IEC TS 61850-7-7

Edition 1.1 2023-01
CONSOLIDATED VERSION

TECHNICAL SPECIFICATION

colour inside

Communication networks and systems for power utility automation – Part 7-7: Machine-processable format of IEC 61850-related data models for tools



IEC TS 61850-7-7:2018-03+AMD1:2023-01 CSV(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC TS 61850-7-7

Edition 1.1 2023-01
CONSOLIDATED VERSION

TECHNICAL SPECIFICATION

colour inside

Communication networks and systems for power utility automation – Part 7-7: Machine-processable format of IEC 61850-related data models for tools

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.200

ISBN 978-2-8322-6372-3

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

IEC TS 61850-7-7

Edition 1.1 2023-01
CONSOLIDATED VERSION

REDLINE VERSION

colour inside

Communication networks and systems for power utility automation – Part 7-7: Machine-processable format of IEC 61850-related data models for tools



IEC TS 61850-7-7:2018-03+AMD1:2023-01 CSV(en)

CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
1.1 General 8
1.2 ~~Namespace name and version~~ Published versions 8
1.4 Namespace name and version 9
1.3 Code Component distribution 9
1.3.1 General 9
1.3.2 XML schema namespace code component 11
2 Normative references 11
3 Terms and definitions 12
4 Abbreviated terms 12
5 Use cases 13
5.1 Generation of SCL data type templates for system specification 13
5.1.1 Description of the use case 13
5.1.2 Technical details 14
5.1.3 Information exchanged 15
5.2 Generation of SCL data type templates for ICD files 15
5.2.1 Description of the use case 15
5.2.2 Technical details 17
5.2.3 Information exchanged 18
5.3 Validation of data model conformity 18
5.3.1 Description of the use case 18
5.3.2 Diagrams of use case 19
5.3.3 Technical details 20
5.4 Definition of private data model extensions by following the rules of the standard 21
5.4.1 Description of the use case 21
5.4.2 Diagrams of use case 22
5.4.3 Technical details 23
5.4.4 Information exchanged 24
5.5 Supporting the IEC 61850 data model change management 24
5.5.1 Description of the use case 24
5.5.2 Diagrams of use case 26
5.5.3 Technical details 28
5.5.4 Information exchanged 29
5.5.5 Common terms and definitions 30
6 Namespace file breakdown 30
6.1 General 30
6.2 Namespace dependencies 30
6.3 Namespace types 32
6.3.1 General 32
6.3.2 Core namespace 32
6.3.3 Domain namespace 32
6.3.4 Technical report namespace 32
6.3.5 Private namespace 33

7 Overview of the format 33
7.1 General 33
7.2 File types 33
7.2.1 NSD 33
7.2.2 SNSD 37
7.2.3 AppNS 39
7.2.4 NSDoc 39
7.3 NSD usage convention 40
7.3.1 General 40
7.3.2 Element identification 40
7.3.3 Inheritance and extension 41
7.3.4 DataObject parameterization 42
7.3.5 CDC variants 43
7.4 Naming convention 44
7.4.1 File extension 44
7.4.2 File name 44
7.5 Example 44
7.5.1 General 44
7.5.2 NSD file example 44
7.5.3 SNSD file example 45
7.5.4 AppNS file example 45
7.5.5 NSDoc file example 45
8 File usage 45
8.1 General 45
8.2 System specification creation 46
8.3 Manufacturer IED creation 47
8.4 Creation of a non-standard name space 47
8.5 IED data model validation 47
8.6 Data model update management 47
Annex A (normative) Schema NSD.xsd 48
Annex B (normative) Compatibility of the different revisions of the standard 73
B.1 General 73
B.2 NSD version management 73
B.2.1 NSD Schema version 73
B.2.2 NSD version identification 73
B.2.3 NSD version dependency 74
B.3 DataObject parameterization 74

