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IEC TC 57 : POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE	
SECRETARIAT:	SECRETARY:
Germany	Mr Heiko Englert
OF INTEREST TO THE FOLLOWING COMMITTEES:	HORIZONTAL STANDARD: ☐

FUNCTIONS CONCERNED:			
☐ EMC	☐ ENVIRONMENT	☐ QUALITY ASSURANCE	☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING	☐ NOT 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 Final Draft International Standard (FDIS) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	

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TITLE:

Amendment 1 – Communication networks and systems for power utility automation – Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3

PROPOSED STABILITY DATE: 2022

NOTE FROM TC/SC OFFICERS:

The present FDIS reflects the amendment 1 to IEC 61850-9-2 ED2.0. TC57 WG 10 has also developed a so-called consolidated edition 2.1 based on the present amendment and the existing ED2.0.

The consolidated edition is circulated in parallel under reference as 57/2113/INF, so that national committees can see the implications of the amendment to the existing edition.

After the complete FDIS approval process the consolidated edition will be published together with the amendment 1 under reference IEC 61850-9-2 ED2.1

When developing their positions (votes and comments) on the present FDIS (amendment), IEC national committees are invited to review the associated INF (consolidated edition) document as well.

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/XX/FDIS	57/XX/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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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2 Normative references

Remove the following 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 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 following references:

IEC TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 62351-6[1], *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*

4   Abbreviations

Remove the following abbreviations:

CSMA/CD

ECT

EVT

GSSE

MAU

Add the following new abbreviation:

PTP   Precision Time Protocol, referring to IEC 61588:2009

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[1]   Under preparation. Stage at the time of publication: IEC/PRVC 62351-6:2019.

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.

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.

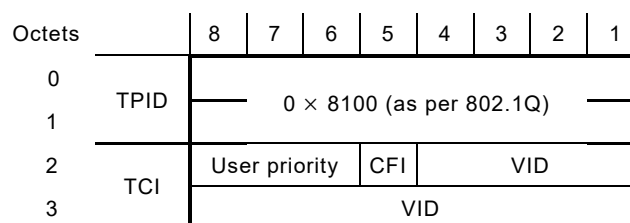See Figure 2 for the structure of the tag header.

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.

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	Condi-tion	Comments
MsvCBNam	Identifier	r	m		MMS Identifier of the structure of the MsvCBName within the MMS object named: LLN0$MV e.g. LLN0$MS$<MsvCBNam>
MsvCBRef	Visible-string	r	m		The value of this component shall contain the IEC Reference of the MsvCB. e.g. <MMSDomain>/LLN0MS<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
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.

MMS component name	MMS TypeDescription	r/w	m/o	Condi-tion	Comments
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 "GmIdentity". FALSE = attribute "GmIdentity" 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		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	Condi-tion	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 4 095.
APPID	Unsigned16	r	m		As defined in 5.3.3.

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

Table 20 – Mapping of OptFlds 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 GetMSVElementNumber	Mapped to Management service

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 84, 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 *n* number of ASDUs as specified before.
		ASDU::= **SEQUENCE {**	
MsvID	VisString129	svID [0] IMPLICIT VisibleString,	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	datset [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. If the counter is used as time alignment information for sampled values, the counter shall be set to zero when the synchronization event occurs (see clause 9). The OCTET STRING is interpreted as INT16U as defined in Table 15.
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
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.

Abstract buffer format according to IEC 61850-7-2		Coding in IEC 61850-9-2	Comments
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 (n) 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
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 DatSet will be signed as optional via the ASN.1 attribute directly.			

　　... }

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 sources are used within a system, 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 source, all PTP compatible devices within the system shall comply with IEC/IEEE 61850-9-3.

A synchronized sampled values source 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 merging units apply.

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

- SmpSynch = 2 (global synchronization):
  - when the device is using PTP and is synchronized to the required accuracy to a grandmaster clock having the time traceable flag set to TRUE with a published accuracy meeting the required accuracy for global synchronization
  - when the device is using former synchronization methods and is synchronized to the required accuracy to a global area time source such as a GPS clock meeting the required accuracy for global synchronization

- SmpSynch = 1 (local synchronization):
  - when the device is using PTP and is synchronized to the required accuracy to a grandmaster clock having the time traceable flag set to FALSE
  - when the device is using PTP and is synchronized to the required accuracy to a grandmaster clock having the time traceable flag set to TRUE but with a published accuracy not meeting the required accuracy for global synchronization
  - when the device is using former synchronization methods and is synchronized to the required accuracy to a local area time source, such as a GPS clock not receiving GPS signals

- SmpSynch = 0 (internally synchronized):
  - when the device is not or no longer externally synchronized.

