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AMENDMENT 1
AMENDEMENT 1

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

[IEC 61850-9-2:2011/AMD1:2020](https://standards.iteh.ai/catalog/standards/sist/668739dc-2aab-4534-8c8c-)

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**Réseaux et systèmes de communication pour l'automatisation des systèmes
électriques –**

**Partie 9-2: Mise en correspondance des services de communication spécifiques
(SCSM) – Valeurs échantillonnées sur ISO/IEC 8802-3**





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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.200

ISBN 978-2-8322--7380-7

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FOREWORD

This amendment has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

FDIS	Report on voting
57/2112/FDIS	57/2135/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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2 Normative references

Remove the following existing references:

IEC/TR 61850-1

IEC 61850-7-1

IEC 61850-7-4

IEC 60874-10-1

IEC 60874-10-2

IEC 60874-10-2

ISO/IEC 7498-1

Add the following new references:

IEC 61588:2009, *Precision clock synchronization protocol for networked measurement and control systems*

IEC/IEEE 61850-9-3, *Communication networks and systems for power utility automation - Part 9-3: Precision Time Protocol Profile for Power Utility Automation*

IEC TR 61850-90-4, *Communication networks and systems for power utility automation - Part 90-4: Network engineering guidelines*

ISO 4217:2015, *Code for the representation of currencies*

RFC 2460, *Internet Protocol, Version 6 (IPv6) Specification*, IETF, available at <http://www.ietf.org>

Update the following existing references:

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

IEC TS 62351-6¹, *Power systems management and associated information exchange - Data and communications security - Part 6: Security for IEC 61850*

IEC 62439-3:2016, *Industrial communication networks - High availability automation networks - Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)*

ISO/IEC/IEEE 8802-3, *Standard for Ethernet*

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4 Abbreviations

[IEC 61850-9-2:2011/AMD1:2020](https://standards.iteh.ai/catalog/standards/sist/668739dc-2aab-4534-8c8c-03088ad133c6/iec-61850-9-2-2011-amd1-2020)

Remove the following abbreviations:

CSMA/CD

ECT

EVT

GSSE

MAU

Add the following new abbreviation:

PTP Precision Time Protocol, referring to IEC 61588:2009

¹ Under preparation. Stage at the time of publication: IEC TS/PRVC 62351-6:2020.

5 Communication stack

5.2 Client/server services and communication profiles

Replace the existing text of Subclause 5.2 by the following new text:

Content removed; see IEC 61850-8-1.

5.3 SV service and communication profile

5.3.1 SV mapping overview

Table 4 – Service requiring SV communication profile

Replace existing Table 4 with the following new Table 4:

Model	IEC 61850-7-2 service
Multicast sampled value class model	Multicast SV message
Unicast sampled value class model	Unicast SV message (deprecated)

5.3.2 A-Profile

Table 5 – Service and protocols for SV communication A-Profile

Replace existing Table 5 with the following new Table 5:

OSI model layer	Specification			m/o
	Name	Service specification	Protocol specification	
Application	SendMSVMessage service	See clause 8.5		m
	Security	IEC 62351-6		o
Presentation	Abstract syntax	ISO/IEC 8824-1:2008	ISO/IEC 8825-1	m
Session				

Remove the third paragraph of Subclause 5.3.2.

5.3.3 T-Profile

Add a new heading 5.3.3.1 General before the first paragraph and renumber subsequent subclauses accordingly.

Table 6 – SV T-Profile

Replace existing Table 6 with the following new Table 6:

OSI model layer	Specification			m/o
	Name	Service specification	Protocol specification	
Transport				
Network				
Link Redundancy	Parallel redundancy protocol and high availability seamless ring	IEC 62439-3:2016		o
DataLink	Priority tagging/VLAN	IEEE 802.1Q		m
	Standard for Ethernet	ISO/IEC/IEEE 8802-3		m
Physical	Interface	IEC TR 61850-90-4		c

c If the product standard profiling this standard is not specifying another physical interface, IEC/TR 61850-90-4 applies

Add the following new note after Table 6:

NOTE This document only considers layer 2 sampled values transmission. Routable sampled values mechanisms are defined in IEC 61850-8-1.

5.3.3.2 Physical layer: Specifications for the medium attachment unit (MAU)

Remove existing Subclause 5.3.3.2 (formerly 5.3.3.1).

