Communication networks and systems in substations - Part 7-1: Basic communication structure for substation and feeder equipment - Principles and models

Communication networks and systems in substations - Part 7-1: Basic communication structure for substation and feeder equipment - Principles and models

EESTI STANDARDI EESSÕNA **NATIONAL FOREWORD**

Käesolev Eesti standard EVS-EN 61850-7-1:2004 sisaldab Euroopa standardi EN 61850-7-1:2003 ingliskeelset teksti. Käesolev dokument on jõustatud 20.01.2004 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 61850-7-1:2004 consists of the English text of the European standard EN 61850-7-1:2003. This document is endorsed on 20.01.2004 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: Provides an overview of the architecture for communication and interactions between substation devices such as protection devices, breakers, transformers, substation hosts, etc. Uses simple examples of functions to describe the concepts and methods applied in the IEC 61850 series. Also describes the relationships between other parts of the IEC 61850 series and defines how inter-operability is reached	**Scope:** Provides an overview of the architecture for communication and interactions between substation devices such as protection devices, breakers, transformers, substation hosts, etc. Uses simple examples of functions to describe the concepts and methods applied in the IEC 61850 series. Also describes the relationships between other parts of the IEC 61850 series and defines how inter-operability is reached

ICS 33.200

Võtmesõnad: buildings, electrical equ, logi, modelling, network control system, organization of data, power supplies, project management, signal transmission, specification (approval), specifications, stations, substation, system management, telecommunication, telecommunications

EUROPEAN STANDARD **EN 61850-7-1**

NORME EUROPÉENNE

EUROPÄISCHE NORM September 2003

ICS 33.200

English version

Communication networks and systems in substations Part 7-1: Basic communication structure for substation and feeder equipment - Principles and models

(IEC 61850-7-1:2003)

Réseaux et systèmes de communication dans les postes
Partie 7-1: Structure des communications de base pour les postes électriques et les équipements de lignes - Principes et modèles
(CEI 61850-7-1:2003)

Kommunikationsnetze und -systeme in Stationen
Teil 7-1: Grundlegende Kommunikationsstruktur für stations- und feldbezogene Ausrüstung - Grundsätze und Modelle
(IEC 61850-7-1:2003)

This European Standard was approved by CENELEC on 2003-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 61850-7-1:2003 E

Foreword

The text of document 57/637/FDIS, future edition 1 of IEC 61850-7-1, prepared by IEC TC 57, Power system control and associated communications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61850-7-1 on 2003-09-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2004-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2006-09-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A to F are informative.
Annex ZA has been added by CENELEC.

_____

Endorsement notice

The text of the International Standard IEC 61850-7-1:2003 was approved by CENELEC as a European Standard without any modification.

_____

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

Publication	Year	Title	EN/HD	Year
IEC/TS 61850-2	- [1)]	Communication networks and systems in substations Part 2: Glossary	-	-
IEC 61850-5	- [1)]	Part 5: Communication requirements for functions and device models	-	-
IEC 61850-7-2	- [1)]	Part 7-2: Basic communication structure for substation and feeder equipment - Abstract communication service interface (ACSI)	EN 61850-7-2	2003 [2)]
IEC 61850-7-3	- [1)]	Part 7-3: Basic communication structure for substation and feeder equipment - Common data classes	EN 61850-7-3	2003 [2)]
IEC 61850-7-4	- [1)]	Part 7-4: Basic communication structure for substation and feeder equipment - Compatible logical node classes and data classes	EN 61850-7-4	2003 [2)]
ISO/IEC 8802-3	2001	Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications	-	-
ISO/IEC 8825	Series	Information technology - ASN.1 encoding rules	-	-

[1)] Undated reference.

[2)] Valid edition at date of issue.

