

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 61850-90-7:2013](https://standards.iteh.ai/catalog/standards/sist/27c39826-43fd-449d-9d38-b165a646a524/iec-tr-61850-90-7-2013)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.200

ISBN 978-2-83220-647-8

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CONTENTS

FOREWORD.....	7
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and acronyms	10
3.1 Terms and definitions	10
3.2 Acronyms	13
4 Abbreviated terms	14
5 Overview of power converter-based DER functions	15
5.1 General.....	15
5.2 Power converter configurations and interactions.....	16
5.3 Power converter methods.....	18
5.4 Power converter functions	19
5.5 Differing DER architectures	20
5.5.1 Conceptual architecture: electrical coupling point (ECP).....	20
5.5.2 Conceptual architecture: point of common coupling (PCC).....	20
5.5.3 Utility interactions directly with power converters or indirectly via a customer EMS	21
5.5.4 Communication profiles	21
5.6 General Sequence of information exchange interactions	22
6 Concepts and constructs for managing power converter functions	23
6.1 Basic settings of power converters	23
6.1.1 Nameplate values versus basic settings	23
6.1.2 Power factor and power converter quadrants.....	23
6.1.3 Maximum watts, vars, and volt-amp settings.....	25
6.1.4 Active power ramp rate settings.....	27
6.1.5 Voltage phase and correction settings	27
6.1.6 Charging settings	28
6.1.7 Example of basic settings	28
6.1.8 Basic setting process.....	29
6.2 Modes for managing autonomous behaviour.....	29
6.2.1 Benefits of modes to manage DER at ECPs.....	29
6.2.2 Modes using curves to describe behaviour	30
6.2.3 Paired arrays to describe mode curves	31
6.2.4 Percentages as size-neutral parameters: voltage and var calculations.....	32
6.2.5 Hysteresis as values cycle within mode curves	32
6.2.6 Low pass exponential time rate.....	33
6.2.7 Ramp rates.....	34
6.2.8 Randomized response times.....	34
6.2.9 Timeout period	35
6.2.10 Multiple curves for a mode.....	35
6.2.11 Multiple modes	35
6.2.12 Use of modes for loosely coupled, autonomous actions	35
6.3 Schedules for establishing time-based behaviour	35
6.3.1 Purpose of schedules	35
6.3.2 Schedule components	36
7 DER management functions for power converters.....	37

7.1	Immediate control functions for power converters	37
7.1.1	General	37
7.1.2	Function INV1: connect / disconnect from grid	38
7.1.3	Function INV2: adjust maximum generation level up/down	38
7.1.4	Function INV3: adjust power factor	39
7.1.5	Function INV4: request active power (charge or discharge storage)	39
7.1.6	Function INV5: pricing signal for charge/discharge action	40
7.2	Modes for volt-var management	41
7.2.1	VAr management modes using volt-var arrays	41
7.2.2	Example setting volt-var mode VV11: available var support mode with no impact on watts	42
7.2.3	Example setting volt-var mode VV12: maximum var support mode based on <i>WMax</i>	44
7.2.4	Example setting volt-var mode VV13: static power converter mode based on settings	45
7.2.5	Example setting volt-var mode VV14: passive mode with no var support	46
7.3	Modes for frequency-related behaviours	47
7.3.1	Frequency management modes	47
7.3.2	Frequency-watt mode FW21: high frequency reduces active power	48
7.3.3	Frequency-watt mode FW22: constraining generating/charging by frequency	50
7.4	Dynamic reactive current support during abnormally high or low voltage levels	53
7.4.1	Purpose of dynamic reactive current support	53
7.4.2	Dynamic reactive current support mode TV31: support during abnormally high or low voltage levels	54
7.5	Low/high voltage ride-through curves for “must disconnect” and “must remain connected” zones	57
7.5.1	Purpose of L/HVRT	57
7.5.2	“Must disconnect” (MD) and “must remain connected” (MRC) curves	57
7.6	Modes for watt-triggered behaviours	59
7.6.1	Watt-power factor mode WP41: feed-in power controls power factor	59
7.6.2	Alternative watt-power factor mode WP42: feed-in power controls power factor	59
7.7	Modes for voltage-watt management	60
7.7.1	Voltage-watt mode VW51: voltage-watt management: generating by voltage	60
7.7.2	Voltage-watt mode VW52: voltage-watt management: charging by voltage	60
7.8	Modes for behaviours triggered by non-power parameters	61
7.8.1	Temperature mode TMP	61
7.8.2	Pricing signal mode PS	61
7.9	Setting and reporting functions	62
7.9.1	Purpose of setting and reporting functions	62
7.9.2	Establishing settings DS91: modify power converter-based DER settings	62
7.9.3	Event logging DS92: log alarms and events, retrieve logs	62
7.9.4	Reporting status DS93: selecting status points, establishing reporting mechanisms	66
7.9.5	Time synchronization DS94: time synchronization requirements	68
8	IEC 61850 information models for power converter-based functions	68

