SLOVENSKI STANDARD
oSIST prEN IEC 63409-3:2024

01-junij-2024

Povezava fotonapetostnih sistemov za proizvodnjo električne energije z omrežjem - Preskušanje opreme za pretvorbo električne energije - 3. del: Osnovne operacije

Photovoltaic power generating systems connection with grid - Testing of power conversion equipment - Part 3: Basic operations

Ta slovenski standard je istoveten z: **prEN IEC 63409-3:2024**

ICS:

27.160	Sončna energija	Solar energy engineering
29.240.01	Omrežja za prenos in distribucijo električne energije na splošno	Power transmission and distribution networks in general

oSIST prEN IEC 63409-3:2024 **en,fr,de**

82/2226/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 63409-3 ED1**	
DATE OF CIRCULATION: **2024-03-29**	CLOSING DATE FOR VOTING: **2024-06-21**
SUPERSEDES DOCUMENTS: **82/2114/CD, 82/2153A/CC**	

IEC TC 82 : SOLAR PHOTOVOLTAIC ENERGY SYSTEMS	
SECRETARIAT: United States of America	SECRETARY: Mr George Kelly
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 8, TC 22, TC 57, TC 69, TC 77, TC 88, ACTAD	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Photovoltaic power generating systems connection with grid – Testing of power conversion equipment – Part 3: Basic operations

PROPOSED STABILITY DATE: 2030

NOTE FROM TC/SC OFFICERS:

This project was discussed and supported by WG6 during their meeting in 2023-10.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PHOTOVOLTAIC POWER GENERATING SYSTEMS CONNECTION WITH THE GRID – TESTING OF POWER CONVERSION EQUIPMENT –

Part 3: Basic operations

FOREWORD

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International Standard IEC PHOTOVOLTAIC POWER GENERATING SYSTEMS CONNECTION WITH THE GRID – TESTING FOR POWER CONVERSION EQUIPMENT – Part 3: Basic operations has been prepared by IEC technical committee 82.

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

Draft	Report on voting
82/XX/FDIS	82/XX/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.

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, or
- revised.

The National Committees are requested to note that for this document the stability date is 20XX..

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

INTRODUCTION

Background

TC82 has been making efforts to contribute the standardization of DER connection with the grid. In 2016, TC82 joined TC8/JWG10 to harmonize with utility power system operation requirements. In parallel with such a liaison work, TC82 has also been preparing the standardization of testing requirements to evaluate grid connection requirements for power conversion equipment (PCE) for use in PV systems since 2016.

Purpose

This document proposes the Part 3 of this series which gives test procedures for confirming the basic operation characteristics of PCE.

The main purpose of Part 3 is to confirm basic power conversion control of PCE at steady state condition and at transient response. Figure 1 shows the relationships of the seven parts in IEC 63409. Part 3 is focused on the control functions in PCE in respect of power conversion. Power flow control and grid support functions will generate active and reactive power commands according to the grid conditions. The commands are sent to power conversion control, and power conversion control will make current or voltage references, which manipulate signals for the switching devices.

It is important to confirm the basic control performance of the PCE as power conversion equipment without power flow control and grid support functions so that additional functions such as power flow control and grid support functions can perform appropriately.

The responses of PCE against abnormal grid conditions will be covered in Part 4 (IEC 63409-4).

Power quality of the PCE output will be covered in Part 5 (IEC 63409-5).

Power flow control and grid support functions will be covered in Part 6 (IEC 63409-6).

Responses against commands through communication will be covered Part 7 (IEC 63409-7).