Publication	Year	Title	EN/HD	Year
ISO 9506-1	2003	Industrial automation systems - Manufacturing Message Specification Part 1: Service definition	-	-
ISO 9506-2	2003	Part 2: Protocol specification	-	-

INTERNATIONAL STANDARD

IEC 61850-7-1

First edition
2003-07

Communication networks and systems in substations –

Part 7-1:
Basic communication structure for substation and feeder equipment – Principles and models

Reference number
IEC 61850-7-1:2003(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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- **Catalogue of IEC publications**

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INTERNATIONAL STANDARD

IEC 61850-7-1

First edition
2003-07

Communication networks and systems in substations –

Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE XE

For price, see current catalogue

CONTENTS

FOREWORD 7
INTRODUCTION 9

1 Scope 11
2 Normative references 12
3 Terms and definitions 12
4 Abbreviated terms 13
5 Overview of concepts the IEC 61850 series 13
5.1 Objective 13
5.2 Topology and communication functions of substation automation systems 14
5.3 The information models of substation automation systems 15
5.4 Applications modelled by logical nodes defined in IEC 61850-7-4 16
5.5 The semantic is attached to data 19
5.6 The services to exchange information 21
5.7 Services mapped to concrete communication protocols 22
5.8 The configuration of a substation 23
5.9 Summary 23
6 Modelling approach of the IEC 61850 series 24
6.1 Decomposition of application functions and information 24
6.2 Creating information models by stepwise composition 26
6.3 Example of an IED composition 29
6.4 Information exchange models 29
7 Application view 42
7.1 Introduction 42
7.2 First modelling step – Logical nodes and data 44
8 Device view 47
8.1 Introduction 47
8.2 Second modelling step – logical device model 47
9 Communication view 49
9.1 The service models of the IEC 61850 series 49
9.2 The virtualisation 52
9.3 Basic information exchange mechanisms 53
9.4 The client-server building blocks 54
9.5 Interfaces inside and between devices 57
10 Where physical devices, application models and communication meet 58
11 Relationships between IEC 61850-7-2, IEC 61850-7-3 and IEC 61850-7-4 59
11.1 Refinements of class definitions 59
11.2 Example 1 – Logical node and data class 60
11.3 Example 2 – Relationship of IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4 62
12 Mapping the ACSI to real communication systems 64
12.1 Introduction 64
12.2 Mapping example (IEC 61850-8-1) 66

13 Formal specification method 71
13.1 Notation of ACSI classes 71
13.2 Class modelling 72
13.3 Service tables 77
13.4 Referencing instances 78
14 Name spaces 80
14.1 General 80
14.2 Name spaces defined in IEC 61850-7-x 82
14.3 Specification of name spaces 85
14.4 Attributes for references to name spaces 87
14.5 Common rules for extensions of name spaces 89
15 Approaches for the definition of a new semantic 91
15.1 General 91
15.2 Semantic for new definition 92
15.3 Approach 1 (fixed semantic) 92
15.4 Approach 2 (flexible semantic) 92
15.5 Approach 3 (reusable flexible semantic) 93

Annex A (informative) Overview of IEC 61850-7-x, IEC 61850-8-x, and IEC 61850-9-x 94
Annex B (informative) Allocation of data to logical nodes 97
Annex C (informative) Use of the substation configuration language (SCL) 100
Annex D (informative) Applying the LN concept to options for future extensions 102
Annex E (informative) Relation between logical nodes and PICOMs 107
Annex F (informative) Relation between IEC 61850-7-x (IEC 61850-8-x) and UCA 2.0® 108

Bibliography 109

Index 111

Figure 1 – Sample substation automation topology 14
Figure 2 – Modelling approach (conceptual) 15
Figure 3 – Logical node information categories 18
Figure 4 – Build up of devices (principle) 18
Figure 5 – Position information depicted as a tree (conceptual) 19
Figure 6 – Service excerpt 21
Figure 7 – Example of communication mapping 22
Figure 8 – Summary 24
Figure 9 – Decomposition and composition process (conceptual) 25
Figure 10 – XCBR1 information depicted as a tree 28
Figure 11 – Example of IED composition 29
Figure 12 – Output and Input model (principle) 30
Figure 13 – Output model (step 1) (conceptual) 31
Figure 14 – Output model (step 2) (conceptual) 31
Figure 15 – GSE output model (conceptual) 32
Figure 16 – Setting data (conceptual) 33

