

Guide for

Local area networks CSMA/DC 10 Mbits/s baseband planning and installation

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Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	iii
1 General	1
1.1 Scope	1
1.2 References	1
1.3 Terminology	2
2 System overview	2
2.1 General	2
2.2 Component descriptions	3
2.3 Network configuration	6
3 Planning and design	10
3.1 Introduction	10
3.2 Building types	11
3.3 Network site requirements	11
3.4 Plans	14
4 Network system installation	16
4.1 Introduction	16
4.2 Standards and specifications	16
4.3 Service accessibility	17
4.4 Trunk cable	17
4.5 IEC 169-16 connector	17
4.6 Tap connector	17
4.7 Barrel connector	17
4.8 Terminator	18
4.9 Earthing arrangements	18
4.10 Data port	18
4.11 Medium attachment unit (MAU)	18
4.12 Acceptance checks/tests	19
4.13 Repair	19
5 Installation test	20
5.1 Introduction	20
5.2 The need for rigorous testing	20
5.3 Acceptance tests	20
6 Network expansion	21
6.1 Introduction	21
6.2 Expansion	21
6.3 Moving MAUs	23
6.4 Protection of the cable network	23
Appendix A Typical network topologies	24
Appendix B Cable network acceptance tests and equipment	27
Appendix C LAN installation in multiple buildings	30
Publications referred to	Inside back cover

National foreword

This British Standard, prepared under the direction of the Information Systems Technology Standards Policy Committee, is identical with IEC 907:1988 *“Local area networks CSMS/CD 10 Mbits/s baseband planning and installation guide”*, published by the International Electrotechnical Commission (IEC).

The IEC standard is very unconventional in its editorial style. For example, the scope clause (1.1) does not state substantively what the standard does or what form it takes. Also, conventional wording is not used throughout and “must”, “may not”, “will”, “should”, etc., are used without apparent consistency.

Nevertheless the BSI committee believes the text comprises a useful guide to the subject and it is therefore implemented in the form of a British Standard guide.

Potential users of this guide should be fully aware of the UK regulatory requirements for connection to the Public Telecommunications Network (PTN). In addition, connection to the PTN could require users and suppliers to conform to British Standards; EN's (Norme Européenne) and NET's (Norme Européenne de Télécommunications), produced specifically for telecommunications apparatus, which have been the subject of some form of regulation or ratification.

Cross-references. The Technical Committee has reviewed the provisions of ECMA-80, ECMA-81, ECMA-82, ECMA/TR 19 and IEEE 802.3, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Foreword

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

Preface

This report is a bilingual version of ECMA (European Computer Manufacturers Association) technical report TR/26 published in March 1985. This technical report has been proposed by ECMA for adoption without change as an IEC report. This report has been prepared by IEC Technical Committee No. 83: Information technology equipment.

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

Six Months' Rule	Report on Voting
83(CO)4+A	83(CO)12

Full information on the voting for the approval of this report can be found in the Voting Report indicated in the above table.

1 General

1.1 Scope

This report is intended to assist in the planning, design, installation and system testing of the standard CSMA/CD¹⁾ baseband LAN, according to Draft International Standard ISO/DIS 8802-3.

The main component of the transmission medium, a trunk cable of unique design and specification, requires no special installation techniques. In addition to the passive trunk cable the network system comprises terminators, drop cables, medium attachment unit (MAU) and repeaters. These items, once installed and connected together constitute the transmission medium that supports the local area network (LAN).

Simplicity of installation and flexibility of layout are important characteristics of the approach in providing a high-performance, high-integrity local area network. Equally important is the ease with which a system may be enlarged to cope with expanding needs. A small network system concentrated on one floor, supporting a small number of data terminal equipments (DTEs) may be progressively enlarged to a final system servicing an entire multi-storey building with up to 1 024 units of data terminal equipments (see Appendix C).

Such a system may also be connected to remote DTEs of systems via a communications gateway and external transmission lines. Clearly, the planning and installation activity will vary greatly depending on the size and complexity of the system.

Successful network operation is the end-product of good and thorough planning. The planner will evaluate the restrictions imposed by the building lease, type of structure, facilities requirements, health and safety regulations, equipment location and quantity, cable performance specifications, floor plan and budget.

The key activities consistent with the above are:

- to plan and design the cable route according to the distribution of the DTEs;
- to install the network hardware;
- to test the network hardware.

As it is anticipated that most networks will grow and evolve over a period of time, this shall be taken into consideration at the initial design stage.

