

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Communication networks and systems for power utility automation –  
Part 7-420: Basic communication structure – Distributed energy resources  
logical nodes**

**Réseaux et systèmes de communication pour l'automatisation des systèmes  
électriques –  
Partie 7-420: Structure de communication de base – Nœuds logiques de  
ressources énergétiques distribuées**



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## CONTENTS

CONTENTS .....	2
FOREWORD .....	7
INTRODUCTION .....	9
1 Scope .....	12
2 Normative references .....	12
3 Terms, definitions and abbreviations .....	13
3.1 Terms and definitions .....	13
3.2 DER abbreviated terms .....	18
4 Conformance .....	2
5 Logical nodes for DER management systems .....	20
5.1 Overview of information modelling (informative) .....	20
5.1.1 Data information modelling constructs .....	20
5.1.2 Logical devices concepts .....	21
5.1.3 Logical nodes structure .....	22
5.1.4 Naming structure .....	22
5.1.5 Interpretation of logical node tables .....	23
5.1.6 System logical nodes LN Group: L (informative) .....	24
5.1.7 Overview of DER management system LNs .....	27
5.2 Logical nodes for the DER plant ECP logical device .....	29
5.2.1 DER plant electrical connection point (ECP) logical device (informative) .....	29
5.2.2 LN: DER plant corporate characteristics at the ECP Name: DCRP .....	31
5.2.3 LN: Operational characteristics at ECP Name: DOPR .....	31
5.2.4 LN: DER operational authority at the ECP Name: DOPA .....	32
5.2.5 LN: Operating mode at ECP Name: DOPM .....	33
5.2.6 LN: Status information at the ECP Name: DPST .....	34
5.2.7 LN: DER economic dispatch parameters Name: DCCT .....	35
5.2.8 LN: DER energy and/or ancillary services schedule control Name: DSCC .....	36
5.2.9 LN: DER energy and/or ancillary services schedule Name: DSCH .....	37
5.3 Logical nodes for the DER unit controller logical device .....	38
5.3.1 DER device controller logical device (informative) .....	38
5.3.2 LN: DER controller characteristics Name: DRCT .....	38
5.3.3 LN: DER controller status Name: DRCS .....	39
5.3.4 LN: DER supervisory control Name: DRCC .....	40
6 Logical nodes for DER generation systems .....	42
6.1 Logical nodes for DER generation logical device .....	42
6.1.1 DER generator logical device (informative) .....	42
6.1.2 LN: DER unit generator Name: DGEN .....	42
6.1.3 LN: DER generator ratings Name: DRAT .....	44
6.1.4 LN: DER advanced generator ratings Name: DRAZ .....	45
6.1.5 LN: Generator cost Name: DCST .....	46
6.2 Logical nodes for DER excitation logical device .....	47
6.2.1 DER excitation logical device (informative) .....	47
6.2.2 LN: Excitation ratings Name: DREX .....	47
6.2.3 LN: Excitation Name: DEXC .....	48

