
**Povezava fotonapetostnih sistemov za proizvodnjo električne energije z omrežjem
- Preskušanje opreme za pretvorbo električne energije - 7- del: Daljinska
konfiguracija, upravljanje in nadzor**

Photovoltaic power generating systems connection with the grid - Testing of power conversion equipment - Part 7: Remote configuration, control and monitoring

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OF INTEREST TO THE FOLLOWING COMMITTEES:

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☒ SUBMITTED FOR CENELEC PARALLEL VOTING☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING**Attention IEC-CENELEC parallel voting**

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TITLE:

Photovoltaic power generating systems connection with the grid - Testing of power conversion equipment- Part 7: Remote configuration, control and monitoring

PROPOSED STABILITY DATE: 2032

NOTE FROM TC/SC OFFICERS:

This project was discussed and supported by WG6 during their meeting in 2025-10.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 7: Remote configuration, control and monitoring

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International Standard IEC PHOTOVOLTAIC POWER GENERATING SYSTEMS CONNECTION WITH THE GRID – TESTING OF POWER CONVERSION EQUIPMENT Part 7: Information exchange has been prepared by IEC technical committee 82.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table..

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.

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171 The committee has decided that the contents of this document will remain unchanged until the
172 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
173 specific document. At this date, the document will be

- 174 • reconfirmed,
- 175 • withdrawn,
- 176 • replaced by a revised edition, or
- 177 • amended.

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INTRODUCTION

Since 2016, TC82 has been contributing to the standardization of requirements for DER connection with the grid under TC8/JWG10, which is a joint working group consisting with TC82, TC120 and SC22E. In parallel with the join work with TC8, since 2016, TC82 has been considering the development of testing standards to evaluate performance and characteristics of power conversion equipment which are relevant to connection with the grid.

Having multiple issues into a single document may not only require a lot of time and effort but could also cause difficulties where a single issue could delay the standardization process. Therefore, TC82/WG6 agreed to separate the IEC 63409 into seven parts. In 2021, TC82/WG6 started the official project to develop IEC 63409 series.

Figure 1 gives an overview of the structure of the whole IEC 63409 series.

The part 7 specifies testing conditions and procedures to evaluate functions which can be realised by information exchange with energy management systems.

