

## TECHNICAL REPORT



**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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(DER) systems**

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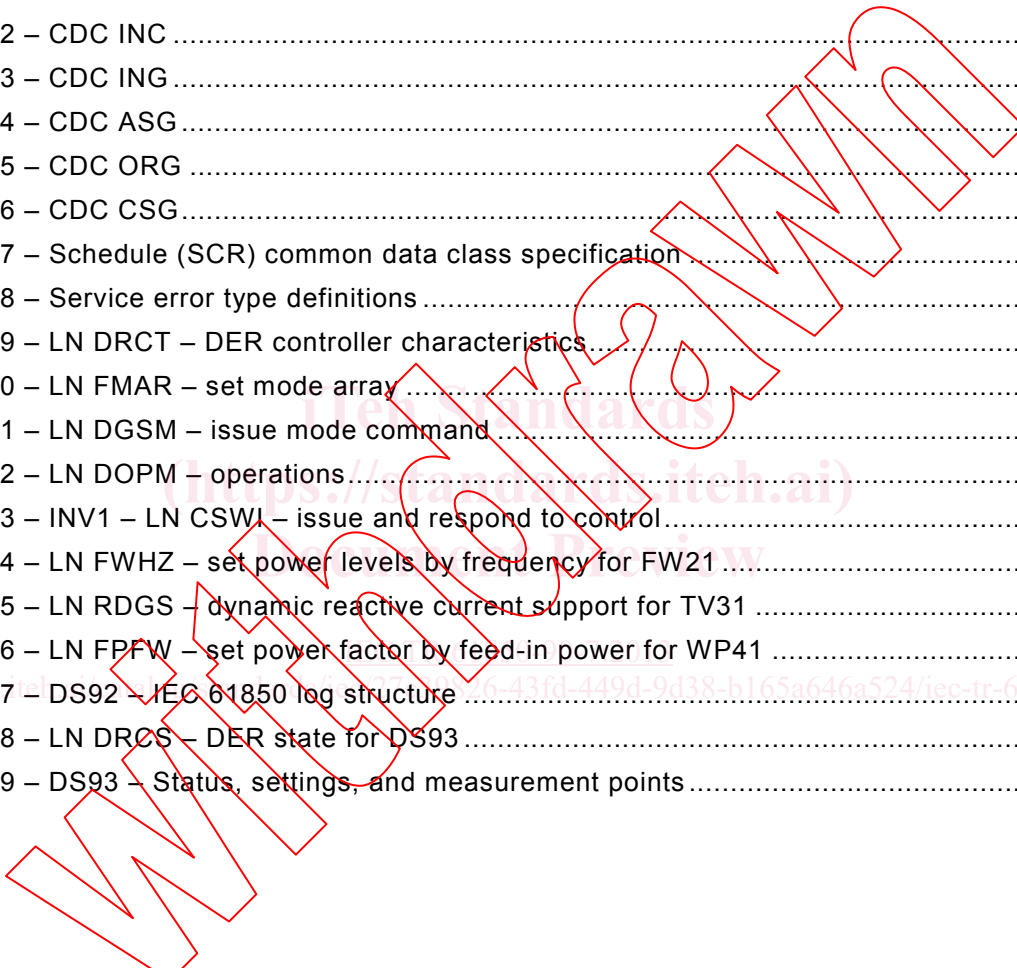
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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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IEC 61850-90-7, which is a technical report, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
57/1239/DTR	57/1281/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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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 describes the 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. It defines the IEC 61850 information models to 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 an 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.

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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*, 10<sup>th</sup> Edition (2002), Edison Electric Institute, Washington, D.C.

### 3 Terms, definitions and acronyms

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

#### 3.1 Terms and definitions

##### 3.1.1

##### **autonomous**

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

[SOURCE: Merriam-Webster dictionary]

##### 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]

##### 3.1.4

##### **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]

### **3.1.5 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]

### **3.1.6 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]

### **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]

### **3.1.8.2 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 by addition of 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]

**3.1.10****3.1.10.1****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 by 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.

**3.1.13****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]