SLOVENSKI STANDARD
oSIST prEN IEC 62439-3:2020
01-maj-2020

Industrijska komunikacijska omrežja - Avtomatizacija omrežja z visoko razpoložljivostjo - 3. del: Protokol vzporedne redundance (PRP) in brezprehodna zanka z visoko razpoložljivostjo (HSR)

Industrial communication networks - High availability automation networks - Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 3: Parallelredundanz-Protokoll (PRP) und nahtloser Hochverfügbarkeits-Ring (HSR)

Réseaux de communication industriels Réseaux d'automatisme à haute disponibilité Partie 3: Protocole de redondance en parallèle (PRP) et redondance transparente de haute disponibilité (HSR)

Ta slovenski standard je istoveten z: prEN IEC 62439-3:2020

ICS:

25.040.01	Sistemi za avtomatizacijo v industriji na splošno	Industrial automation systems in general
35.110	Omreževanje	Networking

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65C/998/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 62439-3 ED4**	
DATE OF CIRCULATION: **2020-03-06**	CLOSING DATE FOR VOTING: **2020-05-29**
SUPERSEDES DOCUMENTS: **65C/958/CD,65C/972/CC**	

IEC SC 65C : INDUSTRIAL NETWORKS	
SECRETARIAT: France	SECRETARY: Ms Valérie DEMASSIEUX
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 22G,TC 57	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
☒ 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 Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Industrial communication networks - High availability automation networks - Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

NC comments will be addressed during the SC65C/WG15 meeting scheduled on June 8th-10h, 2020 in Baden (Switzerland). Corresponding meeting notice will be provided in due time by the convenor.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL COMMUNICATION NETWORKS – HIGH AVAILABILITY AUTOMATION NETWORKS –

Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)

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International Standard IEC 62439-3 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This fourth edition cancels and replaces the third edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- technical corrections;
- extension of HSR specifications (RSTP over HSR);
- alignment of the precision time protocol industry profile with IEC/IEEE 61850-9-3;
- consideration of IEEE 1588-2019 in PTP over PRP/HSR
- conformance testing

The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

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

This International Standard is to be read in conjunction with IEC 62439-1.

A list of all parts in the IEC 62439 series, published under the general title *Industrial communication networks – High availability automation networks*, can be found on the IEC website.

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

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

The National Committees are requested to note that for this document the stability date is 2025.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

0.1 General

IEC 62439-3 belongs to the IEC 62439 series *"Industrial communication networks – High availability automation networks"*. It was developed jointly with IEC TC57 WG10 as the redundancy method for demanding substation automation networks operating on layer 2 networks, according to IEC 61850-8-1 and IEC 61850-9-3 and extended to encompass the needs of the Open DeviceNet Vendor Association (ODVA).

It specifies two related redundancy protocols that in case of failure of any network element provide seamless switchover with zero recovery time:

- PRP (Parallel Redundancy Protocol), which allows attaching nodes to two separate networks while allowing attachment of nodes to one network only; and
- HSR (High-availability Seamless Redundancy), which allows threading two-port nodes in a ring or multi-port nodes in a meshed network.

The seamless redundancy principle has been applied to clocks operating according to the Precision Time Protocol (IEC 61588, tutorial in Annex D) attached to redundant networks (Annex A).

A PTP Industry profile (PIP) specifies the performance needed to achieve sub-microsecond time accuracy. This profile can be applied to any industrial communication network based on Ethernet. Two variants of PIP are specified in Annex C:

- L3E2E (Layer 3, End-to-End) for clocks operating on layer 3 networks with end-to-end path delay measurement such as EtherNet/IP™; and
- L2P2P (Layer 2, Peer-to-Peer) for clocks operating on layer 2 with peer-to-peer link delay measurement (P2P). L2P2P has been adopted by IEC TC57 WG10 and the IEEE PSRC as the Power Utility Profile (PUP) and copied to IEC/IEEE 61850-9-3. The involved standard organisations agreed to keep the contents of the two documents aligned.

0.2 Changes with respect to the previous edition

The major changes with respect to IEC 62439-3:2016 are:

- Terms and abbreviations have been aligned with IEC/IEEE 61850-9-3;
- The PRP+HSR network management MIB is now a "code component" available as machine-readable separate document, errors were corrected;
- The PRP sequence number is only incremented for frames with PRP trailer;
- Support of RSTP in HSR is specified;
- Exclusion of future IEEE 802.1 source address rule for HSR;
- Annex A (PTP operation over PRP/HSR) has been aligned with IEC/IEEE 61850-9-3;
- Annex C (PTP profile) has been aligned with IEC/IEEE 61850-9-3 and extended by:
  - Padding of Sync messages for media converters
  - Change in ClockClass definition (back in line with IEC 61588)
  - Support of any time domain in TCs (ensures backward compatibility)
  - Behaviour of BCs in holdover and recovery
  - Clarification on timeTraceable
  - Clarification on currentUtcOffsetValid
  - Recommendation on handling of UTC leap seconds
  - Recommendation for handling the ALTERNATE_TIME_OFFSET_INDICATOR;
- Annex D (Tutorial) has been extended to explain the media converter issue;

- Annex E (PIP network management MIB) is now a “code component” available as machine-readable separate document, errors were corrected.
- Annex F (conformance testing for PRP and HSR) has been added.