8.1	Overall structure of IEC 61850	68
8.2	IEC 61850 system logical nodes	69
8.3	Key components of IEC 61850 information modelling of power converter-based functions	71
8.3.1	Subsets of 61850 models for power converter-based DER functions	71
8.3.2	Types of interactions for settings, functions, and modes	72
8.3.3	Key common data classes (CDCs)	73
8.3.4	Messaging services	77
8.3.5	Message errors	78
8.4	Basic settings in IEC 61850	78
8.4.1	Logical nodes for basic settings	78
8.4.2	IEC 61850 models for basic settings	79
8.5	Mode settings in IEC 61850	80
8.5.1	Logical nodes for establishing and managing modes	80
8.5.2	IEC 61850 models for modes	81
8.6	Schedules in IEC 61850	83
8.6.1	Scheduling structures	83
8.6.2	IEC 61850 models for schedules	84
8.7	Immediate control functions in IEC 61850	84
8.7.1	IEC 61850 models for INV1: connect/disconnect	84
8.7.2	IEC 61850 models for INV2: adjust maximum generation level up/down	85
8.7.3	IEC 61850 models for INV3: adjust power factor	86
8.7.4	IEC 61850 models for INV4: charge/discharge storage	86
8.7.5	IEC 61850 models for INV5: pricing signal for charge/discharge of storage	87
8.8	Volt-var management modes in IEC 61850	88
8.8.1	IEC 61850 models for VV11 – VV12: volt-var curve settings	88
8.8.2	IEC 61850 models for VV13 – VV14: volt-var parameter settings	88
8.9	Frequency-related modes in IEC 61850	89
8.9.1	IEC 61850 for FW21: frequency-driven active power modification	89
8.9.2	IEC 61850 for FW22: Frequency-watt mode FW22: generating/charging by frequency	90
8.10	Voltage management modes in IEC 61850	91
8.10.1	IEC 61850 for TV31: dynamic reactive current support	91
8.10.2	IEC 61850 for “must disconnect”	92
8.10.3	IEC 61850 for “must remain connected”	92
8.11	Watt-triggered behaviour modes in IEC 61850	93
8.11.1	IEC 61850 for WP41 and WP42: feed-in watts control of power factor	93
8.12	Voltage-watt management modes in IEC 61850	94
8.12.1	IEC 61850 for VW51: voltage-watt management in generation and charging	94
8.13	Non-power mode behaviours in IEC 61850	95
8.13.1	IEC 61850 models for temperature mode TMP	95
8.13.2	IEC 61850 models for pricing signal mode PS	95
8.14	IEC 61850 reporting commands	96
8.14.1	IEC 61850 models for DS91: modify DER settings	96
8.14.2	IEC 61850 models for DS92: event/history logging	96
8.14.3	IEC 61850 models for DS93: status reporting	97
	Bibliography	102

Figure 1 – DER management hierarchical interactions: autonomous, loosely-coupled, broadcast/multicast.....	18
Figure 2 – Electrical Connection Points (ECP) and Point of Common Coupling (PCC)	21
Figure 3 – Producer and Consumer Reference Frame conventions	24
Figure 4 – EEI Power Factor sign convention.....	25
Figure 5 – Working areas for different modes.....	26
Figure 6 – Example of voltage offsets (V_{RefOf}) with respect to the reference voltage (V_{Ref}).....	28
Figure 7 – Example of modes associated with different ECPs	30
Figure 8 – Example of a volt-var mode curve	31
Figure 9 – Example of hysteresis in volt-var curves.....	33
Figure 10 – Example of deadband in volt-var curves	33
Figure 11 – Local function block diagram	34
Figure 12 – Time domain response of first order low pass filter.....	34
Figure 13 – Interrelationships of schedule controllers, schedules, and schedule references	37
Figure 14 – Volt-var mode VV11 – available vars mode	43
Figure 15 – Power converter mode VV12 – Maximum var support mode based on W_{Max}	44
Figure 16 – Power converter mode VV13 – Example static var support mode based on V_{ArMax}	46
Figure 17 – Frequency-watt mode curves.....	48
Figure 18 – Frequency-based active power reduction.....	49
Figure 19 – Frequency-based active power modification with the use of an array.....	50
Figure 20 – Example of a basic frequency-watt mode configuration	51
Figure 21 – Example array settings with hysteresis.....	52
Figure 22 – Example of an asymmetrical hysteresis configuration.....	52
Figure 23 – Example array configuration for absorbed watts vs. frequency	53
Figure 24 – Basic concepts of the dynamic reactive current support function	54
Figure 25 – Calculation of delta voltage over the filter time window.....	55
Figure 26 – Activation zones for dynamic reactive current support.....	55
Figure 27 – Alternative gradient behaviour, selected by ArGraMod	56
Figure 28 – Settings to define a blocking zone.....	57
Figure 29 – Must disconnect and must remain connected zones	58
Figure 30 – Examples of “must remain connected” requirements for different regions	58
Figure 31 – Power factor controlled by feed-in power.....	59
Figure 32 – Example configuration curve for maximum watts vs. voltage	60
Figure 33 – Example configuration curve for maximum watts absorbed vs. voltage	61
Figure 34 – Structure of the IEC 61850 Parts.....	69
Figure 35 – Interrelationships of schedule controllers, schedules, and schedule references	84
Table 1 – Producer Reference Frame (PRF) conventions.....	24
Table 2 – Example basic settings for a storage DER unit	28

