ANSI/IEEE Std
802.3a,b,c,and e-1988

LOCAL AREA NETWORKS

Supplements to Carrier Sense Multiple Access with Collision Detection

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IEEE Standards for
Local Area Networks:

Supplements to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications



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ANSI/IEEE
Std 802.3a,b,c,e-1988
(Supplements to ANSI/IEEE Std 802.3-1985)

An American National Standard

IEEE Standards for
Local Area Networks:

Supplements to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

ANSI/IEEE 802.3a-1988, Medium Attachment Unit and Baseband Medium Specifications, Type 10BASE2 (Section 10)

ANSI/IEEE 802.3b-1988, Broadband Medium Attachment Unit and Broadband Medium Specifications, Type 10BROAD36 (Section 11)

ANSI/IEEE 802.3c-1988, Repeater Unit for 10 Mb/s Baseband Networks (Section 9)

ANSI/IEEE 802.3e-1988, Physical Signaling, Medium Attachment, and Baseband Medium Specifications, Type 1BASE5 (Section 12)

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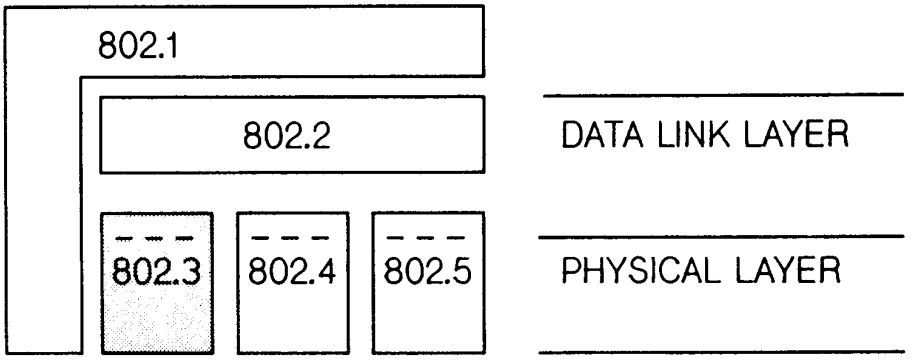
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Foreword

(This Foreword is not a part of ANSI/IEEE Std 802.3a,b,c,e-1988, Supplements to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.)

Part I

These supplements to ANSI/IEEE Std 802.3 are part of a family of standards for Local Area Networks (LANs). The relationship between this standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)



This family of standards deals with the Physical and Data Link Layers as defined by the ISO Open System Interconnection Reference Model. The access standards define three types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. The standards defining these technologies are:

(1) ANSI/IEEE Std 802.3-1985 [pending ISO 8802-3], a bus utilizing CSMA/CD as the access method,

(2) ANSI/IEEE Std 802.4-1985 [pending ISO 8802-4], a bus utilizing token passing as the access method,

(3) ANSI/IEEE Std 802.5-1985 [pending ISO 8802-5], a ring utilizing token passing as the access method.

ANSI/IEEE Std 802.2-1985 [pending ISO 8802-2], the Logical Link Control standard, is used in conjunction with the medium access standards.

IEEE P802.1 describes the relationship among these standards and their relationship to the ISO Open Systems Interconnection Reference Model in more detail. This companion document also will contain networking management standards and information on internetworking. The reader of this standard is urged to become familiar with the complete family of standards.

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The local area network access mechanism specified by this standard may include patented matter. The IEEE Standards Office calls attention to the fact that it is claimed that the process of the local area network access mechanism described throughout this standard is the subject of United States patent numbers 4 063 220 and 4 099 024 and corresponding patents of foreign countries owned by the Xerox Corporation. Although these patents appear to cover the access mechanism subject in this standard, the IEEE takes no position with respect to patent validity. The Xerox Corporation has assured the IEEE that it is willing to grant a license under these patents on reasonable and nondiscriminatory terms and conditions to anyone wishing to obtain such a license. The Xerox Corporation's undertakings in this respect are on file with the IEEE Standards Office and the license details may be obtained from the Office of General Counsel of Xerox Corporation, whose address is Post Office Box 1600, Stamford, CT 06904, USA.

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are anticipated to this standard within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material.

Readers wishing to know the state of revisions should contact:

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Part II

Historical Overview

It has long been the intent of the IEEE 802.3 Working Group to add new physical media sections as the need for such additions was justified. There are, in fact, placeholders for Section 10, Baseband Medium Specifications and Section 11, Broadband Medium Specifications in ANSI/IEEE Std 802.3-1985. It was further recognized at the time the initial IEEE 802.3 Standard was developed that Section 9, Repeater Unit, was not totally complete and would have to be revised at some future time.

Within the past few years it has become feasible to consider the use of already installed twisted pair wiring, commonly used in the telephone industry, as a basic medium for transmission of local area network digital data. A specification has been developed to support this type of medium.

This standard contains four basic supplements to the IEEE 802.3 Standard:

(1) Section 9, Repeater Unit for 10 Mb/s Baseband Networks, Supplement c
(2) Section 10, Medium Attachment Unit and Baseband Medium Specifications, Type 10BASE2, Supplement a
(3) Section 11, Broadband Medium Attachment Unit and Broadband Medium Specifications, Type 10BROAD36, Supplement b
(4) Section 12, Physical Signaling, Medium Attachment, and Baseband Medium Specifications, Type 1BASE5, Supplement e

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Relationships to IEEE Standard 802.3, Sections 1–7

This Supplement standard is intended to be a companion document to ANSI/IEEE Std 802.3-1985, with which the reader should be thoroughly familiar.

It is intended that IEEE Standard 802.3 Sections 1–7 form the base specification for all of these supplements. Each specification with a "TYPE" designation is a specification for an alternate medium to be used in the CSMA/CD Access Method. Therefore, one, and only one, of these medium types may be used in any given implementation. It should be noted, of course, that it is possible to interconnect different implementations in a hierarchical fashion to satisfy certain application requirements (eg, Type 10BASE2 LANs interconnected to a Type 10BASE5 backbone LAN, etc).

The reader should understand that the use of Type 10BASE2, medium per Supplement a requires utilization of Sections 1–7, 9, 10, and ignores use of Section 8, 11, and 12. Similarly, the use of Type 10BROAD36 medium requires use of Sections 1–7 and Section 11 and ignores Sections 8, 9, 10, and 12. The use of twisted pair medium, Type 1BASE5, requires consideration of Sections 1–6 and Section 12, ignoring Sections 7–11.

The notation used throughout the IEEE 802.3 Standard family for identifying different physical layer capabilities is included here for convenient reference and is a duplication of Section 1.2.3 of the basic standard.

1.2.3. Physical Layer and Media Notation. Users of this standard need to reference which particular implementation is being used or identified. Therefore, a means of identifying each implementation is given by a simple, three-field, type notation that is explicitly stated at the beginning of each relevant section. In general, the Physical Layer type is specified by these fields.

<data rate in Mb/s> <medium type> <maximum segment length (× 100m)>

For example, the standard contains a 10Mb/s baseband specification identified as: "TYPE 10BASE5", meaning a 10Mb/s baseband medium whose maximum segment length is 500 m. Each successive Physical Layer specification will state is own unique TYPE identifier along similar lines.

At the time IEEE Standard 802.3 was first published, a basic decision was made to include the definition of a Repeater Unit, even though not all aspects of the Repeater Unit itself were completely defined. The decision to do this was made on the basis that a comprehensive CSMA/CD system would require a Repeater Unit and a complete list of system parameters was essential. In particular, the system parameters having to do with various delays throughout the system from DTE to DTE and system jitter budgets were essential considerations for complete system design. In summary, the overall system budgets were included in the original specification for the Repeater Unit; however, the means to achieve them within the Repeater Unit were not completely specified. The specifications presented in the 1985 publication were necessary, but not sufficient for a complete Repeater Unit implementation. It is believed the Repeater Unit specifications contained in this edition of the IEEE 802.3 Standard are both necessary and sufficient for a complete Repeater Unit implementation. It is to be pointed out that one embodiment of repeater functionality can be implemented

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using optical fiber medium. This capability is known as a Fiber Optic Inter Repeater Link, and its specifications and performance are very closely related to those of the Repeater Unit itself. Section 9.9 of the Repeater Unit makes reference to work now under consideration for such an optical inter repeater link.

The reader should note that several isolated paragraphs throughout Sections 1–7 make reference to the initial Type 10BASE5 implementation as this was in fact the subject of the first 802.3 Standard. The reader is cautioned to read these sections "liberally" to permit interpretation and use with media other than Type 10BASE5. In most instances, there are no technical specifications involved, rather, comments and descriptions relating to the general application and scope of the CSMA/CD Access Method. The one section that may contain parameters and values unique to a particular implementation are contained in Section 4.2, Allowable Implementations. The reader should pay particular attention to any reference to these values when implementing a specific medium. Those subsections that refer to media dependent statements in a general way are: 1.1.1 Basic Concepts, and 1.2.3 Physical Layer and Media Notation.

Relationship to ISO 8802-3

ANSI/IEEE Std 802.3-1985 has been submitted to ISO JTC1 for consideration as an international standard. Publication ISO 8802-3 : 1988 [ANSI/IEEE Std 802.3-1988] is pending as a revision of ANSI/IEEE 802.3-1985 with editorial and clarification changes and without substantive technical changes. The ISO ANSI/IEEE Standard Carrier Sense Multiple Access with Collision Detection specifies the Type 10BASE5 medium as contained in ANSI/IEEE Std 802.3-1985. The first printing of this joint ISO/ANSI/IEEE Standard is expected in 1988 and will supercede the original 1985 edition.