6.3	Logical nodes for DER speed/frequency controller .....	49
6.3.1	Speed/frequency logical device (informative).....	49
6.3.2	LN: Speed/Frequency controller Name: DSFC .....	49
6.4	Logical nodes for DER inverter/converter logical device .....	50
6.4.1	Inverter/converter logical device (informative).....	50
6.4.2	LN: Rectifier Name: ZRCT .....	51
6.4.3	LN: Inverter Name: ZINV .....	53
7	Logical nodes for specific types of DER.....	55
7.1	Logical nodes for reciprocating engine logical device .....	55
7.1.1	Reciprocating engine description (informative) .....	55
7.1.2	Reciprocating engine logical device (informative) .....	55
7.1.3	LN: Reciprocating engine Name: DCIP .....	56
7.2	Logical nodes for fuel cell logical device.....	57
7.2.1	Fuel cell description (informative) .....	57
7.2.2	Fuel cell logical device (informative) .....	59
7.2.3	LN: Fuel cell controller Name: DFCL.....	60
7.2.4	LN: Fuel cell stack Name: DSTK.....	61
7.2.5	LN: Fuel processing module Name: DFPM.....	62
7.3	Logical nodes for photovoltaic system (PV) logical device .....	63
7.3.1	Photovoltaic system description (informative) .....	63
7.3.2	Photovoltaics system logical device (informative) .....	65
7.3.3	LN: Photovoltaics module ratings Name: DPVM.....	67
7.3.4	LN: Photovoltaics array characteristic Name: DPVA.....	68
7.3.5	LN: Photovoltaics array controller Name: DPVC .....	69
7.3.6	LN: Tracking controller Name: DTRC.....	70
7.4	Logical nodes for combined heat and power (CHP) logical device .....	72
7.4.1	Combined heat and power description (informative).....	72
7.4.2	Combined heat and power logical device (informative) .....	75
7.4.3	LN: CHP system controller Name: DCHC.....	76
7.4.4	LN: Thermal storage Name: DCTS .....	77
7.4.5	LN: Boiler Name: DCHB .....	78
8	Logical nodes for auxiliary systems .....	78
8.1	Logical nodes for fuel system logical device .....	78
8.1.1	Fuel system logical device (informative) .....	78
8.1.2	LN: Fuel characteristics Name: MFUL.....	80
8.1.3	LN: Fuel delivery system Name: DFLV.....	80
8.2	Logical nodes for battery system logical device .....	81
8.2.1	Battery system logical device (informative) .....	81
8.2.2	LN: Battery systems Name: ZBAT.....	82
8.2.3	LN: Battery charger Name: ZBTC .....	83
8.3	Logical node for fuse device .....	84
8.3.1	Fuse logical device (informative) .....	84
8.3.2	LN: Fuse Name: XFUS .....	84
8.4	Logical node for sequencer .....	85
8.4.1	Sequencer logical device.....	85
8.4.2	LN: Sequencer Name: FSEQ .....	85
8.5	Logical nodes for physical measurements .....	86
8.5.1	Physical measurements (informative) .....	86

8.5.2	LN: Temperature measurements Name: STMP .....	86
8.5.3	LN: Pressure measurements Name: MPRS .....	87
8.5.4	LN: Heat measured values Name: MHET .....	87
8.5.5	LN: Flow measurements Name: MFLW .....	88
8.5.6	LN: Vibration conditions Name: SVBR .....	89
8.5.7	LN: Emissions measurements Name: MENV .....	90
8.5.8	LN: Meteorological conditions Name: MMET .....	91
8.6	Logical nodes for metering .....	91
8.6.1	Electric metering (informative) .....	91
9	DER common data classes (CDC) .....	91
9.1	Array CDCs .....	91
9.1.1	E-Array (ERY) enumerated common data class specification .....	91
9.1.2	V-Array (VRY) visible string common data class specification .....	92
9.2	Schedule common data classes .....	93
9.2.1	Absolute time schedule (SCA) settings common data class specification .....	93
9.2.2	Relative time schedule (SCR) settings common data class specification .....	93
	Annex A (informative) Glossary .....	95
	Bibliography .....	97
	Figure 1 – Example of a communications configuration for a DER plant .....	10
	Figure 2 – IEC 61850 modelling and connections with CIM and other IEC TC 57 models .....	11
	Figure 3 – Information model hierarchy .....	21
	Figure 4 – Example of relationship of logical device, logical nodes, data objects, and common data classes .....	22
	Figure 5 – Overview: Conceptual organization of DER logical devices and logical nodes .....	28
	Figure 6 – Illustration of electrical connection points (ECP) in a DER plant .....	29
	Figure 7 – Inverter / converter configuration .....	50
	Figure 8 – Example of a reciprocating engine system (e.g. Diesel Gen-Set) .....	55
	Figure 9 – Example of LNs in a reciprocating engine system .....	56
	Figure 10 – Fuel cell – hydrogen/oxygen proton-exchange membrane fuel cell (PEM) .....	58
	Figure 11 – PEM fuel cell operation .....	58
	Figure 12 – Example of LNs used in a fuel cell system .....	59
	Figure 13 – Example: One line diagram of an interconnected PV system .....	64
	Figure 14 – Schematic diagram of a large PV installation with two arrays of several sub-arrays .....	65
	Figure 15 – Example of LNs associated with a photovoltaics system .....	66
	Figure 16a – CHP based on fuel cells .....	73
	Figure 16b – CHP based on internal combustion units .....	73
	Figure 16 – Two examples of CHP configurations .....	73
	Figure 17 – CHP unit includes both domestic hot water and heating loops .....	74
	Figure 18 – CHP unit includes domestic hot water with hybrid storage .....	74
	Figure 19 – CHP unit includes domestic hot water without hybrid storage .....	74

