

INTERNATIONAL  
STANDARD

**ISO/IEC**  
**8802-5**

**ANSI/IEEE**  
**Std 802.5**

Second edition  
1995-12-29

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**Information technology —  
Telecommunications and information  
exchange between systems — Local and  
metropolitan area networks — Specific  
requirements —**

**Part 5:**

Token ring access method and physical layer  
specifications

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*Technologies de l'information — Télécommunications et échange  
d'information entre systèmes — Réseaux locaux et urbains — Exigences  
spécifiques —*

*Partie 5: Méthode d'accès par anneau à jeton et spécifications pour la  
couche physique*



Reference number  
ISO/IEC 8802-5:1995(E)  
ANSI/IEEE  
Std 802.5, 1995 edition

**Abstract:** This Local and Metropolitan Area Network standard, ISO/IEC 8802-5 : 1995, is part of a family of local area network (LAN) standards dealing with the physical and data link layers as defined by the ISO Open System Interconnection Reference Model. Its purpose is to provide compatible interconnection of data processing equipment by means of a local area network using the token-passing ring access method. The frame format, including delimiters, addressing, and priority stacks, are defined. The MAC protocol is defined. The finite-state machine and state tables are supplemented with a prose description of the algorithms. The physical layer (PHY) functions of symbol encoding and decoding, symbol time, and latency buffering are defined. The services provided by the MAC to the station management (SMT) and the services provided by the PHY to SMT and the MAC are described. These services are defined in terms of service primitives and associated parameters. The 4 and 16 Mbit/s, shielded twisted pair attachment of the station to the medium, including the medium interface connector (MIC) are also defined. The applications environments for the LAN is intended to be commercial and light industrial. The use of token ring LANs in home and heavy industrial environments, while not precluded, has not been considered in the development of the standard. A Protocol Implementation Conformance Statement (PICS) proforma is provided as an annex to the standard.

**Keywords:** data processing interconnection, local area network (LAN), medium access control (MAC), token ring

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December 29, 1995

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**ANSI/IEEE Std 802.5-1995**

(Revision of ISO/IEC 8802-5 : 1992 [ANSI/IEEE Std 802.5-1992],  
incorporating ISO/IEC TR 10738 : 1992 [ANSI/IEEE Std 802.5b-1991])

**Information technology—  
Telecommunications and information  
exchange between systems—  
Local and metropolitan area networks—  
Specific requirements**

**Part 5: Token ring access method and  
physical layer specifications**

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# International Standard ISO/IEC 8802-5: 1995

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International Standard ISO/IEC 8802-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This second edition cancels and replaces the first edition (ISO/IEC 8802-5: 1992), which has been technically revised. This edition also supersedes ISO/IEC TR 10738: 1992.

ISO/IEC 8802 consists of the following parts, under the general title *Information technology—Local and metropolitan area networks*:

- *Part 1: Overview and Architecture*
- *Part 2: Logical link control*
- *Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*
- *Part 4: Token-passing bus access method and physical layer specifications*
- *Part 5: Token ring access method and physical layer specifications*
- *Part 6: Distributed Queue Dual Bus (DQDB) access method and physical layer specifications*
- *Part 7: Slotted ring access method and physical layer specification*

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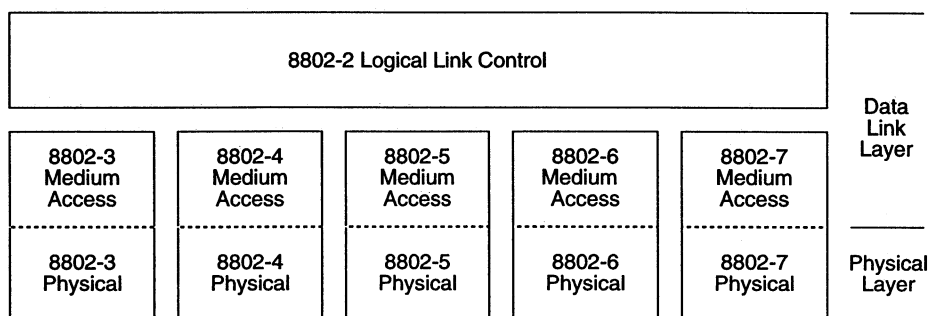
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## Foreword to International Standard ISO/IEC 8802-5 : 1995

This International Standard is part of a family of International Standards for Local and Metropolitan Area Networks. The relationship between this International Standard and the other members of the family is shown below. (The numbers in the figure refer to ISO/IEC Standard numbers.)



