
**Komunikacijska omrežja in sistemi za avtomatizacijo porabe električne energije -
10. del: Preskušanje skladnosti - Dopolnilo A1**

Communication networks and systems for power utility automation - Part 10:
Conformance testing

Kommunikationsnetze und -systeme in Stationen - Teil 10: Konformitätsprüfung

Réseaux et systèmes de communication pour l'automatisation des systèmes électriques
- Partie 10: Essais de conformité

Ta slovenski standard je istoveten z: EN 61850-10:2013/prA1:2023

ICS:

29.240.30	Krmilna oprema za elektroenergetske sisteme	Control equipment for electric power systems
33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)	Telecontrol. Telemetry

SIST EN 61850-10:2013/oprA1:2024 **en**



57/2628/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: IEC 61850-10/AMD1 ED2	
DATE OF CIRCULATION: 2023-12-29	CLOSING DATE FOR VOTING: 2024-03-22
SUPERSEDES DOCUMENTS: 57/2607/RR	

IEC TC 57 : POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE	
SECRETARIAT: Germany	SECRETARY: Mr Heiko Englert
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input checked="" type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING Attention IEC-CENELEC parallel voting The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Amendment 1 – Communication networks and systems for power utility automation – Part 10: Conformance testing

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

In addition to this Amendment, the working group has as well prepared a so-called consolidated edition 2.1 based on the amendment and the existing Ed.2. The document with the consolidated version is circulated in parallel to this CDV as 57/2629/INF so that national committees can see the implications of the amendment to the existing edition. After the complete CDV/FDIS approval process the consolidated edition will be published together with the amendment under reference IEC 61850-10, Ed.2.1.

When preparing their comments, National Committees are kindly asked to refer to the line numbers in the consolidated version for simplicity.

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Name of intervening person	Document received		Brief description of the changes introduced	Document sent	
	From	Date		To	Date
Ch. Brunner	R. Schimmel	4.8.23	Added this first page; sent document to secretary	N. Heidger	23.10.23

This table will be removed by IEC editors before FDIS circulation (in case of IS) or before final publication (in case of TS or TR).

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS
FOR POWER UTILITY AUTOMATION –
Part 10: Conformance testing**

AMENDMENT 1

FOREWORD

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Amendment 1 to International Standard IEC 61850-10 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The major changes in this amendment are as follows:

- server device conformance test procedures have been updated;
- client device conformance test procedures have been updated;
- sampled values test procedures have been merged into server;
- server IED configuration tool related conformance test procedures have been updated;
- GOOSE performance test procedures have been updated.

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

FDIS	Report on voting
57/xxxx/FDIS	57/xxxx/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.

A list of all parts of IEC 61850 series, 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 publication will remain unchanged until the stability date indicated on the IEC web site under "<http://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.

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1 **1 Scope**

2 *Insert after the first paragraph:*

3 Cyber security extensions provided by IEC 62351 shall be conformance tested against the IEC
4 62351-100-4 and IEC 62351-100-6.

5 **2 Normative references**

6 *Insert:*

7 IEC/IEEE 61850-9-3:2016, Communication networks and systems for power utility automation
8 – Part 9-3: Precision time protocol profile for power utility

9 IEC 61869-9:2016, Instrument transformers – Part 9: Digital interface for instrument
10 transformers

11 *Remove:*

12 IEC 62439-3:2012, Industrial communication networks – High availability automation networks
13 – Part 3: Parallel Redundancy Protocol (PRP) and High Availability Seamless Redundancy
14 (HSR)

15

16 **4 Abbreviated terms**

17 *Insert:*

PTP Precision Time Protocol

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18 **5 Introduction to conformance testing**

19 *No change*

20 **6 Device related conformance testing**

21 *Replace the existing Clause 6 by the following text:*

22 **6.1 Test methodology**

23 Communication testing needs at least two devices to communicate with each other.
24 Comprehensive interoperability testing of all possible products is not feasible. Therefore, the
25 test concept shall include test devices, test configurations, and test scenarios. The dynamic
26 behaviour should be tested properly by using well-defined test cases.