Figure 20 – Example of LNs associated with a combined heat and power (CHP) system..... 75

Table 1 – Interpretation of logical node tables.....	23
Table 2 – LPHD class .....	25
Table 3 – Common LN class .....	26
Table 4 – LLN0 class .....	27
Table 5 – DER plant corporate characteristics at the ECP, LN (DCRP) .....	31
Table 6 – Operational characteristics at the ECP, LN (DOPR) .....	32
Table 7 – DER operational authority at the ECP, LN (DOPA) .....	33
Table 8 – Operating mode at the ECP, LN (DOPM).....	34
Table 9 – Status at the ECP, LN (DPST).....	35
Table 10 – DER Economic dispatch parameters, LN (DCCT) .....	35
Table 11 – DER energy schedule control, LN (DSCC).....	36
Table 12 – DER Energy and ancillary services schedule, LN (DSCH) .....	37
Table 13 – DER controller characteristics, LN DRCT .....	38
Table 14 – DER controller status, LN DRCS .....	39
Table 15 – DER supervisory control, LN DRCC.....	40
Table 16 – DER unit generator, LN (DGEN).....	42
Table 17 – DER Basic Generator ratings, LN (DRAT).....	44
Table 18 – DER advanced generator ratings, LN (DPAZ).....	46
Table 19 – Generator cost, LN DCST.....	47
Table 20 – Excitation ratings, LN (DREX) .....	47
Table 21 – Excitation, LN (DEXC).....	48
Table 22 – Speed/frequency controller, LN (DSFC).....	49
Table 23 – Rectifier, LN (ZRCT).....	51
Table 24 – Inverter, LN (ZINV).....	53
Table 25 – Reciprocating engine, LN (DCIP).....	57
Table 26 – Fuel cell controller, LN (DFCL).....	60
Table 27 – Fuel cell stack, LN (DSTK) .....	61
Table 28 – Fuel cell processing module, LN (DFPM).....	62
Table 29 – Photovoltaic module characteristics, LN (DPVM).....	67
Table 30 – Photovoltaic array characteristics, LN (DPVA).....	68
Table 31 – Photovoltaic array controller, LN (DPVC).....	69
Table 32 – Tracking controller, LN (DTRC) .....	70
Table 33 – CHP system controller, LN (DCHC) .....	76
Table 34 – CHP thermal storage, LN (DCTS).....	77
Table 35 – CHP Boiler System, LN (DCHB) .....	78
Table 36 – Fuel types .....	79
Table 37 – Fuel characteristics, LN (MFUL) .....	80
Table 38 – Fuel systems, LN (DFLV) .....	81
Table 39 – Battery systems, LN (ZBAT) .....	82
Table 40 – Battery charger, LN (ZBTC).....	83