This family of International Standards deals with the Physical and Data Link layers as defined by the ISO Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1 : 1994). The access standards define five types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Other types are under investigation.

The International Standards defining the access technologies are as follows:

- a) ISO/IEC 8802-3 [ANSI/IEEE Std 802.3, 1993 Edition], a bus utilizing CSMA/CD as the access method.
- b) ISO/IEC 8802-4 [ANSI/IEEE Std 802.4-1990], a bus utilizing token passing as the access method.
- c) ISO/IEC 8802-5 [ANSI/IEEE Std 802.5-1995], a ring utilizing token passing as the access method.
- d) ISO/IEC 8802-6 [ANSI/IEEE Std 802.6, 1994 Edition], a dual bus utilizing distributed queuing as the access method.
- e) ISO 8802-7, a ring utilizing slotted ring as the access method.

ISO/IEC 8802-2 [ANSI/IEEE Std 802.2, 1994 Edition], *Logical Link Control*, is used in conjunction with the medium access standards to provide the data link layer service to network layer protocols.

ISO/IEC 15802-2 [IEEE Std 802.1B-1992 and 802.1k-1993], *LAN/MAN Management*, Defines an OSI management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.

ISO/IEC 10038 [ANSI/IEEE Std 802.1D, 1993 Edition], *Media Access Control (MAC) bridges*, specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the level of the logical link control protocol.

The reader of this document is urged to become familiar with the complete family of International Standards.

The main body of the International Standard serves for both the ISO/IEC 8802-2 : 1994 and IEEE Std 802.2, 1994 Edition standards. ISO and IEEE each have a unique foreword.

## ANSI/IEEE Std 802.5-1995

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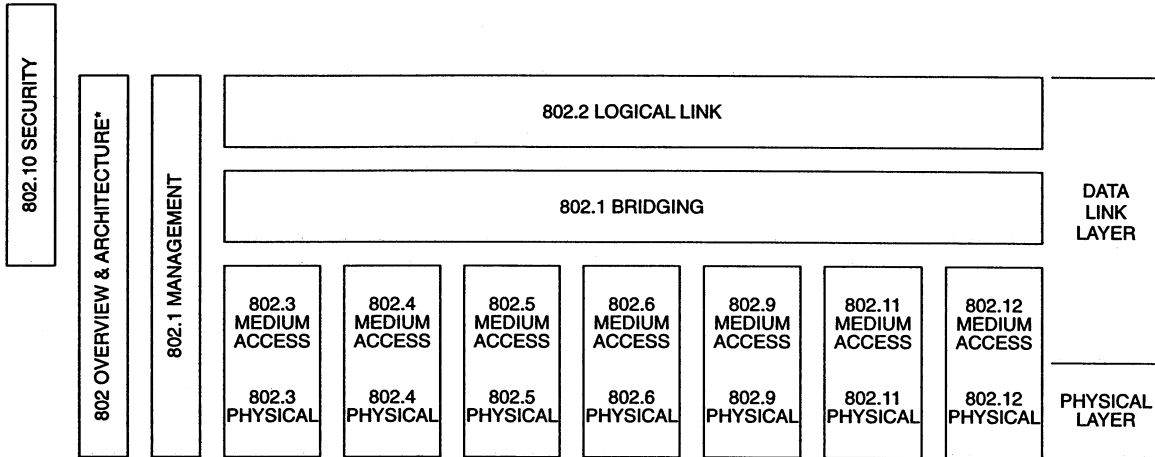
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# Introduction to ANSI/IEEE Std 802.5-1995

(This introduction is not a part of ANSI/IEEE Std 802.5-1995 or of ISO/IEC 8802-5 : 1995.)

This standard is part of a family of standards for local and metropolitan area networks. The relationship between the standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)



\* Formerly IEEE Std 802.1A.

This family of standards deals with the Physical and Data Link Layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection Basic Reference Model (ISO 7498 : 1984). The access standards define several types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Other types are under investigation.

