

TECHNICAL REPORT



**Communication networks and systems for power utility automation –
Part 90-7: Object models for power converters in distributed energy resources
(DER) systems**

[IEC TR 61850-90-7:2023](https://standards.iteh.ai/catalog/standards/sist/439f2e6b-64e0-4c36-b11e-0dc6f1619643/iec-tr-61850-90-7-2023)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-7: Object models for power converters in distributed energy resources (DER) systems

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC TR 61850-90-7:2013. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC TR 61850-90-7 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is a Technical Report.

This second edition cancels and replaces the first edition published in 2013. This edition is primarily an editorial revision in order to be consistent with the publication of Edition 2 of IEC 61850-7-420:2021.

This edition includes the following significant changes with respect to the previous edition:

- a) Clause 3 has been updated.
- b) Clause 8 (IEC 61850 information models for power converter-based functions) has been deleted. This clause defined data models with the transitional namespace “(Tr) IEC 61850-90-7:2012”. The data models are now defined in IEC 61850-7-420.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
57/2558/DTR	57/2610/RVDTR

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 Technical Report 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 of the IEC 61850 series, under the general title *Communication networks and systems for power utility automation*, 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

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-7: Object models for power converters in distributed energy resources (DER) systems

1 Scope

This part of IEC 61850, which is a Technical Report, describes functions for power converter-based distributed energy resources (DER) systems, focused on DC-to-AC and AC-to-AC conversions and including photovoltaic systems (PV), battery storage systems, electric vehicle (EV) charging systems, and any other DER systems with a controllable power converter.

The functions defined in this document were used to help define the ~~IEC 61850~~ information models ~~to described in IEC 61850-7-420 and which can~~ be used in the exchange of information between these power converter-based DER systems and the utilities, energy service providers (ESPs), or other entities which are tasked with managing the volt, var, and watt capabilities of these power converter-based systems.

These power converter-based DER systems can range from very small grid-connected systems at residential customer sites, to medium-sized systems configured as microgrids on campuses or communities, to very large systems in utility-operated power plants, and to many other configurations and ownership models. They may or may not combine different types of DER systems behind the power converter, such as a power converter-based DER system and a battery that are connected at the DC level.

~~The namespace of this document is:~~

~~“(Tr) IEC 61850-90-7:2012”~~

~~The namespace “IEC 61850-90-7” is considered as “transitional” since the models are expected to be included in IEC 61850-7-420. Potential extensions/modifications may happen if/when the models are moved to International Standard status.~~

~~Only the new data objects and CDCs which are represented in **bold-italic font** will be tagged with this namespace name. The others should still refer to the namespace where they are primarily defined.~~

NOTE The term power converter is being used in place of “inverter” since it covers more types of conversion from input to output power:

- AC to DC (rectifier)
- DC to AC (inverter)
- DC to DC (DC-to-DC converter)
- AC to AC (AC-to-AC converter)

2 Normative references

~~The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.~~

~~IEC 61850-7-2, Communication networks and systems for power utility automation—Part 7-2: Basic communication structure—Abstract communication service interface (ACSI)~~

~~IEC 61850-7-3, Communication networks and systems for power utility automation—Part 7-3: Basic communication structure—Common data classes~~

~~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 61850-7-410, Communication networks and systems for power utility automation—Part 7-410: Hydroelectric power plants—Communication for monitoring and control~~

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

~~IEC 61850-8-1, 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~~

~~ISO 4217, Codes for the representation of currencies and funds~~

~~EI Handbook for Electricity Metering, 10th Edition (2002), Edison Electric Institute, Washington, D.C.~~

There are no normative references in this document.

3 Terms, definitions, acronyms and abbreviated terms

For the purposes of the present document, the following terms, definitions, acronyms and abbreviated terms apply.

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

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

3.1 Terms and definitions

3.1.1

autonomous

automatic operation

~~responding, reacting, or developing independently of the whole; not controlled by others or by outside forces; independent~~

~~[SOURCE: Merriam-Webster dictionary]~~

operating mode in which all functions of the control equipment are performed without action of a human operator

[SOURCE: IEC 60050-351:2013, 351-55-03]

3.1.2

common data class

CDC

~~classes of commonly used data structures which are mostly defined in IEC 61850-7-3, but are sometimes initially defined in other IEC 61850 documents until they can be updated in IEC 61850-7-3~~

3.1.3

device

~~material element or assembly of such elements intended to perform a required function~~

~~Note 1 to entry:— A device may form part of a larger device.~~

~~[SOURCE: IEC 60050-151:2001, 151-11-20]~~

3.1.2

distributed energy resource

DER

energy resource comprised of generation and/or storage and/or controllable load connected at the low or medium voltage distribution level

Note 1 to entry: DER may include associated protection, control, and monitoring capabilities, and may consist of aggregated DER units.

Note 2 to entry: DER may interact with the area and/or local electric power systems (EPS) by providing energy through the EPSs, by adapting their behaviour based on EPS conditions, and/or by providing other EPS-related services for regulatory, contractual, or market reasons.

[SOURCE: IEC 61850-7-420:2021, 3.1.13]

3.1.3

electrical connection point

ECP

point of electrical connection between the DER ~~source of energy (generation or storage)~~ and any electric power system (EPS)

Note 1 to entry: Each DER (generation or storage) unit has an ECP connecting it to its local power system; groups of DER units have an ECP where they interconnect to the power system at a specific site or plant; a group of DER units plus local loads have an ECP where they are interconnected to the utility power system.

