

Communication networks and systems for power utility automation - Part 5: Communication requirements for functions and device models (IEC 61850-5:2013)

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NATIONAL FOREWORD

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English version

**Communication networks and systems for power utility automation -
Part 5: Communication requirements for functions and device models
(IEC 61850-5:2013)**

Réseaux et systèmes de communication
pour l'automatisation des systèmes
électriques -
Partie 5: Exigences de communication
pour les modèles de fonctions et
d'appareils
(CEI 61850-5:2013)

Kommunikationsnetze und -systeme für
die Automatisierung in der elektrischen
Energieversorgung -
Teil 5: Kommunikationsanforderungen
für Funktionen und Gerätemodelle
(IEC 61850-5:2013)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 57/1286/FDIS, future edition 2 of IEC 61850-5, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61850-5:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-12-06
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-03-06

This document supersedes EN 61850-5:2003.

EN 61850-5:2013 includes the following significant technical changes with respect to EN 61850-5:2003:

- extension from substation automation systems to utility automation systems;
- including the interfaces for communication between substations (interfaces 2 and 11);
- requirements from communication beyond the boundary of the substation.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61850-5:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60834-1:1999	NOTE	Harmonised as EN 60834-1.
IEC 60870-5 Series	NOTE	Harmonised as EN 60870-5 Series (not modified).
IEC 61000-4-30	NOTE	Harmonised as EN 61000-4-30.
IEC 61850-3	NOTE	Harmonised as EN 61850-3.
IEC 61850-7 Series	NOTE	Harmonised as EN 61850-7 Series (not modified).
IEC 61850-7-1	NOTE	Harmonised as EN 61850-7-1.
IEC 61850-7-2	NOTE	Harmonised as EN 61850-7-2.
IEC 61850-7-3	NOTE	Harmonised as EN 61850-7-3.
IEC 61850-7-4	NOTE	Harmonised as EN 61850-7-4.
IEC 61850-8 Series	NOTE	Only Part 8-1 is Harmonised as EN 61850-8-1.
IEC 61850-9 Series	NOTE	Harmonised as EN 61850-9-2 Series (not modified).
IEC 61850-10	NOTE	Harmonised as EN 61850-10.

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61000-4-15	-	Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications	EN 61000-4-15	-
IEC/TS 61850-2	-	Communication networks and systems in substations - Part 2: Glossary	-	-
IEC 61850-6	-	Communication networks and systems for power utility automation - Part 6: Configuration description language for communication in electrical substations related to IEDs	EN 61850-6	-
IEC 81346	Series	Industrial systems, installations and equipment and industrial products - Structuring principles and reference designations	EN 81346	Series
Cigre JWG 34./35.11	2007	Protection using telecommunication, Cigre Technical Brochure (TB) 192	-	-

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CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	11
2 Normative references	11
3 Terms and definitions	12
3.1 General.....	12
3.2 Connections	14
3.3 Relations between IEDs	15
3.4 Substation structures.....	15
3.5 Power utility automation functions at different levels.....	16
3.6 Miscellaneous	17
4 Abbreviations	17
5 Power utility automation functions	17
5.1 General.....	17
5.2 Example substation automation system	18
5.2.1 General	18
5.2.2 Logical allocation of functions and interfaces.....	18
5.2.3 The physical allocation of functions and interfaces	20
5.2.4 The role of interfaces.....	20
5.3 Other application examples	21
5.3.1 Substation – Substation.....	21
5.3.2 Substation – Network Control	21
5.3.3 Wind.....	21
5.3.4 Hydro	21
5.3.5 DER	21
6 Goal and requirements	21
6.1 Interoperability	21
6.2 Static design requirements	22
6.3 Dynamic interaction requirements	22
6.4 Response behaviour requirements	23
6.5 Approach to interoperability.....	23
6.6 Conformance test requirements.....	24
7 Categories of functions.....	24
7.1 General.....	24
7.2 System support functions	24
7.3 System configuration or maintenance functions.....	24
7.4 Operational or control functions.....	25
7.5 Bay local process automation functions	25
7.6 Distributed process automation functions	25
8 Function description and function requirements	26
8.1 Approach.....	26
8.2 Function description	27
8.3 The PICOM description	27
8.3.1 The PICOM approach	27
8.3.2 The content of PICOM description	27

