-4-15, prepared by SC 77A, Low-frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-4-15 on 1998-04-01.

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- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-01-01
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Annexes designated “normative” are part of the body of the standard.

In this standard, Annex A and Annex ZA are normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61000-4-15:1997 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 77A/389/FDIS, future amendment 1 to IEC 61000-4-15:1997, prepared by SC 77A, Low-frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61000-4-15:1998 on 2003-03-01.

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2006-03-01

Annexes designated “normative” are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of amendment 1:2003 to the International Standard IEC 61000-4-15:1997 was approved by CENELEC as an amendment to the European Standard without any modification.

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INTRODUCTION

IEC 61000-4 is a part of the IEC 61000 series, according to the following structure:

- Part 1: General
 - General consideration (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 sections which are to be published either as International Standards or as technical reports.

These sections of IEC 61000-4 will be published in chronological order and numbered accordingly.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4: Testing and measurement techniques –

Section 15: Flickermeter – Functional and design specifications

1 Scope and object

This section of IEC 61000-4 gives a functional and design specification for flicker measuring apparatus intended to indicate the correct flicker perception level for all practical voltage fluctuation waveforms. Information is presented to enable such an instrument to be constructed. A method is given for the evaluation of flicker severity on the basis of the output of flickermeters complying with this standard.

This section is based partly on work by the “Disturbances” Working Group of the International Union for Electroheat (UIE), partly on work of the IEEE, and partly on work within IEC itself. The flickermeter specifications in this section relate only to measurements of 230 V, 50 Hz inputs and 120 V, 60 Hz inputs; specifications for other voltages and other frequencies are under consideration.

The object of this section is to provide basic information for the design and the instrumentation of an analogue or digital flicker measuring apparatus. It does not give tolerance limit values of flicker severity.

2 Normative references

The following referenced documents are indispensable for the application 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 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-3:1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test*

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances induced by radio-frequency fields*

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test*

IEC 61000-4-9:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 9: Pulse magnetic field immunity test*

IEC 61000-4-11:1994, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-12:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 12: Oscillatory waves immunity test*

IEC 61010-1:1990, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61326-1:1997, *Electrical equipment for measurement, control and laboratory use – Electromagnetic compatibility (EMC) requirements – Part 1: General requirements*

IEC 61326-10, – *Electrical equipment for measurement, control and laboratory use – Electromagnetic compatibility (EMC) requirements – Part 10: Particular requirements for equipment used in industrial locations* *

3 Description of the instrument

3.1 General

The description given below is based on an analogue implementation.

The flickermeter architecture is described by the block diagram of figure 1, and can be divided into two parts, each performing one of the following tasks:

- simulation of the response of the lamp-eye-brain chain;
- on-line statistical analysis of the flicker signal and presentation of the results.

The first task is performed by blocks 2, 3 and 4 of figure 1, while the second task is accomplished by block 5.

3.2 Block 1 – Input voltage adaptor and calibration checking circuit

This block contains a signal generator to check the calibration of the flickermeter on site and a voltage adapting circuit that scales the mean r.m.s. value of the input mains frequency voltage down to an internal reference level. In this way flicker measurements can be made independently of the actual input carrier voltage level and expressed as a per cent ratio. Taps on the input transformer establish suitable input voltage ranges to keep the input signal to the voltage adaptor within its permissible range.

* To be published.

3.3 Block 2 – Square law demodulator

The purpose of this block is to recover the voltage fluctuation by squaring the input voltage scaled to the reference level, thus simulating the behaviour of a lamp.

3.4 Blocks 3 and 4 – Weighting filters, squaring and smoothing

Block 3 is composed of a cascade of two filters and a measuring range selector, which can precede or follow the selective filter circuit.

The first filter eliminates the d.c. and double mains frequency ripple components of the demodulator output.

The second filter is a weighting filter block that simulates the frequency response to sinusoidal voltage fluctuations of a coiled filament gas-filled lamp (60 W – 230 V and/or 60 W – 120 V) combined with the human visual system. The response function is based on the perceptibility threshold found at each frequency by 50 % of the persons tested.

NOTE A reference filament lamp for 100 V systems would have a different frequency response and would require a corresponding adjustment of the weighting filter. The characteristics of discharge lamps are totally different, and substantial modifications to this standard would be necessary if they were taken into account.

Block 4 is composed of a squaring multiplier and a first order low-pass filter. The human flicker sensation via lamp, eye and brain is simulated by the combined non-linear response of blocks 2, 3 and 4.

Block 3 alone is based on the borderline perceptibility curve for sinusoidal voltage fluctuations; the correct weighting of non-sinusoidal and stochastic fluctuations is achieved by an appropriate choice of the complex transfer function for blocks 3 and 4. Accordingly the correct performance of the model has also been checked with periodic rectangular signals as well as with transient signals.

The output of block 4 represents the instantaneous flicker sensation.

3.5 Block 5 – On-line statistical analysis

Block 5 incorporates a microprocessor that performs an on-line analysis of the flicker level, thus allowing direct calculation of significant evaluation parameters.

A suitable interface allows data presentation and recording. The use of this block is related to methods of deriving measurements of flicker severity by statistical analysis. The statistical analysis, performed on line by block 5 shall be made by subdividing the amplitude of the flicker level signal into a suitable number of classes. The flicker level signal is sampled at a constant rate.

Every time that the appropriate value occurs, the counter of the corresponding class is incremented by one. In this way, the frequency distribution function of the input values is obtained. By choosing a scanning frequency of at least twice the maximum flicker frequency, the final result at the end of the measuring interval represents the distribution of flicker level duration in each class. Adding the content of the counters of all classes and expressing the count of each class relative to the total gives the probability density function of the flicker levels.

From this function is obtained the cumulative probability function used in the time-at-level statistical method. Figure 2 schematically represents the statistical analysis method, limited for simplicity of presentation to 10 classes.