0.3 Patent declaration

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning filtering of redundant frames in a network node (Siemens Aktiengesellschaft – EP 2127329, US 8184650, CN 101611615B) given in 5.2.3.3.

IEC takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured the IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from:

Siemens Aktiengesellschaft
Oto-Hahn-Ring 6
81379 Munich, Germany

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning Reception of redundant and non-redundant frames (ABB Research Ltd – EP 1825657, US 8582426, CN 101057483, IN 254425) given in 4.2.7, concerning Identifying improper cabling of devices (ABB Technology AG – EP 2163024, US 8344736, CN 101689985) given in 4.3,
concerning Critical device with increased availability (ABB Research Ltd – EP 2090950) given in 4.4,
concerning Ring coupling nodes for high availability networks (ABB Research Ltd – US 8582424, EP 2327185, CN 102106121) given in 5.2.3 and
concerning WO 2012/010619 A1 1 (Frame transmission and communication network, applicable to 5.3.7).

IEC takes no position concerning the evidence, validity and scope of these patent rights.

The holder of these patent rights has assured the IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of these patent rights is registered with IEC. Information may be obtained from:

ABB Schweiz AG
Intellectual Property CH-IP (CH-150016-L)
Brown Boveri Strasse 6
CH-5400 Baden, Switzerland
ch-ip.patent@abb.com

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ISO (www.iso.org/patents) and IEC (http://patents.iec.ch) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

INDUSTRIAL COMMUNICATION NETWORKS – HIGH AVAILABILITY AUTOMATION NETWORKS –

Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)

1 Scope

The IEC 62439 series is applicable to high-availability automation networks based on the Ethernet technology.

This part of IEC 62439 specifies two related redundancy protocols designed to provide seamless recovery in case of single failure of an inter-bridge link or bridge in the network, which are based on the same scheme: parallel transmission of duplicated information.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-191, *International Electrotechnical Vocabulary – Chapter 191: Dependability and quality of service*

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

IEC TR 61850-90-4:2020, *Communication networks and systems for power utility automation – Part 90-4: Network engineering guidelines*[1]

IEC 62439-1:2020, *Industrial communication networks – High availability automation networks – Part 1: General concepts and calculation methods*[2]

IEC/IEEE 61850-9-3:2016, *Communication networks and systems for power utility automation - Part 9-3: Precision time protocol profile for power utility automation*

ISO/IEC/IEEE 8802-3:2014, *Standard for Ethernet*

IEEE 802.1D-2004, *IEEE Standard for Local and metropolitan area networks – Media Access Control (MAC) Bridges*

IEEE 802.1AB-2019, *IEEE Standard for Local and metropolitan area networks – Link Layer Discovery Protocol*

IEEE 802.1Q-2014, *IEEE Standard for Local and metropolitan area networks – Media Access Control (MAC) Bridges and Virtual Bridge Local Area Network*

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[1] Edition 2 to be published

[2] Edition 3 to be published

IEEE 1588-2019 *Precision Clock Synchronization Protocol for Networked Measurement and Control Systems*[3]

Note to IETF entries: IETF references are dated with the original Request for Comment (RFC). Subsequent versions receive a new RFC number. Since IETF amends or extends documents and publishes errata on-line, the valid version can be found on the internet at *https://tools.ietf.org/*.

IETF RFC 768, *User Datagram Protocol (UDP)*

IETF RFC 791, *Internet Protocol (IP)*

IETF RFC 792, *Internet Control Message Protocol (ICMP)*

IETF RFC 793, *Transmission Control Protocol (TCP)*

IETF RFC 826, *Address Resolution Protocol (ARP)*

IETF RFC 2578, *Structure of Management Information Version 2 (SMIv2)*

IETF RFC 3418, *Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)*

3 Terms, definitions, abbreviations, acronyms, and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in definitions given in IEC 60050-191 and in IEC 62439-1, and the following 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

3.1.1
device time inaccuracy
time inaccuracy evaluated or measured between the time signal applied to the input of a device and the time signal that this device generates

Note 1 to entry: This definition applies to TCs, BCs and media converters.

Note 2 to entry: Device time inaccuracy includes the uncertainty in the computation of the peer delay from an upstream peer clock, assuming that the peer responds with an ideal Pdelay_Resp message to the Pdelay_Req message, and the uncertainty introduced in the Pdelay_Resp to an ideal Pdelay_Req from a downstream peer.

3.1.2
frame
the layer 2 protocol data unit from the preamble to the frame check sequence

3.1.3
grandmaster-capable
ordinary clock or boundary clock that is able to take the role of a grandmaster

Note 1 to entry: A grandmaster-capable clock is not necessarily connected to a recognized time source.

[3] Approved 2019. to be published