27 Messages are generated to test the communication capabilities. Hardwired stimuli (contacts,
28 voltages, currents, etc.) and stimuli coming over a serial link if applicable should be used if
29 applicable.

30 Special attention shall be given to communication equipment such as star-couplers, switches,
31 etc. which shall support all requested features of the standard but not introduce additional
32 contingencies and limitations. The impact of the communication method (client-server, GOOSE,
33 SV, etc.) used by the DUT shall be considered properly in the test procedures. Verification of
34 functional applications (use of GOOSE messages) is not part of a conformance test even if
35 advanced tools may offer such analysis.

36 **6.2 Conformance test procedures**

37 **6.2.1 General**

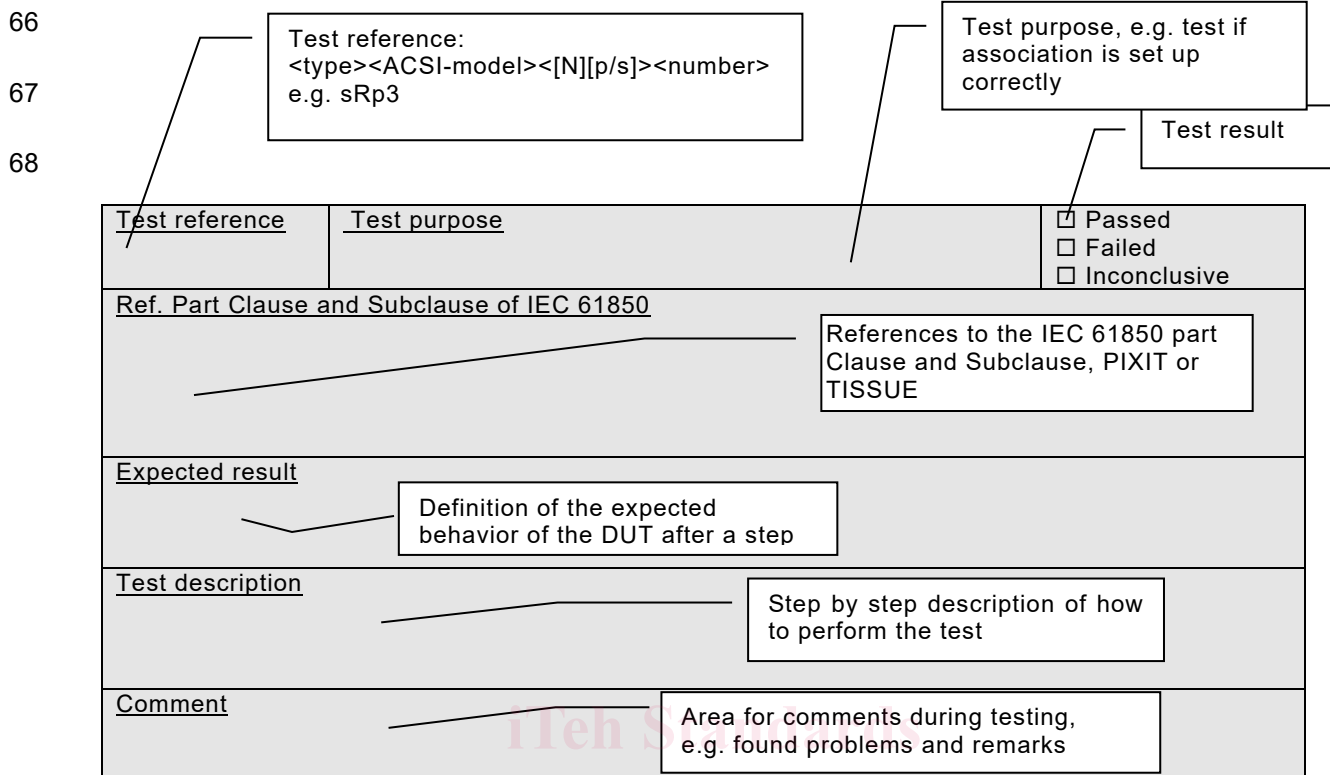
38 This subclause describes the test procedure requirements, test structure, the abstract test
39 cases (what is to be tested). The format and a few examples of detailed test procedures (how
40 to perform the test) are given in Annex A.

