



BSI Standards Publication

Communication networks and systems for power utility automation

Part 7-500: Basic information and communication structure
– Use of logical nodes for modeling application functions
and related concepts and guidelines for substations

National foreword

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TECHNICAL REPORT



**Communication networks and systems for power utility automation –
Part 7-500: Basic information and communication structure – Use of logical
nodes for modeling application functions and related concepts and guidelines
for substations**

INTERNATIONAL
ELECTROTECHNICAL
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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and abbreviated terms	10
3.1 Terms and definitions.....	10
3.2 Abbreviated terms.....	11
4 Basics of substation automation with IEC 61850.....	12
4.1 Architecture	12
4.2 Communication and relevance of bus definitions.....	12
5 Summary of substation automation functions	13
5.1 HMI and related station level functions.....	13
5.2 Operational or control functions	13
5.3 Monitoring and metering functions	13
5.4 Local automation functions (protection and others)	13
5.5 Distributed automation functions (protection and others).....	13
5.6 System support functions	14
6 Basic interaction of control and protection functions modeled by logical nodes	14
7 Function allocation and logical architecture	17
7.1 Allocation of functions to IEDs	17
7.2 Data Model as used in this Technical Report	17
7.3 Logical architecture.....	17
7.3.1 Station level.....	17
7.3.2 Bay level	17
7.3.3 Process level	17
7.4 Interfaces.....	17
7.4.1 Interface to CC and other remote operator places.....	17
7.4.2 Interface to neighbouring substation	18
7.4.3 Interface to the process (switchyard)	18
7.4.4 Implementation remark	18
8 Communication system architectures.....	18
8.1 Modeling and communication architectures.....	18
8.2 Specific modeling aspects of the process interface	18
8.2.1 Merging unit and data sampling	18
8.2.2 Breaker IED and switchgear control.....	19
8.2.3 Time synchronization.....	19
8.3 Use cases	19
8.3.1 General remarks.....	19
8.3.2 Station bus and process bus separated	20
8.3.3 Station bus and process bus connected by proxy servers.....	21
8.3.4 Station bus and process bus interconnected.....	23
8.3.5 Common features for all three use case architectures.....	23
9 Basic modeling principles	26
9.1 Protection, measurement and control.....	26
9.2 Supervision.....	28
10 General modelling issues in substations	29

10.1	Basic modelling of three-phase systems	29
10.1.1	Acquisition of position indication	29
10.1.2	Acquisition of currents and voltages and the trips	30
10.2	Considering transmission times for GOOSE messages	31
11	Control	32
11.1	Bay control without process bus.....	32
11.1.1	Basic diagram.....	32
11.1.2	General modeling rules.....	33
11.1.3	Modeling with process interface nodes and the role of GGIO and GAPC.....	33
11.2	Bay control with process bus.....	35
11.2.1	Basic diagram.....	35
11.3	Control in the three-phase system.....	36
11.3.1	Interconnection of logical nodes	36
11.4	Interlocking, synchrocheck and blocking	37
11.4.1	General remarks.....	37
11.4.2	Interlocking.....	39
11.4.3	Blocking	40
11.4.4	Recommendation.....	40
11.4.5	Synchrocheck	41
11.5	Control authority	41
11.5.1	Operation 1 out of n.....	41
11.5.2	Control authority management.....	42
11.5.3	Logical node representation.....	45
11.6	Operation of switchgear with process bus	47
11.6.1	The control service	47
11.6.2	Extension of the control model by GOOSE messages in tabular form.....	47
11.6.3	Extension of the control model by a sequence of GOOSE control messages	49
11.6.4	Alignment of the control model in CSWI and XCBR.....	51
11.6.5	Behavior “Blocked” and “Testblocked” in case of process bus.....	51
12	Protection.....	52
12.1	Bay protection without process bus.....	52
12.1.1	Basic diagram.....	52
12.1.2	Modeling rules	52
12.2	Bay protection with process bus.....	53
12.2.1	Basic diagram.....	53
12.2.2	Modeling protection of three-phase system.....	54
12.3	Modelling of a protection function by multiple instances	54
12.3.1	PDIF	54
12.3.2	PDIS.....	55
12.4	Modelling of different stages of a protection function by multiple instances	55
12.4.1	Different trip levels and curves shown by PTOC as example.....	55
12.4.2	PDSC – Phase discrepancy protection.....	55
13	Redundant protection and control	57
13.1	Redundant protection.....	57
13.2	Redundant control.....	58
13.3	Use of PTRC and testing.....	59
14	Circuit breaker modelling by breaker related LNs (XCBR, SCBR and SOPM).....	60
15	Dedicated functions	61

