IEC TS 61850-80-6

Edition 1.0 2026-09

TECHNICAL SPECIFICATION

Communication networks and systems for power utility automation - Part 80-6: Using IEC 61850 for communication between power system automation equipment and control or maintenance centres

ICS 33.200

ISBN 978-2-8327-1492-8

IEC TS 61850-80-6:2026-09(en)

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Communication networks and systems for power utility automation - Part 80-6: Using IEC 61850 for communication between power system automation equipment and control or maintenance centres

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IEC TS 61850-80-6 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
57/2922/DTS	57/2962/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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Table 1 shows all tracking information of IEC 61850-80-6:2022A namespace building-up:

Table 1 – Tracking information of IEC 61850-80-6:2022A namespace building-up

Attribute	Content
Namespace IEC specific information	
Version of the UML model used for generating the document (informative)	WG10build25
Date of the UML model used for generating the document (informative)	2026-07-28
Autogeneration software name and version(informative)	j61850DocBuilder 02.06beta based on jCleanCim beta9.4 (derived from jCleanCim 02-02)

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

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

Following the publication of IEC 61850, substations using IEC 61850 technologies have been implemented. The concepts of IEC 61850 are also used in applications outside of the substation such as distributed energy resources, hydro power plants and wind power plants. Therefore, IEC 61850 forms the foundation for a globally standardized utility communication network. In the context of this technical specification IEDs in substations or those used in other, above-mentioned applications, will be referred to as 'power system automation equipment' (PSAE). The term 'power utility automation systems' is used for substation automation and other automation systems in the power utility domain.

IEC 62357-1 describes the reference architecture for power systems management and associated information exchange. The communication between power system automation equipment and a control centre relate to the information exchange between the station and operation zone in the SGAM model. Beneath other classic telecontrol protocols IEC 62357-1 proposes the use of IEC 61850 for this purpose.

IEC 61850 was initially prepared for information exchange between the devices of a substation automation system. The concepts are now also used in other power system application domains.

The object models and configuration language introduced by IEC 61850 provide new possibilities for the management of the automation system. A direct and seamless access from the control and maintenance centres to the IEDs of the power utility automation system allows efficient data management of the overall control system.

This technical specification provides a comprehensive overview of the matters that need to be considered to use IEC 61850 for information exchange between power system automation equipment and control or maintenance systems.

A similar report discussing the use of IEC 61850 for communication between substations has been issued as IEC TR 61850-90-1. This document was developed as a TS version of IEC TR 61850-90-2.

Currently, power system automation equipment configuration information is available in the SCL. Control centre configuration information is available in the CIM model. The models have been harmonized, so that an automatic transfer of the information from one model to the other is possible. New work will describe how that configuration information can be transferred between CIM and SCL. However, this document does not address the overall topic of CIM/IEC 61850 harmonisation. That is addressed separately in IEC TR 62361-102.

1 Scope

1.1 General

This part of IEC 61850, which is a technical specification, provides a comprehensive overview of the various aspects that need to be considered while using IEC 61850 for information exchange between power system automation equipment and control or maintenance centres or other system level applications. This document:

– defines use cases and communication requirements that require an information exchange between power system automation equipment and control or maintenance centres;

– describes the usage of the configuration language of IEC 61850-6;

– gives guidelines for the selection of communication services and architectures compatible with IEC 61850;

– describes the engineering workflow;

– introduces the use of a Proxy/Gateway concept;

– describes the links regarding the Specific Communication Service Mapping (SCSM);

– defines the abstract conformance test cases that build the basis for the conformance test procedures elaborated by the UCAIug Testing Sub Committee.

This document does not define constraints or limitations for specific device implementations. There is no specific clause for cyber security, which is tackled when it is necessary. The model for IEC TS 61850-80-6 provides security functions based upon the security threats and security functions found in IEC TS 62351-1 and IEC TS 62351-2. This document touches on several security aspects with the following basic assumptions:

– Information authentication and integrity (e.g., the ability to provide tamper detection) is needed.

– In case of operational issues, encryption (to achieve confidentiality) is optional. This typically applies for GOOSE and SV messages in the power utility automation system LAN.

End-to-end information authentication and integrity methods, regardless of information hierarchies, need to be provided. The typical method to provide this security function is through some type of information/message authentication code. IEC 62351-4 and IEC 62351-9 describe how authentication and integrity is achieved for IEC 61850-8-1. IEC 62351-4 provides means to ensure end-to-end data integrity through Proxy/Gateways.

Beneath information authentication and integrity, information availability is an important aspect for telecontrol. This document provides redundancy architectures to enhance the availability of information in control and maintenance centres.

The scheme shown in Figure 1 gives an overview of the connectivity and the communication paths. It indicates the principle to access directly or indirectly – via the Proxy/Gateway – to an IED. An application of security controls for power system automation equipment to control centre communication can be found in IEC 62351-10:2012, 6.4.3. Thus, the power system automation equipment is considered to be inside a perimeter of cyber security. The access is totally checked by network security access points (this document does not describe such a network security access point). The boundary of the electronic security perimeter is defined by the point, where the communication line leaves the perimeter of the power utility automation system over public ground. There can be more than one network security access point, where separation of applications (e.g., control centre and maintenance centre) is required. When more than one client needs access to the same network security access point information level access control, e.g. according to IEC TS 62351-8, can be added. IEC TS 62351-8 can also be used in other cases, where different access rights are required.