Figure 1 – Generation of SCL data type templates for system specification diagrams 14
Figure 2 – Generation of SCL data type templates for ICD files diagrams 17
Figure 3 – Validation of data model conformity diagrams 20
Figure 4 – Definition of private data model extensions by following the rules of the standard diagrams 23
Figure 5 – Supporting the IEC 61850 data model change management 27
Figure 6 – Namespace dependencies 31
Figure 7 – Service Namespace usage 32
Figure 8 – Abstract LNClass hierarchy example 37

Figure 9 – Specification type creation example 46

Table 1 – Reference between published versions of the standard and related namespace name 9

Table 2 – Attributes of xsd namespace 9

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-7: Machine-processable format of IEC 61850-related data models for tools

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC TS 61850-7-7 edition 1.1 contains the first edition (2018-03) [documents 57/1925/DTS and 57/1956/RVDTS] and its amendment 1 (2023-01) [documents 57/2471/DTS and 57/2523/RVDTS].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

Technical Specification IEC TS 61850-7-7 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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.

This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer. Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labeled in this standard as a Code Component.

The purchase of this IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard directly to end users and to end users via distributors, subject to IEC software licensing conditions, which can be found at: http://www.iec.ch/CCv1.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under webstore.iec.ch in the data related to the specific publication. At this date, the publication will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Year after year the IEC 61850 data models are extended both in depth with hundreds of new data items, and in width with tens of new parts.

In order to foster an active tool market with good quality, and at the end to improve IEC 61850 interoperability, a machine-processable file, describing data model related parts of the standard as input, is needed. This is the purpose of the new language Name Space Definition (NSD) defined by this part of IEC 61850.

This will avoid the need for any engineering tool related to the IEC 61850 data models to get the content of the standard manually entered, with a high risk of mistakes. This will also help to easily spread any corrections to the data model, as requested to reach interoperability. Tool vendors will be able to integrate NSD in their tools to distribute the standard data models directly to end users.

The description of namespace concept and relation between each kind of namespace is defined by IEC 61850-7-1 and process for creation of a namespace (domain, product, …) is defined by IEC 61850-1-2.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-7: Machine-processable format of IEC 61850-related data models for tools

1 Scope

1.1 General

This part of IEC 61850, which is a Technical Specification, specifies a way to model the code components of IEC 61850 data model (e.g., the tables describing logical nodes, common data classes, structured data attributes, and enumerations) in an XML format that can be imported and interpreted by tools. The following main use cases are supported:

- Generation of SCL data type templates for system specification or ICD files.
- Validation of SCL data type templates.
- Definition of private extensions by following the rules of the standard.
- Adapting rapidly the whole engineering chain as soon as a new version of IEC 61850 data model (an addendum, a corrigenda or a Tissue) affects the content of the standard.
- Provide tool-neutral textual help to users of tools on the data model contents.
- Supporting multi-language publication, i.e., enabling the expression of the data model in different languages, through a machine processable format.

The purpose of this ~~proposal~~ document is limited to the publication of the XML format which should support the data model part of any IEC 61850-related standard. The publication of code components themselves will be part of the related IEC 61850 part, and IEC 61850-1-2 will indicate the requirements to produce NSD files for other purpose than core datamodel.

1.2 ~~Namespace name and version~~ Published versions

~~The new namespace name and version section is mandatory for any IEC 61850 namespace (as defined by IEC 61850-7-1:2011).~~

~~The parameters which identify this new release of the NSD namespace xmlns:nsd="http://www.iec.ch/61850/2016/NSD" are:~~

- ~~Namespace Version: 2017~~
- ~~Namespace Revision: A~~
- ~~Namespace Release: 1~~
- ~~Namespace release date: 2017/08/28~~

~~Edition~~	~~Publication date~~	~~Webstore~~	~~Namespace~~
~~Edition 1.0~~	~~2017-??~~	~~IEC 61850-7-7:2017~~	~~IEC 61850-7-7:2017A~~