Note 2 to entry: For those ECPs between a utility EPS and a plant or site EPS, this point is identical to the point of common coupling (PCC) in the IEEE 1547, *Standard for Interconnecting Distributed Resources with Electric Power Systems*.

~~[SOURCE: IEC 61850-7-420:2009, modified by transforming second paragraph into Note 1 to entry 2021, 3.1.17]~~

3.1.4

electric power system

EPS

~~facilities that deliver electric power to a load~~

~~Note 1 to entry:— This may include generation units.~~

~~[SOURCE: IEEE 1547:2003]~~

composite, comprised of one or more generating sources, and connecting transmission and distribution facilities, operated to supply electric energy

Note 1 to entry: A specific electric power system includes all installations and plant, within defined bounds, provided for the purpose of generating, transmitting and distributing electric energy.

[SOURCE IEC 60050-692:2017, 692-01-02]

3.1.5

electric power system, area

area EPS

~~electric power system (EPS) that serves Local EPSs~~

~~Note 1 to entry:— Typically, an Area EPS has primary access to public rights-of-way, priority crossing of property boundaries, etc. and is subject to regulatory oversight.~~

~~[SOURCE: IEEE 1547:2003]~~

electric power system that serves multiple local electric power systems

Note 1 to entry: A typical area EPS is a MV/LV distribution network.

[SOURCE: IEEE 1547:2018, modified - addition of Note 1 to entry]

~~3.1.7~~

~~**electric power system, local
local EPS**~~

~~EPS contained entirely within a single premises or group of premises~~

~~[SOURCE: IEEE 1547:2003]~~

~~3.1.8~~

~~3.1.8.1~~

~~**event**~~

~~**event information**~~

~~something that happens in time~~

~~Note 1 to entry: In power system operations, an event is typically state information and/or state transition (status, alarm, or command) reflecting power system conditions.~~

~~[SOURCE: IEC 60050-113:2005, 113-01-04, modified by removal of "subspace ... of space-time" and alteration of Note 1 to entry]~~

3.1.6

event

event information

monitored information on the change of state of operational equipment

Note 1 to entry: In power system operations, an event is typically state information and/or state transition (status, alarm, or command) reflecting power system conditions.

[SOURCE: IEC 60050-371:1984, 371-02-04, modified – addition of term "event" and Note 1 to entry]

~~3.1.9~~

~~**function**~~

~~computer subroutine; specifically: one that performs a calculation with variables provided by a program and supplies the program with a single result~~

~~Note 1 to entry: This term is very general and can often be used to mean different ideas in different contexts. However, in the context of computer-based technologies, it is used to imply software or computer hardware tasks.~~

~~[SOURCE: Merriam-Webster dictionary]~~

3.1.7

process control function

function to work on process variable quantities, which is composed of basic functions of process control, specific to particular functional units of the plant

[SOURCE: IEC 60050-351:2013, 351-55-16, modified - deletion of Note 1 to entry]

3.1.8

generator

energy transducer that transforms non-electric energy into electric energy

Note 1 to entry: The reverse conversion of electrical energy into mechanical energy is done by an electric motor, and motors and generators have many similarities. The ~~prime mover~~ source of mechanical energy may be a reciprocating or turbine steam engine, water falling through a hydropower turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, or any other source of mechanical energy.

[SOURCE: IEC 60050-151:2001, 151-13-35, modified - addition of Note 1 to entry]

3.1.10.2

generator

~~device that converts kinetic energy to electrical energy, generally using electromagnetic induction.~~

~~Note 1 to entry:—The reverse conversion of electrical energy into mechanical energy is done by an electric motor, and motors and generators have many similarities. The prime mover source of mechanical energy may be a reciprocating or turbine steam engine, water falling through a hydropower turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, or any other source of mechanical energy.~~

~~[SOURCE: Wikipedia 2007-12]~~

3.1.11

3.1.11.1

information

~~intelligence or knowledge capable of being represented in forms suitable for communication, storage or processing~~

~~Note 1 to entry:—Information may be represented for example by signs, symbols, pictures, or sounds.~~

~~[SOURCE: IEC 60050-701:1988,701-01-01]~~

3.1.11.2

information

~~knowledge concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning~~

~~Note 1 to entry:—Information may be represented for example by signs, symbols, pictures, or sounds.~~

~~[SOURCE: ISO/IEC 2382-1:1993, 01.01.01, modified by addition of Note 1 to entry]~~

3.1.12

information exchange

~~communication process between two or more computer-based systems in order to transmit and receive information~~

~~Note 1 to entry:—The exchange of information between systems requires interoperable communication services.~~

3.1.9

inverter

~~static power converter (SPC)~~

~~device that converts DC electricity into AC electricity. Equipment that converts direct current from the array field to alternating current. The electric equipment used to convert electrical power into a form or forms of electrical power suitable for subsequent use by the electric utility~~

~~Note 1 to entry:—Any static power converter with control, protection, and filtering functions used to interface an electric energy source with an electric utility system. Sometimes referred to as power conditioning subsystems, power conversion systems, solid-state converters, or power conditioning units.~~

~~[SOURCE: IEC 61727:2004, 3.8, modified by deletion of Note 2 to entry]~~

electric energy converter that changes direct electric current to single-phase or polyphase alternating currents

[SOURCE: IEC 60050-151:2001, 151-13-46]

3.1.10

monitor

~~to check at regular intervals selected values regarding their compliance to specified values, ranges of values or switching conditions~~