IEC 63409-3

Edition 1.0 2025-12

INTERNATIONAL STANDARD

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

ICS 27.160

ISBN 978-2-8327-0818-7

IEC 63409-3:2025-12(en)

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

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

Draft	Report on voting
82/2456/FDIS	82/2525/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.

A list of all parts in the IEC 63409 series, published under the general title *Photovoltaic power generating systems connection with the grid – Testing of power conversion equipment*, can be found on the IEC website.

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– withdrawn, or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.

INTRODUCTION

This document gives test procedures for confirming the basic operation characteristics of power conversion equipment (PCE).

Part 3 confirms basic power conversion control of PCE at steady state condition and at transient response. Figure 1 shows the relationships of the seven parts in the IEC 63409 series. Part 3 is focused on the control functions in PCE with respect to 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).

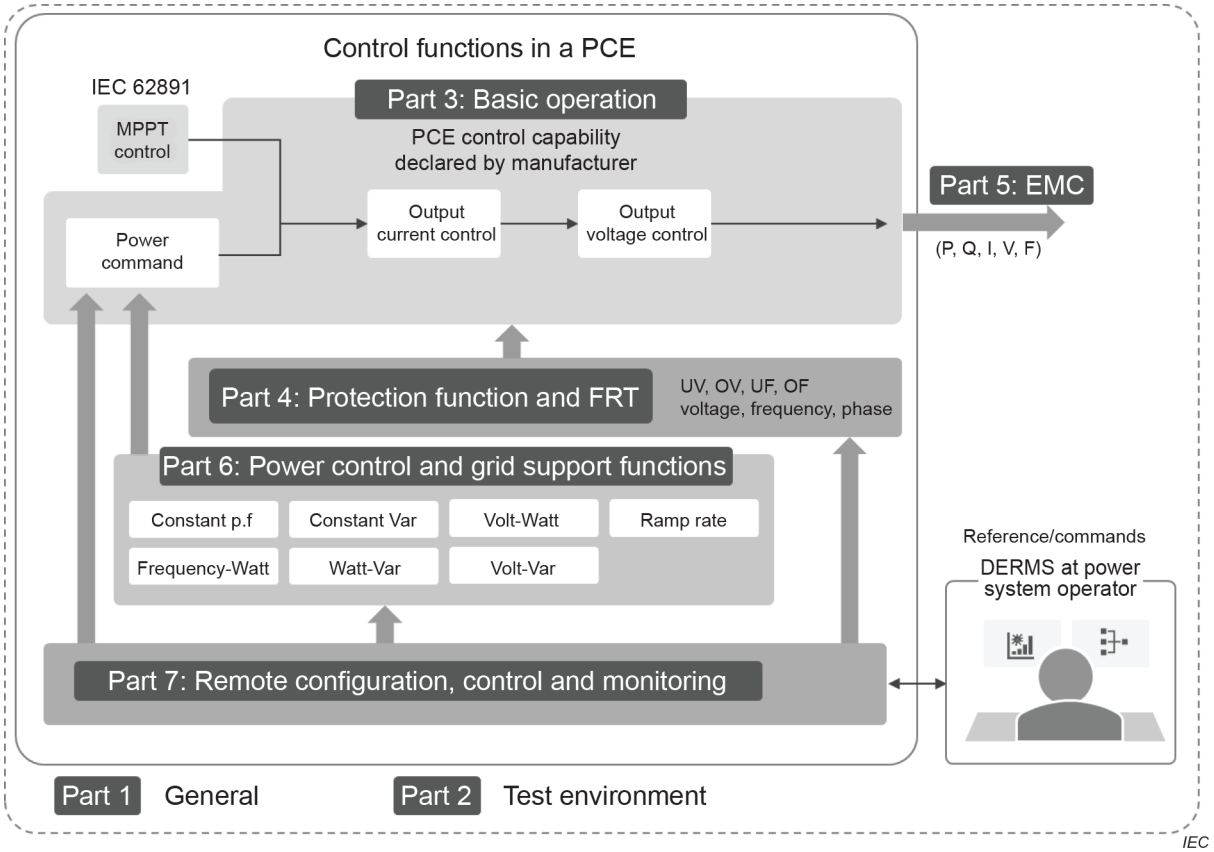


Figure 1 – Scopes of IEC 63409 series

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 the 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 are 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.

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, *Solar photovoltaic energy systems - Terms, definitions and symbols*

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IEC 61557-12:, *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 61850-7-420, *Communication networks and systems for power utility automation – Part 7-420: Basic communication structure - Distributed energy resources and distribution automation logical nodes*

IEC 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure - Compatible logical node classes and data object classes*

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

IEC 62109-1:2010, *Safety of power converters for use in photovoltaic power systems - Part 1: General requirements*

IEC 62116, *Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures*

IEC 62446-1, *Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 1: Grid connected systems - Documentation, commissioning tests and inspection*

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

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

IEC 60375, *Conventions concerning electric circuits*

National or regional standards

Australia and New Zealand - AS/NZS 4777.2:2020, *Grid connection of energy systems via inverters, Part 2: Inverter requirements*

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