

Direct acting indicating analogue electrical measuring instruments and their accessories —

Part 1: Definitions and general requirements common to all parts

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/85, Measuring equipment for electrical and electromagnetic quantities, which has the responsibility to:

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Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 35 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 June 1999

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English version

Direct acting indicating analogue electrical measuring
instruments and their accessories
Part 1: Definitions and general requirements common to
all parts

(IEC 60051-1:1997)

Appareils mesureurs électriques
indicateurs analogiques à action directe
et leurs accessoires
Partie 1: Définitions et prescriptions
générales communes à toutes les parties
(CEI 60051-1:1997)

Direkt wirkende anzeigende elektrische
Meßgeräte und ihr Zubehör — Meßgeräte
mit Skalenanzeige
Teil 1: Definitionen und allgemeine
Anforderungen für alle Teile dieser Norm
(IEC 60051-1:1997)

This European Standard was approved by CENELEC on 1997-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 85/166/FDIS, future amendment to IEC 60051-1:1984, prepared by IEC TC 85, Measuring equipment for electromagnetic quantities, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A3 to EN 60051-1:1989 on 1997-10-01.

The text of this document, together with that of IEC 60051-1:1984 and its amendments 1:1994 and 2:1995, was published by IEC as the fifth edition of IEC 60051-1 in December 1997. According to a decision of principle taken by the Technical Board of CENELEC, the approval of EN 60051-1:1989/A3 has been converted into the approval of a new EN 60051-1.

The following dates were fixed:

- latest date by which the
EN has to be implemented
at national level by
publication of an identical
national standard or by
endorsement (dop) 1999-09-01
- latest date by which the
national standards
conflicting with the EN
have to be withdrawn (dow) 1999-09-01

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 the International Standard IEC 60051-1:1997 was approved by CENELEC as a European Standard without any modification.

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Introduction

IEC 60051 is published in separate parts according to the following structure and under the general title *Direct acting indicating analogue electrical measuring instruments and their accessories*.

- *Part 1: Definitions and General Requirements Common to all Pans;*
- *Part 2: Special Requirements for Ammeters and Voltmeters;*
- *Part 3: Special Requirements for Wattmeters and Varmeters;*
- *Part 4: Special Requirements for Frequency Meters;*
- *Part 5: Special Requirements for Phase Meters, Power Factor Meters and Synchrosopes;;*
- *Part 6: Special Requirements for Ohmmeters (Impedance Meters) and Conductance Meters;*
- *Part 7: Special Requirements for Multi-function Instruments;*
- *Part 8: Special Requirements for Accessories;*
- *Part 9: Recommended Test Methods.*

Parts 2 to 9 are not complete in themselves and shall be read in conjunction with this Part 1.

All of these pans are arranged in the same format and a standard relationship between subject and clause number is maintained throughout. In addition, tables, figures and annexes add a suffix to the part number in order to differentiate the pans. This re-arrangement will assist the reader of IEC 60051 to distinguish information relating to the different types of instruments.

1 General

1.1 Scope

This standard applies to direct acting indicating electrical measuring instruments having an analogue display, such as:

- ammeters and voltmeters;
- wattmeters and varmeters;
- frequency meters of pointer and vibrating-reed types;
- phasemeters, power-factor meters and synchrosopes;
- ohmmeters, impedance meters and conductance meters;
- multi-function instruments of the above types.

It also applies to certain accessories used with these instruments, such as:

- shunts;
- series resistors and impedance elements.

If other accessories are associated with instruments, this standard is applicable to the combination of the instrument and the accessory provided that the adjustments have been made for the combination.

This standard also applies to a direct acting indicating electrical measuring instrument whose scale marks do not correspond directly to its electrical input quantity, provided that the relationship between them is known.

This standard also applies to instruments and accessories having electronic devices in their measuring and/or auxiliary circuits.

This standard does not apply to special purpose instruments which are covered by their own IEC standards.

This standard does not apply to special purpose devices which are covered by their own IEC standards when they are used as accessories.

This standard does not contain either requirements for protection against environmental conditions or the relevant tests. However, when necessary, and then only by agreement between the manufacturer and the user, tests to approximate the conditions of use may be selected from IEC 60068.

This standard does not specify requirements concerning dimensions of instruments or accessories (for the former, see IEC 60473).

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60051. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60051 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60027, *Letter symbols to be used in electrical technology*.

IEC 60050(301), (302), (303):1983, *International Electrotechnical Vocabulary (IEV) — Chapter 301: General terms on measurements in electricity — Chapter 302: Electrical measuring instruments — Chapter 303: Electronic measuring instruments*.

IEC 60051-9:1988, *Direct acting indicating analogue electrical measuring instruments and their accessories — Part 9: Recommended test methods*.

IEC 60068-2-6:1995, *Environmental tests — Part 2: Tests — Test Fc and guidance: Vibrations (sinusoidal)*.

IEC 60068-2-27:1987, *Environmental testing — Part 2: Tests — Test Ea and guidance: Shock*.

IEC 60417:1973, *Graphical symbols for use on equipment — Index, survey and compilation of the single sheets*.

IEC 60473:1974, *Dimensions for panel-mounted indicating and recording electrical measuring instruments*¹⁾.

IEC 60617-2:1996, *Graphical symbols for diagrams — Part 2: Symbol elements, qualifying symbols and other symbols having general application*.

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

2 Definitions

The values of a.c quantities, given in this standard, are r.m.s. values unless otherwise stated.

For the purpose of this standard, terms as defined in IEC 60050 apply, together with the following additional terms.

2.1 General terms

2.1.1 electrical measuring instrument

a measuring instrument intended to measure an electrical or non-electrical quantity using electrical means

2.1.2 analogue display instrument

a measuring instrument intended to present or display the output information as a continuous function of the measured quantity

NOTE An instrument in which a change of the indication occurs by small discrete steps, but which does not have a digital display, is considered to be an analogue instrument.

2.1.3 indicating instrument

a measuring instrument which displays at any time the value of the measured quantity without recording it

NOTE The indicated value may be different from the value of the quantity measured by the instrument and may be in units of a different quantity.

2.1.4 direct acting indicating instrument

an instrument in which the indicating device is mechanically connected to and actuated by the moving element

¹⁾ Revision in preparation

2.1.5**electronic measuring instrument**

a measuring instrument intended to measure an electrical or non-electrical quantity using electronic means

2.1.6**single function instrument**

an instrument intended for the measurement of one kind of quantity only

2.1.7**multi-function instrument**

an instrument having a single means of indication intended for the measurement of more than one kind of quantity (e.g. an instrument measuring current, voltage and resistance)

2.1.8**fixed instrument**

an instrument designed to be permanently mounted and which is intended to be connected to (an) external circuit(s) by means of permanently installed leads

2.1.9**portable instrument**

an instrument specifically designed to be carried out by hand

NOTE The instrument is intended to be connected and disconnected by the user.

2.1.10**polyphase instrument**

an instrument for measurement in a polyphase system and arranged for connection to more than one phase of the system

2.1.11**balanced load polyphase instrument**

a polyphase instrument for use in a balanced polyphase system. This does not include a single phase wattmeter scaled in terms of polyphase power

2.1.12**instrument with magnetic screen**

an instrument shielded by ferro-magnetic material from the influence of a magnetic field of external origin

2.1.13**astatic instrument**

an instrument in which the measuring element is so constructed as to be unaffected by a uniform magnetic field of external origin

2.1.14**instrument with electric screen**

an instrument shielded by conductive material from the influence of an electric field of external origin

2.1.15 accessory

an element group of elements or device associated with the measuring circuit of a measuring instrument in order to confer specified characteristics to the measuring instrument

2.1.15.1**interchangeable accessory**

an accessory having its own properties and accuracy, these being independent of those of the instrument with which it may be associated

NOTE An accessory is considered to be interchangeable when its rated characteristics are known and marked and are sufficient to enable its errors and variations to be determined without using the associated instrument. A shunt whose adjustment takes into account an instrument current which is not negligible and which is known, is considered to be interchangeable.

2.1.15.2**accessory of limited interchangeability**

an accessory having its own properties and accuracy, which can only be associated with measuring instruments for which certain characteristics are within specified limits

2.1.15.3**non-interchangeable accessory**

an accessory adjusted to take into account the electrical characteristics of a specific measuring instrument

2.1.16**shunt**

a resistor connected in parallel with a measuring circuit of a measuring instrument

NOTE A shunt is generally intended to provide a voltage proportional to a current to be measured.

2.1.17**series resistor (impedance)**

a resistor (impedance) connected in series with a measuring circuit of a measuring instrument

NOTE A series resistor (impedance) is generally intended to extend the voltage measuring range of an instrument.

2.1.18**instrument lead**

a lead comprising one or more conductors, specially designed for interconnecting measuring instruments to external circuits or to accessories

2.1.19**calibrated instrument lead**

an instrument lead whose resistance has a specified value

NOTE A calibrated instrument lead is considered as being an interchangeable accessory of a measuring instrument.

2.1.20**distortion factor (total harmonic distortion factor) (of a quantity)**

the ratio:
$$\frac{\text{r.m.s. value of the harmonic content}}{\text{r.m.s. value of the non-sinusoidal quantity}}$$

2.1.21**ripple content of a quantity**

the ratio:
$$\frac{\text{r.m.s. value of the fluctuating component}}{\text{value of the d.c. component}}$$

2.1.22**peak factor**

the ratio of the peak value to the r.m.s. value of a periodic quantity

2.2 Description of instruments according to their method of operation**2.2.1****permanent-magnet moving-coil instrument**

an instrument which operates by the interaction of the magnetic field due to a current in a movable coil with the field of a fixed permanent magnet

NOTE The instrument can have more than one coil, measuring the sum or ratio of the currents in them.

2.2.2**moving-magnet instrument**

an instrument which operates by the interaction of the field of a movable permanent magnet with the magnetic field due to a current in a fixed coil

NOTE The instrument can have more than one coil.