

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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

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/CEI 8802-3



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS  
FOR POWER UTILITY AUTOMATION –**

**Part 9-2: Specific communication service mapping (SCSM) –  
Sampled values over ISO/IEC 8802-3**

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FDIS	Report on voting
57/1133/FDIS	57/1161/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 second edition cancels and replaces the first edition published in 2004 and constitutes a technical revision.

Main changes with respect to the first edition are:

- addition of an optional Link redundancy layer (Tables 3 to 6);
- redefinition of “reserved” fields in link layer (5.3.3.4);
- evolution of USVCB and MSVCB components (Tables 9, 10, 12);
- evolution of encoding for the transmission of the sampled value buffer (Table 14).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the 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

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## INTRODUCTION

This part of IEC 61850 defines the SCSM for sampled values over ISO/IEC 8802-3. The intent of this SCSM definition is to include the complete mapping of the sampled value model.

This part of IEC 61850 applies to electronic current and voltage transformers (ECT and EVT having a digital output), merging units, and intelligent electronic devices, for example protection units, bay controllers and meters, or sensors.

Process bus communication structures can be arranged in different ways as described in IEC/TR 61850-1. In addition to the transmission of sampled value data sets, which are directly connected to ISO/IEC 8802-3, a selection of IEC 61850-8-1 services is necessary to support the access to the SV control block. References to the relevant IEC 61850-8-1 services are provided in this SCSM. For less complex devices (for example merging units), the sampled value control block can be pre-configured, in which case there is no need to implement IEC 61850-8-1 services based on the MMS-Stack.

This document defines the mapping of sampled value class model (IEC 61850-7-2) to ISO/IEC 8802-3. This SCSM, in combination with IEC 61850-7 and IEC 61850-6, allows interoperability between devices from different manufacturers.

This standard does not specify individual implementations or products, nor does it constrain the implementation of entities and interfaces within a computer system. This standard specifies the externally visible functionality of implementations together with conformance requirements for such functionalities.

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Reading guide:

- This document is an extended mapping specification of IEC 61850-8-1 to cover sampled value transmission over ISO/IEC 8802-3.
- This document can best be understood if the reader is thoroughly familiar with IEC 61850-7-1, IEC 61850-7-2, IEC 61850-7-3 and IEC 61850-7-4.
- The ACSI services defined in IEC 61850-7-2 are not explained in this part of IEC 61850.



## COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

### Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3

#### 1 Scope

This part of IEC 61850 defines the specific communication service mapping (SCSM) for the transmission of sampled values according to the abstract specification in IEC 61850-7-2. The mapping is that of the abstract model on a mixed stack using direct access to an ISO/IEC 8802-3 link for the transmission of the samples in combination with IEC 61850-8-1.

Each SCSM consists of three parts:

- a specification of the communication stack being used,
- the mapping of the abstract specifications of IEC 61850-7 series on the real elements of the stack being used, and
- the implementation specification of functionality, which is not covered by the stack being used.

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#### 2 Normative references

[IEC 61850-9-2:2011](#)

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 60874-10-1, *Connectors for optical fibres and cables – Part 10-1: Detail specification for fibre optic connector type BFOC/2,5 terminated to multimode fibre type A1* (withdrawn)

IEC 60874-10-2, *Connectors for optical fibres and cables – Part 10-2: Detail specification for fibre optic connector type BFOC/2,5 terminated to single-mode fibre type B1* (withdrawn)

IEC 60874-10-3, *Connectors for optical fibres and cables – Part 10-3: Detail specification for fibre optic adaptor type BFOC/2,5 for single and multimode fibre* (withdrawn)

IEC/TR 61850-1, *Communication networks and systems for power utility automation – Part 1: Introduction and overview*

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

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, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Part 7-1: Principles and models*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

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

IEC 62439-3:2010, *Industrial communication networks – High availability automation networks – Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) Amendment 1<sup>1</sup>*

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 8326:1996, *Information technology – Open Systems Interconnection – Session service definition*

ISO/IEC 8327-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented session protocols: Protocol specification*

ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the Associated Control Service Element*

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ISO/IEC 8650-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented protocol for the Association Control Service Element: Protocol specification*

ISO/IEC 8802-3:2000, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8823-1:1994, *Information technology – Open Systems Interconnection – Connection-oriented presentation protocol: Protocol specification*

ISO/IEC 8824-1:2008, *Information technology – Abstract Syntax Notation One (ASN. 1): Specification of basic notation*

ISO/IEC 8825-1, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO 9506-1:2003, *Industrial automation systems – Manufacturing Message Specification – Part 1: Service definition*

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<sup>1</sup> To be published.

