SLOVENSKI STANDARD
SIST EN 62439-6:2010

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Industrijska komunikacijska omrežja za avtomatizacijo z visoko razpoložljivostjo - 6. del: Protokol porazdeljene redundance (DRP) (IEC 62439-6:2010)

Industrial communication networks high availability automation networks - Part 6: Distributed Redundancy Protocol (DRP) (IEC 62439-6:2010)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 6: Protokoll für verteilte Redundanz (DRP) (IEC 62439-6:2010)

Réseaux de communication industrielle - Réseaux d'automatisme à haute disponibilité - Partie 6 :Protocole de redondance distribuée (DRP) (CEI 62439-6:2010)

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ICS:

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

SIST EN 62439-6:2010 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62439-6

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ICS 25.040; 35.040

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English version

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

(IEC 62439-6:2010)

Réseaux de communication industrielle - Réseaux d'automatisme à haute disponibilité - Partie 6 :Protocole de redondance distribuée (DRP) (CEI 62439-6:2010)

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This European Standard was approved by CENELEC on 2010-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 62439-6:2010 E

Foreword

The text of document 65C/583/FDIS, future edition 1 of IEC 62439-6, 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 was approved by CENELEC as EN 62439-6 on 2010-03-01.

This EN 62439-6 together with EN 62439-1, EN 62439-2, EN 62439-3, EN 62439-4 and EN 62439-5 supersedes EN 62439:2008.

EN 62439-6:2010 includes the following significant technical changes with respect to EN 62439:2008:

– adding a calculation method for RSTP (rapid spanning tree protocol, IEEE 802.1Q),

– adding two new redundancy protocols: HSR (High-availability Seamless Redundancy) and DRP (Distributed Redundancy Protocol),

– moving former Clauses 1 to 4 (introduction, definitions, general aspects) and the Annexes (taxonomy, availability calculation) to EN 62439-1, which serves now as a base for the other documents,

– moving Clause 5 (MRP) to EN 62439-2 with minor editorial changes,

– moving Clause 6 (PRP) was to EN 62439-3 with minor editorial changes,

– moving Clause 7 (CRP) was to EN 62439-4 with minor editorial changes, and

– moving Clause 8 (BRP) was to EN 62439-5 with minor editorial changes,

– adding a method to calculate the maximum recovery time of RSTP in a restricted configuration (ring) to EN 62439-1 as Clause 8,

– adding specifications of the HSR (High-availability Seamless Redundancy) protocol, which shares the principles of PRP to EN 62439-3 as Clause 5, and

– introducing the DRP protocol as EN 62439-6.

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

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-03-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62439-6:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 62439-2	NOTE	Harmonized as EN 62439-2.
IEC 62439-3	NOTE	Harmonized as EN 62439-3.
IEC 62439-4	NOTE	Harmonized as EN 62439-4.
IEC 62439-5	NOTE	Harmonized as EN 62439-5.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

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

Publication	Year	Title	EN/HD	Year
IEC 60050-191	-	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-
IEC 61158	Series	Fieldbus standard for use in industrial control systems	EN 61158	Series
IEC 61588	2009	Precision clock synchronization protocol for networked measurement and control systems	-	-
IEC 62439-1	2010	Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods	EN 62439-1	2010
ISO/IEC/TR 8802-1	-	Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 1: Overview of Local Area Network Standards	-	-
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 Metropoitan Area Networks - Media Access Control (MAC) Bridges	-	-
IEEE 802.1Q	-	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks	-	-

IEC 62439-6

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INTERNATIONAL STANDARD

colour inside

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – HIGH AVAILABILITY AUTOMATION NETWORKS –

Part 6: Distributed Redundancy Protocol (DRP)

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 committees; 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 62439-6 has been prepared by subcommittee 65C: Industrial Networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This standard cancels and replaces IEC 62439 published in 2008. This first edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62439 (2008):

– adding a calculation method for RSTP (rapid spanning tree protocol, IEEE 802.1Q),
– adding two new redundancy protocols: HSR (High-availability Seamless Redundancy) and DRP (Distributed Redundancy Protocol),
– moving former Clauses 1 to 4 (introduction, definitions, general aspects) and the Annexes (taxonomy, availability calculation) to IEC 62439-1, which serves now as a base for the other documents,
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- adding specifications of the HSR (High-availability Seamless Redundancy) protocol, which shares the principles of PRP to IEC 62439-3 as Clause 5, and
- introducing the DRP protocol as IEC 62439-6.

