IEC 62439-3

Edition 3.0 2016-03
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Withdrawn

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

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/iec/4778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016

IEC 62439-3:2016-03 RLV(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

Withdrawn
IECNORM.COM : Click to view the full PDF of IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/iec/4778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016
(https://standards.iteh.ai)

IEC 62439-3

Edition 3.0 2016-03
REDLINE VERSION

INTERNATIONAL STANDARD

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/iec/4778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040, 35.040

ISBN 978-2-8322-3291-0

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 8
INTRODUCTION 10
0.1 General 10
0.2 Changes with respect to the previous edition 10
0.3 Patent declaration 11
1 Scope 13
2 Normative references 13
3 Terms, definitions, abbreviations, acronyms, and conventions 14
3.1 Terms and definitions 14
3.2 Abbreviations and acronyms 15
3.3 Conventions 16
4 Parallel Redundancy Protocol (PRP) 16
4.1 PRP principle of operation 16
4.1.1 PRP network topology 16
4.1.2 PRP LANs with linear or bus topology 17
4.1.3 PRP LANs with ring topology 17
4.1.4 DANP node structure 18
4.1.5 PRP attachment of singly attached nodes 19
4.1.6 Compatibility between singly and doubly attached nodes 19
4.1.7 Network management 19
4.1.8 Implication on ~~configuration~~ application 20
4.1.9 Transition to non-redundant networks 20
4.1.10 Duplicate handling 20
4.1.11 Network supervision 26
4.1.12 Redundancy management interface 26
4.2 PRP protocol specifications 26
4.2.1 Installation, configuration and repair guidelines 26
4.2.2 Unicast MAC addresses 27
4.2.3 Multicast MAC addresses 27
4.2.4 IP addresses 27
4.2.5 Nodes 27
4.2.6 Duplicate Accept mode (testing only) 28
4.2.7 Duplicate Discard mode 28
4.3.2 PRP_Supervision frame contents 33
4.3.3 PRP_Supervision frame for RedBox 34
4.3.4 Reception of a PRP_Supervision frame and NodesTable 34
4.3 PRP_Supervision frame 32
4.3.1 PRP_Supervision frame format 32
4.4 Bridging node 35
4.5 Constants 35
4.6 PRP service specification 35
5 High-availability Seamless Redundancy (HSR) 36
5.1 HSR objectives 36
5.2 HSR principle of operation 36
5.2.1 Basic operation with a ring topology 36

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/iec/a778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016

5.2.2 DANH node structure 38
5.2.3 Topology 38
5.2.4 RedBox structure 46
5.3 HSR node specifications 48
5.3.1 HSR operation 48
5.3.2 DANH receiving from its link layer interface 48
5.3.3 DANH receiving from an HSR port 49
5.3.4 DANH forwarding rules 50
5.3.5 CoS 52
5.3.6 Clock synchronization 52
5.3.7 Deterministic medium access 52
5.4 HSR RedBox specifications 52
5.4.1 RedBox properties 52
5.4.2 RedBox receiving from interlink 53
5.4.3 RedBox forwarding on the ring 55
5.4.4 RedBox receiving from an HSR port 55
5.4.5 RedBox receiving from its link layer interface 57
5.4.6 Redbox ProxyNodeTable handling 57
5.4.7 RedBox CoS 57
5.4.8 RedBox clock synchronization 58
5.4.9 RedBox medium access 58
5.5 QuadBox specification 58
5.6 Duplicate Discard method 58
5.7 Frame format for HSR 58
5.7.1 Frame format for all frames 58
5.7.2 HSR_Supervision frame 59
5.8 Constants 62
5.9 HSR service specification 63
6 Protocol Implementation Conformance Statement (PICS) 64
7 PRP/HSR Management Information Base (MIB) 65
~~Annex A (normative) Use of IEC 61588 and IEEE C37.238 for IEC 62439-3 ....~~
Annex A (normative) Clocks synchronization over redundant paths in IEC 62439-3 96
A.1 Overview 96
A.2 Attachment to redundant LANs by a boundary clock 96
A.3 Attachment to redundant LANs by doubly attached ordinary clocks 97
A.4 PRP mapping to PTP 99
A.4.1 Scenarios and device roles 99
A.4.2 Operation in PRP 101
A.4.3 Configuration specification 102
A.4.4 Specifications of DANP as DAC 103
A.4.5 Clock model of a RedBox for PTP 103
A.5 HSR Mapping to PTP 120
A.5.1 PTP traffic in HSR 120
A.5.2 HSR nodes specifications 123
A.5.3 Redundant clocks in HSR 124
A.5.4 Attachment of an MC to an external LAN 124
A.6 PRP to HSR Mapping 125
A.6.1 Connection methods 125