The standards defining these technologies are as follows:

- IEEE Std 802<sup>a</sup>: Overview and Architecture. This standard provides an overview to the family of IEEE 802 Standards. This document forms part of the 802.1 scope of work.
- IEEE Std 802.1B and 802.1k [ISO/IEC 15802-2]: LAN/MAN Management. Defines an Open Systems Interconnection (OSI) management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- ANSI/IEEE Std 802.1D [ISO/IEC 10038]: MAC Bridging. Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.
- ANSI/IEEE Std 802.1E [ISO/IEC 15802-4]: System Load Protocol. Specifies a set of services and protocol for those aspects of management concerned with the loading of systems on IEEE 802 LANs.

<sup>a</sup>The 802 Architecture and Overview Specification, originally known as IEEE Std 802.1A, has been renumbered as IEEE Std 802. This has been done to accommodate recognition of the base standard in a family of standards. References to IEEE Std 802.1A should be considered as references to IEEE Std 802.

- ISO 8802-2 [ANSI/IEEE Std 802.2]: Logical Link Control
- ISO/IEC 8802-3 [ANSI/IEEE Std 802.3]: CSMA/CD Access Method and Physical Layer Specifications
- ISO/IEC 8802-4 [ANSI/IEEE Std 802.4]: Token Bus Access Method and Physical Layer Specifications
- ISO/IEC 8802-5 [ANSI/IEEE Std 802.5]: Token Ring Access Method and Physical Layer Specifications
- ISO/IEC 8802-6 [ANSI/IEEE Std 802.6]: Distributed Queue Dual Bus Access Method/Physical Layer Specifications
- IEEE Std 802.9 Integrated Services (IS) LAN Interface at the Medium Access Control (MAC) and Physical Layers
- IEEE Std 802.10: Interoperable LAN/MAN Security, *Currently approved:* Secure Data Exchange
- IEEE Std 802.12 Demand Priority Access Method and Physical Layer Specifications

In addition to the family of standards, the following is a recommended practice for a common Physical Layer technology:

- IEEE Std 802.7: IEEE Recommended Practice for Broadband Local Area Networks

The following additional working groups have authorized standards projects under development:

- IEEE 802.11 Wireless LAN Medium Access Control (MAC)/Physical Layer Specifications
- IEEE 802.14 Standard Protocol for Cable-TV Based Broadband Communication Network

The reader of this standard is urged to become familiar with the complete family of standards.

### Conformance test methodology

An additional standards series, identified by the number 1802, has been established to identify the conformance test methodology documents for the 802 family of standards. Thus the conformance test documents for 802.3 are numbered 1802.3, the conformance test documents for 802.5 will be 1802.5, and so on. Similarly, ISO will use 18802 to number conformance test standards for 8802 standards.

### ANSI/IEEE Std 802.5 [ISO/IEC 8802-5 : 1995]

This standard specifies that each octet of the information field shall be transmitted most significant bit (MSB) first. This convention is reversed from that used in the CSMA/CD and Token Bus standards, which are least significant bit (LSB) first transmission. While the transmission of MSB first is used for token ring, this does not imply that MSB transmission is preferable.

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<sup>d</sup> Clauses 7; Annexes B, C, D, E

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ISO/IEC 8802-5 : 1995 [ANSI/IEEE Std 802.5-1995] was approved by the American National Standards Institute (ANSI) on December 1, 1995.

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**Part 5: Token ring access method and physical  
layer specifications**

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**1. Overview**

**1.1 Scope**

ISO/IEC 8802-5:1995

For the purpose of compatible interconnection of data processing equipment via a local area network (LAN) using the token ring access method, this part of ISO/IEC 8802.

- a) Provides a general description of the token ring local area network (LAN) architecture (clause 2);
- b) Defines the frame format, including the delimiters, address fields, information field, and frame-check sequence (FCS). Defines the Medium Access Control (MAC) frames, timers, and error counters (clause 3);
- c) Defines the MAC protocols including finite-state machines and state tables (clause 4);
- d) Defines the system level Physical layer (PHY) signaling specifications that are specific to a ring station (clause 5);
- e) Defines the managed objects necessary to manage the service and protocol elements that are involved in the management of a token ring station (clause 6);
- f) Defines the PHY station attachment specification for 4 and 16 Mbit/s operation. This includes the transmitter, receiver, medium interface connector, and transmission channel for both shielded twisted pair (STP) and unshielded twisted pair (UTP) medium (clause 7);
- g) Defines the concentrator, incorporating multiple trunk coupling units (TCUs), for the attachment of a group of stations to the ring (clause 8);

