SLOVENSKI STANDARD

SIST EN 62439-1:2010/A1:2012

01-oktober-2012

Industrijska komunikacijska omrežja za avtomatizacijo z visoko razpoložljivostjo - 1. del: Splošni koncept in metode izračunavanja (IEC 62439-1:2010/A1:2012)

Industrial communication networks - High availability automation networks - Part 1: General concepts and calculation methods (IEC 62439-1:2010/A1:2012)

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

Réseaux de communication industrielle - Réseaux d'automatisme à haute disponibilité - Partie 1 : Concepts généraux et méthodes de calcul (CEI 62439-1:2010/A1:2012)

Ta slovenski standard je istoveten z: EN 62439-1:2010/A1:2012

ICS:

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

SIST EN 62439-1:2010/A1:2012 en

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

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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.

IEC 62439-1

Edition 1.0 2012-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

AMENDMENT 1
AMENDEMENT 1

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

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FOREWORD

This amendment has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation, working group 15.

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

FDIS	Report on voting
65C/684/FDIS	65C/691/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.

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.

3.1 Terms and definitions

Add the following new terms and definitions 3.1.67 and 3.1.68:

3.1.67
bridge
device connecting LAN segments at layer 2 according to IEEE 802.1D

NOTE The words “switch” and “bridge” are considered synonyms, the word “bridge” is used in the context of standards such as RSTP (IEEE 802.1D), PTP (IEC 61588) or IEC 62439-3 (PRP & HSR).

3.1.68
network recovery time
time span from the moment of the first failure of a component or media inside the network to the moment the network reconfiguration is finished and from which all devices that are still able to participate in network communication are able to reach all other such devices in the network again

NOTE When a network redundancy control protocol (like RSTP) reconfigures the network due to a fault, parts of the network may still be available and communication outages may vary in time and location over the whole network. In the calculations, only the worst case scenario is considered.

3.2 Abbreviations and acronyms

Add, in alphabetical order, in the list of abbreviations the following new abbreviation:

RRP Ring-based Redundancy Protocol, see IEC 62439-7

3.4 Reserved network addresses

Add at the end of the list given in the second paragraph, the following new item:

- RRP (see IEC 62439-7) uses 00-E0-91-02-05-99.

Add at the end of the list given in the third paragraph, the following new item:

- RRP (see IEC 62439-7) uses 0x88FE.

4.1 Conformance to redundancy protocols

Add at the end of the existing list, the following new item:

- compliance to IEC 62439-7 (RRP).

5.1.1 Resilience in case of failure

Add, at the end of the fourth paragraph ("… are met"*), the following new sentence:*

A network provides a deterministic recovery if it is possible to calculate a finite worst case recovery time of a given topology when a single failure occurs.

5.1.4 Comparison and indicators

*Add, in the existing Table 2, the following new line between the existing lines "*BRP*" and "*PRP*":*

RRP	IEC 62439-7	Yes	In the end nodes	Double (switching end nodes)	Single ring	8 ms in 100BASEX, 4 ms in 1000BASEX

8 RSTP for High Availability Networks: configuration rules, calculation and measurement method for deterministic recovery time in a ring topology

*Replace, in the existing title of this clause, the words "*for deterministic recovery time in a ring topology*" by "*for predictible recovery time*".*

Add, between the existing title of this clause and the existing title of 8.1, the following new note:

NOTE In the context of this Clause, the word “bridge” is used in place of “switch”, respectively “bridging” instead of “switching”.

Add, at the end of this clause, the following new Subclause 8.5:

8.5 RSTP topology limits and maximum recovery time

NOTE In the next edition of IEC 62439-1, this new Subclause 8.5 will be renumbered as 8.2.

8.5.1 RSTP protocol parameters

This subclause explains the RSTP protocol parameters that impact network recovery times and shows how a specific topology and protocol configuration influence them. First, RSTP-specific terms are defined. Then, basic guidelines on network design are given and finally a method to determine an approximation of an upper bond worst case network reconfiguration time for meshed RSTP networks is given.