8.3.3	Attributes of PICOMs	27
8.3.4	PICOM attributes to be covered by any message	27
8.3.5	PICOM attributes to be covered at configuration time only	28
8.3.6	PICOM attributes to be used for data flow calculations only	28
8.4	Logical node description	28
8.4.1	The logical node concept	28
8.4.2	Logical nodes and logical connections	29
8.4.3	Examples for decomposition of common functions into logical nodes	30
8.5	List of logical nodes	31
8.5.1	Logical Node allocation and distributed functions	31
8.5.2	Explanation to tables	32
8.5.3	Protection	33
8.5.4	Logical nodes for protection related functions	40
8.5.5	Control	42
8.5.6	Interfaces, logging, and archiving	43
8.5.7	Automatic process control	44
8.5.8	Functional blocks	45
8.5.9	Metering and measurement	46
8.5.10	Power quality	47
8.5.11	Physical device and common data	48
8.6	LN related to system services	48
8.6.1	System and device security	48
8.6.2	Switching devices	49
8.6.3	LN for supervision and monitoring	50
8.6.4	Instrument transformers	51
8.6.5	Position sensors	51
8.6.6	Material status sensors	52
8.6.7	Flow status sensors	52
8.6.8	Generic sensors	52
8.6.9	Power transformers	53
8.6.10	Further power system equipment	53
8.6.11	Generic process I/O	54
8.7	Mechanical non-electrical primary equipment	54
9	The application concept for logical nodes	54
9.1	Example out of the domain substation automation	54
9.2	Typical allocation and use of logical nodes	54
9.2.1	Free allocation of LNs	54
9.2.2	Station level	55
9.2.3	Bay level	55
9.2.4	Process/switchgear level	55
9.2.5	The use of generic logical nodes	55
9.3	Basic examples	55
9.4	Additional examples	56
9.5	Modelling	58
9.5.1	Important remarks	58
9.5.2	Object classes and instances	58
9.5.3	Requirements and modelling	58
9.5.4	LN and modelling	58
9.5.5	Use of LN for applications	59

10	System description and system requirements	59
10.1	Need for a formal system description.....	59
10.2	Requirements for logical node behaviour in the system	59
11	Performance requirements	60
11.1	Message performance requirements.....	60
11.1.1	Basic definitions and requirements	60
11.1.2	Message types and performance classes.....	65
11.1.3	Definition of transfer time and synchronization classes	66
11.2	Messages types and performances classes	69
11.2.1	Type 1 – Fast messages (“Protection”)	69
11.2.2	Type 2 – Medium speed messages (“Automatics”).....	69
11.2.3	Type 3 – Low speed messages (“Operator”)	70
11.2.4	Type 4 – Raw data messages (“Samples”).....	70
11.2.5	Type 5 – File transfer functions	70
11.2.6	Type 6 – Command messages and file transfer with access control	71
11.3	Requirements for data and communication quality.....	71
11.3.1	General remarks	71
11.3.2	Data integrity.....	72
11.3.3	Reliability	73
11.3.4	Availability.....	74
11.4	Requirements concerning the communication system	74
11.4.1	Communication failures	74
11.4.2	Requirements for station and bay level communication.....	75
11.4.3	Requirements for process level communication	75
11.4.4	Requirements for recovery delay	76
11.4.5	Requirements for communication redundancy.....	76
11.5	System performance requirements	76
12	Additional requirements for the data model.....	77
12.1	Semantics	77
12.2	Logical and physical identification and addressing.....	77
12.3	Self-description	77
12.4	Administrative issues.....	77
Annex A (informative)	Logical nodes and related PICOMs	78
Annex B (informative)	PICOM identification and message classification.....	93
Annex C (informative)	Communication optimization	101
Annex D (informative)	Rules for function definition.....	102
Annex E (informative)	Interaction of functions and logical nodes	104
Annex F (informative)	Functions	105
Annex G (informative)	Results from function description	129
Annex H (informative)	Substation configurations	135
Annex I (informative)	Examples for protection functions in compensated networks.....	140
Bibliography	142
Figure 1	– Relative position of this part of the standard.....	10
Figure 2	– Levels and logical interfaces in substation automation systems.....	19
Figure 3	– The logical node and link concept (explanation see text).....	30

