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Communication networks and systems for power utility automation - Part 90-28: Specification for subscriber IED to validate GOOSE and SV messages

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

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

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Communication networks and systems for power utility automation - Part 90-28: Specification for subscriber IED to validate GOOSE and SV messages

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

Draft	Report on voting
57/2923/DPAS	57/2966/RVDPAS

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 Publicly Available 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.

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.

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– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

GOOSE and SV messages carry critical data as measurements, trip signals, blocking signals, etc. which are exchanged between IEDs. Those messages could cause a mis-operation if they are processed when they should not be. Therefore, it becomes critical to make validation of those messages more resilient to ensure that data forwarded to the application are the expected ones.

Each vendor implements validation on different parameters of the GOOSE and SV messages. Therefore validation has to be harmonized. In addition, this will make commissioning easier.

Issues caused by the engineering process or human error during operation is expected to be detected by subscriber IED.

Efficient filtering of messages is expected to be implemented to achieve expected timing performance.

IEDs must notify the user of any identified issues so they can be validated by testing.

The aim of this Publicly Available Specification is to provide new requirements related to validation of GOOSE and SV messages for the IEC 61850 series:

– Part 6 for configuration description,
– Part 7-x for data model and abstract services,
– Part 8-1 and part 9-2 for specific communication service mappings,
– Part 10 for conformance testing

Once this document has been published, the affected parts of the core standards will be updated with the results from this specification.

As it contains some description of the different parameters of the GOOSE and SV messages and some recommendations, this document could be used as a guideline for implementation too.

This document focuses on the validation and supervision of GOOSE and SV messages.

1 Scope

1.1 General

This of the IEC 61850 series, which is a Publicly Available Specification, specifies the expected behavior and associated documentation related to the validation of received GOOSE and SV messages. It considers engineering rules and guidance to ensure that the communication configuration process is well designed for this validation. Conformance statements related to this validation are also considered.

This document considers subscribers claiming conformance to latest editions of the IEC 61850 series in combination with publishers claiming conformance to any previous version and revision of the IEC 61850 series.

1.2 Published versions of the standard and related namespace names

Table 1 shows all tracking information of (Tr)IEC 61850-90-28:2024A namespace building-up.

Table 1 – Tracking information of (Tr)IEC 61850-90-28:2024A namespace building-up

Attribute	Content
Namespace IEC specific information	
Version of the UML model used for generating the document (informative)	WG10build26
Date of the UML model used for generating the document (informative)	2026-08-05
Autogeneration software name and version(informative)	j61850DocBuilder 02.06bbeta based on jCleanCim beta9.4 (derived from jCleanCim 02-02)

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

Table 2 – Published version

Edition	Publication date	Webstore	Namespace
Edition 1.0	2025-xx	IEC PAS 61850-90-28:2025	(Tr)IEC 61850-90-28:2024

1.3 Identification of the namespace

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 (Tr)IEC 61850-90-28:2024A namespace.

Table 3 – Attributes of (Tr)IEC 61850-90-28:2024A namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier	(Tr)IEC 61850-90-28
Version	2024
Revision	A
Release	2
Full Namespace Name	(Tr)IEC 61850-90-28:2024A
Full Code Component Name	IEC_PAS_61850-90-28.NSD.2024A2.Full
Light Code Component Name	IEC_PAS_61850-90-28.NSD.2024A2.Light
Namespace type	transitional
Namespace dependencies	
extends	IEC 61850-7-4 version:2007 revision: B
Namespace transitional status	
Future handling of namespace content	The namespace (Tr)IEC 61850-90-28:2024A is considered as "transitional" since the models are expected to be included in further editions of IEC 61850. Extensions or modifications to the model may occur when the model is merged into the International Standard documents

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 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/supportdocuments.

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_PAS_61850-90-28.NSD.{VersionStateInfo}.Light.{Light | Full}.zip.*

For conformance testing, implementations should always use the latest downloadable Code Components, as the Code Components may 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 https://www.iec.ch/tc57/supportdocuments, but the usage remains under the licensing conditions.

2 Normative references

The following documents, in whole or in part, are normative reference for this document and required for its application. 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, *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 61850-7-1:2011/AMD1:2020

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, *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 61850-8-1:2011, *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 61850-8-1:2011/AMD1:2020

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

IEC 62351-6:2020, *Power systems management and associated information exchange - Data and communications security - Part 6: Security for IEC 61850*

3 Terms and definitions

For the purpose of this document, the following terms and definitions 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
publisher
entity that sends messages without considering and being aware of the subscriber(s) of this message

3.2
subscriber
entity that receives and accepts expected messages being aware of the publisher configuration of this message

3.3
operational GOOSE or SV message
GOOSE or SV message published by an IED in a usual context

Note 1 to entry: This is the default kind of GOOSE and SV message.

3.4
simulated GOOSE or SV message
GOOSE or SV message published by a test entity to be used by subscriber operating in simulation mode instead of operational GOOSE or SV message

Note 1 to entry: This message has to be distinct from operational message. To achieve that, it contains a simulation property in the message. Simulated GOOSE and SV messages are used in a non-operational context.