The Supplements contained in this IEEE publication have also been submitted to ISO for consideration as addenda to ISO 8802-3. They are not yet, however, fully approved as ISO standards and therefore, are being printed only as IEEE standards in a separate publication on an interim basis. It is the intention, when these supplements are fully approved by ISO as addenda to 8802-3, that they will be incorporated in a single complete edition of joint ISO/ANSI/IEEE CSMA/CD Media Access Specifications.

IEEE 802.3 Related Specifications Under Consideration

It is anticipated that a few additional media will eventually be added to the basic ISO 8802-3 [IEEE 802.3] specification along with the normal revision cycle based on practical use and application of the CSMA/CD concepts.

Part III

The addition of these supplements has necessitated several minor changes to the base ANSI/IEEE 802.3 standard to accommodate the new media and repeater specifications. These additions or revisions are identified below and make the text of the published ANSI/IEEE 802.3 standard consistent with these supplements.

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1. Introduction

1.1.1 Basic Concepts

[change last sentence to read:]

This supplementary edition of the standard provides the necessary specifications for additional 10Mb/s baseband and broadband specifications, 1Mb/s baseband specification, and revised Repeater Unit specification.

1.1.2.2

[add to last paragraph:]

The AUI may be optional or not specified for some implementations of this standard that are expected to be connected directly to the medium and so do not use a separate MAU or its interconnecting AUI cable. The PLS and PMA are then part of a single unit, and no explicit AUI specification is required.

1.2.1 State Diagram Conventions

[add to section:]

Some of the devices described in this standard (repeaters and hubs) are allowed to have two or more ports. State diagrams capable of describing the operation of devices with an unspecified number of ports, required qualifier notation that allows testing for conditions at multiple ports. The notation used is a term that includes a description in parentheses of which ports must meet the term for the qualifier to be satisfied (eg, ANY and ALL). It is also necessary to provide for term-assignment statements that assign a name to a port that satisfies a qualifier. The following convention is used to describe a term-assignment statement that is associated with a transition:

(1) The character ":" (colon) is a delimiter used to denote that a term assignment statement follows.

(2) The character "⇐" (left arrow) denotes assignment of the value following the arrow to the term preceding the arrow.

The state diagrams contain the authoritative statement of the functions they depict; when apparent conflicts between descriptive text and state diagrams arise, the state diagrams are to take precedence. This does not override, however, any explicit description in the text that has no parallel in the state diagrams.

The models presented by state diagrams are intended as the primary specifications of the functions to be provided. It is important to distinguish, however, between a model and a real implementation. The models are optimized for simplicity and clarity of presentation, while any realistic implementation may place heavier emphasis on efficiency and suitability to a particular implementation technology. It is the functional behavior of any unit that must match the standard, not its internal structure. The internal details of the model are useful only to the extent that they specify the external behavior clearly and precisely.

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1.3 References

[add to section:]

(8) IEC Publication 950 (1986), Safety of Information Technology Equipment Including Electrical Business Equipment.[1]

[add these references:]

(11) IEC Publication 60 (1973), High Voltage Test Methods.[1]

(12) ISO/DIS 8877, Interface Connector and Contact Assignments for ISDN Basic Access Interface Located at Reference Points S and T.[2]

1.4 Definitions

The definitions used in this standard are consistent with ISO 2382/09, the Information Processing Vocabulary, IPV, Part 09, Data Communication. A more specific IPV Part 25 pertaining to LAN systems is in development.

4. Media Access Control

4.4.2.1 Parameterized Values

[add to section:]

See also DTE Deference Delay in 12.9.2.

4.4.2.2 Parameterized Values

[add to section:]

The following parameter values shall be used for 1BASE5 implementations:

Parameter	Value
slotTime	512 bit-times
interFrameGap	96 μs
attemptLimit	16
backoffLimit	10
jamSize	32 bits
maxFrameSize	1518 octets
minFrameSize	512 bits (64 octets)
addressSize	48 bits

See also DTE Deference Delay in 12.9.2.

WARNING: Any deviation from the above specified values may affect proper operation of the network.

4.4.2.3 Parameterized Values. Other implementations under consideration.

---

[1] IEC documents are available in the US from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, USA. IEC documents are also available from International Electrotechnical Commission, 3 rue de Varembe, Case Postale 131, CH-1211, Geneve 20, Switzerland/Suisse.

[2] ISO documents are available in the US from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, USA. ISO documents are also available from the ISO office, 1 rue de Varembe, Case Postale 56, CH-1211, Geneve 20, Switzerland/Suisse.

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7.2.4 PLS Functions

[add to first paragraph]

These functions are depicted in the state diagrams shown in Fig 7-3 through 7-8, using notation described in 1.2.1.

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Appreciation is expressed to dozens of people who attended 802.3 Plenary or Task Force meetings and also contributed to the elaboration of these supplemental standards.

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Medium Attachment Unit and Baseband Medium Specifications, Type 10BASE2 (Section 10)

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Donald Wittman
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10. Medium Attachment Unit and Baseband Medium Specifications, Type 10BASE2

10.1 Scope

10.1.1 Overview. This standard defines the functional, electrical, and mechanical characteristics of the Medium Attachment Unit (MAU) and one specific medium for use with local area networks. The relationship of this specification to the entire ANSI/IEEE Std 802.3-1988 Local Area Network Specification is shown in Fig 10-1. The purpose of the MAU is to provide a simple, inexpensive, and flexible means of attaching devices to the local area network medium. This is achieved through the use of industry standard coaxial cables and BNC connectors.

10.1.1.1 Medium Attachment Unit (normally contained within the data terminal equipment [DTE]). The MAU has the following general characteristics:

(1) Enables coupling the PLS to the explicit baseband coaxial transmission system defined in this section of the standard

(2) Supports message traffic at a data rate of 10 megabits per second (Mb/s)

(3) Provides for driving up to 185 m (600 ft) coaxial trunk cable segment without a repeater

(4) Permits the DTE to test the MAU and the medium itself

(5) Supports system configurations using the CSMA/CD access mechanism defined in the ANSI/IEEE Std 802.3-1988 Local Area Network Specification

(6) Supports a bus topology interconnection means

(7) Supports low-cost capability by incorporating the MAU function within the physical bounds of the DTE, thereby eliminating the need for an Attachment Unit Interface (AUI)

10.1.1.2 Repeater Unit. The Repeater Unit is used to extend the physical system topology and provides for coupling two or more coaxial trunk cable segments. Multiple Repeater Units are permitted within a single system to provide the maximum trunk cable connection path specified in 10.7. The repeater is not a DTE and therefore has slightly different attachment requirements.

10.1.2 Definitions. This section defines the specialized terminology applicable to MAUs and Repeater Units.

Attachment Unit Interface (AUI). (Optional) In a local area network, the interface between the Medium Attachment Unit (MAU) and the data terminal unit within a data station.

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(6) Supports a bus topology interconnection means

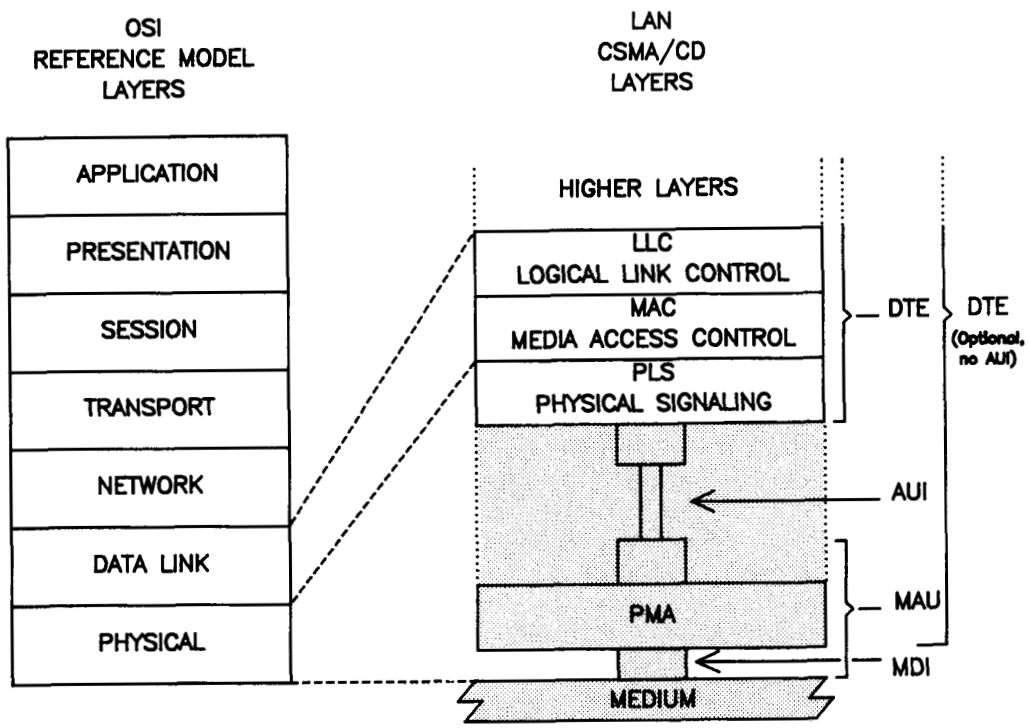
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AUI = ATTACHMENT UNIT INTERFACE
MAU = MEDIUM ATTACHMENT UNIT
MDI = MEDIUM DEPENDENT INTERFACE
PMA = PHYSICAL MEDIUM ATTACHMENT

Fig 10-1
Physical Layer Partitioning;
Relationship to the ISO Open System
Interconnection (OSI) Reference Model

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baseband coaxial system. A system whereby information is directly encoded and impressed on the coaxial transmission medium. At any point on the medium only one information signal at a time can be present without disruption.

carrier sense. In a local area network, an ongoing activity of a data station to detect whether or not another station is transmitting.
NOTE: A collision presence signal is provided by the PLS to the PMA sublayer to indicate that one or more stations are currently transmitting on the trunk coaxial cable.

coaxial cable section. A single length of coaxial cable terminated at each end with a BNC male connector. Cable sections are joined to other cable sections via BNC plug/receptacle barrel or Type T adapters.

coaxial cable segment. A length of coaxial cable made up from one or more coaxial cable sections and coaxial connectors, terminated at each end in its characteristic impedance.

collision. An unwanted condition that results from concurrent transmission on the physical medium.

collision presence. A signal provided by the PLS to the PMA sublayer (within the Data Link Layer) to indicate that multiple stations are contending for access to the transmission medium.

