IEC 61010-2-032

Edition 5.0 2023-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Safety requirements for electrical equipment for measurement, control, and laboratory use –
Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement

Exigences de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire –
Partie 2-032: Exigences particulières pour les capteurs de courant, portatifs et manipulés manuellement, pour essai électrique et mesurage



IEC 61010-2-032:2023-09(en-fr)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 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 Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
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 once a month by email.

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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

Recherche de publications IEC - webstore.iec.ch/advsearchform
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 une fois par mois par email.

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

IEC Products & Services Portal - products.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 61010-2-032

Edition 5.0 2023-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Safety requirements for electrical equipment for measurement, control, and laboratory use –
Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement

Exigences de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire –
Partie 2-032: Exigences particulières pour les capteurs de courant, portatifs et manipulés manuellement, pour essai électrique et mesurage

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 19.080

ISBN 978-2-8322-7423-1

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.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

FOREWORD 4
INTRODUCTION 8
1 Scope and object 9
2 Normative references 10
3 Terms and definitions 11
4 Tests 12
5 Marking and documentation 13
6 Protection against electric shock 16
7 Protection against mechanical HAZARDS 24
8 Resistance to mechanical stresses 24
9 Protection against the spread of fire and arc flash 31
10 Equipment temperature limits and resistance to heat 37
11 Protection against HAZARDS from fluids and solid foreign objects 38
12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure 38
13 Protection against liberated gases and substances, explosion and implosion 38
14 Components and subassemblies 39
15 Protection by interlocks 39
16 HAZARDS resulting from application 39
17 RISK assessment 39
101 Measuring circuits 39
Annexes 42
Annex D (normative) Parts between which insulation requirements are specified (see 6.4, 6.5.3 and 6.101) 42
Annex F (normative) Routine tests 44
Annex K (normative) Insulation requirements not covered by 6.7 45
Annex L (informative) Index of defined terms 58
Annex AA (normative) MEASUREMENT CATEGORIES 59
Annex BB (informative) HAZARDS pertaining to measurements performed in certain environments 62
Annex CC (informative) 4 mm "banana" TERMINALS 65
Annex DD (informative) Flowchart for insulation according to the type of circuit 67
Annex EE (informative) Determination of CLEARANCES for Table 101 70
Annex FF (normative) Type of current sensors 71
Annex GG (normative) CLAMP MULTIMETER 73
Bibliography 75

Figure 4 – Acceptable arrangement of protective means against electric shock 17
Figure 101 – CLEARANCE between the PROTECTIVE FINGERGUARD to the JAWS and to the HAZARDOUS LIVE conductor 23
Figure 102 – Abrasion test of the JAW ENDS 25
Figure 103 – Impact points for JAW impact test 26
Figure 104 – Indentation device 27

Figure 105 – Example of a current sensor with strain reliefs 29
Figure 106 – Flexing test 30
Figure 107 – Test probe to check protection against short-circuits 36
Figure 108 – Use of the test probe of Figure 107 36
Figure D.101 – Parts of current sensors (see also Table D.101) 42
Figure K.101 – CLEARANCES between the conductor, the input/output circuit and the enclosure of a Type A current sensor 49
Figure K.102 – Test circuit for evaluation of TRANSIENT OVERVOLTAGE attenuation 52
Figure AA.1 – Example to identify the locations of MEASUREMENT CATEGORIES 60
Figure CC.1 – Recommended dimensions of 4 mm TERMINALS 66
Figure DD.1 – Requirements for CLEARANCE, CREEPAGE DISTANCE and solid insulation 69
Figure FF.1 – Examples of current sensors and their parts 72
Figure GG.1 – Examples of CLAMP MULTIMETERS 73

Table 1 – Symbols 13
Table 101 – CLEARANCES for unmated measuring circuit TERMINALS 18
Table 102 – Energy level for JAW impact test 26
Table 103 – Pull forces for endcaps of flexible current sensors 28
Table 104 – Pull forces for input/output lead attachment test 31
Table 105 – Thickness of the test probe of Figure 107 and test voltages 37
Table D.101 – Insulation requirements for current sensors 43
Table K.15 – CLEARANCE values for the calculation of K.3.2 46
Table K.16 – Test voltages based on CLEARANCES 47
Table K.101 – Impulse voltages for circuits connected to MAINS 51
Table K.102 – CLEARANCES for measuring circuits RATED for MEASUREMENT CATEGORIES 53
Table K.103 – Impulse test voltages for testing electric strength of solid insulation for measuring circuits RATED for MEASUREMENT CATEGORIES 54
Table K.104 – a.c. test voltages for testing electric strength of solid insulation for measuring circuits RATED for MEASUREMENT CATEGORIES 54
Table K.105 – Minimum values for distance or thickness of solid insulation for measuring circuits RATED for MEASUREMENT CATEGORIES 56
Table AA.1 – Characteristics of MEASUREMENT CATEGORIES 61
Table EE.1 – CLEARANCE values for Table 101 70

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE –

Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement

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.