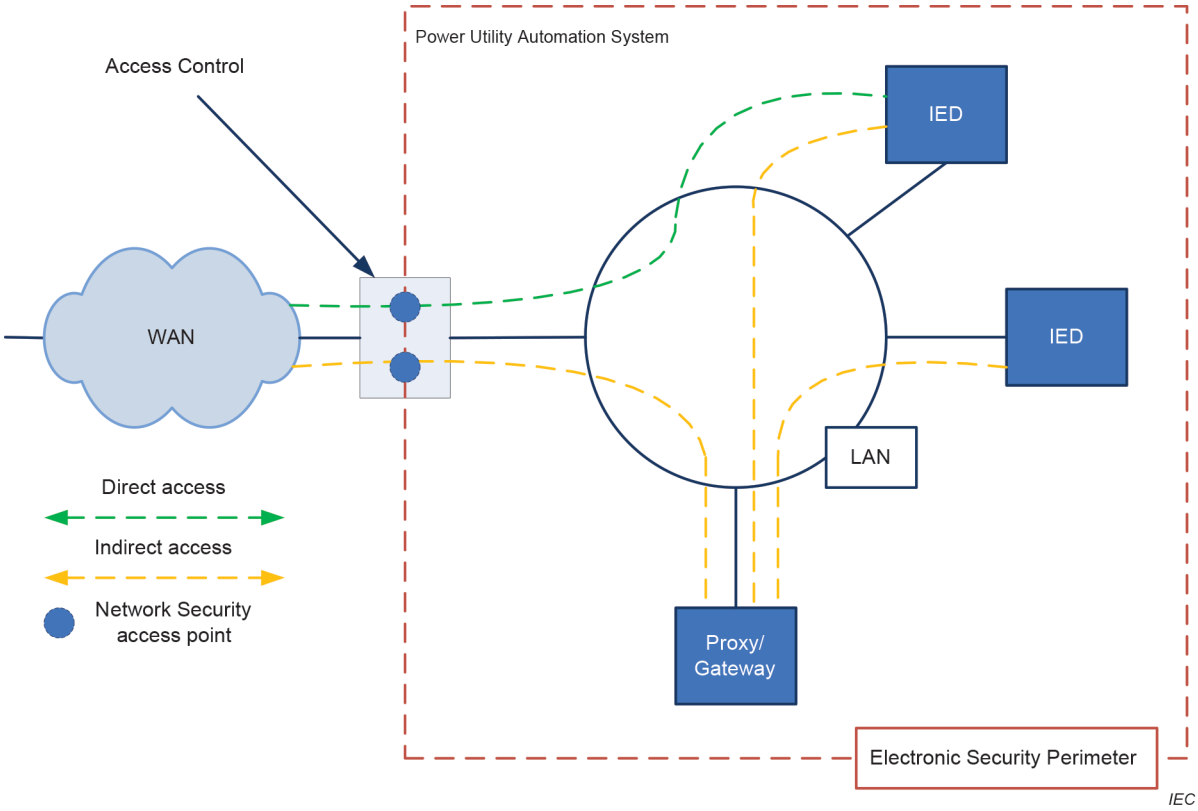


Figure 1 – Connectivity and communication paths of power system automation equipment

Most applications for which this document is applicable will use the services of MMS (ISO 9506) mapped to ISO/IEC 8802-3 frame formats, as described in IEC 61850-8-1.

The primary application for the use of indirect access, as described in this document, will be for telecontrol applications. Nevertheless, this document does not imply that the use of a Proxy/Gateway is required for telecontrol applications. Direct access can also be used for telecontrol applications where applicable and accepted by the customer.

1.2 Published versions of this standard and related namespace name

Table 2 provides a reference between all published editions, amendments or corrigenda of this document and the full name of the namespace.

Table 2 – Reference between published versions of the standard and related namespace names

Edition	Publica-tion date	Webstore	Namespace NSD	Namespace XML
Edition 1.0	2026-??	IEC TS 61850-80-6:2026	IEC 61850-80-6:2022A	http://www.iec.ch/61850/2022/SCL/80-6

1.3 Identification of the Code Components

1.3.1 Identification of the namespace description

The namespace associated with this document is an NSD (Namespace Definition) file as defined in IEC 61850-7-7.

NOTE The NSD files are distributed as a Full (complete machine-readable file) Code Component and as a Light (reduced machine-readable content version) Code Component.

Table 3 shows all attributes of the IEC 61850-80-6:2022A namespace.

