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Irish Standard I.S. EN 62439-3:2012

Industrial communication networks -High availability automation networks -- Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) (IEC 62439-3:2012 (EQV))

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# EUROPEAN STANDARD

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# NORME EUROPÉENNE EUROPÄISCHE NORM

September 2012

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English version

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

(IEC 62439-3:2012)

Réseaux industriels de communication -Réseaux d'automatisme à haute disponibilité -Partie 3 : Protocole de redondance parallèle (PRP) et redondance transparente de haute disponibilité (HSR) (CEI 62439-3:2012) Industrielle Kommunikationsnetze -Hochverfügbare Automatisierungsnetze -Teil 3: Parallelredundanz-Protokoll (PRP) und nahtloser Hochverfügbarkeits-Ring (HSR) (IEC 62439-3:2012)

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EN 62439-3:2012

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# Foreword

The text of document 65C/687/FDIS, future edition 2 of IEC 62439-3, prepared by SC 65C, "Industrial networks", of IEC TC 65, "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62439-3:2012.

The following dates are fixed:

•	latest date by which the document has to be implemented at national level by publication of an identical national	(dop)	2013-05-09
•	latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-08-09

This document supersedes EN 62439-3:2010.

EN 62439-3:2012 includes the following significant technical changes with respect to EN 62439-3:2010:

- specification of the interconnection of PRP and HSR networks;
- introduction of a suffix for PRP frames;
- clarification and modification of specifications to ensure interoperability;
- slackening of the specifications to allow different implementations;
- consideration of clock synchronization according to IEC 61588;
- introduction of test modes to simplify testing and maintenance.

This standard is to be used in conjunction with EN 62439-1:2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

## **Endorsement notice**

The text of the International Standard IEC 62439-3:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61580 series NOTE Harmonized in EN 61580 series (not modified).

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EN 62439-3:2012

# Annex ZA

# (normative)

# Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	<u>Title</u>	<u>EN/HD</u>	Year
IEC 60050-191	-	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-
IEC 61588	-	Precision clock synchronization protocol for networked measurement and control systems	-	-
IEC 62439-1	-	Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods	EN 62439-1	-
IEC 62439-2	-	Industrial communication networks - High availability automation networks - Part 2: Media Redundancy Protocol (MRP)	EN 62439-2	-
IEC 62439-6	-	Industrial communication networks - High availability automation networks - Part 6: Distributed Redundancy Protocol (DRP)	EN 62439-6	-
IEC 62439-7	-	Industrial communication networks - High availability automation networks - Part 7: Ring-based Redundancy Protocol (RRP)	EN 62439-7	-
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	-	-
IEEE 802.1D	2004	IEEE Standard for Local and Metropolitan Area Networks - Media Access Control (MAC) Bridges	-	-
IEEE 802.1Q	2011	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks	-	-

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#### INTERNATIONAL ELECTROTECHNICAL COMMISSION

# INDUSTRIAL COMMUNICATION NETWORKS – HIGH AVAILABILITY AUTOMATION NETWORKS –

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

# FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committee; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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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 second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision. The main changes with respect to the previous edition are listed below:

- specification of the interconnection of PRP and HSR networks;
- introduction of a suffix for PRP frames;
- clarification and modification of specifications to ensure interoperability;
- slackening of the specifications to allow different implementations;
- consideration of clock synchronization according to IEC 61588;
- introduction of test modes to simplify testing and maintenance.

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

FDIS	Report on voting
65C/687/FDIS	65C/705/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 International Standard is to be read in conjunction with IEC 62439-1:2011.

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

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

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

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

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# 0 INTRODUCTION

## 0.1 General

IEC 62439-3 standard belongs to IEC 62439 series, *Industrial communication networks – High availability automation networks*, specifying the HSR and PRP redundancy protocols, and was adopted by TC57 WG10 as the redundancy method for demanding substation automation networks based on IEC 61850 series, introducing new requirements.

#### 0.2 Changes with respect to the previous edition

The major changes with respect to IEC 62439-3:2010 are listed below.

Aligning the sequence number between PRP and HSR, to enable coupling of HSR and PRP networks and simplify the implementation of dual-mode nodes in hardware. At the same time, introduce a suffix in the PRP Redundancy Control Trailer to allow better identification, future extensions and coexistence with other protocols that also happen to use a trailer. This change is not backwards-compatible, so means are provided to identify the version and ensure that the networks are homogeneous.

Removing all implementation restrictions on the Duplicate Discard algorithm (especially references to the drop window algorithm and references to connection orientation) since other methods such as hash tables can be used.

Removing the purging of the duplicate table. Replace this specific method by requiring that any Duplicate Discard algorithm provides a mechanism to remove old entries, thus ensuring that a node can properly reboot.

Making node tables optional for simple nodes to simplify hardware implementation.

Suppression of explicit mention of the HSR-PRP mode (PRP with HSR Tags), but allow it through the Mode N (no forwarding).

Introducing Mode T (forward through) to allow maintenance laptops to configure an open ring when attached to one end and Mode M (mixed) to allow forwarding of non-HSR-tagged frames in a closed ring.

Recommending the position of connectors, rather than impose it.

Defining the behaviour of an HSR node when non-HSR frames are encountered without requiring the recording of the source addresses and specify how IEEE 802.1D:2004, Table 7-10 frames are treated.

Prefixing the supervision frames on HSR by an HSR tag to simplify the hardware implementation and introduce a unique EtherType for HSR to simplify processing.

Changing the rule for the RedBox to allow more than one PRP network to be connected to an HSR ring, and introduce an identifier per RedBox pair.

Specifying tagging of IEC 61588 frames to follow IEEE C37.238 recommendations (informal).

Suppressing MAC address substitution.

Adapting the MIB to above changes.

#### 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 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

#### 80333 München, 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 a patent concerning Reception of redundant and non-redundant frames (ABB Schweiz AG – WO 2006/053459 A1, EP 1825657, US 20070223533, CN 101057483) given in 4.2.7, concerning Identifying improper cabling of devices (ABB Schweiz AG – EP 2 015 501 A1) given in 4.3, concerning Critical device with increased availability (ABB Schweiz AG – EP 2 090 950 A1) given in 4.4, concerning Ring coupling nodes for high availability networks (ABB Schweiz AG – WO 2010/010120 A1) given in 5.2.3.

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

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Brown Boveri Strasse 6

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# 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 ISO/IEC 8802-3 (Ethernet) technology.

This part of the IEC 62439 series specifies two 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: duplication of the LAN, resp. duplication of the transmitted information.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable 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 60050-191, International Electrotechnical Vocabulary – Chapter 191 : Dependability and quality of service

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

IEC 62439-1, Industrial communication networks – High availability automation networks – Part 1: General concepts and calculation methods

IEC 62439-2, Industrial communication networks – High availability automation networks – Part 2: Media Redundancy Protocol (MRP)

IEC 62439-6, Industrial communication networks – High availability automation networks – Part 6: Distributed Redundancy Protocol (DRP)

IEC 62439-7, Industrial communication networks – High availability automation networks – Part 7: Ring-based Redundancy Protocol (RRP)

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

IEEE 802.1D:2004, IEEE Standard for Local and Metropolitan Area Networks – Media Access Control (MAC) Bridges

IEEE 802.1Q:2011, IEEE Standard for Local and Metropolitan Area Networks – Media Access Control (MAC) Bridges and Virtual Bridge Local Area Network



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