- Other values are reserved and shall not be used for SmpSynch.

When PTP is used to synchronize a sampled values source, the use of the optional field gmIdentity is strongly recommended to indicate the identity of the grandmaster clock actually synchronizing the device. The value of gmIdentity shall be the network order of the bytes representing grandmasterIdentity according to 13.5 of IEC 61588:2009.

If SmpSynch = 0 or when PTP is not used to synchronize a sampled values source, the information in the gmIdentity field is irrelevant and not defined.

NOTE Any means to identify a local area clock other than PTP has been deprecated, refer to C.3.4 for compatibility issues.

10 Conformance

10.2 PICS

10.2.1 Profile conformance

Table 16 – PICS for A-Profile support

Replace existing Table 16 with the following new Table 16:

		Client		Server		Value/comment
		F/S		**F/S**		
A1	Security for SV service A-Profile	o		o		Refer to IEC 62351-6
A2	SV service A-Profile	c		c		Refer to 5.3
c: Shall be 'm' if support for service specified in Table 1 is declared within the ACSI basic conformance statement.						

Table 17 – PICS for T-Profile support

Replace existing Table 17 with the following new Table 17:

		Client		Server		Value/comment
		F/S		F/S		
T1	SV T-Profile	c		c		
c: Shall be 'm' if support for A2 is declared. Otherwise, it shall be 'i'.						

10.2.2 SV Services

Table 18 – SV conformance statement

Replace existing Table 18 with the following new Table 18:

Services	Client/ subscriber	Server/ publisher	Value/comment
Multicast			
SendMSVMessage	c1	c1	
GetMSVCBValues	c2	c2	
SetMSVCBValues	c3	c3	
GetMsvReference	o	o	
GetMSVElementNumber	o	o	
Unicast			
SendUSVMessage	c1	c1	deprecated
GetUSVCBValues	c2	c2	deprecated
SetUSVCBValues	c3	c3	deprecated
c1: Shall declare 'm' for at least one (MSV or USV) as declared within ACSI basic conformance statement.			
c2: Shall be 'o' as declared within ACSI basic conformance statement. See IEC 61850-8-1, Table 117 "Read Conformance Statement".			
c3: Shall be 'o' as declared within ACSI basic conformance statement. See IEC 61850-8-1, Table 118 "Write Conformance Statement".			

12   SCSM specific address element definitions

Table 19 – Definitions for SV SCL

Replace existing Table 19 with the following new Table 19:

P-type designation	Description	m/o	Restrictions/comments
MAC-Address	Media Access Address value	m	Shall be 6 groups of 2 visible characters separated by hyphens (-). Characters shall be limited to 0 to 9 and A to F.
APPID	Application Identifier	m	Shall be 4 characters. Characters shall be limited to 0 to 9 and A to F.
VLAN-PRIORITY	VLAN User Priority	m	Shall be a single character. Characters shall be limited to 0 to 7.
VLAN-ID	VLAN ID	m	Shall be 3 characters. Characters shall be limited to 0 to 9 and A to F.

Add the following new text after Table 19:

There shall be a scl.SMV element for each fully configured layer 2 scl.SampledValueControl within an SCD file, where it shall include the P elements specified in Table 19.

Implementations claiming conformance to this standard shall be able to be configured to use MAC-Address outside the recommended ranges specified in Annex B.

Annex A
(informative)

ISO/IEC/IEEE 8802-3 frame format and ASN.1 basic encoding rules

A.1   ISO/IEC/IEEE 8802-3 frame format

Replace existing Figures A.1, A.2 and A.3 with the following new figures:

Figure A.1 – ISO/IEC/IEEE 8802-3 frame format – No link redundancy

Octets		8	7	6	5	4	3	2	1		Notes

Octets			Notes
		Preamble	
		Start of frame	
0	Header MAC	Destination address	Refer to 5.3.3.2.
1			
2			
3			
4			
5			
6		Source address	
7			
8			
9			
10			
11			
12	Priority tagged	TPID (see Figure 2)	Refer to "Priority Tagging/VirtualLAN" section.
13			
14		TCI (see Figure 2)	
15			
16	Link redundancy header	HSR Tag	See IEC 62439-3 (HSR optional field).
17		0x892F	
18		Path – Size H	
19		Size L	
20		Sequence number H	
21		Sequence Number L	
22		Ethertype	Ethertype PDU
23			
24	Length Start	APPID	Refer to "Ethertype and Other Header Information" section.
25			
26		Length (m + 8)	
27			
28		Reserved 1 (see Figure 3)	
29			
30		Reserved 2	
31			
32		APDU (of length m)	
.			
m+32		Extension field (of length s)	See IEC 62351-6 (optional field)
m+32+s		(Pad octets if necessary)	
≤1523			
.		Frame check sequence	
.			
.			
≤1527			