1.2 References

IEC publications:

- | | | |
|--------|---------|---|
| 78 | (1967): | <i>Characteristic impedances and dimensions of radio-frequency coaxial cables.</i> |
| 96: | | <i>Radio-frequency cables.</i> |
| 96-0 | (1970): | <i>Part 0: Guide to the design of detailed specifications.</i> |
| 96-1 | (1986): | <i>Part 1: General requirements and measuring methods. (Concerns especially Appendix B of this report.)</i> |
| 96-2 | (1961): | <i>Part 2: Relevant cable specifications. (Especially sheet 96-IEC-50-7-1.)</i> |
| 169-16 | (1982): | <i>Radio-frequency connectors, Part 16: R.F. coaxial connectors with inner diameter of outer conductor 7 mm (0.276 in) with screw coupling — Characteristic impedance 50 ohms (75 ohms) (Type N).</i> |

Other publications:

- | | |
|--------------------|---|
| ISO/DIS 8802-3: | <i>Information Processing Systems — Local Area Networks — Part 3: Carrier Sense Multiple Access with Collision Detection.</i> |
| ECMA TR/19 (1984): | <i>Local Area Networks, Safety Requirements.</i> |
| ECMA 80 (1984): | <i>Local Area Networks (CSMA/CD Baseband) — Coaxial Cable System.</i> |
| IEEE 802-3 (1985): | <i>CSMA/CD 10 Mbit/s Baseband, Local Area Networks.</i> |

¹⁾ CSMA/CD Network: Carrier sense multiple access with collision detection network.

1.3 Terminology

For the purpose of this report, the following definitions apply:

1.3.1

coaxial cable

a two-conductor (centre conductor and shield), concentric, constant-impedance transmission line

1.3.2

coaxial connector

IEC 169-16 connectors (according to IEC Publication 169-16), attached to each end of a cable section

1.3.3

cable section

a continuous length of coaxial cable, fitted with connectors at each end

1.3.4

cable segment

a length of coaxial cable made up from one or more cable sections and connectors, electrically terminated at each end with its characteristic impedance

1.3.5

data terminal equipment (DTE)

the source and sink for all communications on the network

1.3.6

local area network (LAN)

a data communications system supporting layers 1 and 2 of the ISO reference model for open systems interconnections, having a limited geographic coverage. The technical limitations allow communication of at least 1 km end-to-end and provide for sufficient performance to support the aggregate data throughput required

1.3.7

networks components

the hardware elements that make up the transmission system of the network (i.e. cables, medium attachment units (MAU), repeaters, connectors)

1.3.8

repeater

a device used to extend the length and topology of the network beyond that imposed by a single segment, up to the allowable end-to-end trunk transmission line length. Repeaters perform the basic functions of restoring the signal in both amplitude and time domain

1.3.9

station

a single addressable site on the LAN

1.3.10

medium attachment unit (MAU)

the unit which forms the node between a coaxial cable segment and the MAU cable

1.3.11

trunk cable

the coaxial cable used to form a segment

2 System overview

2.1 General

Before planning and designing the physical layout of a network system, it is necessary to become familiar with the component and configuration specifications. This clause:

- provides details of the network components;

- provides component configuration guidelines and specifications to ensure a properly designed network system.

2.2 Component descriptions

2.2.1 Trunk cable

The trunk cable is a constant impedance transmission line of circular cross-section. It is used to interconnect the medium attachment unit.

The trunk cable is marked at 2.5 m intervals, all measurements should be made with respect to this marking to a tolerance of ± 0.05 m.

Care should be taken to ensure that the cable materials are compatible with the installation environment. Normal PVC polyvinyl chloride materials should satisfy the majority of situations; however local safety codes may in some cases prohibit this. Low smoke and fume grades of PVC or polytetrafluoroethylene (PTFE) may be required for plenums or lift shafts for example.

PVC cables will have a nominal outside diameter of 10.3 mm and PTFE cables 9.5 mm.

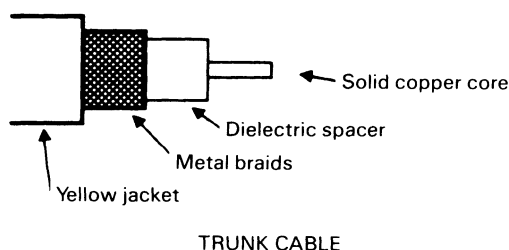
Coaxial cable connectors are used to join trunk cable sections and attach terminators.

All connectors are “N” series (IEC Publication 169-16), 50 Ω constant impedance. As frequencies in the transmitted data are band-limited to approximately 20 MHz, military versions of the connectors are unnecessary, but are acceptable.

- Male plugs are fitted at the ends of all trunk cables.
- Female-to-female barrel connectors are used to join trunk cable sections.
- Female terminators are used for terminating both ends of a trunk cable segment.

Care should be taken to ensure that the connector shell (connected to the trunk cable screen) is insulated using an insulation boot, from any building metal, or other unintended conductor.

An insulation boot shall be used to cover the connector during the installation phase, and shall be replaced after any subsequent work which entails its removal.



