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# Photovoltaic devices —

## Part 1: Measurement of photovoltaic current-voltage characteristics

The European Standard EN 60904-1:2006 has the status of a British Standard

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This British Standard was published by BSI. It is the UK implementation of EN 60904-1:2006. It is identical with IEC 60904-1:2006. It supersedes BS EN 60904-1:1993 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/82, Solar photovoltaic energy systems.

A list of organizations represented on GEL/82 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English version

**Photovoltaic devices**  
**Part 1: Measurement of photovoltaic**  
**current-voltage characteristics**  
(IEC 60904-1:2006)

Dispositifs photovoltaïques  
Partie 1: Mesure des caractéristiques  
courant-tension des dispositifs  
photovoltaïques  
(CEI 60904-1:2006)

Photovoltaische Einrichtungen  
Teil 1: Messen der photovoltaischen  
Strom-/Spannungskennlinien  
(IEC 60904-1:2006)

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**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 82/433/FDIS, future edition 2 of IEC 60904-1, prepared by IEC TC 82, Solar photovoltaic energy systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60904-1 on 2006-10-01.

This European Standard supersedes EN 60904-1:1993.

The main changes with respect to EN 60904-1:1993 are as follows:

- Added object.
- Added normative references.
- Updated original Clause 2 (General Measurement Requirements), removing Figure 1 as it is obsolete.
- Provided more detail and guidance on how to measure in sunlight or simulated sunlight.
- Expanded original Clause 6 (Test Report) with requirements based on ISO 17025.

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) 2007-07-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2009-10-01

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 60904-1:2006 was approved by CENELEC as a European Standard without any modification.

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## PHOTOVOLTAIC DEVICES –

### Part 1: Measurement of photovoltaic current-voltage characteristics

#### 1 Scope and object

This part of IEC 60904 describes procedures for the measurement of current-voltage characteristics of photovoltaic devices in natural or simulated sunlight. These procedures are applicable to a single photovoltaic solar cell, a sub-assembly of photovoltaic solar cells, or a PV module.

NOTE 1 This standard may be applicable to multi-junction test specimens, if each sub-junction generates the same amount of current as it would under the reference AM1,5 spectrum in IEC 60904-3.

NOTE 2 This standard may be applicable to PV devices designed for use under concentrated irradiation if they are irradiated using direct normal irradiance and a mismatch correction with respect to a direct normal reference spectrum is performed.

The purpose of this standard is to lay down basic requirements for the measurement of current-voltage characteristics of photovoltaic devices, to define procedures for different measuring techniques in use and to show practices for minimising measurement uncertainty.

#### 2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60891: *Procedures for temperature and irradiance corrections to measured I-V characteristics of crystalline silicon photovoltaic (PV) devices*

IEC 60904-2: *Photovoltaic devices – Part 2: Requirements for reference solar cells*

IEC 60904-3: *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

IEC 60904-5: *Photovoltaic devices – Part 5: Determination of equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method*

IEC 60904-6: *Photovoltaic devices – Part 6: Requirements for reference solar modules*

IEC 60904-7: *Photovoltaic devices – Part 7: Computation of spectral mismatch error introduced in the testing of a photovoltaic device*

IEC 60904-9: *Photovoltaic devices – Part 9: Solar simulator performance requirements*

IEC 60904-10: *Photovoltaic devices – Part 10: Methods for linearity measurements*

ISO/IEC 17025: *General requirements for competence of testing and calibration laboratories*