ISO 9506-2:2003, *Industrial automation systems – Manufacturing Message Specification – Part 2: Protocol specification*

IEEE 754:1985, *IEEE Standard for Binary Floating-Point Arithmetic*

IEEE 802.1Q:1998, *IEEE Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks*

RFC 791, *Internet Protocol*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

RFC 792, *Internet Control Message Protocol*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

RFC 793, *Transmission Control Procedure*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

RFC 826, *Ethernet Address Resolution Protocol or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

RFC 894, *A Standard for the Transmission of IP Datagrams over Ethernet Networks*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

RFC 919, *Broadcasting Internet Datagrams*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

RFC 1006 *ISO transport services on top of TCP: Version 3*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18] <https://standards.iteh.ai/catalog/standards/sist/db4e9c6a-2e3d-44a1-8ef0-81c22f5651bb/iec-61850-9-2-2011>

RFC 1112, *Host Extensions for IP multicasting*; IETF, available at <http://www.ietf.org> [cited on 2011-03-18]

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC/TS 61850-2 apply.

### 4 Abbreviations

ACSI	Abstract communication service interface
ASDU	Application service data unit
ASN.1	Abstract syntax notation number one
APCI	Application protocol control information
APDU	Application protocol data unit
APPID	Application identifier
AUI	Attachment unit interface
BER	ASN.1 basic encoding rules
BS	Bitstring
c	Conditional support. The item shall be implemented if the stated condition exists
CFI	Canonical format identifier

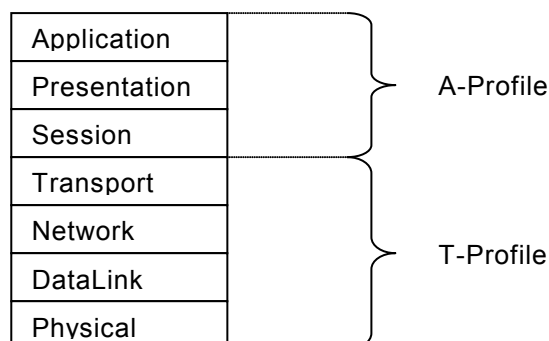
CSMA/CD	Carrier sense multiple access/collision detection
DF	Data frame
DO	Data object
ECT	Electronic current transformer
EVT	Electronic voltage transformer
F/S	Functional standard
GOOSE	Generic object oriented substation event
GSSE	Generic substation status event
i	Out-of-scope: The implementation of the item is not within the scope of this standard
ICD	IED configuration description
IED	Intelligent electronic device
LSDU	Link layer service data unit
m	Mandatory support. The item shall be implemented
MAC	Media access control
MAU	Medium attachment unit
MMS	Manufacturing message specification (ISO 9506)
MSVCB	Multicast sampled value control block
MU	Merging unit
o	Optional support. The implementor may decide to implement the item
PDU	Protocol data unit
PICS	Protocol implementation conformance statement
SCSM	Specific communication services mapping
r	readable
SV	Sampled value
TCI	Tag control information
TPID	Tag protocol identifier
USVCB	Unicast sampled value control block
VID	VLAN identifier
VLAN	Virtual local area network
VMD	Virtual manufacturing device
w	Writeable
x	Excluded: The implementor shall not implement this item
XML	Extensible markup language

## 5 Communication stack

### 5.1 Overview of the protocol usage

The OSI reference model (ISO/IEC 7498-1) defines a model based upon the concept of layering of communication functions. The model includes 7 layers and specifies the functional requirements for each layer to achieve a robust communication system. The model does not

specify the protocols to be used to achieve the functionality, nor does it restrict the solution to a single set of protocols.