Table 3 – Events.....	64
Table 4 – Examples of status points.....	66
Table 5 – Interpretation of logical node tables.....	70
Table 6 – LPHD class.....	70
Table 7 – Common LN class.....	71
Table 8 – LLN0 class.....	71
Table 9 – CDC SPS.....	73
Table 10 – CDC SPC.....	73
Table 11 – CDC DPC.....	74
Table 12 – CDC INC.....	74
Table 13 – CDC ING.....	75
Table 14 – CDC ASG.....	75
Table 15 – CDC ORG.....	76
Table 16 – CDC CSG.....	76
Table 17 – Schedule (SCR) common data class specification.....	77
Table 18 – Service error type definitions.....	78
Table 19 – LN DRCT – DER controller characteristics.....	79
Table 20 – LN FMAR – set mode array.....	81
Table 21 – LN DGSM – issue mode command.....	83
Table 22 – LN DOPM – operations.....	85
Table 23 – INV1 – LN CSWI – issue and respond to control.....	85
Table 24 – LN FWHZ – set power levels by frequency for FW21.....	90
Table 25 – LN RDGS – dynamic reactive current support for TV31.....	92
Table 26 – LN PFFW – set power factor by feed-in power for WP41.....	94
Table 27 – DS92 – IEC 61850 log structure.....	97
Table 28 – LN DRCS – DER state for DS93.....	99
Table 29 – DS93 – Status, settings, and measurement points.....	99

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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**

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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.

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.

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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 a power converter-based DER system and a battery that are connected at the DC level.

The namespace of this document is: [IEC TR 61850-90-7:2013](https://standards.iteh.ai/catalog/standards/sist/27c39826-43fd-449d-9d38-b11c74641e40/iec-61850-90-7-2013)

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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, 10th 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.

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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

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[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]

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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]

[IEC TR 61850-90-7:2013](https://standards.iteh.ai/catalog/standards/sist/27c39826-43fd-449d-9d38-b165a646a524/iec-tr-61850-90-7-2013)

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]

**3.1.14
monitor**

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

[SOURCE: IEC 60050-351:2006,351-22-03]

**3.1.15
point of common coupling
PCC**

the point of a power supply network, electrically nearest to a particular load, at which other loads are, or may be, connected

Note 1 to entry: These loads can be either devices, equipment or systems, or distinct customer's installations.

Note 2 to entry: In some applications, the term "point of common coupling" is restricted to public networks.

Note 3 to entry: The point where a local EPS is connected to an area EPS [IEEE 1547]. The local EPS may include distributed energy resources as well as load (see IEV definition which only includes load).

[SOURCE: IEC 60050-161:1990,161-07-15, modified by replacement of "consumer's installation" by "load" and by addition of Notes 1 to 3 to entry]

**3.1.16
power converter**

electronic equipment that converts:

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

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**3.1.17
prime mover**

equipment acting as the energy source for the generation of electricity

Note 1 to entry: Examples include diesel engine, solar panels, gas turbines, wind turbines, hydro turbines, battery storage, water storage, air storage, etc.

**3.1.18
set point**

target value that an automatic control system will aim to reach

[SOURCE: Wikipedia 2012-3]

**3.1.19
set point command**

a command in which the value for the required state of operational equipment is transmitted to a controlled station where it is stored

Note 1 to entry: A setpoint is usually an analogue value which sets the controllable target for a process or sets limits or other parameters used for managing the process.

[SOURCE: IEC 60050-371:1984,371-03-11, modified by addition of Note 1 to entry]

3.2 Acronyms

CDC:	Common Data Class
CIM:	Common Information Model
DER:	Distributed Energy Resource