IEC 61010-2-032 has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2019. This edition constitutes a technical revision.

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

a) In 1.1.1, definitions of current sensor types have been moved to a new Annex FF;
b) Clause 2, all normative references have been dated and new normative references have been added;
c) 3.2.103, a new definition PROTECTIVE FINGERGUARD has been added which replaces the previous definition of PROTECTIVE BARRIER;
d) 4.4.2.101 is a new subclause about surge protective devices;

e) in 5.1.5.101.2, minimum RATINGS for voltage of measuring TERMINALS are required;

f) Subclause 6.5.1 has been modified;

g) Subclause 6.5.5 is no longer used;

h) Subclause 6.6.101 modifies 6.6.101 and 6.6.102 of previous edition:

   1) in 6.6.101.1, insulating material of group I may be allowed for determination of CREEPAGE DISTANCES of measuring circuit TERMINALS;

   2) in 6.6.101.2, CLEARANCES and CREEPAGE DISTANCES up to 3 000 V for measuring circuit TERMINALS in unmated position have been defined;

   3) in 6.6.101.3, requirements for measuring circuit TERMINALS in partially mated position have been specified;

   4) in 6.6.101.4, requirements for measuring circuit TERMINALS in mated position have been specified;

   5) Subclause 6.6.101.5 replaces 6.6.102;

i) Subclause 6.6.102 replaces 6.101 of previous edition with modifications;

j) Subclause 6.101.2 replaces 6.9.101.1 of previous edition with modifications;

k) Subclause 6.101.3 replaces 6.9.101.2 of previous edition with modifications;

l) Subclause 6.101.4 replaces 6.9.102 of previous edition with modifications;

m) in 8.101, JAW ENDS abrasion test has been modified;

n) 8.105 is a new subclause for input/output leads attachment has been added;

o) in 9.101.2, relocation of 101.3 of previous edition;

p) in 9.101.3, relocation of 101.4 of previous edition, extension to MEASUREMENT CATEGORY II and reference to IEC 61000-4-5 for tests;

q) Table 104 has been replaced by Table K.101;

r) in 9.102, relocation of Clause 102 of previous edition;

s) in 14.101, relocation of 14.102. Subclause 14.101 of previous edition has been deleted;

t) 101.3 is a new subclause for protections against HAZARD occurring from reading a voltage value in replacement of Clause EE.5 of previous edition;

u) in Table D.101, transients are disregarded for insulation between JAW ENDS and input/output circuits;

v) in Clause F.101, test voltages for routine test of JAWS have been modified;

w) in K.2.1, another method for determination of CLEARANCES of secondary circuits is proposed;

x) in K.3.2, new Table K.15 and Table K.16 for CLEARANCE calculation;

y) K.3.101 is a new clause;

z) Clause K.4, redraft of the clause to propose a method for determination of U_t for circuits which reduce TRANSIENT OVERVOLTAGES;

aa) Table K.101 replaces Table 104;

bb) Subclause K.101.4 has been reviewed and tables and tests for solid insulation have been modified;

cc) Table K.104 of previous edition has been deleted;

dd) Annex AA: Figure AA.1 has been redesigned;

ee) Annex EE: addition of a new informative annex for determination of CLEARANCES for Table 101;

ff) Annex GG: this annex was Annex EE of previous edition and the current sensor type of a CLAMP MULTIMETER is type A or type B.

The text of this International Standard is based on the following documents:

Draft	Report on voting
66/788A/FDIS	66/798/RVD

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 International Standard 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 www.iec.ch/publications.

A list of all parts of the IEC 61010 series, under the general title *Safety requirements for electrical equipment for measurement, control, and laboratory use*, can be found on the IEC website.

This document is to be used in conjunction with IEC 61010-1:2010 and IEC 61010-1:2010/AMD1:2016.

This document supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that publication into the IEC standard: *Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement*.

Where a particular subclause of IEC 61010-1 is not mentioned in this document, that subclause applies as far as is reasonable. Where this document states "addition", "modification", "replacement", or "deletion", the relevant requirement, test specification or note in IEC 61010-1 should be adapted accordingly.