Figure 4 – Examples of the application of the logical node concept (explanation see text).....	31
Figure 5 – Protection function consisting of 3 logical nodes	32
Figure 6 – The basic communication links of a logical node of main protection type.....	39
Figure 7 – Decomposition of functions into interacting LNs on different levels: Examples for generic automatic function, breaker control function and voltage control function.....	55
Figure 8 – Decomposition of functions into interacting LN on different levels: Examples for generic function with telecontrol interface, protection function and measuring/metering function	56
Figure 9 – Example for control and protection LNs of a transformer bay combined in one physical device (some kind of maximum allocation).....	56
Figure 10 – Example for interaction of LNs for switchgear control, interlocking, synchrocheck, autoreclosure and protection (Abbreviation for LN see above)	57
Figure 11 – Example for sequential interacting of LNs (local and remote) for a complex function like point-on-wave switching (Abbreviations for LN see above) – Sequence view	57
Figure 12 – Circuit breaker controllable per phase (XCBR instances per phase) and instrument transformers with measuring units per phase (TCTR or TVTR per phase).....	58
Figure 13 – Definition of "overall transfer time" t and indication of processing times	62
Figure 14 – Transfer time for binary signal with conventional output and input relays.....	63
Figure 15 – Definition of transfer time t for binary signals in case of line protection.....	64
Figure 16 – Definition of transfer time t over serial link in case of line protection.....	64
Figure H.1 – T1-1 Small size transmission substation (single busbar 132 kV with infeed from 220 kV)	135
Figure H.2 – D2-1 Medium size distribution substation (double busbar 22 kV with infeed from 69 kV)	135
Figure H.3 – T1-2 Small size transmission substation (1 1/2 breaker busbar at 110 kV).....	135
Figure H.4 – T2-2 Large size transmission substation (ring bus at 526 kV, double busbar at 138 kV)	136
Figure H.5 – Substation of type T1-1 with allocation functions	137
Figure H.6 – Substation of type D2-1 with allocated functions	138
Figure H.7 – Substation of type T1-2 (functions allocated same as for T2-2 in Figure H.8)	138
Figure H.8 – Substation of type T2-2 with allocated functions	139
Figure I.1 – The transient earth fault in a compensated network	140
Figure I.2 – Short term bypass for single earth fault in compensated networks	141
Figure I.3 – Double earth fault in compensated networks	141
Table 1 – Classes for transfer times.....	67
Table 2 – Time synchronization classes for IED synchronization.....	68
Table 3 – Application of time synchronization classes for time tagging or sampling.....	68
Table 4 – Data integrity classes	72
Table 5 – Security classes	73
Table 6 – Dependability classes.....	74
Table 7 – Requirements on recovery time (examples).....	76
Table A.1 – PICOM groups	78

Table A.2 – Logical node list.....	79
Table B.1 – PICOM identification (Part 1)	94
Table B.2 – PICOM identification (Part 2)	95
Table B.3 – PICOM allocation (Part 1)	96
Table B.4 – PICOM allocation (Part 2)	97
Table B.5 – PICOM types	99
Table G.1 – Function-function interaction (Part 1)	129
Table G.2 – Function-function interaction (Part 2)	130
Table G.3 – Function decomposition into logical nodes (Part 1)	131
Table G.4 – Function decomposition into logical nodes (Part 2)	132
Table G.5 – Function decomposition into logical nodes (Part 3)	133
Table G.6 – Function decomposition into logical nodes (Part 4)	134
Table H.1 – Definition of the configuration of all substations evaluated	136

INTRODUCTION

This part of IEC 61850 is part of set of standards, the IEC 61850 series. The IEC 61850 series is intended to provide interoperability between all devices in power utility automation systems. Therefore, it defines communication networks and systems for power utility automation, and more specially the communication architecture for subsystems like substation automation systems. The sum of all subsystems may result also in the description of the communication architecture for the overall power system management.

Communication between these devices in subsystems and between the subsystems within the overall power utility automation system fulfils a lot of requirements imposed by all the functions to be performed in power utility automation systems starting from the core requirements in substations. These requirements are stated both for the data to be organized in a data model and for the data exchange resulting in services. Performance of the data exchange means not only transfer times but also the quality of the data exchange avoiding losses of information in the communication.

Depending on the philosophy both of the vendor and the user and on the state-of-the-art in technology, the allocation of functions to devices and control levels is not commonly fixed. Therefore, the standard shall support any allocation of functions. This results in different requirements for the different communication interfaces within the substation or plant, at its border and beyond.

The standard series shall be long living but allow following the fast changes in communication technology by both its technical approach and its document structure. Figure 1 shows the relationship of Part 5 to subsequent parts of IEC 61850 series.

The standard series IEC 61850 has been organized so that at least minor changes to one part do not require a significant rewriting of another part. For example, the derived data models in subsequent parts (IEC 61850-7-x) and mappings to dedicated stacks (IEC 61850-8-x and IEC 61850-9-x) based on the communication requirements in Part 5 will not change the requirements defined in Part 5. In addition, the general parts, the requirement specification and the modelling parts are independent from any implementation. The implementation needed for the use of the standard is defined in some few dedicated parts referring to main stream communication means thus supporting the long living of the standard and its potential for later technical changes.

This Part 5 of the standard IEC 61850 defines the communication requirements for functions and device models for power utility automation systems.

