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TECHNICAL REPORT

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Communication networks and systems for power utility automation – Part 90-9: Use of IEC 61850 for Electrical Energy Storage Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-9: Use of IEC 61850 for Electrical Energy Storage Systems

FOREWORD

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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 61850-90-9, 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
57/2128/DTR	57/2184/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.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 labelled 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 to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: http://www.iec.ch/CCv1.

Table 1 shows all tracking information of (Tr)IEC 61850-90-9:2018A namespace building-up

Table 1 – Tracking information of (Tr)IEC 61850-90-9:2018A namespace building-up

Attribute	Content
Namespace IEC specific information	
Version of the UML model used for generating the document (informative)	WG17build6
Date of the UML model used for generating the document (informative)	2020-05-19
Autogeneration software name and version(informative)	j61850DocBuilder 01v03 based on jCleanCim 02v02-NS beta6

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.

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

IEC 61850 consists of the following parts, under the general title *Communication networks and systems for power utility automation* (all parts may have not been published yet).

Part 1: Introduction and overview

Part 2: Glossary

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

Part 7-1: Basic communication structure – Principles and models

Part 7-2: Basic communication structure – Abstract communication service interface (ACSI)

Part 7-3: Basic communication structure – Common data classes

Part 7-4: Basic communication structure – Compatible logical node classes and data classes

Part 7-410: Hydroelectric power plants – Communication for monitoring and control

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

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

Part 80-1: Guideline to exchange information from a CDC based data model using IEC 60870-5-101/104

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

Part 90-1: Use of IEC 61850 for the communication between substations

Part 90-2: Using IEC 61850 for the communication between substations and control centres

Part 90-3: Using IEC 61850 for condition monitoring

Part 90-4: Network Engineering Guidelines – Technical report

Part 90-5: Using IEC 61850 to transmit synchrophasor information according to IEEE C37.118

Part 90-7: Object models for power converters in distributed energy resources (DER) systems

Part 90-8: Object model for E-mobility

Part 90-10: Object model for scheduling

Part 10: Conformance testing

In addition to the above, the IEC 61850 basic communication structure for Wind Turbines has been published as IEC 61400-25, *Wind turbines – Communications for monitoring and control of wind power plants*.

This technical report is primarily based on the recommendation 5.7.4. “interface, control and standard data elements”, of the IEC white paper ”Electrical Energy Storage” published in December 2011 by the MSB. The recommendation proposes the necessity of a standardization of interfaces between storage and other grid elements, protocols for data exchange and control rules, and data elements for input, output and control information supplied by or to storage systems. In Chapter 5 of the white paper “Large Capacity EESS”, EESS systems are expected to play an important role in integrating renewable energy by providing flexibility for the grid.

This document also describes the basic functions of Electric Energy Storage System (EESS) and the information model of the interface to integrate EESS in intelligent grids and establish the necessary communication with standardised data objects.

This document is connected with IEC 61850-7-420 Edition 2[1], as well as IEC 61850-7-4:2010 and IEC 61850-7-4/AMD1:2015, explaining how the control system and other functions in a battery based electric energy storage unit utilizes logical nodes and information exchange services within the IEC 61850 framework to specify the information exchanged between functions as well as information that individual functions need and generate. IEC 61850-7-420:2009 provides an information model for batteries which was derived from the proposed data objects of part 7-4. Those data objects (as well as the models proposed within IEC TR 61850-90-3) follow the requirements of batteries that are supposed to be used in substations as an auxiliary power system and as backup power supplies. For this purpose, it was enough to only model the discharge function. Therefore, it is necessary to prepare new logical nodes to be applicable for grid connected electrical energy storage systems, i.e. the scope of this technical report.

This document provides necessary information within the IEC 61850 based object model in order to model functions of a battery based electrical energy storage system as a DER unit. For intelligently operated and/or automated grids, storing energy for optimising the grid operation is a core function. Therefore, shorter periods of storing energy with charging and discharging capability are also an indispensable function. Charging and discharging operations need to be modelled thoroughly and are in the focus of this technical report.