5.3.3.2 Link layer: Ethernet addresses

Replace the reference to ISO/IEC 8802-3 multicast/unicast address with ISO/IEC/IEEE 8802-3 multicast.

[IEC 61850-9-2:2011/AMD1:2020](https://standards.iteh.ai/catalog/standards/sist/668739dc-2aab-4534-8c8c-03088ad153c6/iec-61850-9-2-2011-amd1-2020)

5.3.3.3 Link layer: Priority tagging/virtual LAN

Replace the existing text of Subclause 5.3.3.3 with the following new text:

IEEE 802.1Q field shall be present in the egress frames from a SV publisher.

Priority tagging according to IEEE 802.1Q is used to separate time-critical and high-priority bus traffic for protection-relevant applications from low priority bus loads.

Subscribers conformant to this document shall be prepared that the Virtual LAN tag might have been removed or modified by the network on the path from the publisher to the subscriber.

See Figure 2 for the structure of the tag header.

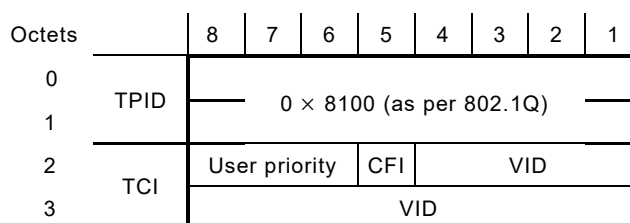


Figure 2 – Structure of the tag header

TPID (tag protocol identifier) field: indicates the Ethernet type assigned for 802.1Q Ethernet encoded frames. This value shall be 0x8100.

TCI (tag control information) fields: user priority: BS3; user priority value shall be set by configuration to separate sampled values from low priority bus load. If the priority is not configured, then the default values of Table 4 shall be used.

CFI (canonical format indicator): BS1 [0]; a single bit flag value. For this standard, the CFI bit value shall be reset (value = 0).

NOTE If set (value = 1), an embedded resource identification field (E-RIF) follows the Length/Type field in the ISO/IEC/IEEE 8802-3 tagged frame.

VID: for backward compatibility reasons, the value of the VLAN Identifier shall be zero (0) if the SMV P-Type VLAN-ID is missing in the configuration.

As IEEE 802.1Q allows implementation with a restricted set of priorities, the higher priority frames should have a priority of 4 to 7 and the lower priority should have a priority of 1 to 3. The value 1 is the priority of untagged frames; thus 0 should be avoided as it may cause unpredictable delay due to normal traffic.

Additionally, since sampled values potentially need to have their own bandwidth allocation, their configured VID will be different from GOOSE.

The default values for priority and VID shall be as defined in Table 7.

Table 7 – Default Virtual LAN IDs and priorities

Service	Default VID	Default priority
Sampled Values	0	4

The general ISO/IEC 8802-3 frame structure for sampled values can be found in Annex A.

All implementations that send Sampled Values and claim conformance to this clause of this standard, shall be capable of configuration of the VID and priority attributes.

All implementations that receive Sampled Values shall be capable of receiving any VID and priority (e.g. these attributes shall not be used for Source address matching). Additionally, such implementations shall be capable of processing incoming messages that do not contain IEEE 802.1Q information.

5.3.3.4 Link layer: Ethertype and other header information

5.3.3.4.1 Ethertype

Replace the reference to ISO/IEC 8802-3 with ISO/IEC/IEEE 8802-3.

5.3.3.4.2 APPID

Replace the reference to ISO/IEC 8802-3 with ISO/IEC/IEEE 8802-3.

5.3.3.4.5 Reserved 2

Replace the reference to IEC/TS 62351-6 with IEC 62351-6.

Add the following new text at the end of Subclause 5.3.3.4.5:

Subscribers that do not support IEC 62351-6 shall ignore the value of the fields when it is not 0.

8 Mapping of the model for the transmission of sampled values

8.1 Overview

Remove, in the second paragraph of Subclause 8.1, the text "for unicast and multicast".