Table 3 – Attributes of IEC 61850-80-6:2022A namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier	IEC 61850-80-6
Version	2022
Revision	A
Release	3
Full Namespace Name	IEC 61850-80-6:2022A
Full Code Component Name	IEC TS 61850-80-6.NSD.2022A3.Full
Light Code Component Name	IEC TS 61850-80-6.NSD.2022A3.Light
Namespace Type	domain
Namespace dependencies	
includes	IEC 61850-7-4:version :2007 revision :B

1.3.2 Identification of the XML schema namespace

The second namespace associated with this document is an XML schema (XSD) for an extension to the System Configuration Language (SCL) as defined in IEC 61850-6. The parameters which identify the namespace are provided in Table 4.

Table 4 – Attributes of the IEC TS 61850-80-6 XML namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier (xmlns)	http://www.iec.ch/61850/2022/SCL/80-6
Version	2022
Revision	A
Release	2
XSD version header attribute	2022A2
Recommended reference name	eIEC 61850-80-6
Code Component Name	IEC 61850-80-6.SCL.2022A2.Full
Namespace dependencies	
includes	http://www.iec.ch/61850/2003/SCL version :2007 revision :C release :5

1.4 Code component distribution

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

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 might 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 a Code Component will be found by selecting the file for the Code Component with the highest value for VersionStateInfo, e.g.{VersionStateInfo}.Full.zip.

For conformance testing, implementations should always use the latest downloadable Code Components, as the Code Components might be subject to updates. See technical corrigenda and XSD history files.

When the Code Components associated with this document have a full version and a light version, the light version is freely accessible.

When the Code Components associated with this document have a full version only, the full version is freely accessible.

The freely accessible Code Components are available on the IEC website for download at: http://www.iec.ch/tc57/supportdocuments, but the usage remains under the licensing conditions.

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 61850-6:2009, *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 61850-7-2:2010, *Communication networks and systems for power utility automation - Part 7-2: Basic information and communication structure - Abstract communication service interface (ACSI)*

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

IEC 61850-8-1:2011, *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*

IEC 61850-9-2, *Communication networks and systems for power utility automation - Part 9-2: Specific communication service mapping (SCSM) - Sampled values over ISO/IEC 8802-3*

IEC 61850-10:2012, *Communication networks and systems for power utility automation - Part 10: Conformance testing*

IEC TR 61850-90-12:2020, *Communication networks and systems for power utility automation - Part 90-12: Wide area network engineering guidelines*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61850-2, IEC 61850-7-2 and the following apply.

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

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
alarm
audible and/or visual means of indicating to the operator an equipment malfunction, process deviation, or abnormal condition requiring a timely response

[SOURCE: IEC 62682:2022, 3.1.7]

3.2
control centre
place where a master station (SCADA, EMS, DMS, GMS, grid operator) receives and processes data coming from power system automation equipment

Note 1 to entry: The control centre may also perform the functions of a maintenance centre.

3.3
maintenance centre
place from where maintenance, management of asset, disturbance analysis, metering, etc., are managed

3.4
Proxy/Gateway
IED containing an IEC 61850 server which services requests of its clients by forwarding requests to other servers through its IEC 61850 client, which may include data from other sources in the server object model

Note 1 to entry: A Proxy/Gateway optionally alters the client requests or the server's response and sometimes it may serve the request without contacting the specified server, e.g., by maintaining a process data image. In some cases, the Proxy/Gateway must reprocess the data to meet the requirements of the control centre interface. In the context of IEC 61850 the Proxy/Gateway consists of both client and server interfaces. The incorporation of data from sources other than IEC 61850 could also be supported within the Proxy/Gateway but the description of this is outside the scope of this document.

3.5
power utility automation system
system consisting of a place where operational resources related to an electrical grid (i.e., circuit breakers, isolators, transformers), facilities necessary for system security, control, and communication (Proxy/Gateway, IED) are located

3.6
power system automation equipment
IEDs used for substation automation, DER applications, hydro power plants, wind power plants and other similar kind of applications

3.7
hardware virtualization
virtualization of IEDs as complete hardware platforms, certain logical abstractions of their componentry, or only the functionality required to run various operating systems

Note 1 to entry: Virtualization hides the physical characteristics of a computing platform from the users, presenting instead an abstract computing platform.

3.8
event
representation of a solicited or unsolicited fact indicating a state change

[SOURCE: IEC 62682:2022, 3.1.52]

4 Abbreviated terms

For the purposes of this document, the abbreviated terms given in IEC TS 61850-2, IEC 61850-7-2 as well as the following apply.

ACSI	Abstract Communication Service Interface
AP	Access Point
BRCB	Buffered Report Control Block
CC	Control Centre
CIM	Common Information Model of IEC 61970 / IEC 61968
COSEM	Companion Specification for Energy Metering
DER	Distributed Energy Resources
DMS	Distribution Management System
EMS	Energy Management System
FACTS	Flexible Alternative Current Transmission System
GMS	Geographical Management System
GOOSE	Generic Object-Oriented System Event
GSE	Generic System Event
GW	Gateway
HMI	Human Machine Interface
ICD	IED Capability Description
IED	Intelligent Electronic Device
ICT	IED Configuration Tool
IID	Instantiated IED Description
IP	Internet Protocol
LAN	Local Area Network
LD	Logical Device
LN	Logical Node
MMS	Manufacturing Message Specification (ISO 9506)
PICS	Protocol Implementation Conformance Statement