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Part 10: Conformance testing

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS IN SUBSTATIONS –

Part 10: Conformance testing

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

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

FDIS	Report on voting
57/742/FDIS	57/749/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.

IEC 61850 consists of the following parts, under the general title *Communication networks and systems in substations*:

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 for substation and feeder equipment – Principles and models
Part 7-2:	Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)
Part 7-3:	Basic communication structure for substation and feeder equipment – Common data classes
Part 7-4:	Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes
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 9-1:	Specific Communication Service Mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link
Part 9-2:	Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3
Part 10:	Conformance testing

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

A bilingual edition of this standard may be issued at a later date.

INTRODUCTION

This part of IEC 61850 is part of a set of specifications which details a layered substation communication architecture.

This part of IEC 61850 defines:

- the methods and abstract test cases for conformance testing of devices used in substation automation systems, and
- the metrics to be measured within devices according to the requirements defined in IEC 61850-5.

The intended readers are test system developers.

NOTE 1 Tests regarding EMC requirements and environmental conditions are subject to IEC 61850-3 and not included in this part of IEC 61850.

NOTE 2 It is recommended that IEC 61850-5 and IEC 61850-7-1 be read first in conjunction with IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4.

NOTE 3 Abbreviations used in IEC 61850-10 are listed in Clause 4 or may be found in other parts of IEC 61850 that are relevant for conformance testing.

COMMUNICATION NETWORKS AND SYSTEMS IN SUBSTATIONS –

Part 10: Conformance testing

1 Scope

This part of IEC 61850 specifies standard techniques for testing of conformance of implementations, as well as specific measurement techniques to be applied when declaring performance parameters. The use of these techniques will enhance the ability of the system integrator to integrate IEDs easily, operate IEDs correctly, and support the applications as intended.

NOTE 1 The role of the test facilities for conformance testing and certifying the results are beyond the scope of this part of IEC 61850.

NOTE 2 The test approach and test system design to test a client device is likely to be different across the broad range of clients. There are many possibilities to test clients. The client tests are beyond the scope of this part of IEC 61850. It is intended to define client test requirements during the maintenance of this part.

2 Normative references

The following referenced documents are indispensable for the application 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 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-4, *Communication networks and systems in substations – Part 4: System and project management*

IEC 61850-5, *Communication networks and systems in substations – Part 5: Communication requirements for functions and device models*

IEC 61850-6, *Communication networks and systems in substations – Part 6: Configuration description language for communication in electrical substations related to IEDs*

IEC 61850-7-1, *Communication networks and systems in substations – Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models*

IEC 61850-7-2 , *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3 , *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes*

IEC 61850-7-4 , *Communication networks and systems in substations – Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes*

IEC 61850-8-1, *Communication networks and systems in substations – 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 61850-9-1, *Communication networks and systems in substations – Part 9-1: Specific Communication Service Mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link*

IEC 61850-9-2, *Communication networks and systems in substations – Part 9-2: Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3*

ISO/IEC 9646-1, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts*

ISO/IEC 9646-2, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 2: Abstract test suite specification*

ISO/IEC 9646-4, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 4: Test realization*

ISO/IEC 9646-5, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 5: Requirements on test laboratories and clients for the conformance assessment process*

ISO/IEC 9646-6, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 6: Protocol profile test specification*

3 Terms and definitions

For the purpose of this document, the terms and definitions provided in IEC 61850-2 as well as the following definitions apply.

3.1
Factory Acceptance Test
FAT
customer agreed functional tests of the specifically manufactured substation automation system or its parts using the parameter set for the planned application as specified in a specific customer specification. The FAT will be carried out in the factory of the manufacturer or other agreed-upon location by the use of process simulating test equipment.

3.2
hold point
point, defined in the appropriate document beyond which an activity shall not proceed without the approval of the initiator of the conformance test. The test facility shall provide a written notice to the initiator at an agreed time prior to the hold point. The initiator or his representative is obligated to verify the hold point and approve the proceeding of the activity.

3.3
interoperability
ability of two or more IEDs from the same vendor (or different vendors) to exchange information and use that information for correct co-operation.

A set of values having defined correspondence with the quantities or values of another set.

3.4
Model Implementation Conformance Statement
MICS
details the standard data object model elements supported by the system or device

3.5
negative test
test to verify the correct response of a system or a device when subjected to:

– IEC 61850 series conformant information and services which are not implemented in the system or device under test;

– non IEC 61850 series conformant information and services sent to the system or device under test

3.6
Protocol Implementation Conformance Statement
PICS
summary of the communication capabilities of the system or device to be tested

3.7
Protocol Implementation eXtra Information for Testing
PIXIT
the Protocol Implementation eXtra Information for Testing document contains system or device specific information regarding the communication capabilities of the system or device to be tested and which are outside the scope of the IEC 61850 series. The PIXIT is not subject to standardisation.

3.8
routine test
performed by the manufacturer in order to ensure device operation and safety

3.9
Site Acceptance Test
SAT
verification of each data and control point and the correct functionality within the SAS and between the SAS and its operating environment at the whole installed plant by use of the final parameter set as specified in a specific customer specification. The SAT is the precondition for the SAS being put into operation.

3.10
system related test
verification of correct behaviour of the IEDs and of the overall SAS under specific application conditions. The system related test is part of the final stage of the development of IEDs as belonging to a SAS-product family.

3.11
test equipment
all tools and instruments which simulate and verify the input/outputs of the operating environment of the SAS such as switchgear, transformers, network control centres or connected telecommunication units on the one side, and the serial links between the IEDs of the SAS on the other

3.12
test facility
organisation able to provide appropriate test equipment and trained staff for conformance testing. The management of conformance tests and the resulting information should follow a quality system.

3.13
type test
verification of correct behaviour of the IEDs of the SAS by use of the system tested software under the test conditions corresponding with the technical data

The type test marks the final stage of the hardware development and is the precondition for the start of the production. This test is carried out with IEDs, which have been manufactured through the normal production cycle.

3.14
witness point
point, defined in the appropriate document at which an inspection will take place on an activity. The activity may proceed without the approval of the initiator of the conformance test. The test facility provides a written notice to the initiator at an agreed time prior to the witness point. The initiator or his representative has the right, but is NOT obligated, to verify the witness point.

4 Abbreviated terms

ACSI	Abstract Communication Service Interface
ASDU	Application Service Data Unit
BRCB	Buffered Report Control Block
CDC	Common Data Class
CT	Current Transducer
DTD	Document Type Definition
DUT	Device Under Test
FAT	Factory Acceptance Test
GI	General Interrogation
GoCB	GOOSE Control Block
GOOSE	Generic Object Oriented Substation Events
GSE	Generic Substation Event
GSSE	Generic Substation Status Event
GsCB	GSSE Control Block
HMI	Human Machine Interface
ICD	IED Capability Description
IED	Intelligent Electronic Device
IP	Internet Protocol
LCB	Log Control Block
LD	Logical Device
LN	Logical Node
MC	MultiCast
MCAA	Multicast Application Association
MICS	Model Implementation Conformance Statement
MMS	Manufacturing Message Specification (ISO 9506 series)
MSVCB	Multicast Sampled Value Control Block
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
RTU	Remote Terminal Unit
SAS	Substation Automation System