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

FDIS	Report on voting
65C/583/FDIS	65C/589/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 62439-1:2010, *Industrial communication networks – High availability automation networks – Part 1: General concepts and calculation methods.*

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 amendment and the base 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.

A bilingual version of this standard may be issued at a later date.

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

The IEC 62439 series specifies relevant principles for high availability networks that meet the requirements for industrial automation networks.

In the fault-free state of the network, the protocols of the IEC 62439 series provide ISO/IEC 8802-3 (IEEE 802.3) compatible, reliable data communication, and preserve determinism of real-time data communication. In cases of fault, removal, and insertion of a component, they provide deterministic recovery times.

These protocols retain fully the typical Ethernet communication capabilities as used in the office world, so that the software involved remains applicable.

The market is in need of several network solutions, each with different performance characteristics and functional capabilities, matching diverse application requirements. These solutions support different redundancy topologies and mechanisms which are introduced in IEC 62439-1 and specified in the other Parts of the IEC 62439 series. IEC 62439-1 also distinguishes between the different solutions, giving guidance to the user.

The IEC 62439 series follows the general structure and terms of IEC 61158 series.

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 about the communication procedure and fault detection and recovery for DRP given in 5.2 and 5.3.

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 either free of charge or 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:

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ISO (www.iso.org/patents) and IEC (http://www.iec.ch/tctools/patent_decl.htm) 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 6: Distributed Redundancy Protocol (DRP)

1 Scope

The IEC 62439 series is applicable to high-availability automation networks based on the ISO/IEC 8802-3 (IEEE 802.3) (Ethernet) technology.

This part of the IEC 62439 series specifies a recovery protocol based on a ring topology, designed to react deterministically on a single failure of an inter-switch link or switch in the network. Each switch has equal management role in the network. Double rings are supported.

2 Normative references

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 60050-191, *International Electrotechnical Vocabulary – Chapter 191: Dependability and quality of service*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61588:2009, *Precision clock synchronization protocol for networked measurement and control systems* (IEEE 1588)

IEC 62439-1:2010, *Industrial communication networks – High availability automation networks – Part 1: General concepts and calculation methods*

ISO/IEC/TR 8802-1, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 1: Overview of Local Area Network Standards Technologies de* (IEEE 802.1)

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 Local and metropolitan area networks Media Access Control (MAC) Bridges*

IEEE 802.1Q, *IEEE standards for local and metropolitan area network. Virtual bridged local area networks*

3 Terms, definitions, abbreviations, acronyms, and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-191, as well as in IEC 62439-1, apply, in addition to the following.

3.1.1
active ring port
ring port which is connected in the ring network and works in Blocking or Forwarding state

3.1.2
cycle
shortest time interval after which the communication traffic pattern repeats itself

3.1.3
standby ring port
ring port which is connected in the ring network and works in the Disabled state

3.1.4
time offset
time difference from a specially designated time

3.2 Abbreviations and acronyms

For the purposes of this document, the abbreviations and acronyms given in IEC 62439-1, apply.

3.3 Conventions

This document follows the conventions defined in IEC 62439-1.

4 Overview

4.1 Principles

The Distributed Redundancy Protocol (DRP) defines a high availability network solution based on ISO/IEC 8802-3 (IEEE 802.3) and the functions of ISO/IEC/TR 8802-1 (IEEE 802.1) for communication link redundancy.

DRP provides a framework for describing the operational behaviour of the switches in a ring topology to detect a single network failure (such as an inter-switch link failure or a ring switch failure) and recover from it within a deterministic recovery time.

A DRP network has a ring topology with multiple switch nodes, each of which may be a switch or a switching end node. Each node requires an integrated switch with at least two ports (ring ports) connected to the ring, and which is able to detect and recover from failures in accordance with the DRP protocol.

Each node has equal management role in a DRP ring network. It means that each node observes and controls the ring topology by multicasting a ring test frame RingCheck and an inter-switch link test frame LinkCheck cyclically, and reacts on network faults. The LinkCheck test frame provides the mechanism to detect the failure of a switch node.

In a DRP network, each switch node is synchronized using IEC 61588 (IEEE 1588) with either boundary clock or transparent clock according to the application.

NOTE Typically, boundary clock is used according to IEC 61588 (IEEE 1588). In larger-scale application, the transparent clock should be used for better time synchronization.

Optionally, DRP supports double ring topology redundancy. In this case, each switch node shall have at least two pairs of ring ports: one pair of active ring ports and one pair of standby ring ports.