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/iec/62439-3:2016

A.6.2 PRP-HSR connection by BC 125
A.6.3 PRP-HSR connection by TCs 126
A.7 Doubly attached clock model 127
A.7.1 State machine 127
A.7.2 Supervision of the port 130
A.7.3 BMCA for paired ports 131
A.7.4 Selection of the port state 132
A.8 PTP datasets for high availability 132
A.8.1 General 132
A.8.2 Data types 132
A.8.3 Datasets for ordinary or boundary clocks 133
A.8.4 Object for transparent clocks 137
~~Annex B (informative) Deterministic medium access in HSR ..... ~~
Annex B (normative) PTP profile for Power Utility Automation – Redundant clock attachment 141
B.1 Application domain 141
B.2 PTP profile specification 141
B.3 Redundant clock attachment 141
Annex C (normative) PTP profiles for high-availability automation networks 142
C.1 Application domain 142
C.2 PTP profile specification 142
C.3 Clock types 142
C.4 Protocol specification common 143
C.5 Protocol specification for L3E2E automation profile 143
C.6 Protocol specification for L2P2P automation profile 143
C.7 Timing requirements 144
C.7.1 Measurement conditions 144
C.7.2 Network time inaccuracy 144
C.7.3 Network elements 144
C.7.4 Requirements for grandmasters 144
C.7.5 Requirements for TCs 145
C.7.6 Requirements for BCs 145
C.7.7 Requirements for media converters 145
C.7.8 Requirements for links 145
C.8 Network engineering 146
C.9 Default settings 146
C.10 Redundant clock handling 147
C.11 Protocol Implementation Conformance Statement (PICS) 148
C.11.1 Conventions 148
C.11.2 PICS 148
Annex D (informative) Precision Time Protocol tutorial for IEC 62439-3 150
D.1 Objective 150
D.2 Precision and accuracy 150
D.3 PTP clock types 151
D.4 PTP main options 152
D.5 Layer 2 and layer 3 communication 153
D.6 1-step and 2-step correction 153
D.6.1 Time correction in TCs 153
D.6.2 2-step to 1-step translation 154

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/sist/8411b-1ccc-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016

D.7 End-To-End link delay measurement 156
D.7.1 General method 156
D.7.2 End-to-End link delay measurement with 1-step clock correction 156
D.7.3 End-to-End link delay measurement with 2-step clock correction 157
D.7.4 End-to-End link delay calculation by Delay_Req/Delay_Resp 158
D.8 Peer-to-Peer link delay calculation 158
D.8.1 Peer-to-Peer link delay calculation with 1-step correction 158
D.8.2 Peer-to-Peer link delay calculation with 2-step correction 159
Annex E (normative) Management Information base for singly and doubly attached clocks 161
Bibliography 186