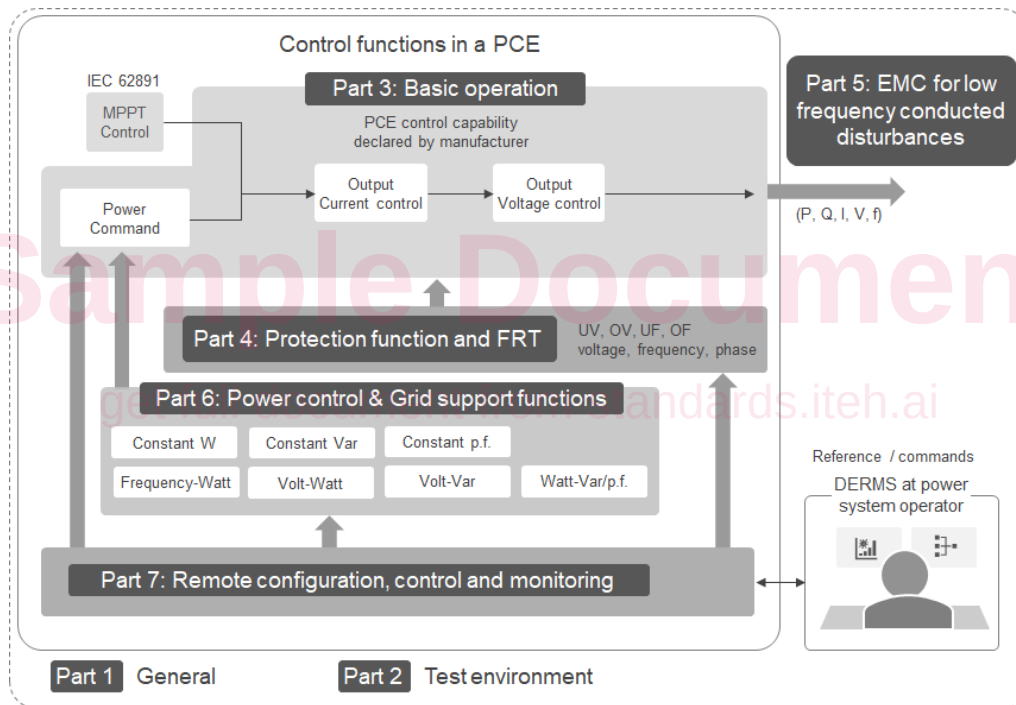


Figure 1 – Overview of IEC 63409 series

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

Part 7: Remote configuration, control and monitoring

1 Scope

The IEC 63409 series specifies requirements for the testing of power conversion equipment (PCE) for use in photovoltaic power systems (PV systems) with or without DC-coupled electrical energy storage devices. Part 7 of IEC 63409 series specifies testing requirements for the evaluation of performance and characteristics of the following three functions with which the PCE may be equipped:

- configuration,
- control,
- monitoring.

Those functions can be realized by information exchange with the management system. Therefore, this document specifies the general test environment and setup which consists of the PCE, communication interfaces and the energy management system. Testing conditions and operating conditions of PCE are given for the evaluation of three functions.

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

IEC TS 61836, *Solar photovoltaic energy systems - Terms, definitions and symbols*

IEC 62934:2021, *Grid integration of renewable energy generation - Terms and definitions*

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

IEC 61850-7-1:2011/AMD1:2020, *Amendment 1 - Communication networks and systems for power utility automation - Part 7-1: Basic communication structure - Principles and models*

IEC 61850-7-4:2010/AMD1:2020, *Amendment 1 - Communication networks and systems for power utility automation - Part 7-4: Basic communication structure - Compatible logical node classes and data object classes*

IEC 61850-8-1:2011/AMD1:2020, *Amendment 1 – Communication networks and systems for power utility automation – Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

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237 IEC 61850-8-2:2018, *Communication networks and systems for power utility automation - Part*
 238 *8-2: Specific communication service mapping (SCSM) - Mapping to Extensible Messaging*
 239 *Presence Protocol (XMPP)*

240 IEC 60375:2018, *Conventions concerning electric circuits*

241 IEC 61557-12:2018/AMD1:2021, *Amendment 1 - Electrical safety in low voltage distribution*
 242 *systems up to 1 000 V AC and 1 500 V DC - Equipment for testing, measuring or monitoring of*
 243 *protective measures - Part 12: Power metering and monitoring devices (PMD)*

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

246 IEC 63409-6, *Photovoltaic power generating systems connection with the grid – Testing of*
 247 *power conversion equipment – Part6: Power control functions and grid support*

248 3 Terms and definitions

249 For the purposes of this document, the terms and definitions given in IEC TS 61836, IEC 62934,
 250 IEC TS 62786-1, and the following apply.

251 ISO and IEC maintain terminology databases for use in standardization at the following
 252 addresses:

- 253 • IEC Electropedia: available at <https://www.electropedia.org/>
- 254 • ISO Online browsing platform: available at <https://www.iso.org/obp>

255 3.1

256 photovoltaic power generating system

257 PV system

258 electric power generating system which uses the photovoltaic effect to convert solar power into
 259 electricity

260 3.2

261 power conversion equipment

262 PCE

263 electrical device converting one form of electrical power to another form of electrical power with
 264 respect to voltage, current, frequency, phase and the number of phases

265 [SOURCE: IEC 62109-1:2010, 3.66, modified – The definition has been rephrased, and the note
 266 has been deleted.]

267 3.3

268 intelligent electronic device

269 IED

270 any device incorporating one or more processors, with the capability to receive data from an
 271 external sender or to send data to an external receiver

272 3.4

273 distributed energy resources management system

274 DERMS

275 The system which, on the behalf of other interested systems, manages the communications and
 276 control of individual Distributed Energy Resource (DER (and may do this with a variety of field
 277 message protocols), and aggregates this information and communicates with other utility
 278 systems, such as a DMS.

279 [SOURCE: IEC 61968-5:2020, 3.1.1]

280

281 **4 Testing environment**

282 **4.1 Test setup**

283 Figure 2 shows an example of the general test setup for the evaluation of the configuration,
284 control and monitoring functions equipped with PCE. The evaluation of performance of those
285 three functions shall be performed in manufacture's factories and/or in testing premises
286 equipped with power supplies and measuring instrument/devices as shown in Figure 2.
287 Examples of the power supplies and the measuring instrument/devices are specified in Annex C.
288 Specifications of the power supplies and the measuring instrument/devices shall be reported in
289 the test report.