This subclause particularly deals with RSTP networks that are composed of more than a single ring. For a single Ethernet ring running RSTP, the network reconfiguration time can be determined as 8.2 shows. However, the subsequent statements concerning RSTP parameters are also applicable in a ring network.

8.5.2 RSTP-specific terms and definitions

NOTE These terms are inherited from IEEE 802.1D.

8.5.2.1 Transmission Hold Count (TxHoldCount)

Each port of an RSTP bridge includes a counter TxHoldCount. This counter starts at zero and is incremented for each BPDU the port sends. A timer decrements every second the counter. If TxHoldCount reaches the maximum value, no further BPDU are transmitted over that port until the counter has been decremented again, regardless of the importance of the BPDU to network reconfiguration. The default maximum value of TxHoldCount is 6 and the maximum configurable number is 10.

8.5.2.2 Bridge Max Age

Each RSTP bridge includes a parameter Bridge Max Age that should be configured to the same value in each bridge. Bridge Max Age defines the maximum total number of “physical hops” or links between the root bridge and any bridge participating in the same RSTP network. Its default value is 20 and it can be configured to from 6 to a maximum of 40. In special cases, Bridge Max Age is configured differently in some bridges.

Because Bridge Max Age defines the maximum extension of an RSTP network, it is sometimes referred to as “network diameter”. But “Bridge Max Age” and the actually usable network diameter are not synonymous, see 8.5.2.4.

8.5.2.3 Message Age

Each BPDU includes a parameter Message Age. Upon reception of a BPDU, a bridge increments Message Age and afterwards compares it to its “Bridge Max Age”. If Message Age is larger than Bridge Max Age, the bridge discards the BPDU and ignores the information it carries.

The root bridge starts by sending BPDUs with Message Age = 0. The first bridge after the root bridge (and subsequent bridges until Message Age reaches Bridge Max Age) receives the BPDU, increment “Message Age” by 1, compares it to the “Bridge Max Age” and transmit BPDUs with the updated information.

8.5.2.4 Network diameter and radius

The “diameter” in an RSTP network is the number of bridges on the longest active path in a network tree between the two bridges that are the farthest away from each other. The diameter does not necessarily correspond to the RSTP parameter Bridge Max Age (see Figure 23).

