This is a free page sample. Access the full version online.

Irish Standard
I.S. EN 62439-7:2012

Industrial communication networks - High availability automation networks -- Part 7: Ring-based Redundancy Protocol (RRP) (IEC 62439-7:2011 (EQV))

© NSAI 2012 No copying without NSAI permission except as permitted by copyright law.

This is a free page sample. Access the full version online.

I.S. EN 62439-7:2012

Incorporating amendments/corrigenda issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces:	*This document is based on:* EN 62439-7:2012	*Published:* 16 March, 2012

This document was published
under the authority of the NSAI and comes into effect on:

16 April, 2012

ICS number:
25.040
35.040

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie

W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

This is a free page sample. Access the full version online.

I.S. EN 62439-7:2012

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62439-7

March 2012

ICS 25.040; 35.040

English version

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

(IEC 62439-7:2011)

Réseaux de communication industriels - Réseau de haute disponibilité pour l'automation - Partie 7: Protocole de redondance pour réseau en anneau (RRP) (CEI 62439-7:2011)

Industrielle Kommunikationsnetze - Hochverfügbare Automatisierungsnetze - Teil 7: Protokoll für ringbasierte Redundanz (RRP) (IEC 62439-7:2011)

This European Standard was approved by CENELEC on 2012-01-20. 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 CEN-CENELEC Management Centre 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 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

© 2012 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Ref. No. EN 62439-7:2012 E

This is a free page sample. Access the full version online.

Foreword

The text of document 65C/668/FDIS, future edition 1 of IEC 62439-7, 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 62439-7:2012.

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)	2012-10-20
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-01-20

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 62439-7:2011 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 61158 series	NOTE	Harmonized in EN 61158 series.

This is a free page sample. Access the full version online.

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	Title	EN/HD	Year
IEC 60050-191	-	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-
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	-	-

This is a free page sample. Access the full version online.

This page is intentionally left BLANK.

This is a free page sample. Access the full version online.

CONTENTS

FOREWORD 6
INTRODUCTION 8
1 Scope 9
2 Normative references 9
3 Terms, definitions, abbreviations, acronyms, and conventions 9
3.1 Terms and definitions 9
3.2 Abbreviations and acronyms 10
3.3 Conventions 10
4 RRP overview 11
4.1 General 11
4.2 Frame forwarding and receiving control 11
4.2.1 General 11
4.2.2 Normal Device (ND) and Gateway Device (GWD) 11
4.2.3 Behaviours of the General Device (GD) 12
4.2.4 Behaviours of the Line Network Manager (LNM) 13
4.2.5 Behaviours of the Ring Network Managers (RNMs) 13
4.3 Link status monitoring 14
4.4 Error detection 14
4.5 Plug and play 14
4.6 Network management information base (NMIB) management 14
4.7 Network recovery 15
4.8 Automatic network configuration 15
4.9 RRP basic operating principle 15
5 RRP redundancy behaviours 17
5.1 Network topology 17
5.2 Network recovery in ring network 18
5.2.1 General 18
5.2.2 Link fault between neighbouring devices 20
5.2.3 Link fault of remote device 21
5.2.4 Device fault on a RNM 22
5.3 Automatic Ring Network Manager (RNM) election procedure 23
5.3.1 General 23
5.3.2 Primary RNM (RNMP) 23
5.3.3 Secondary RNM (RNMS) 24
5.4 Path management 24
5.4.1 General 24
5.4.2 Path in a line topology network 24
5.4.3 Path in a ring topology network 25
5.5 Device address collision 26
6 RRP class specification 27
6.1 General 27
6.2 Template 27
6.3 Attributes 29
7 RRP services specification 34
7.1 Set device information 34
7.2 Get device information 36

This is a free page sample. Access the full version online.

7.3 Get network information 38
7.4 Get path table information 40
8 RRP protocol specification 42
8.1 General 42
8.2 Ethernet header 43
8.2.1 Preamble 43
8.2.2 Start frame delimiter 43
8.2.3 Destination MAC address 43
8.2.4 Source MAC address 43
8.2.5 Length/Type 43
8.3 Encoding of RRP_FrameHDR 43
8.3.1 Version and length 43
8.3.2 DST_addr 44
8.3.3 SRC_addr 45
8.3.4 Frame Control (FC) 45
8.4 Encoding of data and pad 47
8.4.1 General 47
8.4.2 Encoding of FamilyReq 47
8.4.3 Encoding of FamilyRes 48
8.4.4 Encoding of MediaLinked 48
8.4.5 Encoding of AdvThis 49
8.4.6 Encoding of LineStart 49
8.4.7 Encoding of RingStart 50
8.4.8 Encoding of AckRNMS 51
8.4.9 Encoding of CheckRNMS 52
8.5 Frame Check Sequence (FCS) 52
9 RRP protocol machine 52
9.1 Protocol state machine description 52
9.2 Local parameters and variables for protocol state 54
9.2.1 General 54
9.2.2 Variables to support local device information management 54
9.2.3 Variables to support network information management 55
9.2.4 Variables to support device path information management 55
9.2.5 Variables of Received RRP Frame 55
9.2.6 Local variables for protocol state 56
9.2.7 Constants for protocol state 56
9.3 State transitions 57
9.4 Function descriptions 70
10 RRP Management Information Base (MIB) 75
Bibliography 81

Figure 1 – Forwarding and receiving Ethernet frames 11
Figure 2 – Structures of ND and GWD 12
Figure 3 – LNM forwarding control 13
Figure 4 – RNM forwarding control 13
Figure 5 – Link status information 14
Figure 6 – A device operation in initialization phase 15

This is a free page sample. Access the full version online.