Table 41 – Fuse, LN (XFUS).....	84
Table 42 – Sequencer, LN (FSEQ).....	85
Table 43 – Temperature measurements, LN (STMP).....	86
Table 44 – Pressure measurements, LN (MPRS) .....	87
Table 45 – Heat measurement, LN (MHET).....	88
Table 46 – Flow measurement, LN (MFLW) .....	88
Table 47 – Vibration conditions, LN (SVBR).....	90
Table 48 – Emissions measurements, LN (MENV) .....	90
Table 49 – E-Array (ERY) common data class specification .....	92
Table 50 – V-Array (VRY) common data class specification .....	92
Table 51 – Schedule (SCA) common data class specification .....	93
Table 52 – Schedule (SCR) common data class specification .....	94

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND  
SYSTEMS FOR POWER UTILITY AUTOMATION –**

**Part 7-420: Basic communication structure –  
Distributed energy resources logical nodes**

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This bilingual version (2019-09) corresponds to the monolingual English version, published in 2009-03.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/981/FDIS	57/988/RVD

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

The French version of this standard has not been voted upon.

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In Clauses 5 to 8 of this document, each subclause contains an initial informative clause, followed by normative clauses. Specifically, any subclause identified as informative is informative; any clause with no identification is considered normative.

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## INTRODUCTION

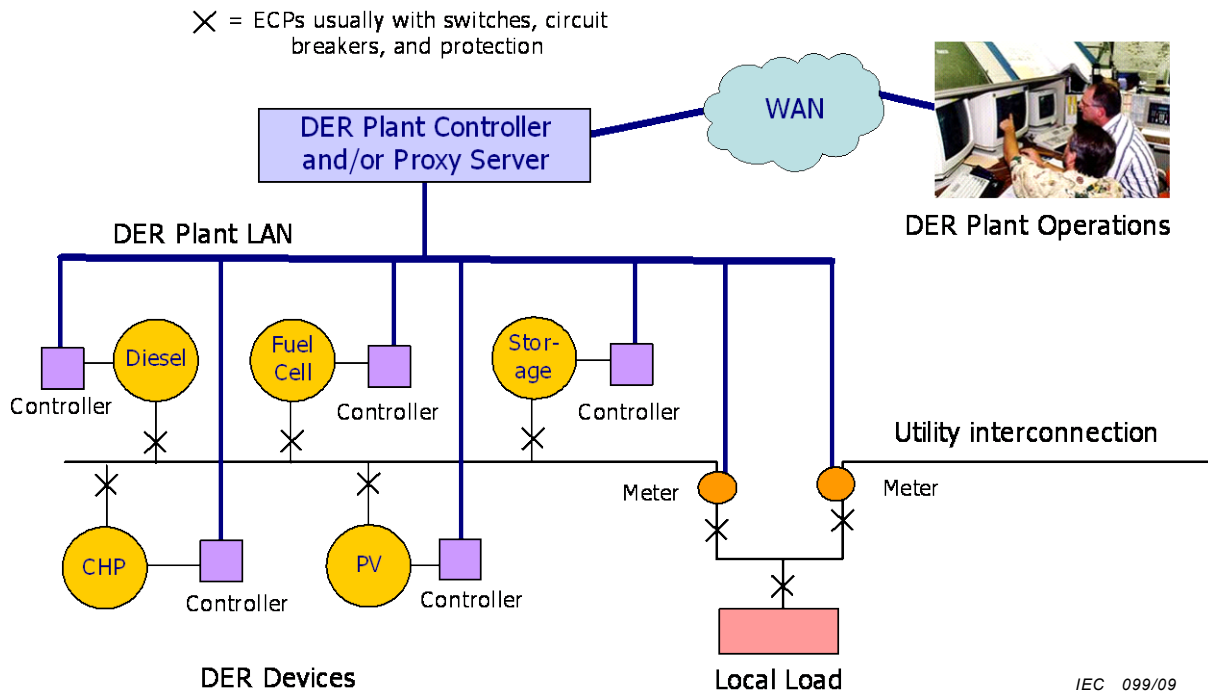
Increasing numbers of DER (distributed energy resources) systems are being interconnected to electric power systems throughout the world. As DER technology evolves and as the impact of dispersed generation on distribution power systems becomes a growing challenge - and opportunity, nations worldwide are recognizing the economic, social, and environmental benefits of integrating DER technology within their electric infrastructure.

