

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Direct acting indicating analogue electrical measuring instruments and their accessories –

Part 1: Definitions and general requirements common to all parts

Appareils de mesure électriques indicateurs analogiques à action directe et leurs accessoires –

Partie 1: Définitions et exigences générales communes à toutes les parties



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Direct acting indicating analogue electrical measuring instruments and their accessories –

Part 1: Definitions and general requirements common to all parts

Appareils de mesure électriques indicateurs analogiques à action directe et leurs accessoires –

Partie 1: Définitions et exigences générales communes à toutes les parties

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.220.20

ISBN 978-2-8322-3162-3

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions	9
3.1 General terms	9
3.2 Description of instruments according to their method of operation	13
3.3 Constructional features of instruments.....	14
3.4 Characteristic features of instruments.....	16
3.5 Characteristic values.....	17
3.6 Influence quantity, reference conditions, nominal range of use and preconditioning	17
3.7 Uncertainty and variations	19
3.8 Accuracy, accuracy class and class index.....	21
3.9 Test.....	21
4 Description, classification and compliance.....	22
4.1 Description.....	22
4.1.1 Description according to methods of operation or nature	22
4.1.2 Description according to environmental conditions	22
4.1.3 Description according to mechanical conditions	22
4.1.4 Description according to degrees of protection.....	22
4.2 Classification	22
4.3 Compliance with the requirements of this standard.....	23
5 Requirements	23
5.1 Reference conditions.....	23
5.2 Limits of intrinsic uncertainty, fiducial value	23
5.2.1 Limits of intrinsic uncertainty	23
5.2.2 Correspondence between intrinsic uncertainty and accuracy class	23
5.2.3 Fiducial value.....	23
5.3 Nominal range of use and variations	25
5.3.1 Nominal range of use	25
5.3.2 Limits of variations	27
5.3.3 Conditions for the determination of variations	28
5.4 Operating uncertainty, overall system uncertainty and variations.....	28
5.5 Electrical requirements.....	28
5.5.1 Electrical safety requirements	28
5.5.2 Self-heating	28
5.5.3 Permissible overloads	29
5.5.4 Limiting range of temperature.....	29
5.5.5 Deviation from zero.....	29
5.5.6 Electromagnetic compatibility (EMC)	29
5.6 Constructional requirements.....	30
5.6.1 General constructional requirements	30
5.6.2 Damping	30
5.6.3 Sealing to prevent access	30
5.6.4 Scales	31

5.6.5	Stopper.....	32
5.6.6	Preferred values	32
5.6.7	Adjusters, mechanical and/or electrical.....	32
5.6.8	Effects of vibration and shock.....	33
5.6.9	Degrees of protection provided by enclosure	33
5.6.10	Terminals.....	34
6	Information, markings and symbols	34
6.1	Information.....	34
6.2	Markings, symbols and their locations.....	35
6.3	Markings relating to the reference values and nominal ranges of use of influence quantities	36
6.4	The symbols for marking instruments and accessories	36
6.5	Markings and symbols for terminals	45
6.5.1	Requirements for markings.....	45
6.5.2	Earthing (grounding) terminals	45
6.5.3	Measuring circuit terminals.....	45
6.5.4	Special markings for terminals.....	45
6.6	Instructions for use.....	45
7	Package	46
8	Test rules	46
8.1	Type of test.....	46
8.2	Type tests	46
8.3	Routine tests.....	46
8.4	Recurrent tests	46
8.5	Nonconformity classification	47
8.6	Judgement of test results	47
	Annex A (normative) Limits of intrinsic uncertainty and variations	48
	Annex B (informative) Relationship between ambient temperature and relative humidity.....	51
	Annex C (informative) Estimation of uncertainties	52
	C.1 Uncertainties in this standard	52
	C.2 Operating uncertainty	52
	C.2.1 General	52
	C.2.2 Estimating absolute operating uncertainty according to type test results.....	52
	C.2.3 Estimating absolute operating uncertainty according to limit of intrinsic uncertainty and limit of variations due to every influence specified by this standard.....	53
	C.3 Overall system uncertainty	54
	C.4 Fiducial operating uncertainty.....	54
	Annex D (normative) Routine Tests.....	55
	Bibliography	56
	Figure 1 – Measuring range 10 A to 50 A.....	31
	Figure 2 – Measuring range 80 V to 110 V.....	32
	Figure 3 – Measuring ranges 0,06 M Ω to 0,4 M Ω and 0,1 M Ω to 2 M Ω	32
	Figure A.1 – Effect of temperature.....	48
	Figure A.2 – Effect of temperature.....	49
	Figure B.1 – Relationship between ambient temperature and relative humidity	51

Figure C.1 – Different kinds of uncertainty52

Table 1 – Minimum IP requirements22

Table 2 – Reference conditions and tolerances for testing purposes relating to the influence quantities24

Table 3 – Limits of the nominal range of use and permissible variations26

Table 4 – The diameters of conductive screw and the diameters or the area of contact surface34

Table 5 – Units, quantities and SI prefixes.....37

Table 6 – Symbols for marking instruments and accessories.....38

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIRECT ACTING INDICATING ANALOGUE ELECTRICAL
MEASURING INSTRUMENTS AND THEIR ACCESSORIES –****Part 1: Definitions and general requirements common to all parts**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60051-1 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This sixth edition cancels and replaces the fifth edition published in 1997. This edition constitutes a technical revision.

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

- adding the EMC requirements;
- updating the safety symbols and requirements according to new IEC 61010 series;
- replacing the concept of “error” to the concept of “uncertainty”;
- adding service environment classification and classification by method of operation, mechanical condition and the degrees of protection;