Figure 7 – Devices operation in line network establishing phase 16
Figure 8 – Extension of line network operation 16
Figure 9 – Ring network establishment operation 17
Figure 10 – Ring to line network change operation 17
Figure 11 – Ring topology 18
Figure 12 – Link fault between neighbouring devices 21
Figure 13 – Link fault of remote device 22
Figure 14 – Device fault on a RNM 22
Figure 15 – Path management in a line topology network 24
Figure 16 – Path management in a ring topology network 25
Figure 17 – RRP device address collision in a ring network 26
Figure 18 – Common MAC frame format for RRP DLPDU 43
Figure 19 – RRP protocol state machine 53

Table 1 – RRP network recovery parameter 19
Table 2 – Parameters for calculation 19
Table 3 – Path table of Device1 in a line topology network 24
Table 4 – Path table of Device4 in a line topology network 25
Table 5 – Path table of Device1 in a ring topology network 25
Table 6 – Path table of Device3 in a ring topology network 26
Table 7 – Device address collision information 27
Table 8 – Parameters of set device information service 34
Table 9 – Parameters of get device information service 36
Table 10 – Parameters of get network information service 38
Table 11 – Parameters of get path table information service 40
Table 12 – RRP Length/Type field 43
Table 13 – Version 44
Table 14 – DST_addr 44
Table 15 – SRC_addr 45
Table 16 – Network control message type 45
Table 17 – Type of service 45
Table 18 – Priority 46
Table 19 – Validation of extension code 46
Table 20 – Encoding of FamilyReq frame 47
Table 21 – Encoding of FamilyRes frame 48
Table 22 – Encoding of MediaLinked frame 48
Table 23 – Encoding of AdvThis frame 49
Table 24 – Encoding of LineStart frame 49
Table 25 – Encoding of RingStart frame 50
Table 26 – Encoding of AckRNMS frame 51
Table 27 – Encoding of CheckRNMS frame 52
Table 28 – Variables to support device information management 54
Table 29 – Variables to support managing network information 55

This is a free page sample. Access the full version online.

Table 30 – Variables to support device path information management 55
Table 31 – Variables of Received RRP Frame 55
Table 32 – Local variables for protocol state 56
Table 33 – Constants for protocol state 56
Table 34 – RRP State transitions 57
Table 35 – RRP Function descriptions 70

This is a free page sample. Access the full version online.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – HIGH AVAILABILITY AUTOMATION NETWORKS –

Part 7: Ring-based Redundancy Protocol (RRP)

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62439-7 has been prepared by subcommittee 65C: Industrial Networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65C/668/FDIS	65C/673/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.*

This is a free page sample. Access the full version online.

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

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

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.

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 document using a colour printer.

This is a free page sample. Access the full version online.

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 8802-3:2000 (IEEE 802.3) with compatible, reliable data communications, and preserve determinism in real-time data communications. In cases of fault, removal, and insertion of a component, they provide deterministic recovery times.

These protocols retain fully the Ethernet communication capabilities typically used in the office world, to ensure that software that relies on these protocols will remain applicable.

The market is in need of several network solutions, each with different performance characteristics and functional capabilities, meeting diverse application requirements. These solutions support different redundancy topologies and mechanisms, which are introduced in IEC 62439-1 and specified in the companion International Standards. IEC 62439-1 also distinguishes between these different solutions, providing guidance for 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 patents concerning IEC 61158-4-21 given in Clause 4 and Clause 5.

Patent Number KR 0789444 “COMMUNICATION PACKET PROCESSING APPARATUS AND METHOD FOR RING TOPOLOGY ETHERNET NETWORK CAPABLE OF PREVENTING PERMANENT PACKET LOOPING,” owned by LS INDUSTRIAL SYSTEMS CO., LTD., Anyang, Korea

Patent Number KR 0732510 “NETWORK SYSTEM” owned by LS INDUSTRIAL SYSTEMS CO., LTD., Anyang, Korea

Patent Number KR 0870670 “Method For Determining a Ring Manager Node”, owned by LS INDUSTRIAL SYSTEMS CO., LTD., Anyang, Korea

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 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 these patent rights is registered with IEC. Information may be obtained from:

LSIS Co Ltd

LS Tower

1026-6, Hogye-Dong

Dongan-Gu

Anyang, Gyeonggi-Do, 431-848

South Korea

Phone +82 2 2034 4917

Fax +82 2 2034 4648

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

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.

SAI GLOBAL

This is a free preview. Purchase the entire publication at the link below:

Product Page

Looking for additional Standards? Visit Intertek Inform Infostore

Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation