
**Industrijska komunikacijska omrežja za avtomatizacijo z visoko razpoložljivostjo -
2. del: Protokol z redundanco medijev (MRP) (IEC 62439-2:2010)**

Industrial communication networks high availability automation networks - Part 2: Media Redundancy Protocol (MRP) (IEC 62439-2:2010)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 2: Medienredundanz-Protokoll (MRP) (IEC 62439-2:2010)

Réseaux de communication industrielle – Réseaux d'automatisme à haute disponibilité –
Partie 2 : Protocol de redondance de média (MRP) (IEC 62439-2:2010)

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EUROPEAN STANDARD
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English version

**Industrial communication networks -
High availability automation networks -
Part 2: Media Redundancy Protocol (MRP)
(IEC 62439-2:2010)**

Réseaux de communication industrielle –
Réseaux d'automatisme à haute
disponibilité –
Partie 2 : Protocol de redondance
de média (MRP)
(CEI 62439-2:2010)

Industrielle Kommunikationsnetze -
Hochverfügbare Automatisierungsnetze -
Teil 2: Medienredundanz-Protokoll (MRP)
(IEC 62439-2:2010)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 65C/583/FDIS, future edition 1 of IEC 62439-2, 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 62439-2 on 2010-03-01.

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

EN 62439-2:2010 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 EN 62439-2:2010
- 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 62439-2:2010 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 61158-2:2007	NOTE	Harmonized as EN 61158-2:2008 (not modified).
IEC 61158-5-10	NOTE	Harmonized as EN 61158-5-10.
IEC 61784-1:2007	NOTE	Harmonized as EN 61784-1:2008 (not modified).
IEC 61784-2:2007	NOTE	Harmonized as EN 61784-2:2008 (not modified).
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.
IEC 62439-6	NOTE	Harmonized as EN 62439-6.

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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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-191	1990	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-
IEC 61158-6-10	-	Industrial communication networks - Fieldbus specifications - Part 6-10: Application layer protocol specification - Type 10 elements	EN 61158-6-10	-
IEC 62439-1	2010	Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods	EN 62439-1	2010
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	-	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks	-	-



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Edition 1.0 2010-02

INTERNATIONAL STANDARD

**Industrial communication networks – High availability automation networks –
Part 2: Media Redundancy Protocol (MRP)**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
HIGH AVAILABILITY AUTOMATION NETWORKS –**
Part 2: Media Redundancy Protocol (MRP)

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 62439-2 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,
- moving Clause 5 (MRP) to IEC 62439-2 with minor editorial changes,
- moving Clause 6 (PRP) was to IEC 62439-3 with minor editorial changes,
- moving Clause 7 (CRP) was to IEC 62439-4 with minor editorial changes, and

- moving Clause 8 (BRP) was to IEC 62439-5 with minor editorial changes,
- adding a method to calculate the maximum recovery time of RSTP in a restricted configuration (ring) to IEC 62439-1 as Clause 8,
- 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 <https://standards.iteh.ai/catalog/standards/sist/725d51a9-b47c-48dd-b51a-36402679ccf3/sist-en-62439-2-2010>

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

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

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 ring protocol given in Clause 5.

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 2: Media Redundancy Protocol (MRP)

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, under the control of a dedicated media redundancy manager node.

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 60050-191:1990, *International Electrotechnical Vocabulary – Chapter 191: Dependability and quality of service*

IEC 61158-6-10, *Industrial communication networks – Fieldbus specifications – Part 6-10: Application layer protocol specification – Type 10 elements*

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

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

IEEE 802.1D:2004, *IEEE standard for local Local and metropolitan area networks Media Access Control (MAC) Bridges*

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.

3.2 Abbreviations and acronyms

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

MRC Media Redundancy Client

MRM Media Redundancy Manager

MRP Media Redundancy Protocol

3.3 Conventions

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

4 MRP Overview

The Media Redundancy Protocol (MRP) specifies a recovery protocol based on a ring topology.

MRP is designed to react deterministically on a single failure of an inter-switch link or switch in the network.

MRP is based on functions of ISO/IEC 8802-3 (IEEE 802.3) and IEEE 802.1D including the Filtering Data Base (FDB) and is located between the Data Link Layer and Application Layer (see Figure 1).

NOTE 1 Layering is assumed to be according to IEC 61158-1.

A compliant network shall have a ring topology with multiple nodes.

One of the nodes has the role of a media redundancy manager (MRM). The function of the MRM is to observe and to control the ring topology in order to react on network faults. The MRM does this by sending frames on one ring port over the ring and receiving them from the ring over its other ring port, and vice-versa in the other direction.

The other nodes in the ring have the role of media redundancy clients (MRC). An MRC reacts on received reconfiguration frames from the MRM and can detect and signal link changes on its ring ports.

A compliant node shall have the ability to perform as one of the following:

- media redundancy manager (MRM),
- media redundancy client (MRC), or
- both MRM and MRC (but both roles shall not be active at the same time).

Each MRP compliant node requires a switch element with two ring ports connected to the ring.

NOTE 2 Additional ring ports may be used to connect to another ring.

Each node in the ring is able to detect the failure or recovery of an inter-switch link or the failure or recovery of a neighboring node (see 5.1).

The MRP consists of a service and a protocol entity, see stack model in Figure 1.

The service entity specifies, in an abstract way, the externally visible service provided by the Data Link Layer in terms of:

- primitive actions and events of the service,
- parameters associated with each primitive action and event, and the form which they take, and
- interrelationship between these actions and events, and their valid sequences.

MRP defines the services provided to