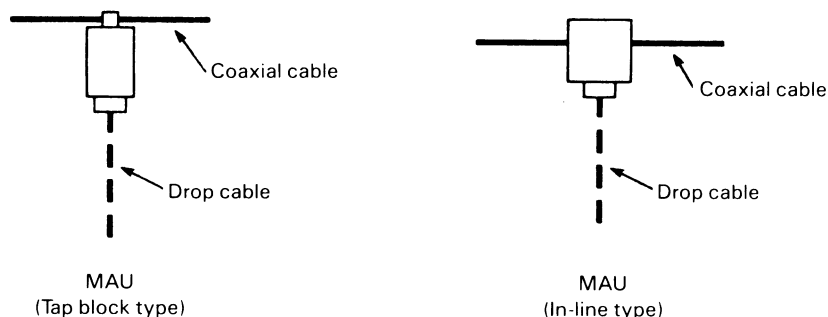
2.2.2 Medium attachment unit (MAU)

Device that connects directly to the trunk cable, by means of either a tap block connector or directly in line. MAU provides the electronics to transmit and receive encoded signals on the cable and to provide the required electrical isolation.

One cable segment (up to 500 m) will support up to 100 MAUs.

One network will support up to 1 024 MAUs.

The MAUs should be placed every 2.5 ± 0.05 m or multiple thereof. The trunk cable is physically marked every 2.5 m to assist with the placement of the MAUs.

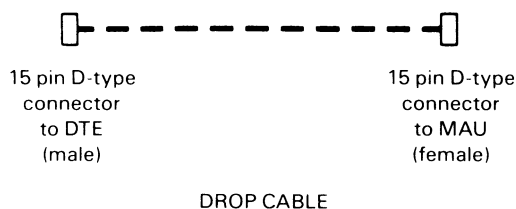


2.2.3 Medium attachment unit interface (drop) cable

The drop cable connects an MAU to a DTE, allowing that DTE access to the network. It is made up of a length (variable) of cable (with 8 conductors consisting of four individually shielded twisted pairs, plus an overall shield and insulating jacket) with 15-pin D connectors (1 male; 1 female) at either end. The D connectors are fitted with slide lock strain relief mechanisms. The maximum length of drop cable attached to any MAU is 50 m.

In normal usage a single drop cable should be used to connect a user device to an MAU on the trunk cable. Theoretically multiple lengths of drop cable could be chained like extension cords, but each additional connector introduces performance and reliability degradation. If chaining is deemed necessary to meet an unusual layout requirement, two lengths may be chained. Chaining of more than two lengths is not recommended.

An installed drop cable should be physically restrained in order to protect the slide lock mechanism of the D connectors from accidental strain or damage.



2.2.4 Data ports

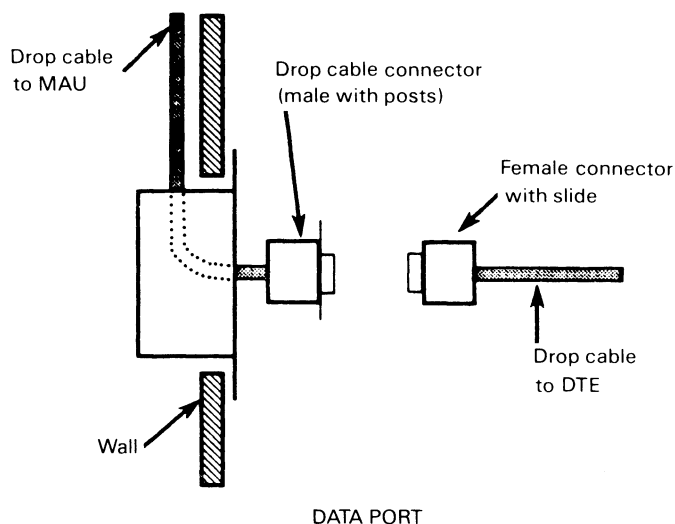
These provide a neat and unobtrusive means of pre-cabling a building, or part of a building, such that connection points are provided at convenient points. These can be selected, as required, as equipment connectivity needs change.

A data port is connected via a drop cable to an MAU installed on the trunk cable, the drop cable being concealed in or behind a wall. The DTE is then connected to the data port by means of a second drop cable. When planning this type of installation care shall be taken to ensure that the maximum length restriction of 50 m is adhered to.

The state and configuration of this device will vary, but the following shall be ensured:

- the 15-pin way D-type socket shall be male with posts;

— the body of the data port shall totally enclose the drop cable termination and shall be an effective radiation screen (e.g. steel).



2.2.5 Repeater

Although a cable segment is restricted to a maximum length of 500 m, two or more segments can be linked using repeaters. These extend the signal between two segments of the trunk cable.

A maximum of two repeaters is permitted in any communicating path on the network. Thus the maximum separation between any two work stations is 1 500 m (three segments) plus the drop cable lengths.