Figure 1 – PRP example of general redundant network 16
Figure 2 – PRP example of redundant network as two LANs (bus topology) 17
Figure 3 – PRP example of redundant ring with SANs and DANPs 18
Figure 4 – PRP with two DANPs communicating 18
Figure 5 – PRP RedBox, transition from single to double LAN 20
Figure 6 – PRP frame extended by an RCT 21
Figure 7 – PRP VLAN-tagged frame extended by an RCT 22
Figure 8 – PRP padded frame closed by an RCT 22
Figure 9 – Duplicate Discard algorithm boundaries 24
Figure 10 – HSR example of ring configuration for multicast traffic 36
Figure 11 – HSR example of ring configuration for unicast traffic 37
Figure 12 – HSR structure of a DANH 38
Figure 13 – HSR example of topology using two independent networks 39
Figure 14 – HSR example of peer coupling of two rings 40
Figure 15 – HSR example of connected rings 41
Figure 16 – HSR example of coupling two redundant PRP LANs to a ring 42
Figure 17 – HSR example of coupling from a ring node to redundant PRP LANs 43
Figure 18 – HSR example of coupling from a ring to two PRP LANs 44
Figure 19 – HSR example of coupling three rings to one PRP LAN 45
Figure 20 – HSR example of meshed topology 46
Figure 21 – HSR structure of a RedBox 47
Figure 22 – HSR frame without a VLAN tag 58
Figure 23 – HSR frame with VLAN tag 59
Figure 24 – HSR node with management counters 63
Figure 25 – HSR RedBox with management counters 64
Figure A.1 – Doubly Attached Clock as BC (MCA is best master) 96
Figure A.2 – Doubly Attached Clock when MCA is best master 98
Figure A.3 – Doubly attached clocks when OC1 is best master 99
Figure A.4 – Elements of PRP networks 101
Figure A.5 – Connection of a master clock to an ordinary clock over PRP 102
Figure A.6 – PRP RedBox as BCs (OC3 and BC7 are best masters) 104
Figure A.7 – RedBox DABC clock model 105

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview

Figure A.8 – PRP RedBoxes as DABC with E2E – BC7 is master 106
Figure A.9 – PRP RedBoxes as DABC with E2E – timing 107
Figure A.10 – PRP RedBoxes as DABC with P2P – OC5 is best master 108
Figure A.11 – PRP RedBoxes as DABC with P2P – timing 109
Figure A.12 – PRP RedBox as DATC with E2E –signal flow 110
Figure A.13 – PRP RedBox as DATC with E2E – timing 112
Figure A.14 – PRP RedBox as DATC with P2P 113
Figure A.15 – PRP RedBox as DATC with P2P – timing 114
Figure A.16 – PRP RedBox as SLTC with E2E 117
Figure A.17 – PRP RedBox as SLTC with E2E – timing 118
Figure A.18 – PRP RedBox as SLTC with P2P 119
Figure A.19 – HSR with one GMC 121
Figure A.20 – PTP messages sent and received by an HSR node (1-step) 122
Figure A.21 – PTP messages sent and received by an HSR node (2-step) 123
Figure A.22 – Attachment of a GMC to an HSR ring through a RedBox as TC 125
Figure A.23 – PRP to HSR coupling by BCs 126
Figure A.24 – PRP to HSR coupling by TCs 127
Figure A.25 – Port states including transitions for redundant operation 128
Figure A.26 – BMCA for redundant masters 131
Figure D.1 – Precision and accuracy example 150
Figure D.2 – Precision Time Protocol principle 151
Figure D.3 – Precision Time Protocol elements 152
Figure D.4 – Delays and time-stamping logic in TCs 153
Figure D.5 – Correction of the Sync message by 1-step and 2-step (peer-to-peer) 154
Figure D.6 – Translation from 2-step to 1-step in TCs 155
Figure D.7 – Translation from 2-step to 1-step – message view 156
Figure D.8 – End-to-end link delay measurement with 1-step clock correction 157
Figure D.9 – End-to-end delay measurement with 2-step clock correction 158
Figure D.10 – Peer-to-peer link delay measurement with 1-step clock correction 159
Figure D.11 – Peer-to-peer link delay measurement with 2-step clock correction 160

Table 1 – Duplicate discard cases 25
Table 2 – Monitoring data set 28
Table 3 – NodesTable attributes 29
Table 4 – PRP_Supervision frame with no VLAN tag 32
Table 5 – PRP_Supervision frame with (optional) VLAN tag 33
Table 6 – PRP_Supervision frame contents 34
Table 7 – PRP_Supervision TLV for Redbox 34
Table 8 – PRP constants 35
Table 9 – HSR_Supervision frame with no VLAN tag 60
Table 10 – HSR_Supervision frame with optional VLAN tag 61
Table 11 – HSR Constants 63
Table A.1 – States 129

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview

Table A.2 – Transitions 130
Table A.3 – Variables 130
Table C.1 – PTP attributes for the Industrial Automation profile 147
Table C.2 – PICS for clocks 149

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/iec/a778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016

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 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.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/sist/...-iec-62439-3-2016

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 third edition cancels and replaces the second edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) technical corrections and extension of specifications;
b) consideration of IEC 61588 clock synchronization with end-to-end delay measurement alongside the existing peer-to-peer delay measurement in PRP.