15.1	Disturbance recording	61
15.2	Point-on-wave switching	63
15.3	Breaker failure protection	66
15.4	Line differential protection	68
15.5	Line distance protection	69
15.6	Autorecloser (RREC)	70
15.6.1	Introduction	70
15.6.2	Autorecloser interconnection	70
15.6.3	Autorecloser states and transitions	72
15.7	Switch on to fault	75
15.7.1	LN: Switch on to fault Name: PSOF	75
15.8	Reverse blocking	76
Annex A (normative)	Switch-on-to-fault	78
Annex B (normative)	LN PSOF	79
Annex C (normative)	LN RREC: Autoreclosure	82
Bibliography	84
Figure 1	– Architecture of a substation automation system	12
Figure 2	– Interaction of LNs for the application functions in SA focused on XCBR	15
Figure 3	– Interaction of LNs for the application functions in SA focused on XSWI	16
Figure 4	– Station bus and process bus separated	20
Figure 5	– Station bus and process bus connected by proxy servers	22
Figure 6	– Station bus and process bus interconnected	22
Figure 7	– Basic LN models for (a) protection, (b) measurement and (c) control	26
Figure 8	– Basic LN models for supervision of (a) insulation, (b) temperature and (c) arc	28
Figure 9	– Relation between the phase-related positions and the common position	29
Figure 10	– Filtering of phase related position data to a common position	30
Figure 11	– Acquisition of current and voltage and tripping in the three phase system	31
Figure 12	– Modelling bay control without process bus (left: ok, right: wrong)	32
Figure 13	– Bay control with non-defined process object “door” represented by LN GGIO	34
Figure 14	– Bay control (left: without process bus, right: with process bus)	35
Figure 15	– Three-phase (left and middle) and single-phase control (right) with process bus	36
Figure 16	– Interlocking, synchrocheck and blocking check in control IED without PB	38
Figure 17	– Interlocking, synchrocheck and blocking check with process bus PB	39
Figure 18	– Relation between interlocking, synchrocheck, blocking and control authority	41
Figure 19	– Local remote authority switching at bay and process level	45
Figure 20	– Station level authority switching	46
Figure 21	– Switch control (SBO with enhanced security) with a sequence of GOOSE control messages between BCU (“CSWI”) and CBC (“XCBR”) – Part 1	49
Figure 22	– Switch control (SBO with enhanced security) with a sequence of GOOSE control messages between BCU (“CSWI”) and CBC (“XCBR”) – Part 2	50
Figure 23	– Bay protection without process bus (left: modeling = ok, right: modeling = wrong)	52

Figure 24 – Bay protection (left: without process bus, right: with process bus)	53
Figure 25 – Three-phase trip (left) and single-phase trip (right) with process bus	54
Figure 26 – Phase discrepancy protection.....	56
Figure 27 – Single phase tripping and supervision by main 1 and main 2 protection.....	57
Figure 28 – Single phase redundant control	58
Figure 29 – Basic use of PTRC for protection tripping	59
Figure 30 – PTRC used for grouping of closely related LNs	59
Figure 31 – Two PTRCs for partial testing of the protection functions	60
Figure 32 – Structure of the disturbance recorder (RDRE, RADR, RBDR)	62
Figure 33 – Point-on-wave switching with all LNs needed in one IED (IED1)	64
Figure 34 – Point-on-wave switching with Merging Unit (MU) in IED2.....	64
Figure 35 – Point-on-wave switching with process bus and time synchronization	65
Figure 36 – Single and three-phase tripping and breaker failure protection	66
Figure 37 – Single phase tripping and breaker failure protection in a double tripping coil application.....	67
Figure 38 – Three-end line differential protection with LN RMXU	69
Figure 39 – Distance protection with communication (block, permit, direct trip)	70
Figure 40 – Interaction of autorecloser (RREC) with other functions	71
Figure 41 – Autoreclosure (RREC) states and transitions (dashed transitions are examples for possible alternative transitions – see text)	72
Figure 42 – Switch-on-to-fault protection function PSOF	76
Figure 43 – Reverse blocking data flow with one infeed	77
Table 1 – Short summary of logical nodes names	15
Table 2 – Mapping of communication services to architectures 1a, 1b, 2a, 2b, 3.....	25
Table 3 – Logical nodes with control authority and related presence conditions	43
Table 4 – Extension of the control model by GOOSE messages between CSWI and XCBR	48

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS
FOR POWER UTILITY AUTOMATION –****Part 7-500: Basic information and communication structure –
Use of logical nodes for modeling application functions
and related concepts and guidelines for substations****FOREWORD**

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IEC TR 61850-7-500, 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
57/1817/DTR	57/1865/RVDTR

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

A list of all parts in the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

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

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INTRODUCTION

This part of IEC 61850, which is a technical report, shows the use of Logical Nodes as defined in IEC 61850-7-4 for application functions in the substation domain. IEC 61850 defines Communication Networks and Systems for Power Utility Automation, and more specifically the communication architecture for subsystems like substation automation systems. The sum of all subsystems may also result in the description of the communication architecture for the overall power system management. The defined architecture provides in IEC 61850-7-x both a power utility-specific data model and also a substation domain specific data model with abstract definitions of data objects classes and services independently from the specific protocol stacks, implementations, and operating systems. The mapping of these abstract classes and services to communication stacks is outside the scope of IEC 61850-7-x and may be found in IEC 61850-8-x and in IEC 61850-9-x.

