IEC 62439

Edition 1.0 2008-05

INTERNATIONAL STANDARD

High availability automation networks

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE XJ

ICS 25.040; 35.040

ISBN 2-8318-9765-3

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH AVAILABILITY AUTOMATION NETWORKS

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
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) The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of the following patents:

   a) Clause 5 (MRP) may involve Patent WO 99/046908 A1 "Local network, especially Ethernet network, with redundancy properties and redundancy manager", owned by Siemens AG A&D, Gleiwitzerstr. 555, Nürnberg 90475 Germany and Hirschmann Automation and Control GmbH, Stuttgarter Strasse 45-51, Neckartenzlingen 72654, Germany

   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

   IEC takes no position concerning the evidence, validity and scope of these patent rights.

   The holders of these patents have assured the IEC that they are willing to negotiate licenses under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holders of these patent rights is registered with IEC.

   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."

IEC 62439 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement and control.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65C/495/FDIS	65C/498/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 ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

A bilingual version of this publication may be issued at a later date.

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.

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: *Ethertypes 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*