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Draft Jamaican Standard

Method of Test

for

Photovoltaic devices –

**Part 10: Methods of linear dependence and linearity measurements**

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**BUREAU OF STANDARDS JAMAICA**

**NON-OBJECTION PERIOD: 12 November 2023 to 11 December 2023**

Draft Jamaican Standard

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**Method of Test**  
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Jamaican Standards establish requirements in relation to commodities, processes and practices, but not purport to include all the necessary provisions of a contract.

The attention of those using this standard specification is called to the necessity of complying with any relevant legislation.

#### Amendments

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## National Foreword

This standard is an adoption and is identical to IEC 60904-10: 2020 Photovoltaic devices- Part 10: Methods of linear dependence and linearity measurements published by International Electrotechnical Commission (IEC).

### Scope of the Standard

This part of IEC 60904 describes the procedures used to measure the dependence of any electrical parameter ( $Y$ ) of a photovoltaic (PV) device with respect to a test parameter ( $X$ ) and to determine the degree at which this dependence is close to an ideal linear (straight-line) function. It also gives guidance on how to consider deviations from the ideal linear dependence and in general on how to deal with non-linearities of PV device electrical parameters. Typical device parameters are the short-circuit current  $I_{sc}$ , the open-circuit voltage  $V_{oc}$  and the maximum power  $P_{max}$ . Typical test parameters are the temperature  $T$  and the irradiance  $G$ . However, the same principles described in this document can be applied to any other test parameter with proper adjustment of the procedure used to vary the parameter itself.

Performance evaluations of PV modules and systems, as well as performance translations from one set of temperature and irradiance to another, frequently rely on the use of linear equations (see for example IEC 60891, IEC 61853-1, IEC 61829 and IEC 61724-1). This document lays down the requirements for linear dependence test methods, data analysis and acceptance limits of results to ensure that these linear equations will give satisfactory results. Such requirements prescribe also the range of the temperature and irradiance over which the linear equations may be used. This document gives also a procedure on how to correct for deviations of the short-circuit current  $I_{sc}$  from the ideal linear dependence on irradiance (linearity) for PV devices, regardless of whether they are classified linear or non-linear according to the limits set in 9.7. The impact of spectral irradiance distribution and spectral mismatch is considered for measurements using solar simulators as well as under natural sunlight.

The measurement methods described herein apply to all PV devices, with some caution to be used for multi-junction PV devices and are intended to be carried out on a device, or in some cases on an equivalent device of identical technology, that is stable according to the criteria set in the relevant part of IEC 61215. These measurements are meant to be performed prior to all measurements and correction procedures that require a linear device or that prescribe restrictions for non-linear devices.

The main methodology used in this document is based on a fitting procedure in which a linear (straight-line) function is fitted to a set of measured data points  $\{X_i, Y_i\}$ . The linear function uses a least-squares fit calculation routine, which in the most advanced analysis also accounts for the expanded combined uncertainty ( $k=2$ ) of the measurements. The linear function crosses the origin in the case of short-circuit current data versus irradiance. The deviation of the measured data from the ideal linear function is also calculated and limits are prescribed for the permissible percentage deviation.

Procedures to determine the deviation of the  $Y(X)$  dependence from the linear (straight-line) function are described in Clause 6 (measurements under natural sunlight and with solar simulator), Clause 7 (differential spectral responsivity measurements) and Clause 8 (measurements via two-lamp and N-lamp method). Data analyses to determine the deviations from the linear function are given in Clause 9.

A device is considered linear for the specific measured dependence  $Y(X)$  when it meets the requirement of 9.7.

Where the words 'International Standard' appear, referring to this standard, they should be read as 'Jamaican Standard'.

Where reference is made to informative and normative annexes the following definitions should be noted:

- Informative Annex – gives additional information intended to assist in the understanding or use of the document. They do not contain requirements.
- Normative Annex – gives provisions additional to those in the body of a document. They contain requirements.

Users should note that all standards undergo revision from time to time and that any reference made herein to any standard implies its latest edition, unless otherwise stated.

This standard is voluntary.

#### **Acknowledgement**

Acknowledgement is made to the International Electrotechnical Commission (IEC) for permission to adopt IEC 60904-10: 2020.