

Institut luxembourgeois de la normalisation de l'accréditation, de la sécurité et qualité des produits et services

ILNAS-EN IEC 60904-10:2020

Photovoltaic devices - Part 10: Methods of linear dependence and linearity measurements

Photovoltaische Einrichtungen - Teil 10: Methoden zur Messung der linearen Abhängigkeit und Linearität

Dispositifs photovoltaïques - Partie 10: Méthodes de mesure de la dépendance linéaire et de la linéarité

01011010010 0011010010110100101010101111

National Foreword

This European Standard EN IEC 60904-10:2020 was adopted as Luxembourgish Standard ILNAS-EN IEC 60904-10:2020.

Every interested party, which is member of an organization based in Luxembourg, can participate for FREE in the development of Luxembourgish (ILNAS), European (CEN, CENELEC) and International (ISO, IEC) standards:

- Participate in the design of standards
- Foresee future developments
- Participate in technical committee meetings

https://portail-qualite.public.lu/fr/normes-normalisation/participer-normalisation.html

THIS PUBLICATION IS COPYRIGHT PROTECTED

Nothing from this publication may be reproduced or utilized in any form or by any mean - electronic, mechanical, photocopying or any other data carries without prior permission!

EUROPEAN STANDARD LILNAS-EN IEC 60904-10:2020 IEC 60904-10

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2020

ICS 27.160

Supersedes EN 60904-10:2010 and all of its amendments and corrigenda (if any)

English Version

Photovoltaic devices - Part 10: Methods of linear dependence and linearity measurements (IEC 60904-10:2020)

Dispositifs photovoltaïques - Partie 10: Méthodes de mesure de la dépendance linéaire et de la linéarité (IEC 60904-10:2020)

Photovoltaische Einrichtungen - Teil 10: Methoden zur Messung der linearen Abhängigkeit und Linearität (IEC 60904-10:2020)

This European Standard was approved by CENELEC on 2020-10-23. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 82/1759/FDIS, future edition 3 of IEC 60904-10, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60904-10:2020.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2021-07-23 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-10-23

This document supersedes EN 60904-10:2010 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60904-10:2020 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61829 NOTE Harmonized as EN 61829

IEC 61853-1 NOTE Harmonized as EN 61853-1

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	EN/HD	<u>Year</u>
IEC 60891	-	Photovoltaic devices - Procedures for temperature and irradiance corrections to measured I-V characteristics	EN 60891	-
IEC 60904-1	-	Photovoltaic devices - Part 1: Measurement of photovoltaic current-voltage characteristics	EN IEC 60904-1	-
IEC 60904-1-1	-	Photovoltaic devices - Part 1-1: Measurement of current-voltage characteristics of multi-junction photovoltaic (PV) devices	EN 60904-1-1	-
IEC/TS 60904-1-2	-	Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices	-	-
IEC 60904-2	-	Photovoltaic devices - Part 2: Requirements for photovoltaic reference devices	EN 60904-2	-
IEC 60904-3	-	Photovoltaic devices - Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data	EN IEC 60904-3	-
IEC 60904-7	-	Photovoltaic devices - Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices	EN IEC 60904-7	-
IEC 60904-8	-	Photovoltaic devices - Part 8: Measurement of spectral responsivity of a photovoltaic (PV) device	EN 60904-8	-
IEC 60904-8-1	-	Photovoltaic devices - Part 8-1: Measurement of spectral responsivity of multi-junction photovoltaic (PV) devices	EN 60904-8-1	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	EN/HD	Year
IEC 60904-9	-	Photovoltaic devices - Part 9: Classification of solar simulator characteristics	EN IEC 60904-9	-
IEC 61215	series	Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61215	series
IEC 61724-1	-	Photovoltaic system performance - Part 1: Monitoring	-	-
IEC/TS 61836	-	Solar photovoltaic energy systems - Terms, definitions and symbols	-	-
ISO/TS 28037	-	Determination and use of straight-line calibration functions	-	-



IEC 60904-10

Edition 3.0 2020-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Photovoltaic devices -

Part 10: Methods of linear dependence and linearity measurements

Dispositifs photovoltaïques -

Partie 10: Méthodes de mesure de la dépendance linéaire et de la linéarité



CONTENTS

Н	JKEWO	KU	ა			
IN	ITRODU	ICTION	5			
1	Scope					
2	Normative references					
3	Term	s and definitions	8			
4	Devi	ce selection	9			
5		ıratus				
Ū	5.1	General requirements common to all procedures				
	5.2	Apparatus for measurement of all linear dependences under natural sunlight	10			
	0.2	or with a solar simulator	11			
	5.3	Apparatus for measurement of all linear dependences of short-circuit current by differential spectral responsivity measurements	12			
	5.4	Apparatus for linearity measurement of short-circuit current by two-lamp method	12			
	5.5	Apparatus for linearity measurement of short-circuit current by N-lamp method				
6		edures to measure linearity and other linear dependences under natural ght or with a solar simulator				
	6.1	Additional general requirements for natural sunlight				
	6.2	Mounting under natural sunlight				
	6.3	Mounting with a solar simulator				
	6.4	Linear dependence measurements versus irradiance				
	6.5	Linear dependence measurements versus temperature	16			
7	Procedures to measure linearity and other linear dependence of short-circuit current from differential spectral responsivity					
	7.1	Linearity measurements				
	7.2	Linear dependence measurements of short-circuit current versus	17			
	–	temperature	18			
8	Procedure for short-circuit current linearity measurement by the two-lamp or the N-lamp methods					
	8.1	Background	18			
	8.2	Measurement procedure by the two-lamp method	19			
	8.3	Measurement procedure by the N-lamp method	20			
9	Calc	ulation of linear dependence and linearity	21			
	9.1	General considerations	21			
	9.2	Measurement uncertainty evaluation	21			
	9.3	Determination of deviations from a generic linear dependence	22			
	9.3.1					
	9.4	Determination of the short-circuit current non-linearity versus irradiance	22			
	9.5	Determination of the short-circuit current non-linearity versus irradiance using the two-lamp method	23			
	9.6	Determination of the short-circuit current non-linearity versus irradiance using the N-lamp method	24			
	9.7	Requirements for maximum deviations from the ideal linear function	25			
10) Repo	ort	26			
Bi	bliograp	phy	27			