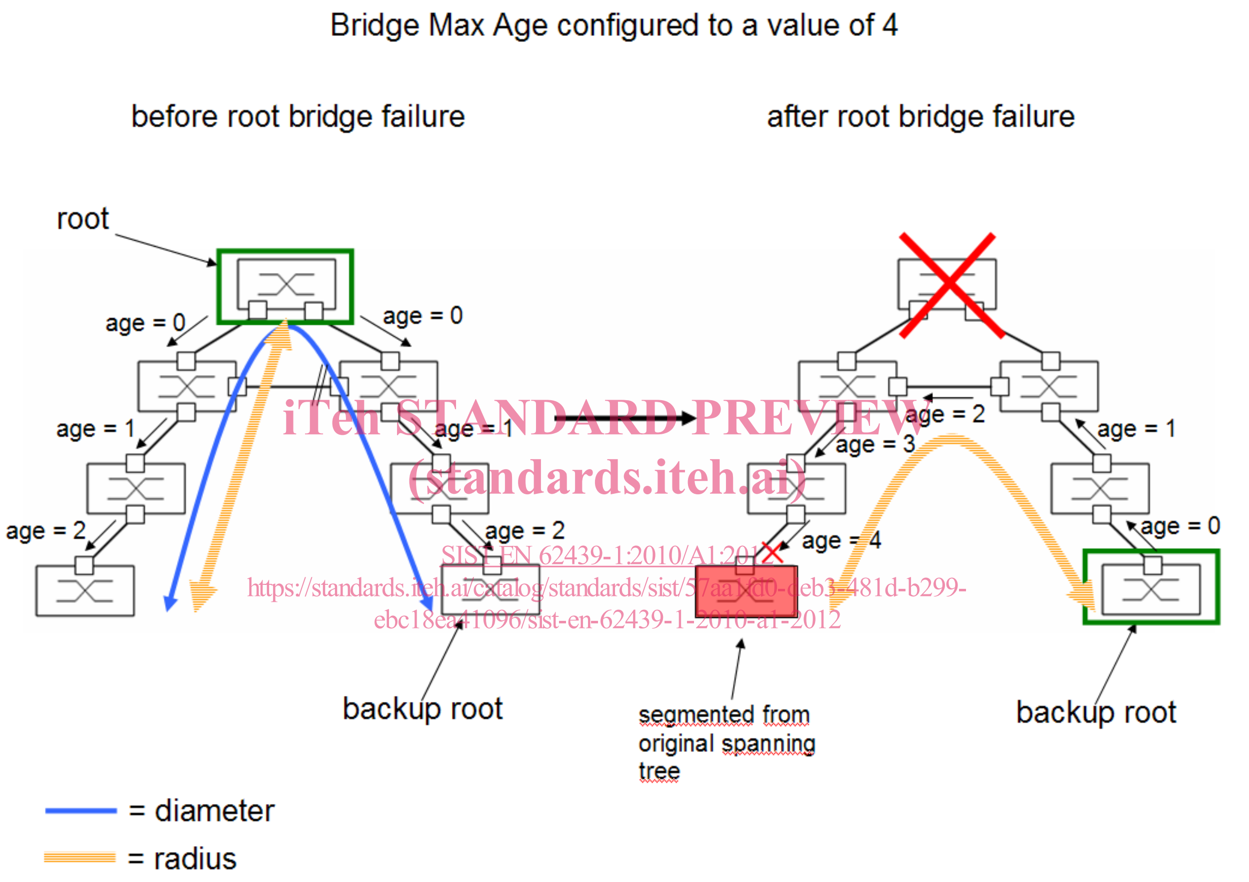
The ”radius” in a RSTP network is the number of bridges from (and including) the active root bridge to the bridge that is the farthest away from this active root in the topology. This is the length (in hops) of the longuest path over which the RSTP protocol information needs to be forwarded (see Figure 23). The maximum supported radius by RSTP can be defined as:

max. radius = Bridge Max Age + 1.

The radius is important to determine worst case topologies. In a worst case fault situation (without an engineered network and consciously placed root bridges), upon failure of a root bridge, the farthest away leaf might be the backup root bridge, which might become the next root. In this case, the diameter of the network can become the radius and it becomes the actual path that the RSTP information to the individual bridges has to travel. (See Figure 23)

NOTE RSTP BPDUs are only transmitted on the link between two directly connected bridges. Each bridge consumes and produces these BPDUs, but the RSTP information which they carry travels distinct paths through the network (in a stable network state without reconfiguration).

8.5.3 Example of a small RSTP tree



IEC 953/12

Figure 23 – Diameter and Bridge Max Age

NOTE 1 The RSTP parameter Bridge Max Age has been assigned the value 4 for the sake of this example although 802.1D does not allow a value lower than 6.

In the example of Figure 23, at first, the network without a failure is in a stable condition with Bridge Max Age = 4 and because the actual radius is 4 (the RSTP configuration could support a maximum radius of 5). The diameter is 7, from one leaf in one branch to the other leaf in the other branch, via the root bridge. Because the root bridge is the root element of a balanced tree, Bridge Max Age = 4 is sufficient for all bridges to receive RSTP BPDUs from the same RSTP root.

A root bridge failure and an unfavorable backup root election changes that. After a root bridge failure, the redundant link that was formerly blocked is activated. The diameter is now 6. At the same time, the radius is also increased to 6. Because one of the leaves of the original branches has now become the root bridge, the Bridge Max Age of 4 is not sufficient for the RSTP root information to reach all bridges of the network, because the RSTP information now has to travel the whole diameter, which is now equivalent to the radius. Thus, the last bridge