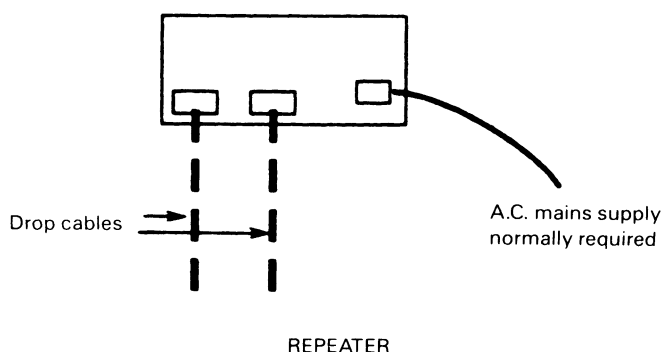
Repeaters shall not be connected in parallel; therefore, before installing a repeater ensure that the two segments are not already connected via repeaters.

Repeaters can be used to create branches from a mains network segment as required.

Repeaters require access to an a.c. mains electricity supply.

To link two segments:

- Install an MAU on both trunk cable segments in the normal manner (at a 2.5 m placement mark on each trunk cable).
- Connect both MAUs to the repeater using normal drop cables.



2.2.6 Terminators

Terminators shall be fitted at each end of a trunk cable segment. If they are not present, the network system will malfunction.

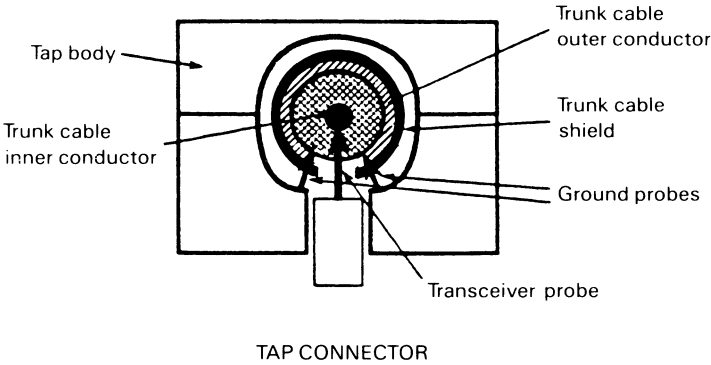
The terminators are 50 Ω , 1 W devices with a female connector. Provision may be made for earth attachment at the terminator (see Sub-clause 2.2.7). The terminator shall be insulated by a boot after it has been located.

2.2.7 Earthing clip (optional)²⁾

The outer screen of the cable shall be earthed once only. An electrical earthing clip provides a means of attachment to a barrel connector, or terminator, and should be connected to the nearest incoming mains electricity earth using 4 mm² copper wire.

2.2.8 Tap connectors

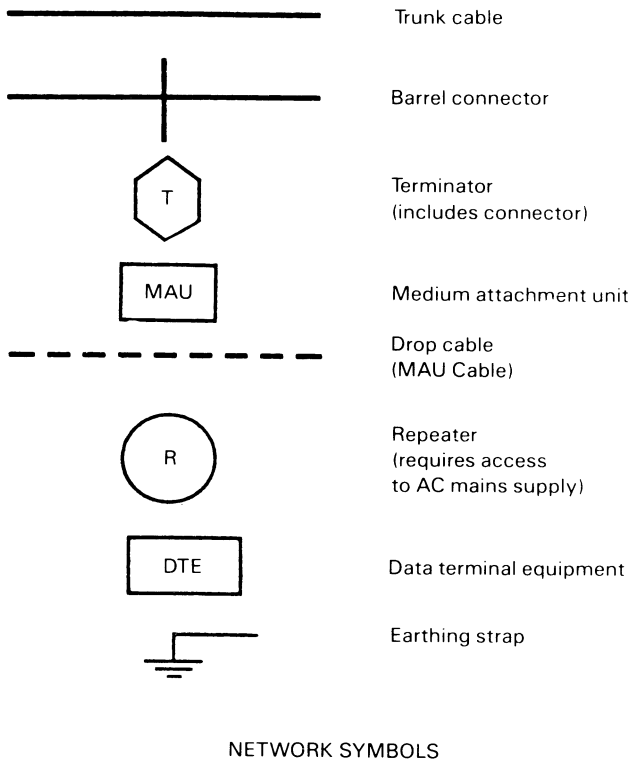
Tap connectors allow MAUs to be connected to the trunk cable without disrupting the data traffic. Eventually tap connectors will allow casual attachment and disconnection from the trunk cable.



2.3 Network configuration

2.3.1 Network symbols

These symbols are used to represent the network equipment on the floor plan.



²⁾ The outer screen of the cable should be earthed (see Sub-clause 4.9). The earthing clip is an optional means.