Medium Attachment Unit (MAU). In a local area network, a device used in a data station to couple the data terminal equipment (DTE) to the transmission medium.

Medium Dependent Interface (MDI). The mechanical and electrical interface between the trunk cable medium and the MAU.

Physical Medium Attachment (PMA). The portion of the MAU that contains the functional circuitry.

Physical Signaling Sublayer (PLS). The portion of the Physical Layer, contained within the DTE, that provides the logical and functional coupling between MAU and Data Link Layers.

repeater. A device used to extend the length, topology, or interconnectivity of the physical medium beyond that imposed by a single segment, up to the maximum allowable end-to-end trunk transmission line length. Repeaters perform the basic actions of restoring signal amplitude, waveform, and timing applied to normal data and collision signals.

trunk cable. The trunk coaxial cable system.

10.1.3 Application Perspective: MAU and Medium Objectives. This sec-

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tion states the broad objectives and assumptions underlying the specifications defined throughout Section 10 of the standard.

10.1.3.1 Object

(1) Provide the physical means for communication between local network Data Link entities.

NOTE: This specification covers a portion of the Physical Layer as defined in the OSI Reference Model and, in addition, the physical medium itself, which is beyond the scope of the OSI Reference Model.

(2) Define a physical interface that can be implemented independently among different manufacturers of hardware and achieves the intended level of compatibility when interconnected in a common local network.

(3) Provide a communication channel capable of high bandwidth and low bit error rate performance. The resultant mean bit error rate, at the Physical Layer service interface, should be less than one part in 10^7 (on the order of one part in 10^8 at the link level).

(4) Provide for ease of installation and service.

(5) Provide for high network availability (ability of a station to gain access to the medium and enable the Data Link connection in a timely fashion).

(6) Enable low-cost implementations.

NOTE: The figures and numerous textual references throughout the section refer to terminology associated with the AUI (that is, DO, DI, CI). Since the normal embodiment of the Type 10BASE2 configuration does not require an AUI, actual existence of the DO, DI, CI circuit may not be required. Use of this terminology, however, is retained throughout Section 10 for purposes of clarity and consistency.

10.1.3.2 Compatibility Considerations. All implementations of this baseband coaxial system shall be compatible at the Medium Dependent Interface (MDI).

This standard provides one explicit trunk cable medium specification for the interconnection of all MAU devices. The medium itself, and the functional capability of the MAU, are defined to provide the highest possible level of compatibility among devices designed by different manufacturers. Designers are free to implement circuitry within the MAU in an application-dependent manner provided the MDI specifications are satisfied.

10.1.3.3 Relationship to PLS and AUI. This section defines the Primary Physical Layer for the local area network, a layer comprised of both the physical medium and the rudimentary circuitry necessary to couple a station's message path directly to/from the medium. The complete Logical Physical Layer of the local area network resides within the DTE. Therefore, a close relationship exists between this section and Section 7. This section specifies the physical medium parameters, the PMA logical functions residing in the MAU; and it references the signal circuits associated with the AUI as defined in Section 7.

NOTE: The design of a MAU component requires the use of both this section and parts of the PLS and AUI specifications contained in Section 7.

10.1.3.4 Mode of Operation. The MAU functions as a direct connection between the baseband medium and the DTE. Data from the DTE is output to

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the coaxial trunk medium and all data on the coaxial trunk medium is input to the DTE.

10.2 References. References to such local or national standards that may be useful resource material for the reader are identified and located in the Annex at the end of this book.

10.3 MAU Functional Specifications. The MAU component provides the means by which signals on the three AUI signal circuits to/from the DTE and their associated interlayer messages are coupled to the single coaxial cable baseband signal line. To achieve this basic objective, the MAU component contains the following functional capabilities to handle message flow between the DTE and the baseband medium:

(1) Transmit Function. The ability to transmit serial data bit streams on the baseband medium from the local DTE entity to one or more remote DTE entities on the same network.

(2) Receive Function. The ability to receive serial data bit streams over the baseband medium.

(3) Collision Presence Function. The ability to detect the presence of two or more stations' concurrent transmissions.

(4) Jabber Function. The ability to automatically interrupt the Transmit Function and inhibit an abnormally long output data stream.

10.3.1 MAU Physical Layer Functional Requirements

10.3.1.1 Transmit Function Requirements. At the start of a frame transmission on the coaxial cable, no more than 2 bits (2 full bit cells) of information may be received from the DO circuit and not transmitted onto the coaxial medium. In addition, it is permissible for the first bit sent to contain invalid data or timing; however, all successive bits of the frame shall be reproduced with no more than the specified amount of jitter. The 4th bit cell shall be carried from the DO signal line and transmitted onto the coaxial trunk cable medium with the correct timing and signal levels. The steady-state propagation delay between the DO circuit receiver input and the coaxial cable output shall not exceed 1/2 bit cell. There shall be no logical signal inversions between the branch cable DO circuit and the coaxial trunk cable (for example, a "high" logic level input to the MAU shall result in the less negative current flow value on the trunk coaxial medium). A positive signal on the A signal lead of the DO circuit shall result in a more positive voltage level on the trunk coaxial medium. It is assumed that the AUI shall provide adequate protection against noise. It is recommended that the designer provide an implementation in which a minimum threshold signal is required to establish a transmit bit stream.

The Transmit Function shall output a signal on the trunk coaxial medium whose levels and waveform comply with 10.4.1.3.

In addition, when the DO circuit has gone idle after a frame is output, the MAU shall then activate the Collision Presence Function as close to the trunk coaxial cable as possible without introducing an extraneous signal on the trunk

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coaxial medium. The MAU shall initiate the Collision Presence state within 0.6 μs to 1.6 μs after the Output Idle signal (Wait_Timer_Done in Fig 10-2) and shall maintain an active Collision Presence state for a time equivalent to 10 ± 5 bit cells.

10.3.1.2 Receive Function Requirements. The signal from the coaxial trunk cable shall be ac coupled before reaching the receive DI circuit. The Receive Function shall output a signal onto the DI circuit that complies with the specification for drivers in MAUs (7.5).

At the start of a frame reception from the coaxial cable, no more than 5 bits (5 full bit cells) of information may be received from the coaxial cable and not transmitted onto the receive DI circuit. In addition, it is permissible for the first bit sent over the receive circuit to contain invalid data or timing; however, all successive bits of the frame shall reproduce the incoming signal with no more than the amount of jitter specified below. This implies that the 7th bit cell presents valid data to the PLS. The steady-state propagation delay between the coaxial cable and the receive DI circuit output shall not exceed 1/2 bit cell. There are no logical signal inversions between the coaxial (trunk) cable and the MAU receive circuit.

A MAU meeting this specification shall exhibit edge jitter into the DI pair when terminated in the appropriate test load specified in 7.4.1.1, of no more than 7.0 ns in either direction when it is installed on the distant end of all lengths up to 185 m (600 ft) of the cable specified in 10.5.1.1 through 10.5.2.1.5 terminated at both ends with terminators meeting the impedance requirements of 10.6.2.1 and driven at one end with pseudorandom Manchester encoded binary data from a data generator that exhibits no more than 1.0 ns of edge jitter in either direction on half bit cells of exactly 1/2 BT and whose output meets the specifications of 10.4.1.3 except that the rise time of the signal shall be 30 ns + 0, -2 ns. The combination of coaxial cable and MAU receiver introduce no more than 6 ns of edge jitter into the system.

The local Transmit and Receive Functions shall operate simultaneously while connected to the medium.

10.3.1.3 Collision Presence Function Requirements. The signal presented to the CI circuit in the absence of a collision shall be the IDL signal.

The signal presented to the CI circuit during the presence of a collision shall be the CSO signal, a periodic waveform at the nominal 10 MHz BR+25%, -15% with the pulse width no less than 35 ns and no greater than 70 ns at the zero crossing points. This signal shall be presented to the CI circuit no more than 9 bit times after the signal (that is, dc average) on the coaxial cable at the MAU equals or exceeds that produced by two (or more) MAU outputs transmitting concurrently under the condition that the MAU detecting collision presence is transmitting. Under no conditions shall the Collision Presence Function generate an output when only one MAU is transmitting. A MAU, while not transmitting, may detect the presence of two other MAUs transmitting and shall detect the presence of more than two other MAUs transmitting. Table 10-1 summarizes the allowable conditions under which collisions shall be detected.