290 The performance and characteristics of PCE shall be evaluated with electrical quantity such as
291 voltage, current and power, which are measured at the AC power ports of PCE. Annex B
292 specifies the definitions of sign conventions for measurements of voltage, current and power.

293 Information exchange with PCE shall be based on the client/server role specified in IEC 61850-
294 7-1. The PCE with the IED (Intelligent Electronic Device) is the server, and DERMS (Distributed
295 Energy Resources Management System) is the client. The IED can be a part of the PCE or be
296 an external device. In both cases, the inner (local) communication network between the IED
297 and the PCE is out of scope. The server which consists of PCE and IED are the devices under
298 test (DUT).

299 Clients issue service requests, such as configuration, control and monitoring. Then, clients
300 receive confirmations of the service that has been processed in the server. A client may also
301 receive report indications from a server. Therefore, configuration, control and monitoring
302 functions of PCE shall be remotely implemented at the DERMS.

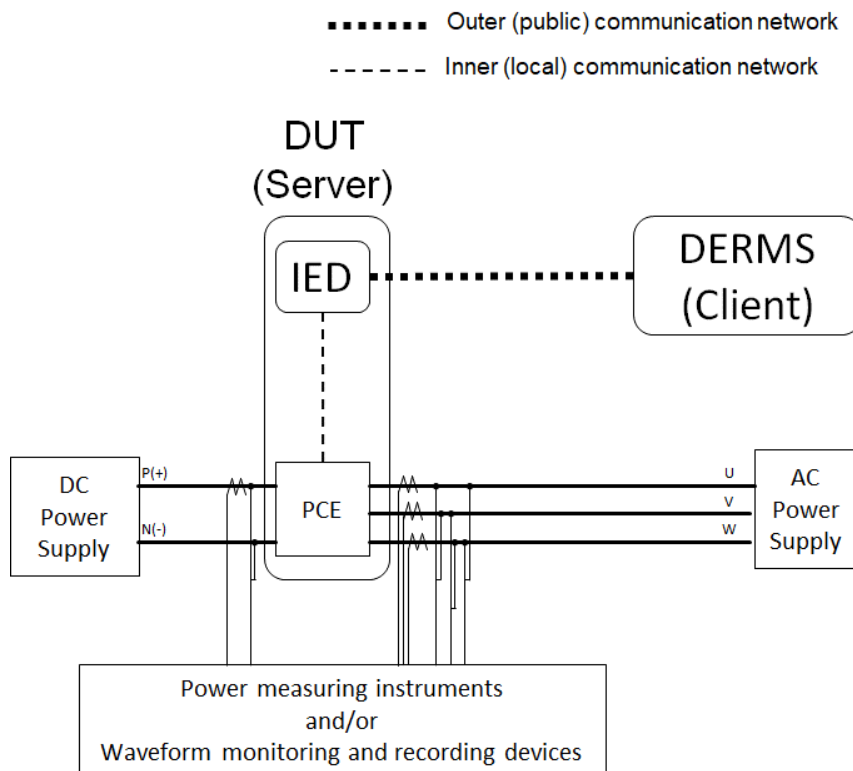


Figure 2 – Example of the general test setup

The testing of the DUT shall not be influenced by the performance of DC power supply used for the test. Therefore, where the EUT has the capability to disable MPPT control, it is allowed to do so and a DC power supply that is able to provide constant voltage at any required power levels shall be used. A PV simulator may be used provided that the test results are not influenced by any DC instability by the PV simulator. In each case, remarks shall be written in the test report to note the type of the DC power supply or PV simulator used in the test. See Annex D for supplemental information regarding the influences from the PV simulator.

4.2 Communication specification

The information model is used for the information exchange to implement remote configuration, control and monitoring of the PCE. The information model is defined in IEC 61850-7-4 and IEC 61850-7-420, and Annex A describes overviews of information model.

IEC 61850-8-2 shall be used as the communication mapping for the outer (public) communication network.

5 Testing requirements

5.1 General

The evaluation of the performance of the information exchange shall be implemented in the following order.