8.2 Mapping of the multicast sampled value control block class and services

8.2.1 Multicast sampled value control block definition

Table 9 – MMS TypeDescription definition for MSVCB MMS structure

Replace existing Table 9 with the following new Table 9:

MMS component name	MMS TypeDescription	r/w	m/o	Condition	Comments
MsvCBNam	Identifier	r	m		MMS Identifier of the structure of the MsvCBName within the MMS object named: LLN0\$MS e.g. LLN0\$MS\$<MsvCBNam>
MsvCBRef	Visible-string	r	m		The value of this component shall contain the IEC Reference of the MsvCB. e.g. <MMSDomain>/LLN0\$MS\$<MsvCBNam>
SvEna	Boolean	r/w	m		TRUE = transmission of sampled value buffer is activated. FALSE = transmission of sampled value buffer is deactivated.
MsvID	Visible-string	r	m		System-wide unique identification. It is strongly recommended to use a four-byte hexadecimal representation of APPID value as system-wide unique identification
DatSet	Visible-string	r	m		The value of this component shall contain the IEC reference of the DataSet conveyed by the MsvCB. This ObjectReference shall be limited to VMD or Domain scoped NamedVariableLists. Only FCDA of Basic Types are allowed to be members of the DataSet.
ConfRev	Unsigned integer	r	m		Count of configuration changes regard to MSVCB.
SmpRate	Unsigned integer	r	m		Amount of samples (default per nominal period, see SmpMod).
OptFlds	Bitstring				See Table 20
refresh-time	Boolean	r	m		TRUE = SV buffer contains the attribute "RefrTm". FALSE = attribute "RefrTm" is not available in the SV buffer.
sample-synchronised	Boolean	r	m		Value will be ignored. Kept to ensure backward compatibility with IEC 61850-9-2:2004

MMS component name	MMS TypeDescription	r/w	m/o	Condition	Comments
sample-rate	Boolean	r	m		TRUE = SV buffer contains the attribute "SmpRate". FALSE = attribute "SmpRate" is not available in the SV buffer.
data-set-name	Boolean	r	m		TRUE = SV buffer contains the attribute "DatSet". FALSE = attribute "DatSet" is not available in the SV buffer.
security	Boolean	r	m		Mapping specific attribute. TRUE = SV buffer contains the attribute "Security". FALSE = attribute "Security" is not available in the SV buffer.
sample-mode	Boolean	r	m		TRUE = SV buffer contains the attribute "SmpMod". FALSE = attribute "SmpMod" is not available in the SV buffer.
synch-source-identity	Boolean	r	m		TRUE = SV buffer contains the attribute "GmlIdentity". FALSE = attribute "GmlIdentity" is not available in the SV buffer.
SmpMod	Enumerated	r	m		smpMod specifies 0 = samples per nominal period (DEFAULT) 1 = samples per second 2 = seconds per sample If not available (backward compatibility) the default value is 0.
DstAddress	PhyComAddr	r	m		Mapping specific attribute. See Table 10
noASDU	Unsigned integer	r	m		Mapping specific attribute. Number of ASDU concatenated into one APDU.

Replace existing Table 10 by the following new Table 10:

Table 10 – PhyComAddr structure

MMS component name	MMS TypeDescription	r/w	m/o	Condition	Comments
Addr	OCTET-STRING	r	m		Length is 6 octets and contains the value of the destination media access control (MAC) address to which the SV message is to be sent. The DstAddress shall be an Ethernet address that has the multicast bit set to TRUE. In order to facilitate the network traffic filtering, it is recommended to use different Ethernet addresses for each DstAddress. See Annex B for multicast addressing recommendations
PRIORITY	Unsigned8	r	m		Range of values shall be limited from 0 to 7.
VID	Unsigned16	r/w	m		Range of values shall be limited from 0 to 4095.
APPID	Unsigned16	r	m		As defined in 5.3.3.

Add, after Table 10, the following new Table 20:

Table 20 – Mapping of OptFIds within Bitstring

MMS component name	Bitstring bit position
refresh-time	0
sample-synchronised	1
sample-rate	2
data-set-name	3
security	4
sample-mode	5
synch-source-identity	6

8.2.2 MSV Services

Table 11 – Mapping of multicast sampled value services

Replace existing Table 11 with the following new Table 11:

Services of MSVCB Class	Service
SendMSVMessage	Transmission of MSV messages is mapped directly on data link layer as defined in 8.4 and 8.5
GetMSVCBValue	Mapped to MMS read service
SetMSVCBValue	Mapped to MMS write service
GetMsvReference	Mapped to Management service
GetMSVElementNumber	

[https://standards.iteh.ai/catalog/standards/sist/668739dc-2aab-4534-8c8c-03088ad133c6/iec-61850-9-2-2011-amd1-2020](https://standards.iteh.ai/catalog/standards/sist/668739dc-2aab-4534-8c8c-03088ad133c6/iec-61850-9-2-2011/amd1-2020)

8.3 Mapping of the unicast sampled value control block class and services

Replace the existing text of Subclause 8.3 with the following new text:

The usage of unicast sampled values frames has been deprecated.