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Table 10-1
Generation of Collision Presence Signal

MAU	Numbers of Transmitters		
	<2	=2	>2
Transmitting	N	Y	Y
Not Transmitting	N	May	Y

Y = will generate SQE message
N = will not generate SQE message
May = may generate SQE message

The collision presence function may, in some implementations, be able to sense an abnormal (for example, open) medium.

The use of MAUs in repeaters requires additional considerations; see 10.4.1.5.

10.3.1.4 Jabber Functional Requirements. The MAU shall contain the capability as defined in Fig 10-3 to interrupt a transmission from a DO circuit that exceeds a time duration determined by the MAU. This time duration shall not be less than 20 ms nor more than 150 ms. If the frame being transmitted continues longer than the specified time duration, the MAU shall inhibit transmission and assume its not-transmitting state on the coaxial cable.

When the Transmit Function has been positively disabled, the MAU shall then activate the Collision Presence Function without introducing an extraneous signal on the trunk coaxial medium. A MAU may reset the Jabber and Collision Presence Functions on power reset once the error condition has been cleared. Alternately, a MAU may reset these functions automatically after a period of 0.5 s ±50%.

10.3.2 MAU Interface Messages

10.3.2.1 DTE to MAU Messages. The following messages can be sent by the DTE Physical Layer (PLS Sublayer) Entities to the MAU Entities:

Message	Circuit	Signal	Meaning
output	DO	CD1, CD0	Output information
output_IDL	DO	IDL	No data to be output

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10.3.2.2 MAU to DTE Messages. The following messages can be sent by the MAU Physical Layer Entities to the DTE Physical Layer Entities:

Message	Circuit	Signal	Meaning
input	DI	CD1, CD0*	Input information
input_idle	DI	IDL	No information to be input
mau_available	CI	IDL	MAU is available for output
SQE	CI	CS0	Error detected by MAU

*It is assumed that no retiming of these clocked data signals takes place within the MAU.

10.3.2.2.1 *input* Message. The MAU sends an *input* message to the DTE Physical Layer when the MAU has a bit of data to send to the DTE. The physical realization of the *input* message is a CD0 or CD1 sent by the MAU to the DTE on the Data In circuit. The MAU sends CD0 if the input bit is a zero or CD1 if the input bit is a one. No retiming of the CD1 or CD0 signals takes place within the MAU.

10.3.2.2.2 *input_idle* Message. The MAU sends an *input_idle* message to the DTE Physical Layer when the MAU does not have data to send to the DTE. The physical realization of the *input_idle* message is the IDL signal sent by the MAU to the DTE on the Data In circuit.

10.3.2.2.3 *mau_available* Message. The MAU sends the *mau_available* message to the DTE Physical Layer when the MAU is available for output. The *mau_available* message is always sent by a MAU that is always prepared to output data unless the SQE message should be sent instead. Such a MAU does not require *mau_request* to prepare itself for data output. The physical realization of the *mau_available* message is an IDL signal sent by the MAU to the DTE on the Control In circuit.

10.3.2.2.4 *signal_quality_error* (SQE) Message. The SQE message shall be implemented in the following fashion:

(1) The SQE message shall not be sent by the MAU if no or only one MAU is transmitting on the trunk coaxial medium.

(2) If more than two remote MAUs are transmitting on the trunk coaxial medium, but the MAU connected to the local DTE is not transmitting, then the local MAU shall send the SQE message. In every instance when more than one MAU is transmitting on the coaxial medium, the MAU shall make the best determination possible. It is acceptable for the MAU to fail to send the SQE

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message when it is unable to conclusively determine that more than one MAU is transmitting.

(3) When the local MAU is transmitting on the trunk coaxial medium, all occurrences of one or more additional MAUs transmitting shall cause the SQE to be sent by the local MAU to its DTE.

(4) When the MAU has completed each output frame it shall perform an SQE test sequence. Note that MAUs associated with repeaters shall not generate the SQE test sequence.

(5) When the MAU has inhibited the Transmit Function, it shall send the SQE message in accordance with the Jabber Function requirements of 10.3.1.4 and Fig 10-3.

The SQE message shall be asserted less than 9 bit cells after the occurrence of the multiple-transmission condition is present at the Medium Dependent Interface (MDI) and shall no longer be asserted within 20 bit cells after the indication of multiple transmissions ceases to be present at the MDI. It is to be noted that an extended delay in the removal of the SQE message may adversely affect the access method performance.

The physical realization of the SQE message is the CS0 signal sent by the MAU to the DTE physical layers on the Control In circuit.

NOTE: The MAU is required to assert the SQE at the appropriate times whenever the MAU is powered and not just when the DTE physical layer is providing data output.

10.3.3 MAU State Diagrams. The state diagrams, Figs 10-2 and 10-3, depict the full set of allowed MAU state functions relative to the control circuits of the DTE-MAU interface for MAU's without conditioning requirements. Messages used in these state diagrams are explained below:

enable_driver—Activates the path employed during normal operation to cause the MAU transmitter to impress data onto the trunk coaxial medium.

disable_driver—Deactivates the path employed during normal operation to cause the MAU transmitter to impress data onto the trunk coaxial medium.

no_collision—Signifies that the condition of multiple transmitters simultaneously active on the trunk coaxial medium does not exist.

collision—Signifies that the condition of multiple transmitters simultaneously active on the trunk coaxial medium does exist.

frame_timer—Measures the time the MAU transmits on the trunk coaxial cable.

test_timer—Measures the length of the SQE Test.

unjab_timer—Measures the amount of time the MAU has been in Jab mode.

wait_timer—Measures the time between output idle and the start of the SQE Test.

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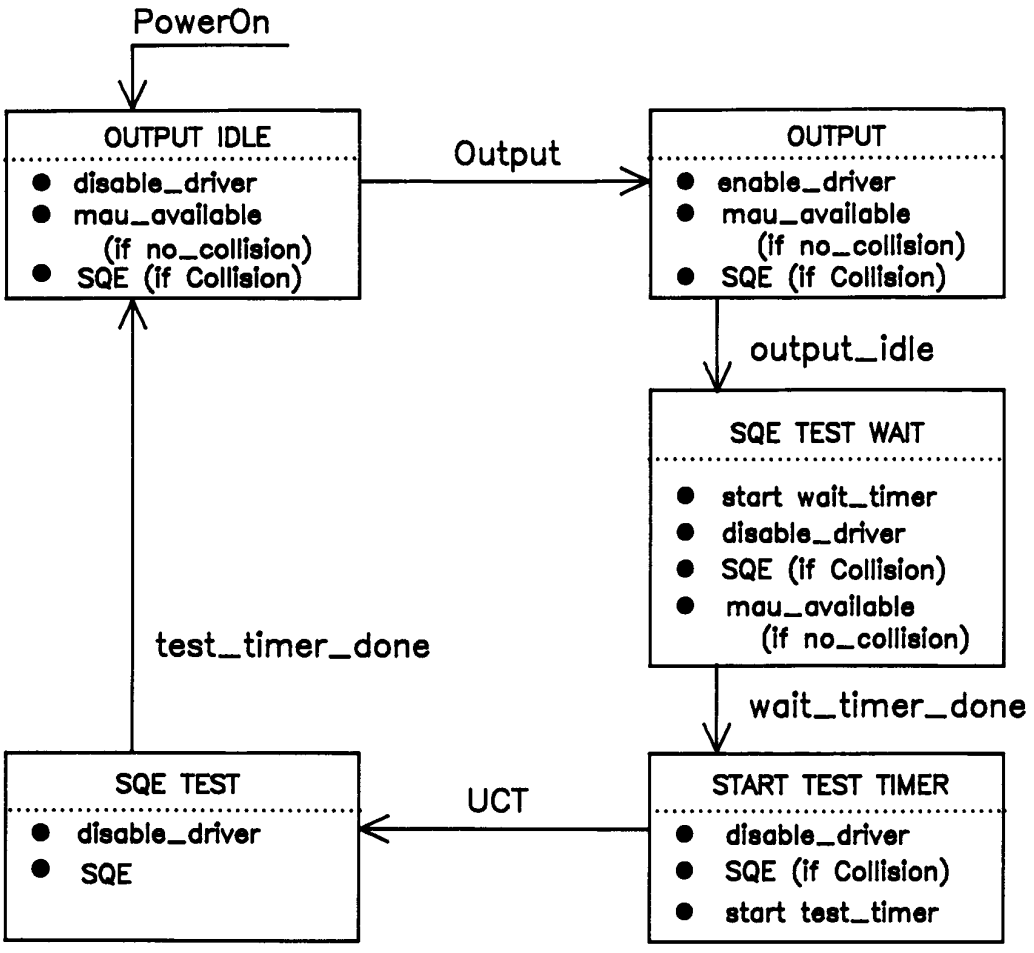


Fig 10-2
MAU Interface Function
(UCT = unconditional transition)
(Wait_Timer_Done is specified in 10.3.1.1)

