UL 61010-2-033

STANDARD FOR SAFETY

Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-033: Particular Requirements for Hand-Held Multimeters for Domestic and Professional Use, Capable of Measuring Mains Voltage

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UL Standard for Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-033: Particular Requirements for Hand-Held Multimeters for Domestic and Professional Use, Capable of Measuring Mains Voltage, UL 61010-2-033

Third Edition, Dated October 17, 2024

Summary of Topics

This new Third Edition of ANSI/UL 61010-2-033 dated October 17, 2024 is an Adoption of IEC 61010-2-033, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-033: Particular Requirements for Hand-Held Multimeters for Domestic and Professional Use, Capable of Measuring Mains Voltage, UL 61010-2-033, (third edition, issued by IEC September 2023) as a new IEC-based UL standard with US Differences.

The requirements are substantially in accordance with Proposal(s) on this subject dated August 2, 2024.

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OCTOBER 17, 2024

ANSI/UL 61010-2-033-2024

UL 61010-2-033

Standard for Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-033: Particular Requirements for Hand-Held Multimeters for Domestic and Professional Use, Capable of Measuring Mains Voltage

First Edition – August, 2014
Second Edition – January, 2020

Third Edition

October 17, 2024

This ANSI/UL Standard for Safety consists of the Third Edition.

The most recent designation of ANSI/UL 61010-2-033 as an American National Standard (ANSI) occurred on October 17, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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CONTENTS

PREFACE (UL) 7

NATIONAL DIFFERENCES 9

FOREWORD 11

INTRODUCTION 15

1 Scope and object 17
1.1.1 Equipment included in scope 17
1.1.2 Equipment excluded from scope 17
1.2.1 Aspects included in scope 17
2 Normative references 18
2DV Modification: Add the following 19
3 Terms and definitions 19
3.5 Safety terms 19
4 Tests 19
4.3.2.5 Power supply 19
4.3.2.6 Input and output voltages or currents 20
4.4.2.101 Surge protective devices 20
5 Marking and documentation 20
5.1.2 Identification 20
5.1.5 TERMINALS, connections and operating devices 20
5.2 Warning markings 21
5.4.1 General 22
6 Protection against electric shock 22
6.5.1 General 22
6.5.2 Not used 24
6.5.5 Not used 24
6.6 Connections to external circuits 24
6.7.1.3 CREEPAGE DISTANCES 26
6.7.1.5 Requirements for insulation according to type of circuit 26
6.8.1 General 27
6.8.3.1 The a.c. voltage test 27
6.8.3.2 The d.c. voltage test 28
6.101 Hand-held multimeter ratings 28
7 Protection against mechanical HAZARDS 28
8 Resistance to mechanical stresses 28
9 Protection against the spread of fire and arc flash 28
9.101 Protection of measuring circuits 28
10 Equipment temperature limits and resistance to heat 33
11 Protection against HAZARDS from fluids and solid foreign objects 33
12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure 33
13 Protection against liberated gases and substances, explosion and implosion 33
14 Components and subassemblies 33
14.8 Not used 33
14.101 Probe assemblies and accessories 33
15 Protection by interlocks 34
16 HAZARDS resulting from application 34
17 RISK assessment 34
101 Measuring circuits 34
101.1 General 34

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101.2 Current measuring circuits 34
101.3 Indicating devices 35

Annexes

Annex K (normative) Insulation requirements not covered by 6.7

K.2 Insulation in secondary circuits 38
K.2.1 General 38
K.3 Insulation in circuits not addressed in 6.7, Clause K.1, Clause K.2 or Clause K.101, and for measuring circuits where MEASUREMENT CATEGORIES do not apply 38
K.3.1 General 38
K.3.2 CLEARANCE calculation 39
K.4 Not used 41
K.101 Insulation requirements for measuring circuits RATED for MEASUREMENT CATEGORIES 41
K.101.1 General 41
K.101.2 CLEARANCES 41
K.101.3 CREEPAGE DISTANCES 42
K.101.4 Solid insulation 42