IEC 61850-7-1 gives an overview of the basic communication architecture to be used for all applications in the power utility domain. IEC 61850-7-3 defines common attribute types and common data classes related to all applications in the power system domain. The attributes of the common data classes may be accessed using services defined in IEC 61850-7-2. These common data classes are used in this part to define the compatible data objects classes.

To reach interoperability, all data objects in the data model (IEC 61850-7-4, IEC 61850-7-3) need a strong definition with regard to syntax and semantics. The semantics of the data objects are mainly provided by names assigned to common logical nodes and data objects they contain as defined in IEC 61850-7-4, and dedicated logical nodes are defined in domain-specific parts (IEC 61850-7-x) e.g. for hydro power control systems in IEC 61850-7-410. Interoperability is reached with minimum effort if as many as possible of the data objects are defined as mandatory. Because of different philosophies and technical features, some data objects, especially settings, were declared as optional in this edition of the standard. After some experience has been gained with this standard, this decision may be reviewed in the next edition of the relevant parts of the standard.

A data object with full semantics is only one of the elements required to achieve interoperability. Standardized access to the data objects is defined in compatible, power utility and domain specific services (see IEC 61850-7-2). Since data objects and services are hosted by devices (IED), a proper device model is also needed. To describe both the device capabilities and the interaction of the devices in the related system, a configuration language is also needed as defined in IEC 61850-6 by the System/Substation Configuration description Language (SCL).

A lot of functions in power systems are complex combinations of local Logical Nodes in one IED, or distributed Logical Nodes in many IEDs linked by a dedicated data exchange. For some functions different solution concepts exist resulting in different implementations. Depending on the kind of differences they may result in increased requirements for system integration engineering tools or, in the worst case, destroy interoperability. The goal of this informative document is to show the most common application of Logical Nodes in modelling simple and complex application functions, to improve common understanding in modelling and data exchange in general, and finally to stimulate implementations which support in any case interoperability.

The data model of IEC 61850 i.e. the Logical Nodes (LN) contain only the data provided by the application functions described but not the source where the data which are needed as input for the application functions are from. This gap is also closed in this document either explicitly by naming the input data or implicitly by showing the connections between the different LNs used.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-500: Basic information and communication structure – Use of logical nodes for modeling application functions and related concepts and guidelines for substations

1 Scope

This part of IEC 61850, which is a technical report, describes the use of the information model for devices and functions of IEC 61850 in applications in substation automation systems, but it may also be used as informative input for the modeling of any other application domain. In particular, it describes the use of compatible logical node names and data objects names for communication between Intelligent Electronic Devices (IED) for use cases. This includes the relationship between Logical Nodes and Data Objects for the given use cases. If needed for the understanding of the use cases, the application of services is also described informatively. If different options cannot be excluded they are also mentioned.

The modelling of the use cases given in this document are based on the class model introduced in IEC 61850-7-1 and defined in IEC 61850-7-2. The logical node and data names used in this document are defined in IEC 61850-7-4 and IEC 61850-7-3, the services applied in IEC 61850-7-2. The naming conventions of IEC 61850-7-2 are also applied in this document.

If extensions are needed in the use cases, the normative naming rules for multiple instances and private, compatible extensions of Logical Node (LN) Classes and Data Object Names defined in IEC 61850-7-1 are considered.

IEC 61850-7-5 describes in examples the use of logical nodes for modeling application functions and related concepts and guidelines in general, independently from any application domain respectively valid for all application domains in the electric power system (substation automation, distributed energy resources, hydro power, wind power, etc.). This document describes in examples the use of logical nodes for application functions in substation automation including also line protection between substations. It also implies some tutorial material where helpful. However it is recommended to read IEC 61850-5 and IEC 61850-7-1 in conjunction with IEC 61850-7-3 and IEC 61850-7-2 first.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60255-24/IEEE C37.111:2013, *Measuring relays and protection equipment – Part 24: Common format for transient data exchange (COMTRADE) for power systems*

IEC 61588, *Precision clock synchronization protocol for networked measurement and control systems*

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