Figure 17 – Input model for analogue values (step 1) (conceptual) 34
Figure 18 – Deadbanded value (conceptual) 35
Figure 19 – Input model for analogue values (step 2) (conceptual) 35
Figure 20 – Range values 36
Figure 21 – Reporting and logging model (conceptual) 36
Figure 22 – Data set members and reporting 37
Figure 23 – Buffered report control block (conceptual) 38
Figure 24 – Buffer time 39
Figure 25 – Data set members and inclusion-bitstring 40
Figure 26 – Log control block - conceptual 40
Figure 27 – Peer-to-peer data value publishing model (conceptual) 41
Figure 28 – Real world devices 43
Figure 29 – Logical nodes and data (IEC 61850-7-2) 44
Figure 30 – Simple example of modelling 45
Figure 31 – Basic building blocks 45
Figure 32 – Logical nodes and PICOM 46
Figure 33 – Logical nodes connected (outside view in IEC 61850-7-x) 46
Figure 34 – Logical device building block 47
Figure 35 – Logical devices and LLN0/LPHD 48
Figure 36 – Logical devices in proxies or gateways 49
Figure 37 – ACSI communication methods 50
Figure 38 – Virtualisation 52
Figure 39 – Virtualisation and usage 52
Figure 40 – Information flow and modelling 53
Figure 41 – Application of the GSE model 53
Figure 42 – Server building blocks 54
Figure 43 – Interaction between application process and application layer (client/server) 55
Figure 44 – Example for a service 55
Figure 45 – Client/server and logical nodes 56
Figure 46 – Client and server role 56
Figure 47 – Logical nodes communicate with logical nodes 57
Figure 48 – Interfaces inside and between devices 57
Figure 49 – Component hierarchy of different views (excerpt) 58
Figure 50 – Refinement of the DATA class 59
Figure 51 – Instances of a DATA class (conceptual) 62
Figure 52 – Relation between parts of the IEC 61850 series 63
Figure 53 – ACSI mapping to an application layer 64
Figure 54 – ACSI mappings (conceptual) 65
Figure 55 – ACSI mapping to communication stacks/profiles 66
Figure 56 – Mapping to MMS (conceptual) 66
Figure 57 – Mapping approach 67
Figure 58 – Mapping detail of mapping to a MMS named variable 68

Figure 59 – Example of MMS named variable (process values) 68
Figure 60 – Use of MMS named variables and named variable list 69
Figure 61 – MMS Information Report message 70
Figure 62 – Mapping example 71
Figure 63 – Abstract data model example for IEC 61850-7 73
Figure 64 – Relation of TrgOp and Reporting 76
Figure 65 – Sequence diagram 78
Figure 66 – References 78
Figure 67 – Use of FCD and FCDA 79
Figure 68 – Object names and object reference 80
Figure 69 – Definition of names and semantics 81
Figure 70 – One name with two meanings 81
Figure 71 – Name space as class repository 82
Figure 72 – All instances derived from classes in a single name space 83
Figure 73 – Instances derived from multiple name spaces 84
Figure 74 – Inherited name spaces 84
Figure 75 – Example of logical node and data name spaces 86
Figure 76 – Example common data class name spaces 87
Figure 77 – Extensions of name spaces (conceptual) 90
Figure 78 – Use of extended name space (conceptual) 91
Figure A.1 – Overall communication system architecture 94
Figure B.1 – Example for control and protection LNs combined in one physical device 97
Figure B.2 – Merging unit and sampled value exchange (topology) 98
Figure B.3 – Merging unit and sampled value exchange (data) 98
Figure C.1 – Application of SCL for LNs (conceptual) 100
Figure C.2 – Application of SCL for data (conceptual) 101
Figure D.1 – Seamless communication (simplified) 102
Figure D.2 – Example for new logical nodes 103
Figure D.3 – Example for control center view and mapping to substation view 105
Figure E.1 – Exchanged data between subfunctions (logical nodes) 107
Figure E.2 – Relationship between PICOMS and client/server model 107
Figure F.1 – Relation between the IEC 61850 series and UCA 108