Annex L (informative) Index of defined terms

Annex AA (normative) MEASUREMENT CATEGORIES

AA.1 General 48
AA.2 MEASUREMENT CATEGORIES 48
AA.2.1 MEASUREMENT CATEGORY II 48
AA.2.2 MEASUREMENT CATEGORY III 48
AA.2.3 MEASUREMENT CATEGORY IV 48
AA.2.4 Measuring circuits without a MEASUREMENT CATEGORY RATING 48

Annex BB (informative) HAZARDS pertaining to measurements performed in certain environments

BB.1 General 52
BB.2 Hazards 52
BB.2.1 General 52
BB.2.2 Electric shock 52
BB.2.3 Arc flash and arc blast 52
BB.2.4 Thermal burns 52
BB.3 Telecommunications networks 53
BB.4 Current measurements in inductive circuits 53
BB.5 Battery-driven circuits 53
BB.6 Measurements at higher frequencies 53
BB.7 Measurements using measuring circuits with a FUNCTIONAL EARTH TERMINAL 53

Annex CC (informative) 4 mm "banana" TERMINALS

CC.1 General 55
CC.2 Dimensions 55

Annex DD (informative) Flowchart for insulation according to the type of circuit

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Annex EE (informative) Determination of CLEARANCES for Table 101

Bibliography

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PREFACE (UL)

This UL Standard is based on IEC Publication 61010-2-033: third edition Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-033: Particular requirements for hand-held multimeters for domestic and professional use, capable of measuring mains voltage. IEC publication 61010-2-033 is copyrighted by the IEC.

This edition has been issued to satisfy UL Standards policy.

This UL Standard 61010-2-033 Standard for Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-033: Particular Requirements for Hand-Held Multimeters for Domestic and Professional Use, Capable of Measuring Mains Voltage, is to be used in conjunction with the lastest edition of UL 61010-1. The requirements for measurement equipment for insulation resistance and test equipment for electric strength are contained in this Part 2 Standard and UL 61010-1.

Requirements of this Part 2 Standard, where stated, amend the requirements of UL 61010-1.

Where a particular subclause of UL 61010-1 is not mentioned in UL 61010-2-033, the UL 61010-1 subclause applies.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 61010-2-033, Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-033: Particular requirements for hand-held multimeters for domestic and professional use, capable of measuring mains voltage, copyright 2023 are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

DR – These are National Differences based on the **national regulatory requirements**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE – Part 2-033: Particular requirements for hand-held multimeters and other meters for domestic and professional use, capable of measuring mains voltage

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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IEC 61010-2-033 has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment. It is an International Standard.

This third edition cancels and replaces the second 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) Clause 2, all normative references have been dated and new normative references have been added;

b) 4.4.2.101 is a new subclause about surge protective devices;

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

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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;

d) Subclause 6.101 replaces 6.9.101 of the previous edition with modifications;

e) 9.101 is a new subclause to consider the protection of measuring circuits against the spread of fire and arc flash;

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

g) in 9.101.3, relocation of 101.4 of previous edition;

h) in 101.3, relocation of Clause 102 of previous edition;

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

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

k) Clause K.4 of the previous edition has been deleted;

l) Subclause K.101.4 has been reviewed;

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

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

o) Annex EE: addition of a new informative annex for determination of CLEARANCES for the purposes of Table 101.

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

Draft	Report on voting
66/787/FDIS	66/797/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

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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 multimeters and other meters for domestic and professional use, capable of measuring mains voltage*.

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.

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101DV DE *Modification to add the following to IEC Foreword:*

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

102DV DE *Modification to add the following to the IEC Foreword:*

For this Standard, all references to "IEC 61010-1:2010" or "IEC 61010-1:2010/AMD1:2016" refer to UL 61010-1.

For this Standard, all references to IEC 61010-2-030, IEC 61010-2-032 and IEC 61010-2-034 refer to UL versions of the particulars.

For this Standard, all references to IEC 61010-031 refer to UL 61010-031.