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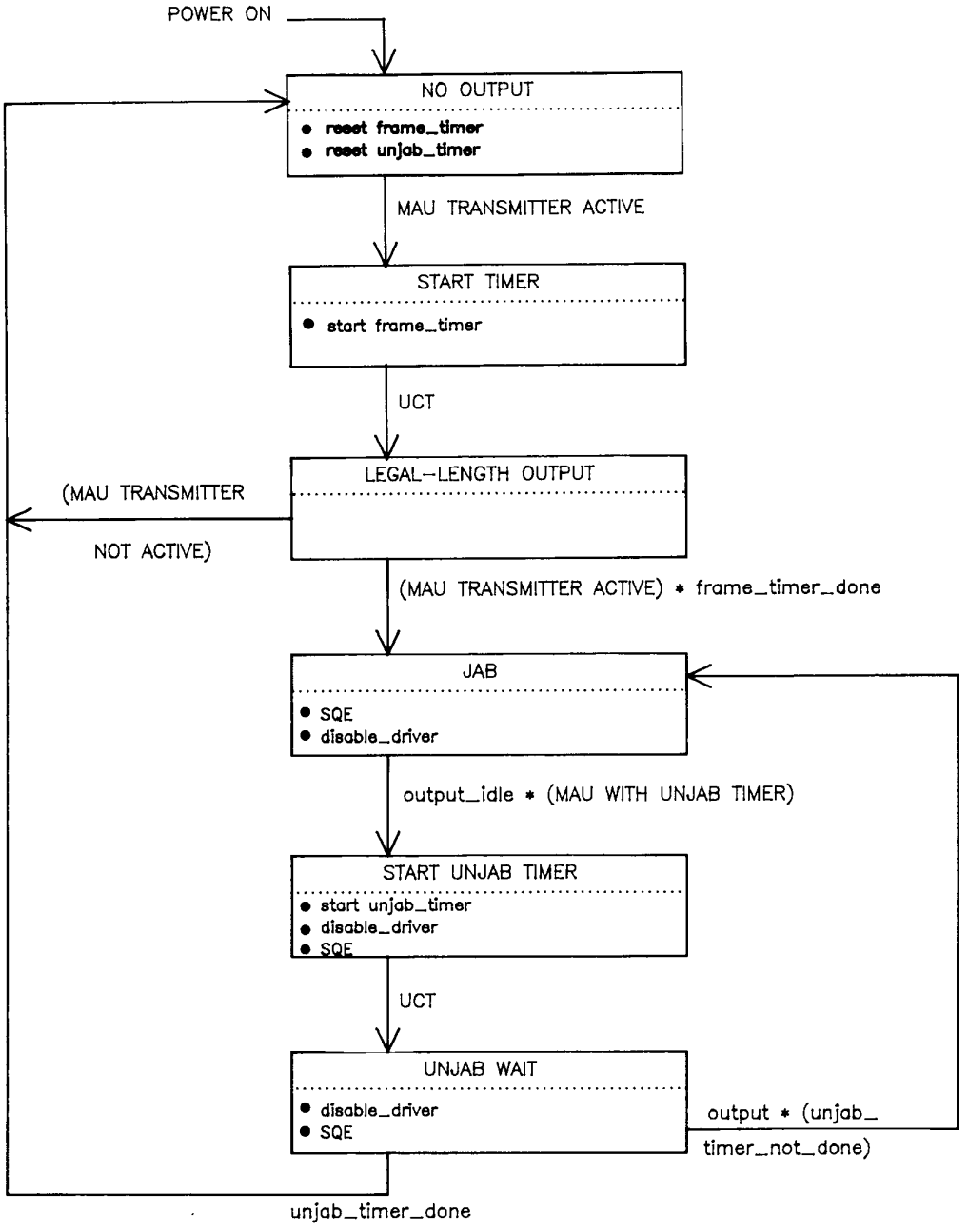


Fig 10-3
Jabber Function State Diagram

(Fig 10-3 outputs override those in Fig 10-2. Optional states: START UNJAB TIMER, UNJAB WAIT.)

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10.4 MAU-Medium Electrical Characteristics

10.4.1 MAU-to-Coaxial Cable Interface. The following subsections describe the interface between the MAU and the coaxial cable. Negative current is defined as current into the MAU (out of the center conductor of the cable).

10.4.1.1 Input Impedance. The shunt capacitance presented to the coaxial cable by the MAU circuitry (not including the means of attachment to the coaxial cable) is recommended to be 6 pF. The magnitude of the reflection from a MAU plus the cable connection specified in 10.6.3 shall not be more than that produced by an 8 pF capacitance when measured by both a 25 ns rise time and 25 ns fall time waveform. The resistance presented to the coaxial cable shall be greater than 100 kΩ.

These conditions shall be met in both the power-off and power-on, not-transmitting states.

The shunt resistance presented to the coaxial cable by the MAU circuitry when it is transmitting shall be greater than 7.5 kΩ over the voltage range of 0 V to -4 V.*

10.4.1.2 Bias Current. The MAU must draw (from the cable) between +2 μA and -25 μA in the power-off and the power-on, not-transmitting states.

10.4.1.3 Coaxial Cable Signaling Levels. The signal on the coaxial cable due to a single MAU as measured at the MAU's transmitter output is composed of an ac component and an offset component. Expressed in terms of current immediately adjacent to the MAU connection (just prior to splitting the current flow in each direction), the signal has an offset component (average dc current including the effects of timing distortion) of from -37 mA min to -45 mA max and an ac component from ± 28 mA up to the offset value.

The current drive limit shall be met even in the presence of one other MAU transmitter. The MAU shall be capable of generating at least 2.2 V of average dc level on the coaxial cable in the presence of two or more other MAUs transmitting concurrently. The MAU shall, in addition, sink no more than ±250 μA when the voltage on the center conductor of the cable drops to -10 V when the MAU is transmitting.

The actual current measured at a given point on the cable is a function of the transmitted current and the cable loss to the point of measurement. Negative current is defined as current out of the center conductor of the cable (into the MAU). The 10%-90% rise/fall times shall be 25 ± 5 ns at 10 Mb/s. The rise and fall times must match within 1 ns**. Figure 10-4 shows typical waveforms present on the cable. Harmonic content generated from the 10 MHz fundamental periodic input shall meet the following requirements:

Second and Third Harmonics: At least 20 dB below fundamental
Fourth and Fifth Harmonics: At least 30 dB below fundamental
Sixth and Seventh Harmonics: At least 40 dB below fundamental
All Higher Harmonics: At least 50 dB below fundamental

(NOTE: Even harmonics are typically much lower.)

The above specifications concerning harmonics cannot be satisfied by a square wave with a single-pole filter, nor can they be satisfied by an output waveform

*Paragraph deletion under consideration.
**A relaxation of this value is under consideration.

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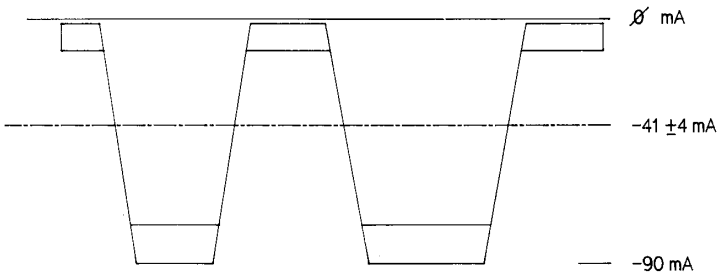


Fig 10-4
Driver Current Signal Levels

generator employing linear ramps without additional waveshaping. The signals as generated from the encoder within PLS shall appear on the coaxial cable without any inversions (see Fig 10-5).

10.4.1.4 Transmit Output Levels Symmetry. Signals received from the DO circuit must be transmitted onto the coaxial cable with the characteristics specified in 10.4.1.3. Since the coaxial cable proceeds in two directions from the MAU, the current into the MAU is nominally twice the current measured on the coaxial cable.

The output signal of a MAU meeting this specification shall exhibit edge jitter of no more than 2.5 ns into a 25 Ω ± 1% resistor substituted for the connection to the coaxial cable when the DO circuit into the MAU is driven with pseudo-random Manchester encoded binary data from a data generator that exhibits no more than 0.5 ns of edge jitter on half bit cells of exactly 1/2 BT, whose output meets the specifications of 7.5.1.1 through 7.5.1.5. The above specified component shall not introduce more than 2 ns of edge jitter into the system.

The MAU shall not transmit a negative going edge after cessation of the CD output data stream or before the first valid edge of the next frame.

10.4.1.5 Collision Detect Thresholds. For receive mode collision detection the MAU shall have its collision detection threshold set in the range -1404 mV and -1581 mV. These limits take account of up to 8% collision detect filter impulse response. If a specific filter implementation has a higher value of impulse response, the lower threshold limit of -1404 mV is required to be replaced by 1300 mV × [1+ impulse response].

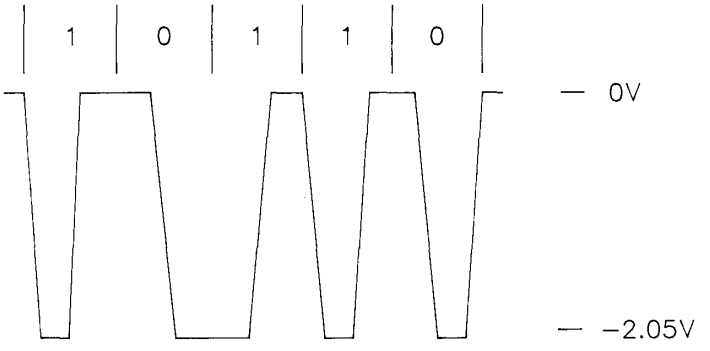
Receive mode collision detection indicates that a nontransmitting MAU has the capability to detect collisions when two or more MAUs are transmitting simultaneously.