- First, the evaluation of the monitoring function shall be done as specified in 5.2.
- Second, the evaluation of the control function shall be done as specified in 5.3.
- Finally, the evaluation of the configuration function shall be done as specified 5.4.

Results of the evaluation of three functions shall be recorded in test reports.

5.2 Evaluation of the nameplate data, the basic information and the monitoring function

5.2.1 Testing items

All data listed from Table 1 to Table 4 shall be read on DERMS while PCE is under halt or rated power condition. Data which are monitored at DERMS shall be evaluated with data which are set in PCE and measured by measuring instruments.

Table 1 and Table 2 show the lists of the minimum required monitored data for the confirmation of the nameplate data and the basic information of PCE.

Table 3 and Table 4 show the lists of the minimum required monitored data for the confirmation of the status and measured values of PCE.

When there are other data to be monitored, all additional monitored data shall be reported in a test report.

Table 1 – Nameplate data

Item	IEC 61850			
	Standard	LN	message parameter	Description
Name of the vendor	IEC 61850-7-4	LPHD	PhyNam.vendor	Name of the vendor.
Serial Number			PhyNam.serNum	Serial number.
Hardware revision.			PhyNam.hwRev	HW-revision.
Software revision			PhyNam.swRev	SW-revision.
Rated apparent power	IEC 61850-7-420	DINV	VARtg	The continuous apparent power capability of the power inverter.
Rated active power			WRtg	Rated active power of the inverter
Rated voltage			VRtg	Rated voltage
Maximum Input voltage limit			InVMax	Maximum Input voltage limit.
Over-Excited Power Factor Rating			OvPFRtg	Specified Over-Excited Power Factor Rating
Under-Excited Power Factor Rating			UnPFRtg	Specified Under-Excited Power Factor Rating

Table 2 – Basic information (Those data not in the nameplate)

Item	IEC 61850			
	Standard	LN	message parameter	Description
Rated Nominal frequency	IEC 61850-7-420	DGEN	HzNomRtg	Rated Nominal frequency of usage of the DER
Rated minimal frequency			HzMinRtg	Rated minimal frequency of usage of the DER
Rated maximum frequency			HzMaxRtg	Rated maximum frequency of usage of the DER
Sign convention for power factor 'PF'			PFSign	Power factor convention: IEC or EEI

340

Table 3 – Status of PCE

Item	IEC 61850			
	Standard	LN	message parameter	Description
Switch controller	IEC 61850-7-4	CSWI	Pos.stVal	Circuit breaker / switch position
Over frequency	IEC 61850-7-420	DHFT	TrZnSt	True = the frequency of the Referenced ECP exceeds the Trip zone
Under Frequency		DLFT	TrZnSt	True = the frequency of the Referenced ECP exceeds the Trip zone
AC Over Voltage		DHVT	TrZnSt	True = the voltage of the Referenced ECP exceeds the Trip zone
AC Under Voltage		DLVT	TrZnSt	True = the voltage of the Referenced ECP exceeds the Trip zone

341

Table 4 – Measured values of PCE

Item	IEC 61850				
	Standard	LN	message parameter	Description	
AC voltage	IEC 61850-7-4	MMXU	PPV.phsAB / PNV.phsA	"PPV: Phase to Phase Voltage PNV: Phase to Neutral Voltage"	
			PPV.phsBC / PNV.phsB	"PPV: Phase to Phase Voltage PNV: Phase to Neutral Voltage"	
			PPV.phsCA / PNV.phsC	"PPV: Phase to Phase Voltage PNV: Phase to Neutral Voltage"	
AC current			A.phsA	phase current	
			A.phsB	phase current	
			A.phsC	phase current	
Apparent power			TotVA	The total apparent power in a three-phase circuit [VA].	
Active power			TotW	The total Active power in a three-phase circuit [W].	
Reactive power			TotVAr	The total Reactive power in a three-phase circuit [VAr].	
Power factor		TotPF	The total power factor in a three-phase circuit		
Frequency		Hz	Frequency [Hz].		
AC voltage		MMXN	Vol	Non-phase-related AC rms voltage.	
AC current			Amp	Non-phase-related AC rms current.	
Apparent power			VolAmp	Non-phase-related AC apparent power.	
Active power			Watt	Non-phase-related AC real power.	