Table 1 – Guide for the reader 10
Table 2 – LN groups 16
Table 3 – Logical node class XCBR (conceptual) 27
Table 4 – Excerpt of integer status setting 33
Table 5 – Comparison of the data access methods 37
Table 6 – ACSI models and services 50
Table 7 – Logical node circuit breaker 60
Table 8 – Controllable double point (DPC) 61
Table 9 – ACSI class definition 72
Table 10 – Single point status common data class (SPS) 74

Table 11 – Quality components attribute definition 74
Table 12 – Basic status information template (excerpt) 75
Table 13 – Trigger option 75
Table 14 – Logical node class (LN) definition 76
Table 15 – Excerpt of logical node name plate common data class (LPL) 87
Table 16 – Excerpt of common data class 88
Table A.1 – Excerpt of data classes for measurands 95
Table A.2 – List of common data classes 96

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS IN SUBSTATIONS –

Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models

FOREWORD

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International Standard IEC 61850-7-1 has been prepared by IEC technical committee 57: Power system control and associated communications.

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

FDIS	Report on voting
57/637/FDIS	57/646/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.

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

IEC 61850 consists of the following parts, under the general title *Communication networks and systems in substations*.

Part 1: Introduction and overview

Part 2: Glossary [1]

Part 3: General requirements

Part 4: System and project management

Part 5: Communication requirements for functions and device models

Part 6: Configuration description language for communication in electrical substations related to IEDs [2]

Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models

Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)

Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes

Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes

Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO/IEC 9506-1 and ISO/IEC 9506-2) and to ISO/IEC 8802-3 [2]

Part 9-1: Specific communication service mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link

Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3 [2]

Part 10: Conformance testing [2]

The content of this part is based on existing or emerging standards and applications.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this standard may be issued at a later date.

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1 To be published.

2 Under consideration.

INTRODUCTION

This part of the IEC 61850 series provides an overview of the architecture for communication and interactions between substation devices such as protection devices, breakers, transformers, substation hosts etc.

This document is part of a set of specifications which details a layered substation communication architecture. This architecture has been chosen to provide abstract definitions of classes (representing hierarchical information models) and services such that the specifications are independent of specific protocol stacks, implementations, and operating systems.

The goal of the IEC 61850 series is to provide interoperability between the IEDs from different suppliers or, more precisely, between functions to be performed in a substation but residing in equipment (physical devices) from different suppliers. Interoperable functions may be those functions that represent interfaces to the process (for example, circuit breaker) or substation automation functions such as protection functions. This part of the IEC 61850 series uses simple examples of functions to describe the concepts and methods applied in the IEC 61850 series.

This part of the IEC 61850 series describes the relationships between other parts of the IEC 61850 series. Finally this part defines how inter-operability is reached.

NOTE Interchangeability, i.e. the ability to replace a device from the same vendor, or from different vendors, utilising the same communication interface and as a minimum, providing the same functionality, and with no impact on the rest of the system. If differences in functionality are accepted, the exchange may require some changes somewhere in the system also. Interchangeability implies a standardisation of functions and, in a strong sense, of devices which are both outside the scope of this standard. Interchangeability is outside the scope, but it will be supported following this standard for interoperability.

Table 1 – Guide for the reader

User		IEC 61850-1 (Introduction and overview)	IEC 61850-5 (Requirements)	IEC 61850-7-1 (Principles)	IEC 61850-7-4 (Logical nodes and data classes)	IEC 61850-7-3 (Common data classes)	IEC 61850-7-2 (Information exchange)	IEC 61850-6[a] (Configuration language)	IEC 61850-8-x IEC 61850-9-x[a] (Concrete communication stack)
Utility	Manager	**x**	**–**	**Clause 5**	**–**	**–**	**–**	**–**	**–**
	Engineer	**x**	**x**	**x**	**x**	**x**	**In extracts**	**x**	**–**
Vendor	Application engineer	**x**	**x**	**x**	**x**	**x**	**In extracts**	**x**	**In extracts**
	Communication engineer	**x**	**x**	**x**	**–**	**–**	**x**	**–**	**x**
	Product manager	**x**	**x**	**x**	**x**	**In extracts**	**In extracts**	**In extracts**	**–**
	Marketing	**x**	**x**	**Clause 5**	**In extracts**	**In extracts**	**In extracts**	**In extracts**	**–**
Consultant	Application engineer	**x**	**x**	**x**	**x**	**x**	**–**	**x**	**–**
	Communication engineer	**x**	**–**	**x**	**–**	**–**	**x**	**x**	**x**
All others		**x**	**x**	**x**	**–**	**–**	**–**	**–**	**–**

The "**x**" means that this part of the IEC 61850 series should be read.