Figure A.2 – ISO/IEC/IEEE 8802-3 frame format – Link redundancy: HSR

Octets		8 7 6 5 4 3 2 1		Notes
		Preamble		
		Start of frame		
0 1 2 3 4 5 6 7 8 9 10 11	Header MAC	Destination address Source address		Refer to 5.3.3.2.
12 13 14 15	Priority tagged	TPID (see Figure 2) TCI (see Figure 2)		Refer to "Priority Tagging/VirtualLAN" section.
16 17		Ethertype		
18 19	Length Start	APPID		Ethertype PDU Refer to "Ethertype and Other Header Information" section.
20 21		Length (m + 8)		
22 23		Reserved 1 (see Figure 3)		
24 25		Reserved 2		
26 .		APDU (of length m)		
m+26 .		Extension field (of length s)		See IEC 62351-6 (optional field)
m+26+ s ≤1517		(Pad octets if necessary)		
	Link redundancy trailer	Sequence number H Sequence Number L Path – Size H Size L 0x88 0xFB		See IEC 62439-3 (PRP optional field).
≤1523 . . . ≤1527		Frame check sequence		

Figure A.3 – ISO/IEC/IEEE 8802-3 frame format – Link redundancy: PRP

A.3   Example for an ASN.1 coded APDU frame structure

Replace existing Figure A.6 with the following new figure:

savPdu	60	L						
noASDU			80	L	4			
security			81	L				
Sequence of ASDU			A2	L				
					30	L		

ASDU 1:

svID	80	L	values
datset	81	L	values
smpCnt	82	L (2)	values
confRev	83	L (4)	values
refrTm	84	L	values
smpSynch	85	L (1)	values
smpRate	86	L (2)	values
Sequence of Data	87	L	

Data Set:
values
values
values
values
values
values
values

smpMod	88	L (2)	values
gmIdentity	89	L (8)	values

30	L	ASDU 2
30	L	ASDU 3
30	L	ASDU 4

ASN.1 Tag	L = Length

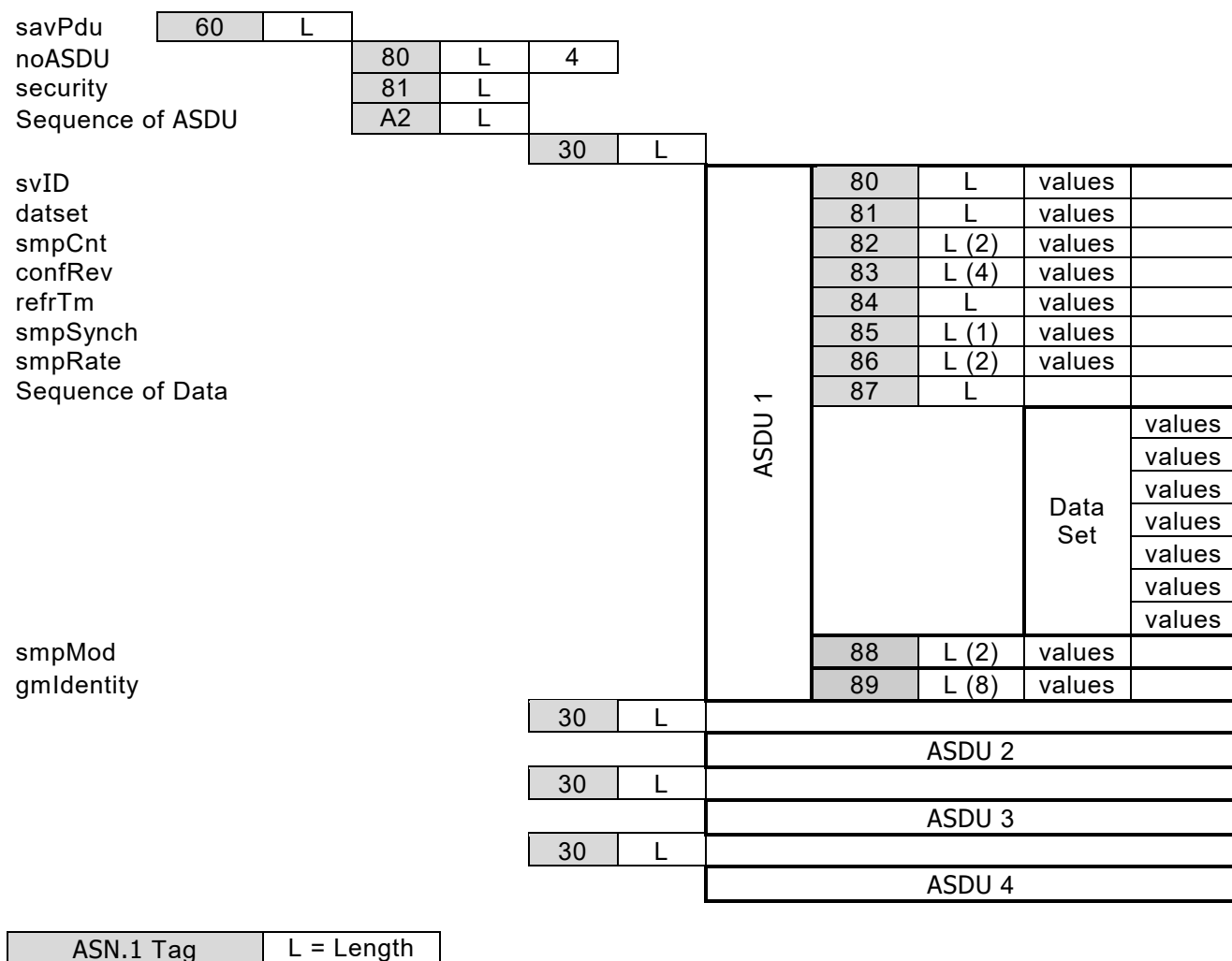**Figure A.6 – Example for an ASN.1 coded APDU frame structure**