41 **6.2.2 Test procedure requirements**

42 The test procedure requirements are:

- 43 – The abstract test cases describe what shall be tested, the detailed test procedures describe
44 how a test engineer, or a test system shall perform the test.
- 45 – Test cases include a reference to the applicable paragraph(s) in the referenced
46 document(s).
- 47 – The test results shall be reproducible in the same test lab and in other test labs.
- 48 – Support automated testing with minimal human intervention, as far as reasonably possible.
- 49 – The tests shall focus on situations that cannot easily be tested during, for example, a factory
50 or site acceptance test, and prevent inter-operability risks, for example:
 - 51 • check behaviour of the device on delayed, lost, double and out of order packets,
 - 52 • configuration, implementation, operation risks,
 - 53 • mismatching names, parameters, settings, or data types,
 - 54 • exceeding certain limits, ranges or timeouts,
 - 55 • force situations to test negative responses,
 - 56 • check all (control) state machine paths, and
 - 57 • force simultaneous control operations from multiple clients.
- 58 – The ACSI tests focus on the application layer (mapping).
- 59 – The device under test (DUT) is considered as a black box. The I/O and the communication
60 interface are used for testing.
- 61 – The test includes testing the versions, data model and configuration file, and the use of
62 applicable ISO/IEC 9646 series terminology.

63 The test procedures shall be formatted as outlined in Figure 2. With this format, the test
 64 procedures document can also be used as test report. A few test procedure examples are
 65 depicted in Annex A.



IEC 2355/12

69 **Figure 2 – Test procedure format**

70 6.2.3 Test structure

71 The test cases are structured as follows:

- 72 – documentation and version control (IEC 61850-4);
- 73 – configuration file (IEC 61850-6);
- 74 – data model (IEC 61850-7-3 and IEC 61850-7-4);
- 75 – mapping of ACSI models and services (IEC 61850-7-2 and applicable SCSM).

76 6.2.4 Test cases to test a server device

77 6.2.4.1 General

78 This part of the IEC 61850 series specifies the test system architecture and abstract test cases
 79 for server devices. The abstract test cases shall be used for the definition of test procedures to
 80 run in tests.

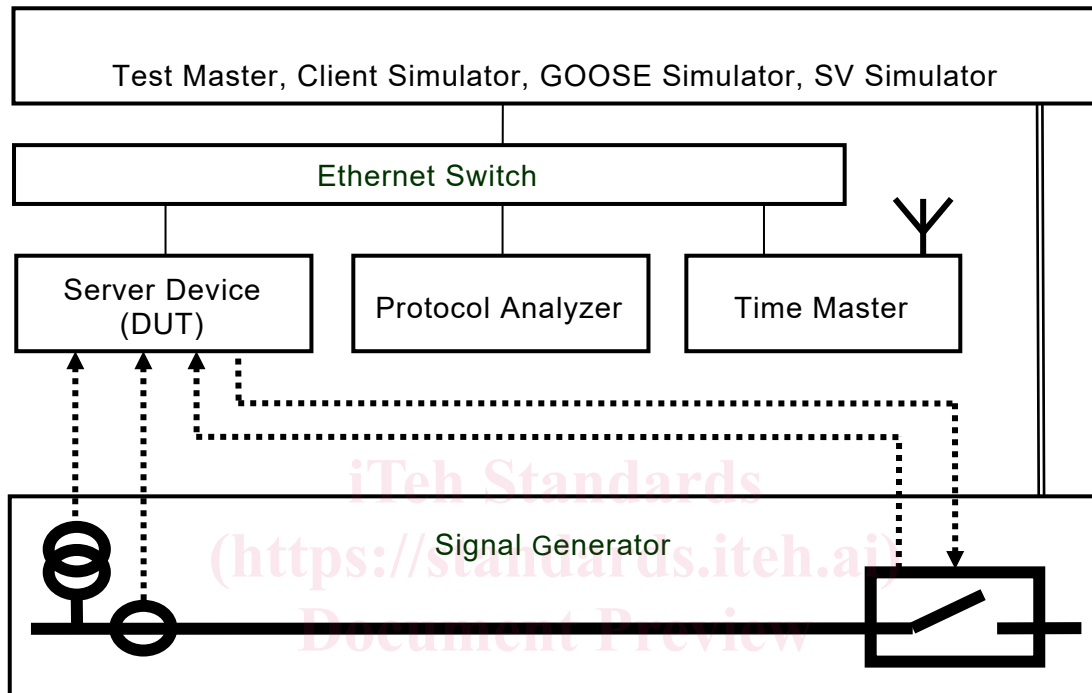
81 NOTE The SCSM specific test procedures are provided by test facilities agreed upon by the market participants.