MAUs included with repeater sets are required to implement receive mode collision detection.

When receive mode collision detection is not implemented, the upper limit of -1581 mV may be relaxed to -1782 mV.

NOTE: The above threshold limits are measured at the coaxial cable center conductor with respect to the shield at the MAU connector. The MAU designer must take into account circuit offsets, low-frequency noise (for example, 50 Hz, 60 Hz), and 5 MHz ripple at the filter output in determining the actual internal threshold value and its tolerance.

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NOTE: (1) Voltages given are nominal, for a single transmitter.
(2) Rise time is 25 ns nominal at 10 Mb/s rate.
(3) Voltages are measured on terminated coaxial cable adjacent to transmitting MAU.
(4) Manchester coding.

Fig 10-5
Coaxial Trunk Cable Signal Waveform

10.4.2 MAU Electrical Characteristics

10.4.2.1 Electrical Isolation. The MAU must provide isolation between the DTE Physical Layer circuits and the coaxial trunk cable. The isolation impedance measured between any conductor in the DTE Physical Layer circuitry and either the center conductor or shield of the coaxial cable shall be greater than 250 kΩ at 50 Hz, 60 Hz. In addition, the isolation impedance between the DTE ground and the coaxial cable shield shall be less than 15 Ω between 3 MHz and 30 MHz. The isolation means provided shall withstand 500 V ac, rms for one minute.

10.4.2.2 Power Consumption. The current drawn by the MAU shall not exceed 0.5 A if powered by the AUI source. The MAU shall be capable of operating from all permissible voltage sources as supplied by the DTE through the resistance of all permissible AUI cables. The MAU shall not disrupt the trunk coaxial medium should the DTE power source fall below the minimum operational level under abnormal MAU load conditions.

The MAU shall be labeled externally to identify the maximum value of current required by the device. This requirement only applies to MAUs that are external to DTEs.

10.4.2.3 Reliability. The MAU shall be designed to provide an MTBF of at least 100 000 hours of continuous operation without causing communication failure among other stations attached to the local network medium. Component failures within the MAU electronics should not impede the communication among other MAUs on the coaxial cable. Connectors and other passive components comprising the means of connecting the MAU to the coaxial cable shall be designed to minimize the probability of total network failure.

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It should be noted that a fault condition that causes a MAU to draw in excess of 2 mA from the coax may cause communication failure among other stations.

10.4.3 MAU-DTE Electrical Characteristics. If the AUI is used, the electrical characteristics for the driver and receiver components connected between the DTE Physical Layer circuitry and the MAU shall be identical with those as specified in Section 7 of this standard.

10.5 Characteristics of Coaxial Cable System. The trunk cable is of constant impedance, coaxial construction. It is terminated at each of the two ends by a terminator (see 10.6.2), and provides the transmission path for connection of MAU devices. Coaxial cable connectors are used to make the connection from the cable to the terminators and between cable sections. The cable has various electrical and mechanical requirements that shall be met to ensure proper operation.

10.5.1 Coaxial Cable Electrical Parameters

10.5.1.1 Characteristic Impedance. The average characteristic cable impedance shall be 50 ± 2 Ω. Periodic variations in impedance along a single piece of cable may be up to ±3 Ω sinusoidal, centered around the average value, with a period of less than 2 m.

10.5.1.2 Attenuation. The attenuation of a 185 m (600 ft) cable segment shall not exceed 8.5 dB measured at 10 MHz, or 6.0 dB measured at 5 MHz.

10.5.1.3 Velocity of Propagation. The minimum required velocity of propagation is 0.65 c.

10.5.1.4 Edge Jitter; Entire Segment without DTEs Attached. A coaxial cable segment meeting this specification shall exhibit edge jitter of no more than 8.0 ns in either direction at the receiving end when 185 m (600 ft) of the cable is terminated at both ends with terminators meeting the impedance requirements of 10.6.2.1 and is driven at one end with pseudorandom Manchester encoded binary data from a data generator that exhibits no more than 1.0 ns of edge jitter in either direction on half bit cells of exactly 1/2 BT and whose output meets the specifications of 10.4.1.3, except that the rise time of the signal must be 30 ns + 0, -2 ns, and no offset component in the output current is required. This test shall be conducted in a noise-free environment. The above specified component is not to introduce more than 7 ns of edge jitter into the system.

10.5.1.5 Transfer Impedance. The coaxial cable medium shall provide sufficient shielding capability to minimize its susceptability to external noise and also to minimize the generation of interference by the medium and related signals. While the cable construction is not mandated, it is necessary to indicate a measure of performance expected from the cable component. A cable's EMC performance is determined, to a large extent, by the transfer impedance value of the cable.

The transfer impedance of the cable shall not exceed the values shown in Fig 10-6 as a function of frequency.

10.5.1.6 Cable DC Loop Resistance. The sum of the center conductor resistance plus the shield resistance measured at 20°C shall not exceed 50 mΩ/m.

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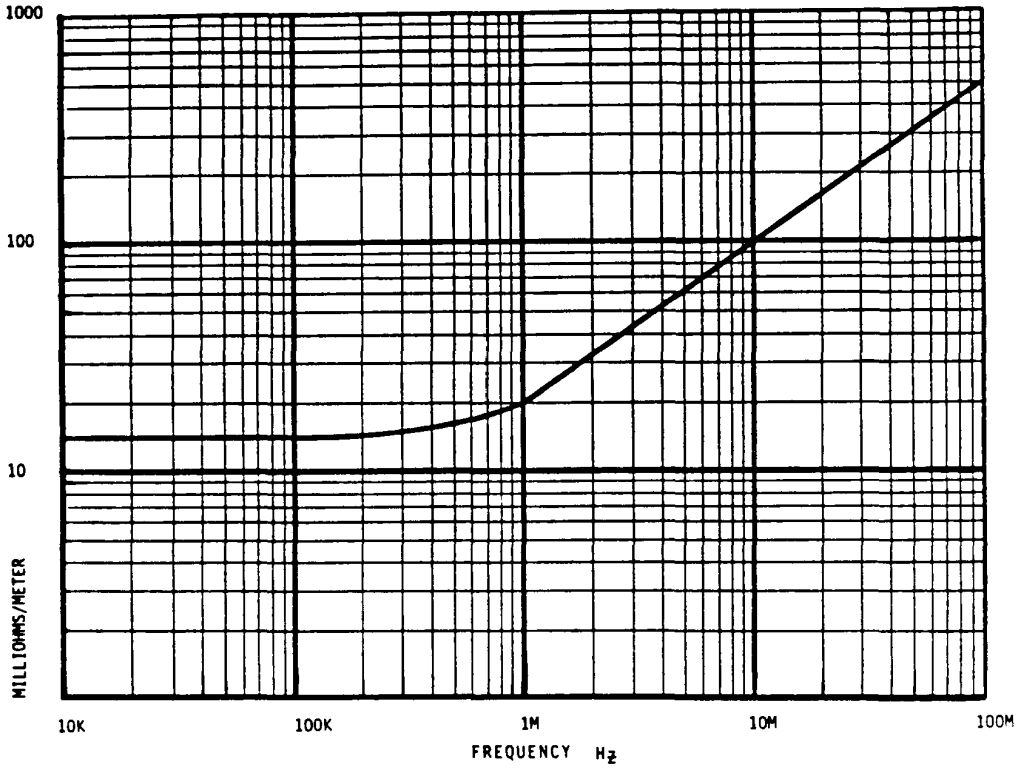


Fig 10-6
Maximum Coaxial Cable Transfer Impedance

The parameters specified in 10.5.1 are met by cable types RG 58 A/U or RG 58 C/U.

10.5.2 Coaxial Cable Physical Parameters

10.5.2.1 Mechanical Requirements. The cable used should be suitable for routing in various environments, including but not limited to, dropped ceilings, raised floors, and cable troughs as well as throughout open floor space. The jacket shall provide insulation between the cable sheath and any building structural metal. Also, the cable shall be capable of accepting coaxial cable connectors, described in 10.6. The cable shall conform to the following requirements.

10.5.2.1.1 General Construction

(1) The coaxial cable shall consist of a center conductor, dielectric, shield system, and overall insulating jacket.

(2) The coaxial cable shall be sufficiently flexible to support a bend radius of 5 cm.

10.5.2.1.2 Center Conductor. The center conductor shall be stranded, tinned copper with an overall diameter of 0.89 mm ± 0.05 mm.

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10.5.2.1.3 Dielectric Material. The dielectric may be of any type, provided that the conditions of 10.5.1.2 and 10.5.1.3 are met; however, a solid dielectric is preferred.

10.5.2.1.4 Shielding System. The shielding system may contain both braid and foil elements sufficient to meet the transfer impedance of 10.5.1.5 and the EMC specifications of 10.8.2.

The inside diameter of the shielding system shall be 2.95 mm ± 0.15 mm.

The shielding system shall be greater than 95% coverage. The use of tinned copper braid is recommended to meet the contact resistance and shielding requirements.

10.5.2.1.5 Overall Jacket

(1) Any one of several jacket materials shall be used provided the specifications of 10.5.1 and 10.5.2 are met.

(2) Either of two jacket dimensions may be used for the two broad classes of materials provided the specification of 10.5.2.1.1 are met:

(a) Polyvinyl chloride (for example, PVC) or equivalent having an OD of 4.9 mm ± 0.3 mm.

(b) Fluoropolymer (for example, FEP, ECTFE) or equivalent having an OD of 4.8 mm ± 0.3 mm.