Once agreed, the content of this report is intended to be merged within a new edition of IEC 61850-7-420. In order to facilitate such merge, this document already mentions by anticipation some elements extracted from a forthcoming second edition of IEC 61850-7-420, and which appear to be key to guarantee the consistency between the future DER model proposed in the forthcoming second edition of IEC 61850-7-420 and the detailed electrical energy storage system model, presented in this document.

These elements are specifically tagged as “referring to the forthcoming second edition of IEC 61850-7-420” and should be updated as soon as this new edition is officially published.

This document has also been worked upon in order to be as close as possible to the forthcoming IEC 62933 series[2].

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1 Under preparation. Stage at the time of publication: IEC/PRVC 61850-7-420:2020.

2 Under consideration.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-9: Use of IEC 61850 for Electrical Energy Storage Systems

1 Scope

1.1 Scope of this document

This technical report, which is part of the IEC 61850 series, describes the IEC 61850 information model for electrical energy storage systems (EESS). Therefore, this document only focuses on storage functionality in the purpose of grid integration of such systems at the DER unit level. Higher level Interactions are already covered in IEC 61850-7-420.

1.2 Namespace

This new subclause is mandatory for any IEC 61850 namespace (as defined by IEC 61850-7-1/AMD1).

Table 2 shows all attributes of (Tr)IEC 61850-90-9:2018A namespace.

Table 2 – Attributes of (Tr)IEC 61850-90-9:2018A namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier	(Tr)IEC 61850-90-9
Version	2018
Revision	A
Release	3
Full Namespace Name	(Tr)IEC 61850-90-9:2018A
Namespace Type	transitional
Namespace dependencies	
Extends	IEC 61850-7-420:2019A version :2019 revision :A
Namespace transitional status	
Future handling of namespace content	The name space (Tr)IEC 61850-90-9:2018A is considered as "transitional" since the models are expected to be included in further editions IEC 61850-7-4xx. Potential extensions/modifications may happen if/when the models are moved to the International Standard status

1.3 Data model Namespace Code Component distribution

The Code Components are in light and full version:

- The full version is named: *IEC_TR_61850-90-9.NSD.2018A.Full*. It contains definition of the whole data model defined in this standard with the documentation associated and access is restricted to purchaser of this part.
- The light version is named: *IEC_TR_61850-90-9.NSD.2018A.Light*. It does not contain any documentations but contains the whole data model as per full version, and this light version is freely accessible on the IEC website for download at: http://www.iec.ch/tc57/supportdocuments, but the usage remains under the licensing conditions.

The Code Components for IEC 61850 data models are formated in compliance with the NSD format defined by the standard IEC 61850-7-7. Each Code Component is a ZIP package containing:

- the electronic representation of the Code Component itself (possibly multiple files),
- the grammar files (XSD) enabling to check the consistency of the associated files against the defined version of NSD, but as well against the IEC 61850 flexibility rules in case of private extensions,
- 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 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.

Consequently new release(s) of the Code Component may be released, which supersede(s) the previous release, and will be distributed through the IEC TC57 web site at: http://www.iec.ch/tc57/supportdocuments.

The latest version/release of the document will be found by selecting the file named *IEC_TR_61850-90-9.NSD.{VersionStateInfo}.Light* with the filed VersionStateInfo of the highest value.

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 61850-2, *Communication networks and systems for power utility automation - Part 2: Glossary*

IEC 61850-7-2:2010, *Communication networks and systems for power utility automation - Part 7-2: Basic information and communication structure - Abstract communication service interface (ACSI)*
IEC 61850-7-2:2010/AMD1:2020

IEC 61850-7-3:2010, *Communication networks and systems for power utility automation - Part 7-3: Basic communication structure - Common data classes*
IEC 61850-7-3:2010/AMD1:2020

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation - Part 7-4: Basic communication structure - Compatible logical node classes and data object classes*

IEC 61850-7-4:2010/AMD1:2020

IEC 61850-7-420, *Communication networks and systems for power utility automation – Part 7-420: Basic communication structure – Distributed energy resources logical nodes*[3]

IEC TS 62933-3-1, *Electrical energy storage (EES) systems - Part 3-1: Planning and performance assessment of electrical energy storage systems - General specification*

[3] Under preparation. Stage at the time of publication: IEC/PRVC 61850-7-420:2020.