- h) Includes the protocol implementation conformance statement (PICS) proforma in compliance with the relevant requirements, and in accordance with the relevant guidance, given in ISO/IEC 9646-2 : 1994<sup>1</sup> (annex A);
- i) Includes channel design examples and formulas for calculating cabling and concentrator system configurations (annex B);
- j) Describes jitter components and provides an example of jitter buildup using a phase lock loop recovery circuit (annex C);
- k) Provides informative transmitter filter design example (annex D);
- l) Provides recommended guidelines for safety and operating environments (annex E);
- m) Illustrates the MAC finite-state machines in a notation similar to that used in ISO/IEC 8802-5 : 1992 (annex F);
- n) Describes major improvements between this standard and the previous edition, ISO/IEC 8802-5 : 1992 (annex G);
- o) Provides a sample algorithm for the parsing of MAC frames (annex H);
- p) Provides recommendations for the use of token ring access priorities to support multimedia traffic (annex I).

A particular emphasis of this standard is to specify the externally visible characteristics needed for interconnection compatibility, while avoiding unnecessary constraints upon and changes to internal design and implementation of the heterogeneous processing equipment to be interconnected.

The applications environment for the LAN is intended to be commercial and light industrial. The use of token ring LANs in home and heavy industrial environments, while not precluded, has not been considered in the development of this standard.

This standard, the Second Edition of part of ISO/IEC 8802, provides greater specificity and improved clarity to the First Edition (1992-06-12) to ensure interoperability of the various components in the token ring network. The intent of this standard is to maintain interoperability with stations designed to this specification and stations designed to the prior standard. However, interoperability with prior implementations (particularly in regard to clause 7) cannot be guaranteed due to nonspecificity within the 1992 edition. Annex G lists the specific differences between the second edition and the first edition.

The following items are subjects for future study:

- a) Controlled bit altering by any device except a station.
- b) Methodology to assure handling of joining of multiple rings as may be used by managed concentrators to assure normal insertion process protection mechanisms (such as duplicate address test or ring parameter server notification).
- c) Ring data rate determination to allow managed data rate adaptation between stations.
- d) Alternative active concentrators or repeaters that provide increased cabling distances and/or enhanced operation of rings containing devices built to the first edition of this standard, ISO/IEC 8802-5 : 1992.
- e) Converters that allow the interconnection of stations on different media types.
- f) Methodologies to provide enhanced transmission reliability over the trunk cable.
- g) Definition of concentrator managed objects.

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<sup>1</sup> Information on references can be found in clause 1.2.

## 1.2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 8802. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on ISO/IEC 8802-5 : 1995 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

CISPR Publication 22 : 1985, Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.<sup>2</sup>

IEC 73 : 1991, Coding of indicating device actuators by colors and supplementary means.<sup>3</sup>

IEC 603-7 : 1990, Connectors for frequencies below 3 MHz for use with printed boards—Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features.

IEC 950 : 1991, Safety of information technology equipment, including electrical business equipment.

ISO/IEC 7498-1 : 1994, Information technology—Open Systems Interconnection—Basic Reference Model: The Basic Model.<sup>4</sup>

ISO/IEC 7498-4 : 1989, Information processing systems—Open Systems Interconnection—Basic Reference Model—Part 4: Management framework.

ISO/IEC 8802-2 : 1994 [ANSI/IEEE Std 802.2, 1994 Edition], Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 2: Logical link control.<sup>5</sup>

ISO/IEC 8824 : 1990, Information technology—Open Systems Interconnection—Specification of Abstract Syntax Notation One (ASN.1).

ISO/IEC 9646-1 : 1994, Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 1: General concepts.

ISO/IEC 9646-2 : 1994, Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 2: Abstract Test Suite specification.

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ISO/IEC 10165-2 : 1992, Information technology—Open Systems Interconnection—Structure of Management Information: Definition of management information.

ISO/IEC 10742 : 1994, Information technology—Telecommunications and information exchange between systems—Elements of management information related to OSI Data Link Layer standards.

<sup>2</sup> CISPR and IEC publications are available from the International Electrotechnical Commission, 3, rue de Varembe, Case Postale 131, CH-1211, Genève 20, Switzerland/Suisse. These publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

<sup>3</sup> See footnote 2.

<sup>4</sup> ISO/IEC publications are available from ISO, Case Postale 56, 1, rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse. These publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

<sup>5</sup> ISO/IEC [ANSI/IEEE] are available from ISO. They are also available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.