IEC 1786/11

**Figure 1 – OSI reference model and profiles**

The use of ISO application (A-Profile) and transport (T-Profile) profiles (see Figure 1) describes the various stack profiles. An ISO A-Profile is the set of specifications and agreements relating to the upper three (3) layers of the ISO OSI reference model (for example the application, presentation, and session layers). An ISO T-Profile is the set of specifications and agreements relating to the lower four (4) layers of the ISO OSI reference model (for example the transport, network, datalink and physical layers).

Two combinations of A-Profiles and T-Profiles are defined in order to support the transmission of sampled values including the access to the associated SV control block, as specified in IEC 61850-7-2. The two different combinations are used for:

- client/server services based on MMS in accordance to IEC 61850-8-1;
- SV services based on datalink layer.

## 5.2 Client/server services and communication profiles

### 5.2.1 Client/server services

This client/server communication profile shall be used in addition to the SV communication profile according to 5.3 if an access to the sampled value control block via client is required. This profile shall be used for any implementation claiming conformance to this standard and declaring support for one of the following IEC 61850-7-2 services in Table 1.

**Table 1 – Service requiring client/server communication profile**

IEC 61850-7-2 model	IEC 61850-7-2 service
Server	GetServerDirectory
Association	Associate
	Abort
	Release
Logical device	GetLogicalDeviceDirectory
Logical node	GetLogicalNodeDirectory
	GetAllDataValues
Data	GetDataValues
	SetDataValues
	GetDataDirectory
	GetDataDefinition
Data set	GetDataSetValues
	SetDataSetValues
	CreateDataSet
	DeleteDataSet
SV class model	GetDataSetDirectory
	GetMSVCBValues
	SetMSVCBValues
	GetUSVCBValues
	SetUSVCBValues

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**5.2.2 A-Profile**

Table 2 shows services and protocols of the A-Profile client/server.

**Table 2 – Service and protocols for client/server communication A-Profile**

OSI model layer	Specification			m/o
	Name	Service specification	Protocol specification	
Application	Manufacturing message specification	ISO 9506-1:2000	ISO 9506-2:2000	m
	Association control service element	ISO/IEC 8649:1996	ISO/IEC 8650-1:1996	m
Presentation	Connection oriented presentation	ISO/IEC 8822:1994	ISO/IEC 8823-1:1994	m
	Abstract syntax	ISO/IEC 8824-1:2008	ISO/IEC 8825-1	m
Session	Connection oriented session	ISO/IEC 8326:1996	ISO/IEC 8327-1:1996	m

There is only one T-Profile (TCP/IP) that may be used by the client/server A-Profile.

### 5.2.3 TCP/IP T-Profile

Table 3 shows services and protocols of the TCP/IP T-Profile client/server.

**Table 3 – Service and protocols for peer TCP/IP T-Profile**

OSI model layer	Specification			m/o
	Name	Service specification	Protocol specification	
Transport	ISO transport on top of TCP	RFC 1006		m
	Internet control message protocol (ICMP)	RFC 792		m
	Transmission control protocol (TCP)	RFC 793		m
Network	Internet protocol	RFC 791		
	Converting network protocol address	RFC 826 (Address resolution protocol: ARP)		m
	Broadcasting internet datagrams	RFC 919		m
	Host extensions for IP multicasting	RFC 1112		m
Link Redundancy	Parallel redundancy protocol and high availability seamless ring	IEC 62439-3, Amendment 1		o
DataLink	Standard for the transmission of IP datagrams over Ethernet networks	RFC 894		m
	Carrier sense multiple access with collision detection (CSMA/CD)	ISO/IEC 8802-3:2000		m
Physical	Fibre optic transmission system 100Base-FX	ISO/IEC 8802-3:2000		c1
	Basic optical fibre connector NOTE This is the specification for the ST connector	IEC 60874-10-1, IEC 60874-10-2 and IEC 60874-10-3		c1
c1 – Recommended, but future technology could be used. -61850-9-2-2011				

## 5.3 SV service and communication profile

### 5.3.1 SV mapping overview

This SV communication profile shall be used for any implementation claiming conformance to this standard and declaring support for one of the following IEC 61850-7-2 services in Table 4.

**Table 4 – Service requiring SV communication profile**

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