~~The namespace version relates to the edition of the standard: here namespace version 2017 refers to the first edition of this document.~~

~~Then, the revision relates to amendments if any: as for the current version of this document, revision A corresponds to the original edition, without amendment. For the first amendment, the revision will be B, etc.~~

~~Finally, namespace release indicates an update of the related code component (if any) without publication of a new version or revision of the current document. This could be used for internal release of the code component during development of a new version of the document, or to provide fixes of interoperability tissues without need to enter into a full document update process.~~

~~The namespace release date is used for information purpose, to indicate when the namespace has been created.~~

This technical specification defines one namespace:

– A NameSpace Definition (NSD)

Table 1 provides an overview of the references between the published versions of this standard and the related namespace name.

Table 1 – Reference between published versions of the standard and related namespace name

Edition	Publication date	Webstore	Namespace
Edition 1.0	2018-03	IEC 61850-7-7:2018	IEC 61850-7-7:2017A
Edition 1.1	2023-01	IEC 61850-7-7:2022	IEC 61850-7-7:2017B5

1.4 Namespace name and version

Table 2 shows all the attributes of the XML schema namespace.

Table 2 – Attributes of xsd namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier (xmlns)	http://www.iec.ch/61850/2016/NSD
XSD version header attribute	2017B5
Version	2017
Revision	B
Release	5
CodeComponentName	NSD

1.3 Code Component distribution

1.3.1 General

~~The Code Components included in this document are also available as electronic machine readable files at:~~
~~http://www.iec.ch/public/TC57/supportdocuments/IEC_61850-7-7.2017.NSD.2017A.full.zip~~

~~The Code Component(s) included in this document are potentially subject to maintenance works and the latest release is available in the repository located at:~~
~~http://www.iec.ch/TC57/supportdocuments~~

~~The latest version/release of the document will be found by selecting the file IEC_61850-7-7.2017.NSD.{VersionStateInfo}.full.zip with the filed VersionStateInfo of the highest value.~~

Each Code Component is a ZIP package containing at least the electronic representation of the Code Component itself~~, with~~ and a file describing the content of the package (IECManifest.xml).

~~The IECManifest contains different sections giving information on:~~

- ~~The copyright notice~~
- ~~The identification of the code component~~
- ~~The publication related to the code component~~
- ~~The list of the electronic files which compose the code component~~
- ~~An optional list of history files to track changes during the evolution process of the code component~~

~~The IECManifest related to this publication is:~~

~~<IECManifest xmlns="http://www.iec.ch/CC/2017/IECManifest" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.iec.ch/CC/2017/IECManifest IECManifest.xsd">~~
~~<Copyright>~~
~~<Notice>~~
~~COPYRIGHT (c) IEC, 2017. This version of this XSD is part of IEC 61850-7-7:2017; see the IEC 61850-7-7:2017 for full legal notices. In case of any differences between the here-below code and the IEC published content, the here-below definition supersedes the IEC publication; it may contain updates. See history files. The whole document has to be taken into account to have a full description of this code component.~~
~~See www.iec.ch/CCv1 for copyright details.~~
~~</Notice>~~
~~<License uri="www.iec.ch/CCv1">IEC License</License>~~
~~</Copyright>~~
~~<CodeComponent id="IEC_61850-7-7.2017A.NSD.XSD" name="NSD schema 2017A" content="full" date="2017-08-09">~~
~~<Publication name="IEC 61850-7-7.2017_ed1.0" comment="Machine-processable format of IEC 61850-related data models for tools"/>~~
~~<File name="NSD.xsd" category="normative" content="full" comment="Schema describing the namespace files"/>~~
~~<File name="IECCopyright.xsd" category="normative" content="full" comment="Schema included in NSD to integrate management of IEC Copyright notice"/>~~
~~<File name="NSD.Doc.HTML.zip" category="normative" content="full" comment="Zip archive containing the HTML documentation of the NSD. Contains the 'NSD.html' file and all related pictures"/>~~
~~<HistoryFile name="History.NSD.v1.0.txt" startingDate="2015-10-12" endingDate="2017-01-25" startingVersion="NSD.XSD.v0.3" endingVersion="NSD.XSD.v1.0"/>~~
~~<HistoryFile name="History.NSD.v1.1.txt" startingDate="2017-01-25" endingDate="2017-06-23" startingVersion="NSD.XSD.v1.0" endingVersion="NSD.XSD.v1.1"/>~~
~~<HistoryFile name="History.NSD.2017A.txt" startingDate="2017-06-23" endingDate="2017-08-09" startingVersion="NSD.XSD.v1.1" endingVersion="NSD.XSD.2017A"/>~~
~~</CodeComponent>~~