In this standard:

a) the following print types are used:
   - requirements: in roman type;
   - NOTES: in small roman type;
   - *conformity and tests: in italic type;*
   - terms used throughout this standard which have been defined in Clause 3: SMALL ROMAN CAPITALS;

b) subclauses, figures, tables and notes which are additional to those in IEC 61010-1 are numbered starting from 101. Additional annexes are lettered starting from AA and additional list items are lettered from aa).

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

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

IMPORTANT – The "colour inside" logo on the cover page of this document 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 61010-1 specifies the safety requirements that are generally applicable to all equipment within its scope. For certain types of equipment, the requirements of IEC 61010-1 and its amendment will be supplemented or modified by the special requirements of one or more standard from the IEC 61010-2 series which is/are read in conjunction with the requirements of IEC 61010-1.

1) IEC 61010-2-030:2023 specifies the safety requirements for equipment with testing or measuring circuits which are connected for test or measurement purposes to devices or circuits outside the measurement equipment itself.
2) This document specifies the safety requirements for hand-held and hand-manipulated current sensors for measuring, detecting or injecting current, or indicating current waveforms on circuits without physically opening the current path of the circuit being measured.

   Most of the requirements of IEC 61010-2-030:2023 have been included in this document. Equipment within the scopes of both IEC 61010-2-030:2023 and this document is considered to be covered by the requirements of this document.

   However, for current sensors in combined equipment with protective bonding and automatic disconnection of the supply, IEC 61010-2-030:2023 and this document are read in conjunction.
3) IEC 61010-2-033:2023 specifies the safety requirements for hand-held multimeters and other meters for domestic and professional use, capable of measuring mains voltage, intended to measure voltage and other electrical quantities such as resistance or current.

   All relevant requirements of IEC 61010-2-030 have been included in IEC 61010-2-033:2023.
4) IEC 61010-2-034:2023 specifies the safety requirements for measurement equipment for insulation resistance and test equipment for electric strength which are connected to units, lines or circuits for test or measurement purposes.

   All relevant requirements of IEC 61010-2-030:2023 have been included in IEC 61010-2-034:2023. However, for equipment within the scope of this document and IEC 61010-2-034:2023, these standards are read in conjunction.

IEC 61010-031 specifies the safety requirements for hand-held and hand-manipulated probe assemblies and their related accessories intended to be used in particular with equipment in the scope of IEC 61010-2-030, this document, IEC 61010-2-033 and IEC 61010-2-034. These probe assemblies are for non-contact or direct electrical connection between a part and electrical test and measurement equipment. They may be fixed to the equipment or be detachable accessories for the equipment.

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE –

Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement

1 Scope and object

IEC 61010-1:2010, Clause 1 and IEC 61010-1:2010/AMD1:2016, Clause 1 apply except as follows:

1.1.1 Equipment included in scope

Replace the existing text with the following:

This document specifies safety requirements for HAND-HELD and hand-manipulated current sensors intended for measuring, detecting or injecting current, or indicating current waveforms on circuits without physically opening the current path of the circuit being measured.

These current sensors are hand-manipulated before and/or after a test or measurement, but are not necessarily HAND-HELD during the test or measurement. They can be stand-alone current sensors or accessories to other equipment or parts of combined equipment. These include measurement circuits which are part of electrical test and measurement equipment, laboratory equipment, or process control equipment.

NOTE 1 Combined equipment is equipment that is electrically connected to a current sensor by means of a permanent connection which can be detached only by the use of a TOOL.

NOTE 2 Some current sensors are also known as current clamps, CLAMP MULTIMETERS and current probes.

The types of current sensors covered by this document are defined in Annex FF.

1.1.2 Equipment excluded from scope

Add the following new paragraph:

This document does not apply to current sensors used as FIXED EQUIPMENT.

1.2.1 Aspects included in scope

Replace item c) of the second paragraph with the following new item c):

c) spread of fire or arc flash from the current sensor (see Clause 9);

Replace the third paragraph with the following two new paragraphs:

Requirements for protection against HAZARDS arising from NORMAL USE, REASONABLY FORESEEABLE MISUSE and ergonomic factors are specified in Clause 16, Clause 101 and Annex GG.

Annex BB provides guidance to equipment manufacturers on HAZARDS that should be considered for equipment intended for performing tests and measurements on hazardous conductors, including MAINS conductors and telecommunication network conductors.