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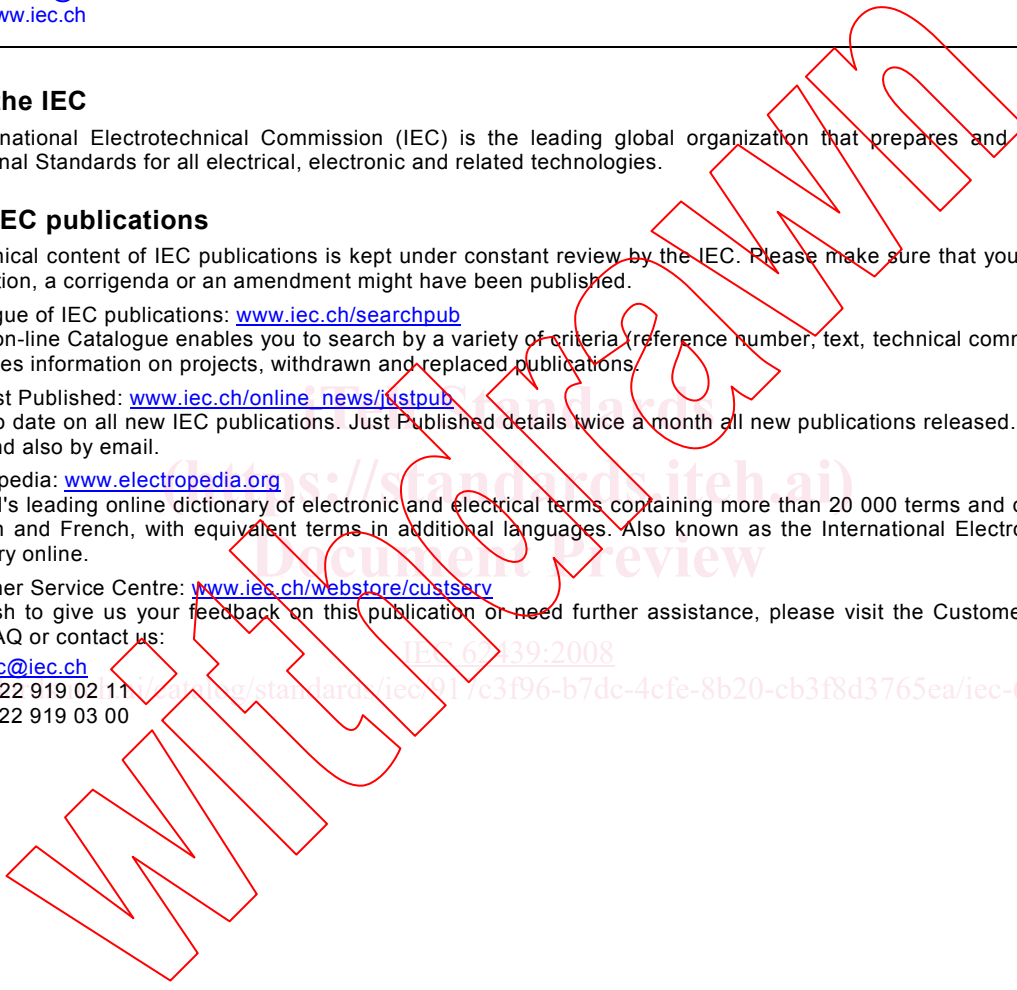
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## HIGH AVAILABILITY AUTOMATION NETWORKS

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  - b) Clause 6 (PRP) may involve Patent WO06053459 "Reception of redundant and non-redundant frames", owned by ABB Switzerland Ltd, Corporate Research, Segelhofstr 1K, 5405 Baden, Switzerland.
  - c) Clause 7 (CRP) may involve Patent U.S. 6,826,590 „Block Oriented Control System on High Speed Ethernet“, owned by the Fieldbus Foundation, 9005 Mountain Ridge Drive – Bowie Bldg, Suite190, Austin, TX 78759
  - d) Clause 8 (BRP) may involve Patent Application Serial No. US 11/520,192, "Multiple fault-tolerant Ethernet redundancy", owned by Rockwell Automation Technologies, Inc., 1 Allen-Bradley Drive, Mayfield Heights, Ohio, USA

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WITHDRAWN

## INTRODUCTION

This International Standard specifies relevant principles for high availability networks that meet the requirements for industrial automation networks.

In the fault-free state of the network, this International Standard provides ISO/IEC 8802-3 compatible, reliable data communication, and preserves determinism of real-time data communication. In cases of fault, removal, and insertion of a component, it provides deterministic recovery times.

The typical Ethernet communication capabilities as used in the office world are fully retained, 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 Clause 4 and specified in the clauses following it. Clause 4 also distinguishes between the different solutions, giving guidance to the user.

This International Standard follows the general structure and terms of IEC 61158.

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# HIGH AVAILABILITY AUTOMATION NETWORKS

## 1 Scope

This International Standard is applicable to high-availability automation networks based on the ISO/IEC 8802-3 (Ethernet) technology.

This International Standard specifies

- a classification scheme for network characteristics (see Annex A);
- a methodology for estimating network availability (see Annex B);
- a set of communication protocols that realize high availability automation networks via the use of redundancy and that can be used in a variety of applications (see Clauses 5, 6, 7, 8).

## 2 Normative references

The following referenced documents are indispensable for the application of this International Standard. 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, *International Electrotechnical Vocabulary (IEV) – Chapter 191: Dependability and quality of service*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61784-2, *Industrial communications networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*

IEC 61918, *Industrial communications networks – Installation of communication networks in industrial premises*

IEEE 802, *IEEE standard for local and metropolitan area networks: Overview and Architecture*

IEEE 802a, *IEEE standard for local and metropolitan area networks: Overview and Architecture*

Amendment 1: *Etherypes for Prototype and Vendor-Specific Protocol Development*

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

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

IEEE 802.3:2005, *Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

IEEE 1588, *IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems*

DARPA Internet Program Protocol Specification, *Internet Protocol, RFC 791*

### 3 Terms, definitions, abbreviated terms, 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 the following, apply.

##### 3.1.1

##### **aggregated link**

set of inter-switch links configured to work as one inter-switch link

[IEEE 802.3:2005, Clause 43]

##### 3.1.2

##### **aggregated ports**

set of inter-switch ports configured to work as one inter-switch port

[IEEE 802.3:2005, Clause 43]

##### 3.1.3

##### **availability (performance)**

ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided.

NOTE 1 This ability depends on the combined aspects of the reliability performance, the maintainability performance, and the maintenance support performance.

NOTE 2 Required external resources, other than maintenance resources, do not affect the availability performance of the item.

[IEV 191-02-05]

##### 3.1.4

##### **channel**

layer 2 connection between two end nodes which consists of one or more paths (for redundancy) between end nodes

##### 3.1.5

##### **common mode failure**

failure that affects all redundant elements for a given function at the same time

##### 3.1.6

##### **complete failure**

failure which results in the complete inability of an item to perform all required functions

[IEV 191-04-20]

##### 3.1.7

##### **connection**

logical relationship between two nodes

##### 3.1.8

##### **coverage**

probability that a failure is discovered within a time short enough for redundancy to handle it, also expressing the percentage of failures caught up by redundancy versus total number of failures