The modelling of communication requires the definition of objects (e.g., data objects, data sets, report control, log control) and services accessing the objects (e.g., get, set, report, create, delete). This is defined in Part 7 with a clear interface to implementation. To use the benefits of communication technology, in this standard no new protocol stacks are defined but a standardized mapping on existing stacks is given in Part 8 and Part 9. A System configuration language (Part 6) for strong formal description of the system usable for software tools and a standardized conformance testing (Part 10) complement the standard. Figure 1 shows the general structure of the documents of IEC 61850 as well as the position of the clauses defined in this document.

NOTE To keep the layered approach of the standard not mixing application and implementation requirements, terms like client, server, data objects, etc. are normally not used in Part 5 (requirements). In Parts 7 (modelling), 8 and 9 (specific communication service mapping) terms belonging to application requirements like PICOM are normally not used.

IEC 61850-10 Conformance testing
IEC 61850-6 Configuration description language for communication
IEC 61850-8-x IEC 61850-9-x Specific communication service mapping
IEC 61850-7-4 Compatible logical node and data object addressing
IEC 61850-7-3 Common data classes and attributes
IEC 61850-7-2 Abstract communication service interface (ACSI)
IEC 61850-7-1 Communication reference model
IEC 61850-5 Communication requirements for functions and device models

IEC 2379/12

Figure 1 – Relative position of this part of the standard

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 5: Communication requirements for functions and device models

1 Scope

This part of IEC 61850 applies to power utility automation systems with the core part of substation automation systems (SAS). It standardizes the communication between intelligent electronic devices (IEDs) and defines the related system requirements to be supported.

The specifications of this part refer to the communication requirements of the functions in power automation systems. Most examples of functions and their communication requirements in this part are originated primarily from the substation automation domain and may be reused or extended for other domains within power utility automation if applicable. Note that sometimes instead of the term substation automation domain the term substation domain is used, especially if both the switchyard devices (primary system) and the automation system (secondary system) is regarded.

The description of the functions is not used to standardize the functions, but to identify communication requirements between Intelligent Electronic Devices within plants and substations in the power system, between such stations (e.g. between substation for line protection) and between the plant or substation and higher-level remote operating places (e.g. network control centres) and maintenance places. Also interfaces to remote technical services (e.g. maintenance centres) are considered. The general scope is the communication requirements for power utility automation systems. The basic goal is interoperability for all interactions providing a seamless communication system for the overall power system management.

Standardizing functions and their implementation is completely outside the scope of this standard. Therefore, it cannot be assumed a single philosophy of allocating functions to devices. To support the resulting request for free allocation of functions, a proper breakdown of functions into parts relevant for communication is defined. The exchanged data and their required performance are defined.

The same or similar intelligent electronic devices from substations like protective and control devices are found in other installations like power plants also. Using this standard for such devices in these plants facilitates the system integration e.g. between the power plant control and the related substation automation system. For some of such other application domains like wind power plants, hydro power plants and distributed energy resources specific standard parts according to IEC 61850 series have been already defined and published.

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 61000-4-15, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications*

IEC/TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-6, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs*

IEC 81346 (all parts), *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations*

Cigre JWG 34./35.11 – *Protection using Telecommunication, Cigre Technical Brochure (TB) 192* (111 pages), 2007

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC/TS 61850-2, as well as the following apply.

3.1 General

3.1.1 application function

task, which is performed in or by power utility automation systems

Note 1 to entry: Generally, a function consists of subparts which may be distributed to different IEDs, which exchange data with each other. More precisely these sub-functions implemented in the IEDs exchange data. Also between different functions data are exchanged. The exchanged data exposed to the communication system shall be standardized based on the semantic content to be understandable by the receiving function. For this purpose the standard groups the exchanged data in objects called Logical Nodes which refer to the name of the allocated functions by their mnemonic name.

3.1.2 local function

function which is performed by sub-functions in one physical device

Note 1 to entry: If the performance of the functions is not depending on functions in other devices no standardized link is needed. Sometimes, functions with a weak dependency only from other ones are also called local functions. The loss of such links should not result in blocking these functions but in worst case to some graceful degradation.

3.1.3 distributed function

function which is performed by sub-functions in two or more different physical devices

Note 1 to entry: The exchanged data is contained in Logical Nodes having a common semantic reference to the distributed function. Since all functions communicate in some way, the definition of a local or a distributed function is not unique but depends on the definition of the functional steps to be performed until the function is defined as complete. In case of losing the data of one Logical Node or losing one included communication link the function may be blocked completely or show a graceful degradation if applicable.

3.1.4 system

set of interacting entities which perform a common functionality

Note 1 to entry: The backbone of the system is the data exchange.

3.1.5 logical system

communicating set of all application functions performing some overall task like “management of a substation” or “management of a plant”

Note 1 to entry: The boundary of a logical system is given by its logical interfaces. The backbone of the logical system is the communication relationship between its functions and sub-functions. The exchanged data are grouped in Logical Nodes.