3.5
duplicated GoCB/SVCB publisher
GoCB or SVCB publisher which publishes duplicated GOOSE or SV messages with different source MAC Address

3.6
missing GOOSE message
GOOSE message which has not been received whereas subscription is active

Note 1 to entry: It could be detected because it leads to a jump in the expected sequence of the subscriber.

For example, latest received stNum is 'n' and latest received SqNum is 'm':

– subscriber receives stNum 'n'+1 and sqNum '1' OR

– subscriber receives stNum 'n'+2 and sqNum '0' OR

– subscriber receives stNum 'n' and sqNum 'm' + 2 …

In case of missing GOOSE message, GoCB subscription shall remain active because GOOSE message is received before expiration timer.

3.7
double GOOSE message
two GOOSE messages which are identical, i.e. same header, same value of the simulation flag, same stNum and same sqNum

Note 1 to entry: This issue could happen due to the network.

It could be detected if two consecutive GOOSE messages are received with the same state number and sequence number. In case of detection of double GOOSE messages, the second received GOOSE message shall be discarded but GoCB subscription shall remain active.

3.8
out of order GOOSE message
GOOSE message which is received out of the expected sequence

Note 1 to entry: It could be detected because it leads to receive a GOOSE message out of acceptance window of the subscriber regarding stNum and sqNum.

For example, latest received stNum is 'n' and latest received SqNum is 'm':

– subscriber receives stNum 'n' and sqNum 'm-1' OR

– subscriber receives stNum 'n-1' and sqNum 'any' OR

– subscriber receives stNum 'n+5' and sqNum 'm' + 2 …

In case of out of order GOOSE message, GOOSE message is accepted or not depending on acceptance window. GoCB subscription remains active until it leads to expiration timer.

3.9
no GOOSE message
situation where no GOOSE message is received at the startup of the subscription or at the end of the expiration timer

Note 1 to entry: In case of no GOOSE message, GoCB subscription is inactive.

3.10
invalid GOOSE message
GOOSE message which corresponds to a configured GoCB subscription but has a wrong configuration or contains an error in the message

Note 1 to entry: In case of invalid GOOSE message, GOOSE message shall be rejected and GoCB subscription remains in its current state.

3.11
missing SV message
SV message which is not received by the subscriber

Note 1 to entry: It could be detected because it leads to a jump of smpCnt in the expected sequence of the subscriber whereas smpSynch does not change.

For example, latest received smpCnt is 'n' and smpSynch is 'm':

– subscriber receives smpCnt 'n'+x and smpSynch is 'm'.

In case of missing SV, SVCB subscription shall remain active because SV is received before expiration timer.

3.12
double SV message
two SV messages which are received with the same configuration, the same value of the simulation flag, the same smpCnt and the same smpSynch

Note 1 to entry: This issue could happen due to the network.

It could be detected if two consecutive SV messages are received with the same sample counter and sample synchronization state. In case of detection of double SV messages, the second received SV message shall be discarded but SVCB subscription shall remain active.

3.13
out of order SV message
SV message which is received out of the expected sequence of smpCnt while the smpSynch and gmIdentity values remain unchanged

Note 1 to entry: It could be detected because it leads to a discontinuity in the sequence of smpCnt.

For example, latest received smpCnt is 'n', and smpSynch value is 1 or 2:

– subscriber receives smpCnt 'n-7' and same smpSynch and gmIdentity if relevant, OR

– subscriber receives smpCnt 'n+5' and same smpSynch and same gmIdentity if relevant.

In case of out-of-order SV message, SV message is accepted or not depending on the acceptance window. The SVCB subscription remains active until it leads to an expiration timer.

3.14
no SV message
situation where no SV message is received at the startup of the subscription or at the end of the loss of SVCB publisher

Note 1 to entry: In case of no SV message, SVCB subscription is inactive.

3.15
invalid SV message
SV message which corresponds to a configured SVCB subscription but has a wrong configuration or contains an error in the message

Note 1 to entry: In case of invalid SV message, SV message shall be rejected and SVCB subscription remains in its current state.

3.16
message filtering
way for an IED to efficiently discard messages that do not correspond to an expected subscription

4 Abbreviated terms

APDU	application protocol data unit
DMAC	destination MAC address
GoCB	GOOSE control block
GOOSE	generic object oriented substation events
IED	intelligent electronic device
MAC	Media Access Control
MMS	manufacturing message specification (ISO 9506)
PICS	protocol implementation conformance statement
PIXIT	protocol implementation extra information for testing
SCL	system configuration language (IEC 61850-6)
SCD	system configuration description
SCT	system configurator tool
SED	system exchange description
SV	sampled value
SVCB	sampled value control block
TAL	time allowed to live

5 GOOSE and SV messages validation principle

Validation of GOOSE and SV messages is essential:

– to avoid any function maloperation
– to have a performant system
– to detect and inform on any configuration issue

GOOSE and SV messages subscription validation requires that

– publisher IEDs shall be conformance tested, and
– engineering tools used in the configuration workflow shall be conformance tested

This document considers

– subscriber IEDs and configuration tools claiming conformance to the latest editions of the IEC 61850 series, and
– any publisher IEDs claiming conformance to any existing version of the IEC 61850 series

NOTE There is no way for subscriber IEDs to identify the edition/revision of publisher IEDs from received GOOSE and SV messages. However, no specific implementation is required on the subscriber IED regarding the edition /revision of the publisher IED.