The cable shall meet applicable flammablity and smoke criteria to meet the local and national codes for the installed environment (see 10.8.3).

Different types of cable sections (for example, polyvinyl chloride and fluoropolymer dielectric) may be interconnected, while meeting the sectioning requirements of 10.7.2.1.

10.5.2.2 Jacket Marking. It is recommended that the cable jacket be marked with manufacturer and type at a nominal frequency of at least once per meter along the cable.

10.5.3 Total Segment DC Loop Resistance. The sum of the center conductor, connectors, and shield resistance shall not exceed 10 Ω total per segment. Each in-line connector pair or MAU shall contribute no more than 10 mΩ.

As a trunk coaxial cable segment consists of several cable sections, all connectors and internal resistance of the shield and center conductor shall be included in the loop resistance measurement.

10.6 Coaxial Trunk Cable Connectors. The trunk coaxial medium requires termination and is partitioned into sections. Devices to be attached to the medium require a means of connection to the medium. This means is provided by a BNC "T" adapter, as shown in Fig 10-7.

The BNC connectors shall be of the 50 Ω constant impedance type. High-quality versions of these connectors (per IEC 169-9) are recommended in order to meet dc loop resistance and reliability considerations. All of the coaxial connectors shall follow the requirements as defined in 10.6.3.

10.6.1 In-Line Coaxial Extension Connector. All coaxial cables shall be terminated with BNC plug connectors. A means shall be provided to ensure that the connector shell (which connects to the cable sheath) does not make contact with any building metal (at ground potential) or other unintended conductor.

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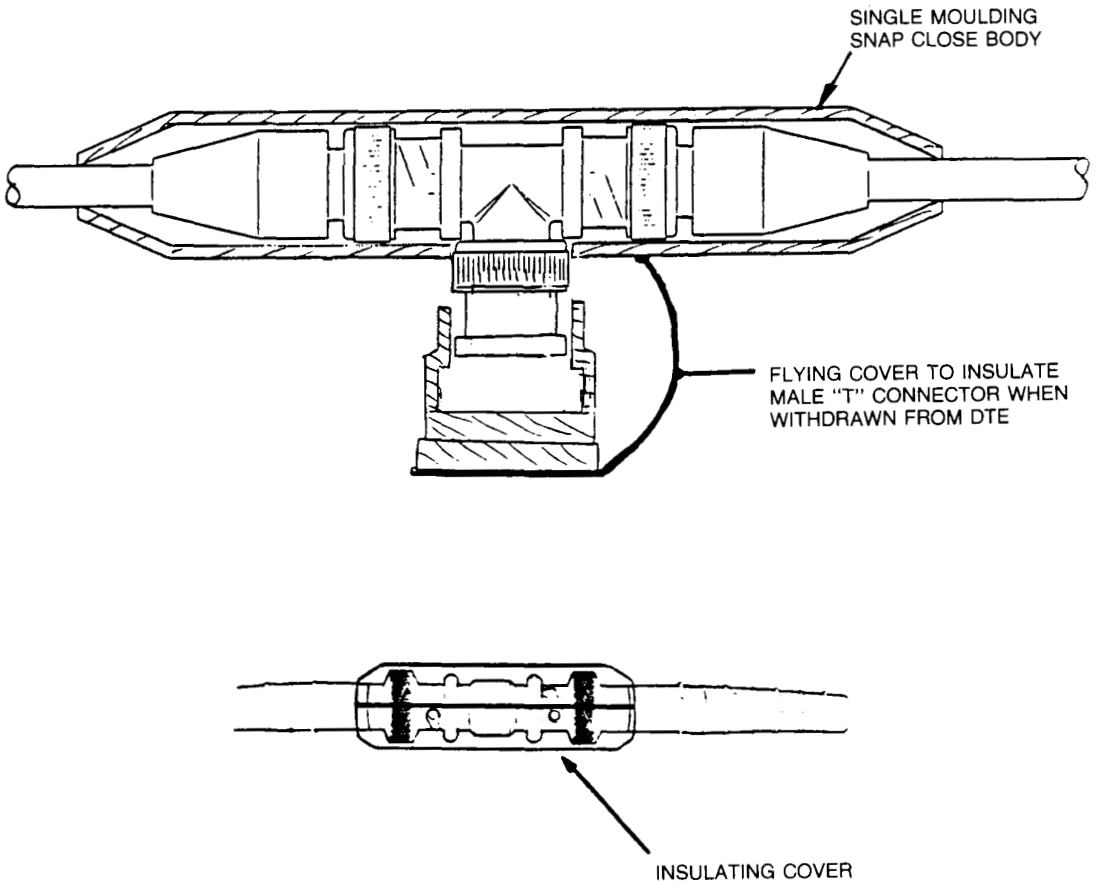


Fig 10-7
Examples of Insulated Connector Cover
(Tutorial only and not part of the standard)

An insulating sleeve or boot slipped over the connector at installation time is suitable.

In-line coaxial extensions shall be made with BNC receptacle-to-receptacle connectors joined together to form one "barrel." An insulating sleeve or boot shall also be provided with each barrel assembly.

10.6.2 Coaxial Cable Terminator

10.6.2.1 Coaxial cable terminators are used to provide a termination impedance for the cable equal in value to its characteristic impedance, thereby minimizing reflection from the ends of the cables. Terminators shall be packaged within a male or female connector. The termination impedance shall be 50

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Ω ± 1% measured from 0-20 MHz, with the magnitude of the phase angle of the impedance not to exceed 5 degrees. The terminator power rating shall be 0.5 W or greater. A means of insulation shall be provided with each terminator.

10.6.3 MAU-to-Coaxial Cable Connection. A BNC "T" (plug, receptacle, plug) adaptor provides a means of attaching a MAU to the coaxial cable. The connection shall not disturb the transmission line characteristics of the cable significantly; it shall present a low shunt capacitance, and therefore a negligibly short stub length. This is facilitated by the MAU being located as close to its cable connection as possible; the MAU and connector are normally considered to be one assembly. Long (greater than 4 cm) connections between the coaxial cable and the input of the MAU jeopardize this objective.

Overall system performance is dependent largely on the MAU-to-coaxial cable connection being of low shunt capacitance.

The design of the connection shall meet the electrical requirements contained in 10.4.1.1 and the reliability specified in 10.4.2.3. The use of BNC "T" adaptors and connectors satisfies these requirements. Figure 10-7 shows a MAU-to-coaxial cable attachment.

A means shall be provided to ensure that the connector assembly (that is, BNC "T" plus male connectors) does not make contact with any building metalwork (at ground potential) or any other unintended conductors. An insulating cover should therefore be applied after connection. A possible design is depicted in Fig 10-7. The insulating cover should have these characteristics:

(1) It should guard against accidental grounding of the connector assembly.

(2) It should allow ease of attachment and detachment of an assembled "T" connector to the MAU without necessitating the removal of section cable connectors (that is, segment integrity is maintained).

(3) It should be a simple moulding that attaches firmly to a connector assembly.

10.7 System Considerations

10.7.1 Transmission System Model. Certain physical limits have been placed on the physical transmission system. These revolve mostly around maximum cable lengths (or maximum propagation times), as these can affect critical time values for the CSMA/CD access method. These maxima, in terms of propagation times, were derived from the physical configuration model described here. The maximum configuration is as follows:

(1) A trunk coaxial cable, terminated in its characteristic impedance at each end, constitutes a coax segment. A coax segment may contain a maximum of 185 m (600 ft) of coaxial cable and a maximum of 30 MAUs. The propagation velocity of the coaxial cable is assumed to be 0.65 c minimum ($c = 3 \times 10^8$ m/s). The maximum end-to-end propagation delay for a coax segment is 950 ns.

(2) Repeater sets are required for segment interconnection. Repeater sets occupy MAU positions on coax segments and count toward the maximum number of MAUs on a coax segment. Repeater sets may be located anywhere on a coax segment.

(3) The maximum transmission path permitted between any two MAUs is

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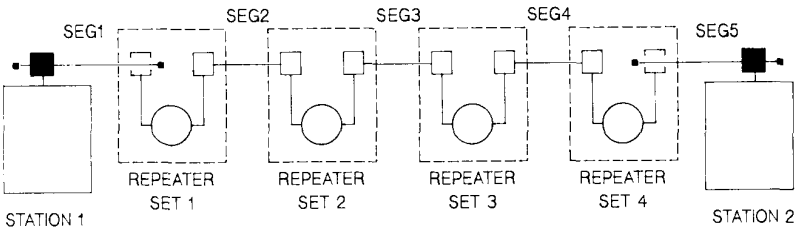


Fig 10-8
Maximum Transmission Path

limited by the number of repeater sets that can be connected in series (that is, four). The maximum number of segments connected in series is therefore five (Fig 10-8), which shall consist of no more than three tapped coax segments; the remainder shall be link segments as defined in 8.6.1.

NOTE: Care should be taken to ensure that the safety requirements are met when extending the trunk cable by the use of repeaters (see 10.7.2.5).

(4) The transmission system may also contain segments comprising trunk coaxial cable specified in Section 8; however, these shall be attached by repeater sets. As such a combination of segments is capable of achieving longer lengths than (3) above, the maximum configuration then becomes limited by propagation delay. Type 10BASE2 segments should not be used to bridge two Type 10BASE5 segments.

Figures 10-9, 10-10, and 10-11 show transmission systems of various types and sizes to illustrate the boundary conditions on topologies generated according to the specifications in this section.