8.4 Mapping of the update of the sampled value buffer

Replace, in the second paragraph of Subclause 8.4, the reference to ISO/IEC 8802-3 with ISO/IEC/IEEE 8802-3.

8.5 Additional definitions for the transmission of sampled values

8.5.2 Presentation layer functionality

Table 14 – Encoding for the transmission of the sampled value buffer

Replace existing Table 14 with the following new Table 14:

IEC61850 DEFINITIONS ::= BEGIN
 IMPORTS Data FROM ISO-IEC-9506-2
 IEC 61850-9-2 Specific Protocol ::= CHOICE {
 savPdu [APPLICATION 0] IMPLICIT SavPdu,

Abstract buffer format according to IEC 61850-7-2		Coding in IEC 61850-9-2	Comments
Attribute name	Attribute type	ASN.1 basic encoding rules (BER) SavPdu ::= SEQUENCE {	
		noASDU [0] IMPLICIT INTEGER (1..65535),	Mapping specific attribute. Number of ASDUs, which will be concatenated into one APDU.
		security [1] ANY OPTIONAL,	Mapping specific attribute. Reserved for future definition (e.g. digital signature).
		asdu [2] IMPLICIT SEQUENCE OF ASDU ... }	1 to <i>n</i> number of ASDUs as specified before.
		ASDU ::= SEQUENCE {	
MsvID	VisString129	svID [0] IMPLICIT VisibleString, https://standards.iteh.ai/catalog/standards/sist/668739dc-2aaf-4743-903088ad133c6/iec-61850-9-2-2011-amd1-2020	Should be a system-wide unique identification. It is strongly recommended to use a four bytes hexadecimal representation of APPID value as this system-wide unique identification
DatSet	ObjectReference	dataset [1] IMPLICIT VisibleString OPTIONAL,	Value from the MSVCB If MsvID allows to have a unique identification of the stream over the subnetwork, it is not recommended to include this field
SmpCnt	INT16U	smpCnt [2] IMPLICIT OCTET STRING (SIZE(2)),	Will be incremented each time a new sampled value is taken. The domain shall define how the counter shall be used. For instance, IEC 61869-9 defines it for time alignment: the counter shall be set to zero when the synchronization occurs. The OCTET STRING is interpreted as INT16U as defined in Table 15. Rollover may occur.
ConfRev	INT32U	confRev [3] IMPLICIT OCTET STRING (SIZE(4)),	Value from the MSVCB. The OCTET STRING is interpreted as INT32U as defined in Table 15.
RefrTm	Timestamp	refrTm [4] IMPLICIT UtcTime OPTIONAL,	Time when the transmission buffer has been refreshed locally. This is the time of the physical event corresponding to the SV transmitted in this ASDU
SmpSynch	INT8U	smpSynch [5] IMPLICIT OCTET STRING (SIZE(1)),	Refer to Synchronization clause for details

Abstract buffer format according to IEC 61850-7-2		Coding in IEC 61850-9-2	Comments
SmpRate	INT16U	smpRate [6] IMPLICIT OCTET STRING (SIZE(2)) OPTIONAL,	Value from the MSVCB. The OCTET STRING is interpreted as INT16U as defined in Table 15.
Sample [1..n]	Type depends on the CDC defined in IEC 61850-7-3.	sample [7] IMPLICIT OCTET STRING (SIZE(n)),	List of data values related to the data set definition. For the encoding of the Data, the rules for the encoding of the basic data types shall apply as defined in 8.6. Only FCDA of Basic Type are allowed to be members of the data set. The SIZE (<i>n</i>) is the cumulated size of all the data conveyed as defined in the DataSet.
SmpMod	INT16U	smpMod [8] IMPLICIT OCTET STRING (SIZE(2)) OPTIONAL ,	Value from the MSVCB. The OCTET STRING is interpreted as INT16U as defined in Table 15.
SynchSrcID	Ident8	gmIdentity [9] IMPLICIT OCTET STRING (SIZE(8)) OPTIONAL ... }	Refer to Synchronization clause for details
<p>NOTE The usage of the OptFlds attribute according to IEC 61850-7-2 is not necessary, because the relating attributes RefrTm, security, SmpRate, SmpMod, SynchSrcID and DataSet will be signed as optional via the ASN.1 attribute directly.</p>			

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END

8.6 Definitions for basic data types – Presentation layer functionality

Replace the existing text of Subclause 8.6 with the following new text:

Table 15 shows the encoding for the basic data types used for the data values referenced by the data set members.

