BS EN 62439-1:2010+A2:2017

BSI Standards Publication

Industrial communication networks – High availability automation networks

Part 1: General concepts and calculation methods (IEC 62439-1:2010)

bsi.

National foreword

This British Standard is the UK implementation of EN 62439-1:2010, incorporating amendment A1:2012 and including amendment A2:2017. It is identical to IEC 62439-1:2010, incorporating amendment 1:2012 and including amendment 2:2016. It supersedes BS EN 62439-1:2010+A1:2012, which will be withdrawn on 10 November 2020.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment A1 is indicated by ▌A1〉 〈A1▐.

The text of IEC amendment 2:2016 has been provided in its entirety at the beginning of this document. BSI's policy of providing consolidated content remains unchanged; however, in the interest of expediency, in this instance BSI have chosen to collate the relevant content at the beginning of this document.

The UK participation in its preparation was entrusted to Technical Committee GEL/65/3, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2010.

Amendments/corrigenda issued since publication

Date	Text affected
30 November 2012	Implementation of IEC amendment 1:2012 with CENELEC endorsement A1:2012
31 March 2018	Implementation of IEC amendment 2:2016 with CENELEC endorsement A2:2017

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62439-1

March 2010

ICS 25.040; 35.040

Supersedes EN 62439:2008 (partially)

English version

Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods

(IEC 62439-1:2010)

Réseaux de communication industrielle – Réseaux d'automatisme à haute disponibilité – Partie 1 : Concepts généraux et méthodes de calcul (CEI 62439-1:2010)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 1: Grundlagen und Berechnungsmethoden (IEC 62439-1:2010)

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.

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.

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.

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

Ref. No. EN 62439-1:2010 E

Foreword

The text of document 65C/583/FDIS, future edition 1 of IEC 662439-1, 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 62439-1 on 2010-03-01.

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

This EN 62439-1:2010 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 62439-1:2010 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 series	NOTE	Harmonized in EN 61158 series (not modified).
IEC/TR 61158-1	NOTE	Harmonized as CLC/TR 61158-1.
IEC/TR 61158-6 series	NOTE	Harmonized in EN 61158-6 series (not modified).
IEC 61784-2:2007	NOTE	Harmonized as EN 61784-2:2008 (not modified).
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.
IEC 62439-6	NOTE	Harmonized as EN 62439-6.
IEC 61918:2007	NOTE	Harmonized as EN 61918:2008 (modified).

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62439-1/A1

August 2012

ICS 25.040.40; 35.100.01

English version

Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods

(IEC 62439-1:2010/A1:2012)

Réseaux de communication industriels - Réseaux de haute disponibilité pour l'automatisation - Partie 1: Concepts généraux et méthodes de calcul (CEI 62439-1:2010/A1:2012)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 1: Grundlagen und Berechnungsmethoden (IEC 62439-1:2010/A1:2012)

This amendment A1 modifies the European Standard EN 62439-1:2010; it was approved by CENELEC on 2012-07-19. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 62439-1:2010/A1:2012 E

Foreword

The text of document 65C/684/FDIS, future edition 1 of IEC 62439-1:2010/A1, 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 62439-1:2010/A1:2012.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-04-19
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-07-19

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 62439-1:2010/A1:2012 was approved by CENELEC as a European Standard without any modification.

Add to the Bibliography of EN 62439-1:2010, the following note for the standard indicated:

IEC 62439-7	NOTE Harmonized as EN 62439-7.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62439-1:2010/A2

November 2017

ICS 35.040; 25.040

English Version

Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods (IEC 62439-1:2010/A2:2016)

Réseaux industriels de communication - Réseaux d'automatisation à haute disponibilité - Partie 1: Concepts généraux et méthodes de calcul (IEC 62439-1:2010/A2:2016)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 1: Grundlagen und Berechnungsmethoden (IEC 62439-1:2010/A2:2016)

This amendment A2 modifies the European Standard EN 62439-1:2010; it was approved by CENELEC on 2016-04-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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

This amendment 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 62439-1:2010/A2:2017 E

European foreword

The text of document 65C/834/FDIS, future edition 1 of IEC 62439-1:2010/A2, 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 62439-1:2010/A2:2017.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-05-10
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-11-10

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

Endorsement notice

The text of the International Standard IEC 62439-1:2010/A2:2016 was approved by CENELEC as a European Standard without any modification.

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	1990	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 61158-6-10	-	Industrial communication networks - Fieldbus specifications - Part 6-10: Application layer protocol specification - Type 10 elements	EN 61158-6-10	-
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	-	-
IETF RFC 791	-	Internet Protocol - DARPA Internet Program Protocol Specification	-	-

IEC 62439-1

Edition 1.0 2016-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 2
AMENDEMENT 2

Industrial communication networks – High availability automation networks – Part 1: General concepts and calculation methods

Réseaux de communication industriels – Réseaux de haute disponibilité pour l'automatisation – Partie 1: Concepts généraux et méthodes de calcul

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
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ICS 25.040; 35.040

ISBN 978-2-8322-3147-0

FOREWORD

This amendment has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65C/834/FDIS	65C/841/RVD

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

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.

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3.4 Reserved network addresses

Add, between items “PRP” and “CRP” of the list given in the third paragraph, the following new item:

- HSR (see IEC 62439-3) uses 0x892F.

5.1.4 Comparison and indicators

Replace, in the existing Table 2, the existing rows "MRP" and “BRP” with the following:

MRP	IEC 62439-2	Yes	Within the network	Single	Ring, meshed	500 ms, 200 ms, 30 ms or 10 ms worst case for 50 switches depending on the parameter set and network topology
BRP	IEC 62439-5	Yes	In the end nodes	Double	Doubly meshed, connected	8,88 ms worst case for 100 end nodes

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CONTENTS

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.

INDUSTRIAL COMMUNICATION NETWORKS – HIGH AVAILABILITY AUTOMATION NETWORKS –

Part 1: General concepts and calculation methods

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

- the common elements and definitions for other parts of the IEC 62439 series;
- the conformance test specification (normative);
- a classification scheme for network characteristics (informative);
- a methodology for estimating network availability (informative);
- the configuration rules, calculation and measurement method for a deterministic recovery time in RSTP.

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

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

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*

IETF RFC 791, *Internet Protocol*; available at <http://www.ietf.org>