10.7.2 Transmission System Requirements

10.7.2.1 Cable Sectioning. The 185 m (600 ft) maximum length coaxial cable segment will be made from a number of cable sections. As the variation on cable characteristic impedance is ±2 Ω on 50 Ω, a possible worst-case reflection of 4% may result from the mismatch between two adjacent cable sections. The MAU will add to this reflection by the introduction of its noninfinite bridging impedance.

The accumulation of this reflection can be minimized by observing a minimum distance between MAUs (and between cable sections). In order to maintain reflections at an acceptable level, the minimum length cable section shall be 0.5 m.

10.7.2.2 MAU Placement. MAU components and their associated connections to the cable cause signal reflections due to their noninfinite bridging impedance. While this impedance must be implemented as specified in 10.6, the placement of MAUs along the coaxial cable must also be controlled to ensure that reflections from the MAU do not accumulate to a significant degree.

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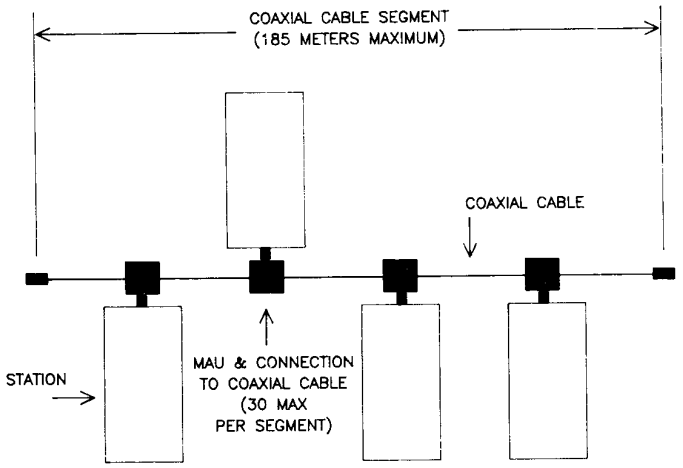


Fig 10-9
The Minimum System Configuration

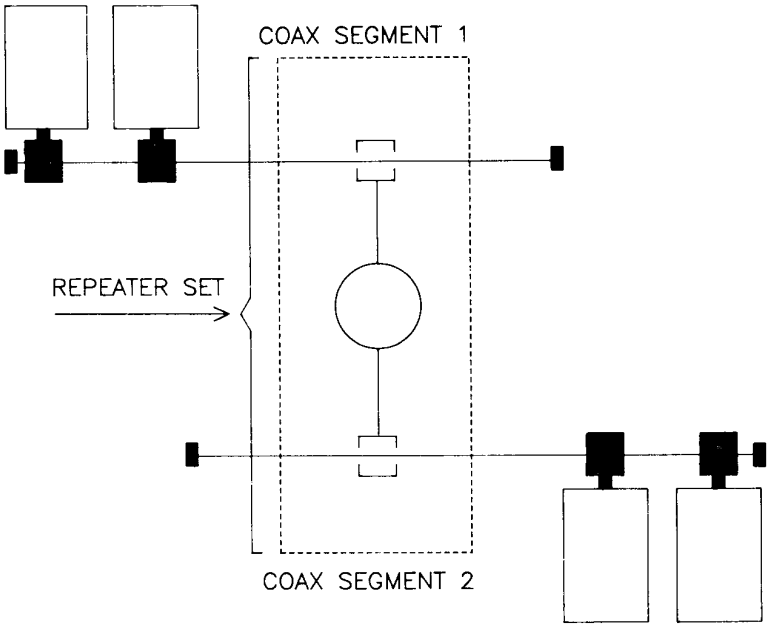


Fig 10-10
The Minimum System Configuration
Requiring a Repeater Set

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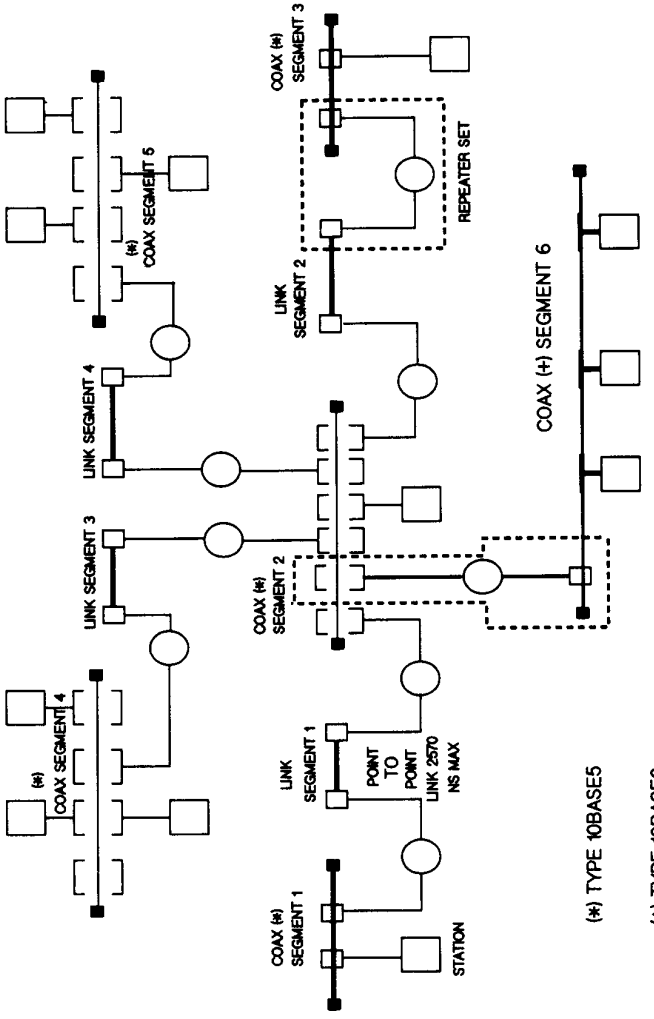


Fig 10-11
An Example of a Large Hybrid System

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Coaxial cable sections as specified in 10.7.2.1 shall be used to connect MAUs. This guarantees a minimum spacing between MAUs of 0.5 m.

The total number of MAUs on a cable segment shall not exceed 30.

10.7.2.3 Trunk Cable System Earthing. The shield conductor of each coaxial cable segment may make electrical contact with an effective earth reference* at one point and shall not make electrical contact with earth elsewhere on such objects as building structural metal, ducting, plumbing fixture, or other unintended conductor. Insulators should be used to cover any coaxial connectors used to join cable sections and terminators, to ensure that this requirement is met. A sleeve or boot attached at installation time is acceptable. (See 10.6.3.)

10.7.2.4 Static Discharge Path. A static discharge path shall be provided. The shield of the trunk coaxial cable is required to be connected to each DTE earth (within the DTE) via a 1 MΩ, 0.25 W resistor that has a voltage rating of at least 750 V dc.

10.7.2.5 Installation Environment. This specification is intended for networks in use within a single building and within an area served by a single low-voltage power distribution system. Applications requiring interplant connections via external (outdoors) means may require special considerations.* Repeaters and nonconducting IRL components may provide the means to satisfy these isolation requirements.

NOTE: The reader is advised that devices should not be operated at significantly different frame potentials. The 10BASE2 connection system may not be capable of handling excessive earth currents.

10.8 Environmental Specifications

10.8.1 Safety Requirements. The designer should consult relevant local and national safety regulations to assure compliance with the appropriate standards (for example, see Appendix A for reference material).

10.8.1.1 Installations. If the trunk coaxial cable is to be installed in close proximity to electrical power cables, then installation practice according to local and national code shall be followed (for example, see the Annex for resource material).

10.8.1.2 Earthing. Where earthing is mandated by locally or nationally prescribed codes of practice, the shield of the trunk coaxial cable shall be effectively earthed at only one point along the length of the cable. Effectively earthed means permanently connected to earth through an earth connection of sufficiently low impedance and having sufficient ampacity to prevent the building up of voltages that may result in undue hazard to connected equipment or to persons.

10.8.2 Electromagnetic Environment

10.8.2.1 Susceptibility Levels. Sources of interference from the environment include electromagnetic fields, electrostatic discharge, transient voltages between earth connections, etc.

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*See local or national regulations for guidance on these matters and Annex [14].

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Several sources of interference will contribute to voltage build-up between the coaxial cable and the earth connection of a DTE.

The physical channel hardware shall meet its specifications when operating in either of the following conditions:

(1) Ambient plane wave field of 1 V/m from 10 kHz through 1 GHz. (NOTE: Levels typically >l km from broadcast stations.)

(2) Interference source voltage of 15.10 V peak 10 MHz sine wave with a 50 Ω source resistance applied between the coaxial cable shield and the DTE ground connection.

MAUs meeting this standard should provide adequate RF ground return (coaxial cable shield to DTE ground) to satisfy the referenced EMC specifications.

10.8.2.2 Emission Levels. The physical MAU and trunk cable system shall comply with local and national regulations (for example, see the Annex for resource material).

10.8.3 Regulatory Requirements. The MAU and medium should consider IEC 435 in addition to local and national regulations. See Reference [6] and Annex [14].

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Std 802.3b-1988
(Supplement to ANSI/IEEE Std 802.3-1985)

An American National Standard

Broadband Medium Attachment Unit and Broadband Medium Specifications, Type 10BROAD36 (Section 11)

Sponsor
IEEE Computer Society

Approved September 19, 1985
IEEE Standards Board

Approved February 28, 1986
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