~~</IECManifest>~~

~~The package is identified using the following naming rule:~~

~~{RefStandard}.{CodeComponentName}.{VersionRevision}.{LightFull}{PublicationStage}.zip~~

~~For current publication, the Code Component package name is:~~

~~IEC_61850-7-7.2017.NSD.2017A.full.zip~~

The life cycle of a code component is not restricted to the life cycle of the related publication. The publication life cycle goes through two stages, Version (corresponding to an edition) and Revision (corresponding to an amendment). A third publication stage (Release) allows publication of Code Component in case of urgent fixes of InterOp Tissues, thus without need to publish an amendment.

~~This is useful when InterOp Tissues need to be fixed. Then a~~ Consequently, new release(s) of the Code Component ~~will~~ may be released, which supersede(s) the previous release, and will be distributed through the IEC TC 57 web site at:

http://www.iec.ch/tc57/supportingdocuments

The latest version/release of the document will be found by selecting the file for the code component with the highest value for VersionStateInfo, e.g. IEC TS 61850-7-7.NSD.{VersionStateInfo}.full.zip.

1.3.2 XML schema namespace code component

The NSD code component namespace is an XML schema file. It will be available in a full version.

The full version is freely accessible on the IEC website for download at:

https://assets.iec.ch/public/tc57/IEC_61850-7-7.2017.NSD.2017B4.full.zip

but the usage remains under the licensing conditions.

In case of any differences between the downloadable code and the IEC pdf published content, the downloadable code(s) is(are) the valid one; it may be subject to updates. See history files.

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 TS 61850-1-2, *Communication networks and systems for power utility automation – Part 1-2: Guidelines on extending IEC 61850*

IEC TS 61850-2, *Communication networks and systems ~~in substations~~ for power utility automation – 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 61850-7-1:2011, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and 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 61850-8-1, *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 639-1:2002, *Codes for the representation of names of languages – Part 1: Alpha-2 code*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
data model
hierarchical structure of data and the related services used to define functions and devices in IEC 61850

Note 1 to entry: The IEC 61850 standard series defines the core data model in IEC 61850-7-2, IEC 61850-7-3 and IEC 61850-7-4, which is also the data model related to Substations. Other domains (like DER, Hydro, Wind, etc.) could define their own data model based on IEC 61850 core data model to be able to use IEC 61850 core parts as a common layer.

3.2
namespace
identification of a data model of a specific part of the standard

Note 1 to entry: This definition will be used in this document when a specific data model has to be represented.

Note 2 to entry: The W3C consortium has also defined the concept of namespace for XML documents to identify the kind of elements which could be used in a file. This is typically the namespace used to identify an XML schema, as per IEC 61850-6 usage. This is not the definition used within this document.

4 Abbreviated terms

In general, the glossary and abbreviated terms defined in IEC 61850-2 apply. The following abbreviated terms are either exclusive to this document or particularly useful for understanding this document and are repeated here for convenience.

CDC Common Data Class
DO Data Object
DA Data Attribute
LN Logical Node
NSD Name Space Definition
SCL System Configuration description Language
UML Unified Modeling Language
XML Extensible Markup Language
XSD XML Schema Definition