Annex B
(informative)

Multicast address selection

Remove from the first paragraph of Annex B, the text GSSE.

Remove from the third paragraphe of Annex B the text 02 *for GSSE.*

Table B.1 – Recommended multicast addressing example

Replace existing Table B.1 with the following new Table B.1:

Service	Recommended address range assignments	
	Starting address (hexadecimal)	**Ending address (hexadecimal)**
GOOSE	01-0C-CD-01-00-00	01-0C-CD-01-01-FF
Multicast sampled values	01-0C-CD-04-00-00	01-0C-CD-04-01-FF

Add the following new Annex C:

Annex C
(normative)

Compatibility of the different revisions of this standard

C.1   General

IEC 61850-7-1:2011/AMD1:2019 standardizes in Annex K rules and associated behaviours following modification use cases to specify the expectation on implementations with regards to backward / forward compatibility of systems.

This annex explains changes related to this revision of IEC 61850-9-2 where one of the rules has to apply. It also defines special compatibility rules where needed.

Further background information can be found in IEC 61850-7-1.

C.2   Compatibility rules for IEC 61850-9-2

Use case 17: Extension of a PACKED LIST	
Edition	Use case 17: Extension of a PACKED LIST
Amendment 1 of Edition 2.0	SMVMessageOption.sample-mode, SMVMessageOption.synch-source-identity See IEC 61850-7-2:2010/AMD1:2019

Use case 35: Removing / Deprecating Control Block Class	
Edition	Use case 35a: Deprecate a control block class
Amendment 1 of Edition 2.0	USVCB See IEC 61850-7-2:2010/AMD1:2019

C.3   Other modifications to consider for backward / forward compatibility

C.3.1   Deferral of Physical Layer specification

This revision of IEC 61850-9-2 removes former specification of physical layer (100 BASE FX and ST connectors) and refers now to IEC/TR 61850-90-4.

C.3.2   Adding new optional fields in frame

This revision of IEC 61850-9-2 introduces the new optional field gmIdentity in SV telegrams.

C.3.3   Adding time synchronization specifications

This revision of IEC 61850-9-2 adds references to IEC 61588:2009 and IEC/IEEE 61850-9-3 for SV synchronization.

C.3.4   Removal of field values

This revision of IEC 61850-9-2 removes local area clock identification (values greater than 2) in SmpSynch field.

SV publishers compliant with this version of the standard shall not use values greater than 2 in the SmpSynch field, nevertheless SV subscribers may receive SV telegrams with SmpSynch values from 5 to 254 from SV publishers compliant with IEC 61850-9-2:2011. In such a case SV telegrams can be accepted and shall be considered as locally synchronized as defined for SmpSynch = 1.

C.3.5   Changing attribute values

This revision of IEC 61850-9-2 modifies the mapping of quality for backward compatibility with existing servers. "Reserved" value shall now be interpreted by clients as "Invalid".

Servers compliant with the current document shall not use the formerly "Reserved" value.

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