As an exception of the BITSTRING encoding shown in Table 15, for backward compatibility with existing implementations of the standard, Table 21 defines a specific mapping for IEC 61850-7-2 quality.

Table 15 – Encoding for the basic data types

Data types according to IEC 61850-7-2	Encoding in data set	Comments
BOOLEAN	8-bit set to 0 FALSE; anything else = TRUE	
INT8	8-bit big-endian	Signed
INT16	16-bit big-endian	Signed
INT32	32-bit big-endian	Signed
INT64	64-bit big-endian	Signed
INT8U	8-bit big-endian	Unsigned
INT16U	16-bit big-endian	Unsigned
INT32U	32-bit big-endian	Unsigned
FLOAT32	32-bit IEEE Floating Point (IEEE 754)	
ENUMERATED	32-bit big-endian	Signed
CODED ENUM	32-bit big-endian	
OCTET STRING	20 -byte ASCII text, null terminated	
VISIBLE STRING	35 -byte ASCII text, null terminated	
UNICODE STRING	20 -byte, null terminated	
ObjectName	20 -byte ASCII text, null terminated	
ObjectReference	20 -byte ASCII text, null terminated	
Timestamp	64-bit timestamp as defined in IEC 61850-8-1	
EntryTime	48-bit timestamp as defined in IEC 61850-8-1	
EntryID	8 bytes	
Currency	4-byte ASCII text, null terminated (ISO 4217)	
Data types according to IEC 61850-8-1	Encoding in data set	Comments
BITSTRING	32-bit – Bit 0 shall be the leftmost (most significant) bit of the first transmitted octet. Bit 7 shall be the rightmost (least significant) bit of the first transmitted octet. Bit 8 shall be the leftmost (most significant) bit of the second octet. Bit 15 shall be the rightmost (least significant) bit of the second octet. This shall be continued in that way in further octets.	

Table 21 – Mapping for IEC 61850-7-2 quality

Bit number	IEC 61850-7-2		Bit-String	
	Attribute name	Attribute value	Value	Default
31-30	Validity	Good	0 0	0 0
		Invalid	0 1	
		Invalid ¹	1 0	
		Questionable	1 1	
29	Overflow		TRUE	FALSE
28	OutofRange		TRUE	FALSE
27	BadReference		TRUE	FALSE
26	Oscillatory		TRUE	FALSE
25	Failure		TRUE	FALSE
24	OldData		TRUE	FALSE
23	Inconsistent		TRUE	FALSE
22	Inaccurate		TRUE	FALSE
21	Source	Process	0	0
		Substituted	1	
20	Test		TRUE	FALSE
19	OperatorBlocked		TRUE	FALSE

¹ The reserved value has been redefined to "invalid" for backward compatibility.

A value quality with a validity = Invalid, Failure = TRUE and Test = TRUE corresponds to a 0x0842.

Add the following new Clause 9 and renumber subsequent clauses accordingly:

9 Synchronization

When several sampled values publishers are used by an application, they all shall be synchronized to a common time reference to have their sampling synchronized. Different methods exist to synchronize IEDs, such as using a 1PPS optical signal from a GPS clock, but the recommended one is using the Precision Time Protocol over Ethernet specified in IEC 61588:2009.

When IEC 61588:2009 synchronization protocol (PTP) is used to synchronize a sampled values publisher, all PTP compatible devices within the system shall comply with IEC/IEEE 61850-9-3.

A synchronized sampled values publisher shall fill SmpCnt, SmpSynch and optionally fields RefrTm and gmIdentity as specified in Table 14.

The required synchronization accuracy of SV during normal operation or in case of clock failure or repair, as well as the specific resetting event for SmpCnt, is out of scope for this standard; relevant standards such as IEC 61869-9 for digital instrument transformers apply.

A sampled values publisher shall fill the SmpSynch field of SV messages as follows:

-