The manufacturers of DER devices are facing the age-old issues of what communication standards and protocols to provide to their customers for monitoring and controlling DER devices, in particular when they are interconnected with the electric utility system. In the past, DER manufacturers developed their own proprietary communication technology. However, as utilities, aggregators, and other energy service providers start to manage DER devices which are interconnected with the utility power system, they are finding that coping with these different communication technologies present major technical difficulties, implementation costs, and maintenance costs. Therefore, utilities and DER manufacturers recognize the growing need to have one international standard that defines the communication and control interfaces for all DER devices. Such standards, along with associated guidelines and uniform procedures would simplify implementation, reduce installation costs, reduce maintenance costs, and improve reliability of power system operations.

The logical nodes in this document are intended for use with DER, but may also be applicable to central-station generation installations that are comprised of groupings of multiple units of the same types of energy conversion systems that are represented by the DER logical nodes in this document. This applicability to central-station generation is strongest for photovoltaics and fuel cells, due to their modular nature.

Communications for DER plants involve not only local communications between DER units and the plant management system, but also between the DER plant and the operators or aggregators who manage the DER plant as a virtual source of energy and/or ancillary services. This is illustrated in Figure 1.

### Example of a Communications Configuration for a DER Plant



**Key**

- CHP combined heat and power
- WAN wide area network
- DER distributed energy resources
- PV photovoltaics
- LAN local area network

**Figure 1 – Example of a communications configuration for a DER plant**

In basic terms, “communications” can be separated into four parts:

- information modelling (the types of data to be exchanged – nouns),
- services modelling (the read, write, or other actions to take on the data – verbs),
- communication protocols (mapping the noun and verb models to actual bits and bytes),
- telecommunication media (fibre optics, radio systems, wireless systems, and other physical equipment).

This document addresses only the IEC 61850 information modelling for DER. Other IEC 61850 documents address the services modelling (IEC 61850-7-2) and the mapping to communication protocols (IEC 61850-8-x). In addition, a systems configuration language (SCL) for DER (IEC 61850-6-x) would address the configuration of DER plants.

The general technology for information modelling has developed to become well-established as the most effective method for managing information exchanges. In particular, the IEC 61850-7-x information models for the exchange of information within substations have become International Standard. Many of the components of this standard can be reused for information models of other types of devices.