82 6.2.4.2 Test system architecture to test a server device

83 In order to be able to perform a server device test, a minimum test set-up is necessary. The
 84 test architecture contains (see Figure 3):

- 85 – DUT;
- 86 – client simulator to initiate and generate TPAA messages;

- 87 – GOOSE simulator to send correct and incorrect GOOSE messages;
 88 – SV simulator to send correct and incorrect SV messages;
 89 – test master to start/stop test cases, start/stop the analyzer and archive test results;
 90 – time master;
 91 – engineering tool to configure the DUT;
 92 – protocol analyzer to store all the network traffic for each test case;
 93 – signal generator to force binary and analogue events, controlled by the test master or test
 94 engineer.



95

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Figure 3 – Test system architecture to test a server device

97 The test system shall include documentation regarding test system hardware and test system
 98 software.

99 6.2.4.3 Documentation and version control test procedure overview

100 The test cases listed in Table 1 shall apply.

101

Table 1 – Server documentation test cases

Test case	Test case description
sDoc1	<p>Check if the major/minor software version in the PICS documentation and the DUT do match (IEC 61850-4). PICS shall contain:</p> <ul style="list-style-type: none"> • ACSI conformance statement according to IEC 61850-7-2 Annex A • IEC 61850-9-3 PICS (when supported) • IEC 61869-9 conformance class a, b, c or d (when supported)
sDoc2	<p>Check if the major/minor software version in the PIXIT documentation and software version of the DUT does match (IEC 61850-4). PIXIT shall indicate the required information as requested in the test cases</p>

Test case	Test case description
sDoc3	Check if the major/minor software version in the MICS documentation and software version of the DUT does match (IEC 61850-4). MICS shall indicate the semantics of all non-standard Logical Nodes, Data Objects, Data Attributes and enumeration. MICS may contain other items in additional sections of the MICS.
sDoc4	Check if the major/minor software version in the TICS documentation and software version of the DUT does match (IEC 61850-4). TICS shall indicate that the mandatory and applicable technical issues are implemented .
sDoc5	Check the ICD if the server capabilities in the IED “services” section(s) do correspond with the ACSI services specified in the PICS

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103 **6.2.4.4 Configuration file test cases**

104 The test cases listed in Table 2 shall apply.

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Table 2 – Server configuration file test cases