The "**in extracts**" means that extracts of this part of the IEC 61850 series should be read to understand the conceptual approach used.

The "**–**" means that this part of the IEC 61850 series may be read.

[a] These documents are under consideration.

This part of the IEC 61850 series is intended for all stakeholders of standardised communication and standardised systems in the utility industry. It provides an overview of and an introduction to IEC 61850-7-4, IEC 61850-7-3, IEC 61850-7-2, IEC 61850-6, and IEC 61850-8-1.

Table 1 provides a simplified guide as to which parts of the IEC 61850 series should be read by various stakeholders. Four groups are shown: utility, vendor, various consultants, and others.

COMMUNICATION NETWORKS AND SYSTEMS IN SUBSTATIONS –

Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models

1 Scope

This part of the IEC 61850 series introduces the modelling methods, communication principles, and information models that are used in the parts of IEC 61850-7-x. The purpose of this part of the IEC 61850 series is to provide – from a conceptual point of view – assistance to understand the basic modelling concepts and description methods for:

– substation-specific information models for substation automation systems,

– device functions used for substation automation purposes, and

– communication systems to provide interoperability within substations.

Furthermore, this part of the IEC 61850 series provides explanations and provides detailed requirements relating to the relation between IEC 61850-7-4, IEC 61850-7-3, IEC 61850-7-2 and IEC 61850-5. This part explains how the abstract services and models of IEC 61850-7-x are mapped to concrete communication protocols as defined in IEC 61850-8-1.

The concepts and models provided in this part of the IEC 61850 series may also be applied to describe information models and functions for:

– substation to substation information exchange,

– substation to control centre information exchange,

– information exchange for distributed automation,

– information exchange for metering,

– condition monitoring and diagnosis, and

– information exchange with engineering systems for device configuration.

NOTE 1 This part of IEC 61850 uses examples and excerpts from other parts of the IEC 61850 series. These excerpts are used to explain concepts and methods. These examples and excerpts are informative in this part of IEC 61850.

NOTE 2 Examples in this part use names of classes (e.g. XCBR for a class of a logical node) defined in IEC 61850-7-4, IEC 61850-7-3, and service names defined in IEC 61850-7-2. The normative names are defined in IEC 61850-7-4, IEC 61850-7-3, and IEC 61850-7-2 only.

NOTE 3 This part of IEC 61850 does not provide a comprehensive tutorial. It is recommended that this part be read first – in conjunction with IEC 61850-7-4, IEC 61850-7-3, and IEC 61850-7-2. In addition, it is recommended that IEC 61850-1 and IEC 61850-5 also be read.

NOTE 4 This part of IEC 61850 does not discuss implementation issues.

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 61850-2, *Communication networks and systems in substations – Part 2: Glossary* [3]

IEC 61850-5, *Communication networks and systems in substations – Part 5: Communication requirements for functions and devices models* [3]

IEC 61850-7-2, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes*

IEC 61850-7-4, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes*

ISO/IEC 8802-3:2000, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 8825 (all parts), *Information technology – ASN.1 encoding rules*

ISO 9506-1:2003, *Industrial automation systems – Manufacturing Message Specification – Part 1: Service definition*

ISO 9506-2:2003, *Industrial automation systems – Manufacturing Message Specification – Part 2: Protocol specification*

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in IEC 61850-2[3] as well as the following, apply.

3.1
information
knowledge concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning

(IEV 101-12-01)

3.2
information model
represents the knowledge concerning substation functions and devices in which the functions are implemented. This knowledge is made visible and accessible through the means of the IEC 61850 series. The model describes in an abstract way a communication oriented representation of a real function or device.

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3 To be published.