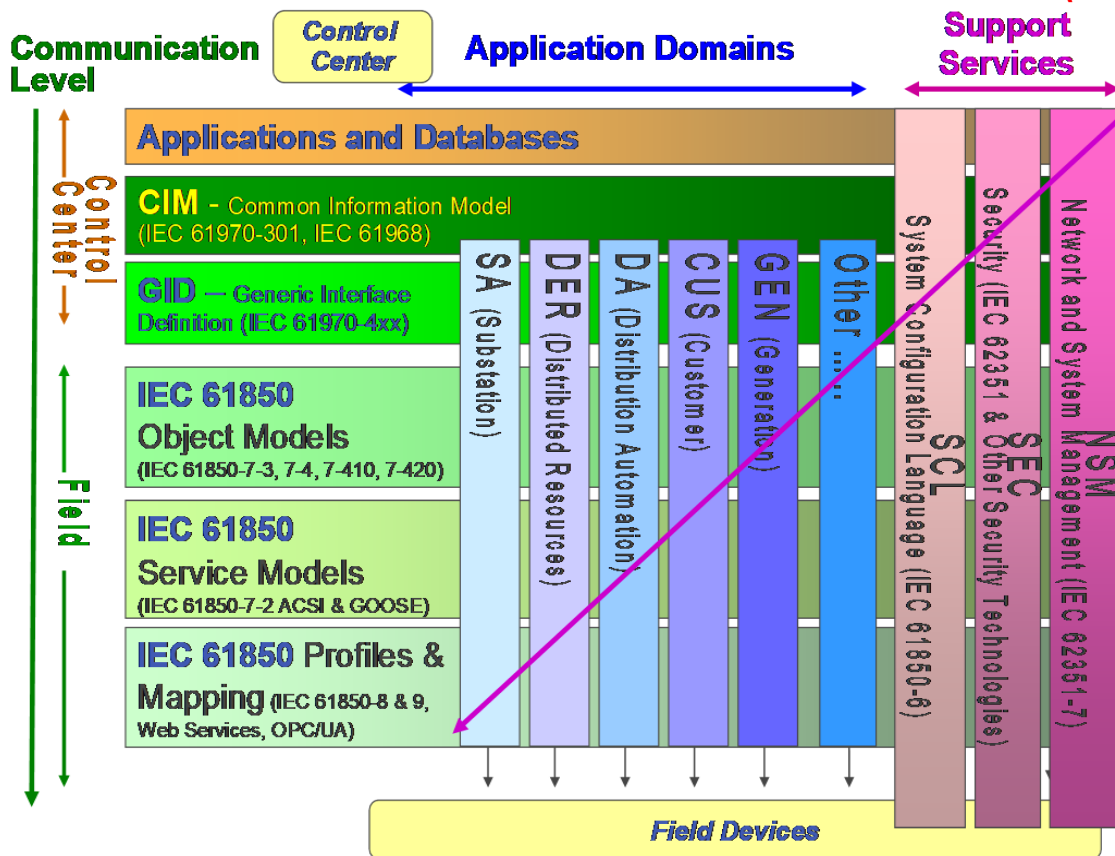
In addition to the IEC 61850 standards, IEC TC 57 has developed the common information model (CIM) that models the relationships among power system elements and other

information elements so that these relationships can be communicated across systems. Although this standard does not address these CIM relationships for DER, it is fully compatible with the CIM concepts.

The interrelationship between IEC TC 57 modelling standards is illustrated in Figure 2. This illustration shows as horizontal layers the three components to an information exchange model for retrieving data from the field, namely, the communication protocol profiles, the service models, and the information models. Above these layers is the information model of utility-specific data, termed the common information model (CIM), as well as all the applications and databases needed in utility operations. Vertically, different information models are shown:

- substation automation (IEC 61850-7-4),
- large hydro plants (IEC 61850-7-410),
- distributed energy resources (DER) (IEC 61850-7-420),
- distribution automation (under development),
- advanced metering infrastructure (as pertinent to utility operations) (pending).

### IEC 61850 Models and the Common Information Model (CIM)



IEC 100/09

Figure 2 – IEC 61850 modelling and connections with CIM and other IEC TC 57 models

# COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

## Part 7-420: Basic communication structure – Distributed energy resources logical nodes

### 1 Scope

This International Standard defines the IEC 61850 information models to be used in the exchange of information with distributed energy resources (DER), which comprise dispersed generation devices and dispersed storage devices, including reciprocating engines, fuel cells, microturbines, photovoltaics, combined heat and power, and energy storage.

The IEC 61850 DER information model standard utilizes existing IEC 61850-7-4 logical nodes where possible, but also defines DER-specific logical nodes where needed.

### 2 Normative references

The following referenced documents are indispensable for the application 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 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substations and feeder equipment – Abstract communication service interface (ACSI)* <sup>1)</sup>

IEC 61850-7-3:2003, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substations and feeder equipment – Common data classes* <sup>1)</sup>

IEC 61850-7-4:2003, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substations and feeder equipment – Compatible logical node classes and data classes* <sup>1)</sup>

IEC 61850-7-410, *Communication networks and systems for power utility automation – Part 7-410: Hydroelectric power plants – Communication for monitoring and control*

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

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<sup>1)</sup> A new edition of this document is in preparation.