The text of this standard 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 standard can be found in the report on voting indicated in the above table.

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

This International Standard is to be read in conjunction with IEC 62439-1.

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

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 publication using a colour printer.

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview

INTRODUCTION

0.1 General

IEC 62439-3 belongs to the IEC 62439 series *"Industrial communication networks – High availability automation networks"*. It specifies the PRP and HSR seamless redundancy protocols. It was adopted by IEC TC57 WG10 as the redundancy method for demanding substation automation networks ~~based on IEC 61850 series, introducing new requirements~~ operating on layer 2 networks, according to IEC 61850-8-1 and IEC 61850-9-2.

The seamless redundancy principle has been extended to clocks operating according to the Precision Time Protocol (IEC 61588) and attached to redundant networks. Two variants are specified: L3E2E for clocks which operate on layer 3 networks with end-to-end link delay measurement (E2E) and L2P2P for clocks that operate on layer 2 with peer-to-peer link delay measurement (P2P).

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).~~

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/sist/e6e6e784-1fc6-4eb5-8b70-07161e9ddcf7/iec-62439-3-2016

~~Suppressing MAC address substitution.~~

~~Adapting the MIB to above changes.~~

The major changes with respect to IEC 62439-3:2012 are:

– Subclause 4.1.10.3 has been rewritten to explain the calculation of the duplicate rejection for different speeds.
– Annex A has been redrafted as a general concept for doubly attached clocks applicable to end-to-end (E2E) and to peer-to-peer (P2P) link delay measurement; the principle of paired port operation has now been specified in terms of a state machine based on IEC 61588:2009.
– Annex B of IEC 62439-3:2012 has been deleted; its properties are mentioned in 5.3.7.
– Annex B (new) makes the support of redundancy mandatory for IEC/IEEE 61850-9-3 that specifies doubly attached clocks on layer 2, with peer-to-peer delay measurement.
– Annex C specifies two profiles of a precision clock for industrial automation:
L3E2E for layer 3, end-to-end delay measurement and
L2P2P for layer 2, peer-to-peer delay measurement.
– Annex D contains the tutorial information on IEC 61588:2009 for understanding the above annexes. It was contained in IEC 62439-3:2012 Annex A.
– Annex E (MIB) contains the SNMP Management Information Base to be used for singly and doubly attached clocks in all profiles.

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 patents concerning filtering of redundant frames in a network node (Siemens Aktiengesellschaft – EP 2127329, US 8184650, CN 101611615B) 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
Oto-Hahn-Ring 6
81379 Munich, 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~~ Research Ltd – EP 1825657, US ~~20070223533~~ 8582426, CN 101057483, IN 254425) given in 4.2.7, concerning Identifying improper cabling of devices (ABB ~~Schweiz~~ Technology AG – EP ~~2 015 501 A1~~ 2163024, US 8344736, CN 101689985) given in 4.3, concerning Critical device with increased availability (ABB ~~Schweiz AG~~ Research Ltd – EP 2090950 ~~A1~~) given in 4.4, concerning Ring coupling nodes for high availability networks (ABB ~~Schweiz AG~~ Research Ltd ~~– WO 2010/010120 A1~~ US 8582424, EP 2327185, CN 102106121) given in 5.2.3.

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 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:

iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/iec/a778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016
Withdrawn

ABB Schweiz AG
Intellectual Property CH-IP (CH-150016-L)
Brown Boveri Strasse 6
CH-5400 Baden, Switzerland
ch-ip.patent@abb.com

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.

Withdrawn
iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 62439-3:2016
https://standards.iteh.ai/catalog/standards/iec/4778411b-1cce-4eb5-bb70-07f61c9ddcff/iec-62439-3-2016