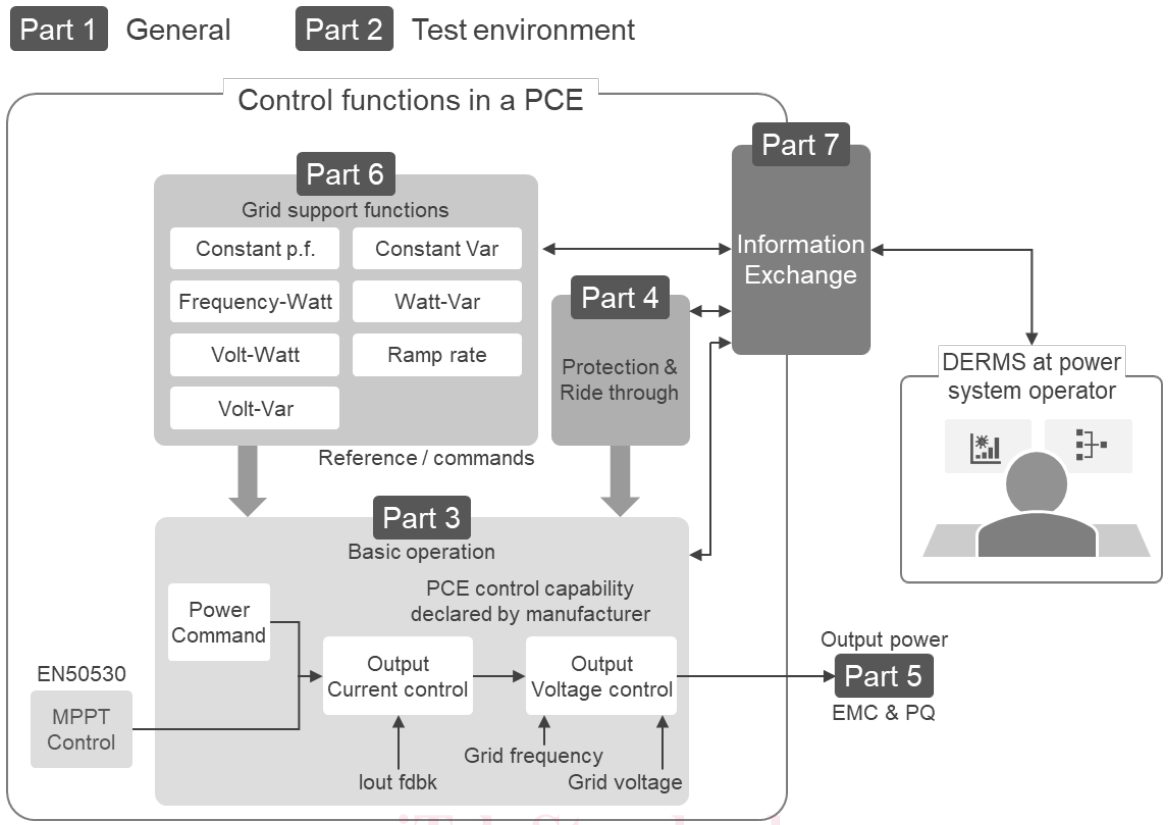

Figure 1- Scopes of IEC 63409 Series

PHOTOVOLTAIC POWER GENERATING SYSTEMS CONNECTION WITH THE GRID – TESTING OF POWER CONVERSION EQUIPMENT

Part 3: Basic operations

1 Scope

This document specifies test procedures for confirming the basic operational characteristics of power conversion equipment (PCE) for use in photovoltaic (PV) power systems with or without energy storage. The basic operational characteristics are the capability of the PCE before any limitations due to internal settings are applied to the PCE to meet specific grid support functions or specific behaviours against abnormal changes.

This document covers the testing of following items:

a) Steady state characteristics

Test procedures to confirm operable range of PCE at steady state condition are described. The operable ranges in apparent power, active power, reactive power, power factor, grid voltage and grid frequency shall be confirmed according to the test procedures.

b) Transient-response characteristics

Test procedures to confirm PCE's response against a change of operational condition are described.

Transient-response characteristics to be confirmed are response behaviours against;

- Active power set point change and reactive power set point change
- Grid voltage change, phase angle change, voltage unbalance and frequency change

This document only considers the changes within normal (continuous) operable ranges. Therefore, the behaviours against abnormal changes and grid support functions are out of the scope and are covered in other parts of this series of International Standards.

2 Normative references

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.

IEC TS 61836:2016, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC TS 62786-1:2023, *Distributed energy resources connection with the grid - Part 1: General requirements*

IEC 61850-7-420:2021, C*ommunication networks and systems for power utility automation - Part 7-420: Basic communication structure - Distributed energy resources and distribution automation logical nodes*

IEC 60375:2018, *Conventions concerning electric circuits*

IEC 61557-12:2018+AMD1:2021, *Amendment 1 - 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 - Part 12: Power metering and monitoring devices (PMD)*

IEC 62053-23:2020, *Electricity metering equipment - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)*

IEC TS 62910:2020, *Utility-interconnected photovoltaic inverters - Test procedure for under voltage ride-through measurements*

IEC 61000-2-2:2002+A1:2017+A2:2018, *Electromagnetic compatibility (EMC) - Environment - Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-4-27:2000+AMD1:2009, *Amendment 1 - Electromagnetic compatibility (EMC) - Part 4-27: Testing and measurement techniques - Unbalance, immunity test for equipment with input current not exceeding 16 A per phase*

IEC 61000-4-30:2015+AMD1:2021, *Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods*

3 Terms and definitions

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

IEC Electropedia: available at http://www.electropedia.org/

ISO Online browsing platform: available at http://www.iso.org/obp

3.1
EUT
Equipment under test

3.2
power conversion equipment
PCE
electrical device converting one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and frequency

[SOURCE: IEC 62109-1:2010, 3.66]

3.3
grid support functions
PCE's functions which controls active power and / or reactive power according to pre-defined characteristics or set point command to support stabilizing the power quality of the grid the PCE is connected to

3.4
maximum power point tracking
MPPT
PCE's control function which tracks the maximum DC power point in the PV module's power generation characteristics

3.5
steady state
equilibrium state in which the relevant characteristics remain constant with time

[SOURCE: IEV 103-05-01, modified – the original definition has been changed to adopt usage in PCE testing]

3.6
response time
elapsed time from the start of a step change or start of event until the observed value first time enters the predefined tolerance band of the target value

Note: See Figure 2.

[SOURCE: IEC 61400-21-1: 2019]

3.7
settling time
elapsed time from the start of a step change event until the observed value continuously stays within the predefined tolerance band of the target value

Note: See Figure 2.

[SOURCE: IEC 61400-21-1: 2019]

3.8
rise time
time from when the observed value reaches 10 % of the step change until the observed value reaches 90 % of the step change

Note: See Figure 2.

[SOURCE: IEC 61400-21-1: 2019]

3.9
overshoot
difference between the maximum value of the response and the steady-state final value

Note: See Figure 2.

[SOURCE: IEC 61400-21-1: 2019]

3.10
reaction time
elapsed time from test command issued until the change in amplitude reaches 10 % of the measured output variable of the step height

Note: See Figure 2.

[SOURCE: IEC 61400-21-1: 2019]

3.11
tolerance
permitted deviation between the declared value of a quantity and the measured value

[SOURCE: IEV 411-36-19]

3.12
tolerance band
acceptable deviation range of measured signal from the defined target value

[SOURCE: IEC 61400-21-1: 2019]

3.13
accuracy
quality which characterizes the ability of a measuring instrument to provide an indicated value close to a true value of the measurand

[SOURCE: IEV 311-06-08]