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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) IEC 61010-2-032:2023 specifies the safety requirements for hand-held and hand-manipulated current sensors for measuring, detecting, 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 IEC 61010-2-032:2023. Equipment within the scopes of both IEC 61010-2-030:2023 and IEC 61010-2-032:2023 is considered to be covered by the requirements of IEC 61010-2-032:2023.

However, for current sensors in combined equipment with protective bonding and automatic disconnection of the supply, IEC 61010-2-030:2023 and IEC 61010-2-032:2023 are read in conjunction.

3) This document 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 61010-2-030:2023 have been included in this document.

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 IEC 61010-2-032:2023 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, IEC 61010-2-032, this document, 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.

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SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE – Part 2-033: Particular requirements for hand-held multimeters and other meters for domestic and professional use, capable of measuring mains voltage

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 multimeters and other meters for domestic and professional use, capable of measuring MAINS.

Hand-held multimeters are multi-range multifunction measuring instruments intended to measure voltage and other electrical quantities such as resistance or current. Their primary purpose is to measure voltage on a live MAINS. They are suitable to be supported by one hand during NORMAL USE.

1.1.2 Equipment excluded from scope

Add the following new item to the list and the following paragraph:

aa) IEC 61557 (all parts), *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures*

HAND-HELD EQUIPMENT such as oscilloscopes, wattmeters, process control multimeters not RATED for measuring voltage on a live MAINS, clamp multimeters and communications test sets are not within the scope of this document.

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 hand-held multimeters (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 and Clause 101.

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.

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2 Normative references

IEC 61010-1:2010, Clause 2 and IEC 61010-1:2010/AMD1:2016, Clause 2 apply except as follows:

Replace the following existing normative references:

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*
IEC 60364-4-44:2007/AMD1:2015

IEC 61010-031, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test*

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

IEC 61180-1, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements*

IEC 61180-2, *High-voltage test techniques for low-voltage equipment – Part 2: Test equipment*

with the following new normative references:

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*
IEC 60364-4-44:2007/AMD1:2015
IEC 60364-4-44:2007/AMD2:2018

IEC 61010-031:2022, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 031: Safety requirements for hand-held and hand-manipulated probe assemblies for electrical test and measurement*

IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*[1]

[1] IEC 61180:2016 replaces everywhere IEC 61180, IEC 61180-1 and IEC 61180-2 are referenced in IEC 61010-1.

Add the following new normative references:

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

IEC 61010-2-030:2023, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Special requirements for testing and measuring circuits*

IEC 61010-2-032:2023, *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*

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2DV DR *Modification: Add the following*

The requirements of this UL Standard shall take precedence over the International Standard on which it is based; any reference within this standard to the International Standard shall be replaced by a reference to the equivalent US Standard.

3 Terms and definitions

IEC 61010-1:2010, Clause 3 and IEC 61010-1:2010/AMD1:2016, Clause 3 apply except as follows:

3.5 Safety terms

Replace the definition of 3.5.4 with the following new definition:

3.5.4
MAINS
electricity supply system

Add the following new term and definition:

3.5.101
MEASUREMENT CATEGORY
classification of testing and measuring circuits according to the type of MAINS to which they are intended to be connected

4 Tests

IEC 61010-1:2010, Clause 4 and IEC 61010-1:2010/AMD1:2016, Clause 4 apply except as follows:

4.3.2.5 MAINS supply

Replace the existing title and text with the following:

4.3.2.5 Power supply

The following requirements apply:

a) the voltage of the power supply connected to the MAINS shall be between 90 % and 110 % of any RATED supply voltage for which the hand-held multimeter can be set or, if the hand-held multimeter is RATED for a greater fluctuation, at any supply voltage within the fluctuation range;

b) the MAINS frequency shall be any RATED frequency;

c) hand-held multimeters for both a.c. and d.c. shall be connected to an a.c. or d.c. supply;

d) hand-held multimeters powered from MAINS by single-phase a.c. shall be connected both with normal and reverse polarity;

e) if the means of connection permit reversal, battery-operated and d.c. hand-held multimeters shall be connected with both reverse and normal polarity.

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