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Test case	Test case description
sCnf1	Verify the SCL version = "2007", revision = "B", release = "4"
sCnf2	Verify the XML encoding is UTF-8 or utf-8; <?xml version="1.0" encoding="UTF-8"?>
sCnf3	Verify that the ICD validates according to SCL schema: version 2007, revision B, release 4
sCnf4	Use the ICT tool to export an ICD file. When ICD is not supported export IID file. Use this file for the remaining tests. It is not allowed to change this SCL file with general purpose tools such as an XML editor. Condition: when the ICD is not fixed
sCnf5	Import the ICD or IID file from sCnf4 into SCT SIMULATOR and generate SCD file as follows: <ul style="list-style-type: none"> • update IED name • change IP/MAC address • change SubNetwork name • add DataSet's (when supported) • add ReportControl's (when supported) • add GSEControl's (when supported) • add SampledValueControl's (when supported) • add data flows (ExtRef's) from other IED's (when nolctBinding=F) Import the SCD file into the ICT tool and select the IED to be handled from IED's named in the SCD file by IED name
sCnf6	Complete the GOOSE and SV subscribe from sCnf5 and export the IID file. Verify that the ExtRef intAddr does not change when the external binding changes. The intAddr should not contain external data. Condition: when GOOSE and/or SV subscribe is supported
sCnf10	Verify the ICD has at most one Substation or Line or Process exists at SCL level and the attribute "name" is "TEMPLATE". Condition: when Substation or Line or Process section is present
sCnf11	Verify the ICD has none of the LNode bound to an IED different from "TEMPLATE" or "none" Condition: when Substation section is present
sCnf20	Verify that the "Communication" element exists: <ul style="list-style-type: none"> • IED/Services/DynAssociation or IED/AccessPoint/Services/DynAssociation is declared) and IED/AccessPoint/ Server is declared or • LN0/GSEControl element exist or • LN0/SampledValueControl element exist
sCnf21	For each ConnectedAP/Address element: <p>Verify that exactly one "P" element with attribute type="OSI-PSEL" with a valid value (non-empty, even number of characters, maximum 16 characters 0-9,A-F)</p> <p>Verify that exactly one "P" element with attribute type="OSI-SSEL" with a valid value (non-empty, even number of characters, maximum 16 characters 0-9,A-F)</p> <p>Verify that exactly one "P" element with attribute type="OSI-TSEL" with a valid value (non-empty, even number of characters, maximum 8 characters 0-9,A-F)</p> <p>(Note that if xsi:type mechanism is used then schema validator can automatically verify the type)</p> <p>Condition: IED/Services/DynAssociation is declared</p>

sCnf22	<p>Verify that for each accesspoint no more than one "P" element with attribute type="OSI-AP-Title" and "OSI-AE-Qualifier and "IP" and "IP-SUBNET", "IP-GATEWAY", OSI-NSAP, OSI-AP-Invoke, OSI-AE-Invoke and DNSName exists. For each of these that exist:</p> <p>Verify OSI-AP-Title value contains only decimal digits and non-repeating commas</p> <p>Verify OSI-AE-Qualifier value is decimal representation from 0-65535</p> <p>Verify IP and IP-SUBNET and IP-GATEWAY contain a "standard dotted-decimal" for Ipv4</p> <p>Verify Ipv6 and Ipv6-SUBNET and Ipv6-GATEWAY contain a RFC 4291 address with leading zeros for Ipv6</p> <p>Verify OSI-AP-Invoke and OSI-AE-Invoke values are between 0 and 65535.</p>
sCnf23	<p>For each GSE element: Address/P[type=MAC-Address] right digit of first octet is odd (1,3,5,7,9,B,D,F) (multicast). Address/P[type=VLAN-ID] present Address/P[type=PRIORITY] present Address/P[type=APPID] = 0000-3FFF or 8000-BFFF</p> <p>Condition: when GSE element is present</p>
sCnf24	<p>For each SMV element referencing a SampledValueControl whose attribute multicast=true or missing, verify Address/P[type=MAC-Address] right digit of first octet is odd (1,3,5,7,9,B,D,F) (multicast)</p> <p>For each SMV element referencing a SampledValueControl whose attribute multicast=false, verify Address/P[type=MAC-Address] right digit of first octet is even (0,2,4,6,8,A,C,E) (unicast)</p> <p>For each SMV element in the ICD:</p> <ul style="list-style-type: none"> • Address/P[type=VLAN-ID] present • Address/P[type=PRIORITY] = present • Address/P[type=APPID] = 4000-7FFF <p>Condition: when SMV element is present</p>
sCnf25	Verify the ICD that each Subnetwork/ConnectedAP@iedName is "TEMPLATE"
sCnf26	Verify each Subnetwork/ConnectedAP@apName matches one of IED/AccessPoint@name
sCnf27	<p>Verify for each GSE element, the GSE@cbName points to a GSEControl within the AccessPoint pointed to by GSE//@apName and GSE@IdInst.</p> <p>Condition: when GSE element is present</p>
sCnf28	<p>Verify for each SMV element, the SMV@cbName points to a SampledValueControl within the AccessPoint pointed to by SMV//@apName and SMV@IdInst.</p> <p>Condition: when SMV element is present</p>
sCnf29	Verify that at least one SubNetwork type has value "8-MMS" when type is present or type is absent
sCnf40	Verify the ICD has exactly one IED element and that the attribute "name" of the element is "TEMPLATE"