

E C M A

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-97

LOCAL AREA NETWORKS

-

SAFETY REQUIREMENTS

Second edition - December 1992

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Brief History

ECMA started work on Local Area Networks (LAN) at the beginning of 1981, in co-operation with IEEE 802. It was soon realised that, although the equipment to be connected via LAN could be designed according to the equipment safety standards (at the time Standard ECMA-57) the special requirements of the cables interconnecting the equipment were not considered in these safety standards.

TC12 was therefore asked to prepare a document, to be used in conjunction with the safety standards, describing specific requirements of LAN.

The field was rather new and further experience was needed. For this reason the document was first published as an ECMA Technical Report, ECMA TR/19. Based on comments received and experience gained since then, the revised version of the technical report was published as an ECMA Standard, ECMA-97, in June 1985.

The evolution of the safety standards, in ECMA and IEC, had as a result the publication of IEC 950 and ECMA-129, safety standard including the consideration of LAN in so-called Situation A. It was therefore decided to publish a second edition of ECMA-97, detailing the requirements for Situation B.

Adopted as an ECMA Standard by the General Assembly of December 1992.

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1 Scope

This ECMA Standard applies to networks equipment which consist of, access units, interface connectors and the design of interface circuits between data terminal equipment and network components. Additionally, installation and maintenance instructions for cabling between units is covered in this Standard.

This Standard applies only to networks that normally operate at ELV or TNV.

Specifically excluded from the scope of this Standard are public switched telephone networks (STNs), private branch telephone exchanges (PBXs), cable television (CATV), fire protective signalling systems, dedicated or industrial control systems, environmental control systems, audio, radio and television signal or antenna systems, and similar systems, although the principles described herein may sometimes be useful to such application.

Other methods of construction or design which provide the same level of safety would also be acceptable.

For information systems designed to have interconnect cabling up to a few hundred meters in length and hence installed in a relatively small area, Standard ECMA-129 or IEC Publication 950 fully covers the safety requirements.

With the introduction of networks which can extend to kilometres and hence enter unspecified and uncontrolled environments, other parameters not covered by Standard ECMA-129 or IEC Publication 950 have to be considered.

These parameters, which also relate to experience from telecommunications installations, include:

- different network systems;
- different mains power system grounding schemes;
- power distribution in high rise or very long buildings;
- networks between buildings;
- single vs. multiple earth connections;
- equipotential bonding;
- design of DTE interface circuits;
- environmental restrictions, e.g. flame spread, flammability, smoke and fumes, etc.
- protective measures against lightening and other transient effects;
- installation and maintenance requirements.

2 Conformance

To conform with the requirements of this ECMA Standard, a network shall be designed and tested according to clause 6, and maintained according to clause 7.

3 References

ECMA-129	Safety of information technology equipment including electrical business equipment
ECMA TR/26	Planning and installation guide for CSMA/CD 10 Mbit/s baseband LAN coaxial cable systems
IEC Publ. 60	High voltage test methods
IEC Publ. 364	Electrical installation in building
IEC Publ. 950	Safety of information technology equipment, including electrical business equipment
EN 60950	Safety of information technology equipment, including electrical business equipment

4 Definitions

For the purpose of this Standard the definitions of ECMA-129 apply. In addition, the following definitions apply.

4.1 Local area network (LAN)

An electronic communications network which has a limited transmission distance due to the protocol definition (i.e. limitations are placed on the recipient's response time).

NOTE 1

LAN sizes range from single departmental workstation networks, to whole building installations, campus installations, and may be as large as city or region wide networks. LANs typically have dedicated transmission media, but may use some of the same types of media as WANs, but within limited distances.

4.2 Wide area network (WAN)

An electronic communications network which have no limitations placed on the total transmission distances.

NOTE 2

WANs typically share long distance transmission media with analogue or digital voice telecommunications networks.

4.3 Local ITE communications

Electronic communications between various units of an ITE system which are typically characterised by point-to-point connections, channelled through a central processor unit, which are limited to internal building installations of very short distances (typically under 300 meters) by the protocol definitions (limitations placed on the response time). These include serial and parallel communications ports, 20 mA loop, magnetic storage media busses, keyboard cabling, etc. and use protocols such as RS-232, IEEE 488 and SCSI.

4.4 Installation type A

A situation in which a segment is installed entirely within a zone which has equipotential bonding conductor according to IEC 364-4-41 clause 413.1.2 and 413.1.6 (See annex B), and which does not contain above-ground conductors external to the installation structure.

4.5 Installation type B

A situation which does not comply with Installation type A.

4.6 Medium access unit (MAU)

A junction unit by which a DTE may obtain access to the trunk cable medium. (Often called a transceiver.)

4.7 Data terminal equipment (DTE)

The source and sink for all communications on the network. It includes all equipment attached to the medium including the means of connection to the cable.

4.8 Segment

A network or section of a network whose MAU are connected to each other by conductive trunk cabling, and which is electrically isolated from each other section.

4.9 Network

A LAN or WAN. As used in this document, a network does not include telecommunications networks or local ITE communications.

4.10 Trunk Cable

The central mechanism of physical cable which carries network signals between MAUs in inter- or intra- building installations. Cables connecting DTEs in intra-building ring configurations are not considered to be trunk cables.

5 Acronyms

DTE	Data terminal equipment
EMC	Electro-magnetic compatibility
ITE	Information technology equipment
LAN	Local area network
MAU	Medium access unit
WAN	Wide area network

6 Design

The design and installation for the DTE, MAU, cables and other network components shall conform with the requirements stated in clause 6 and 7, respectively, as appropriate to the installation type. In respect to design requirements not covered by clause 6, DTE and active and passive hardware of the network shall be designed to ECMA-129 or IEC 950.

Network segments which are to be connected to public or private telecommunications networks shall be designed to ECMA-129 Section III, clause 12, or IEC 950 Section 6.

In addition to general requirements (6.1), this clause defines design criteria for installation type B (6.3), with additional requirements if cables leave buildings.

Any single building installation will normally be installation type A. Single building installations of LANs are typically in installation type A, as well as segments of LANs and WANs which are isolated from other segments.

Interbuilding network segments will normally be installation type B. However, equipment designed for installation type B is required for single building installations if the building wiring design can not insure equipotential bonding throughout the installation.

6.1 General requirements

The following circuits shall be so designed that whether or not they are accessible, they are safe to touch under normal and single fault conditions:

- in the DTE, circuits intended for connection directly or via an MIC to the MAU;
- in the MAU, circuits intended for connection to the trunk cable;
- in the MAU, circuits intended for connection directly or via an MIC to the DTE.

The above requirements apply prior to the connection of the equipment.

The above requirements are considered to be met by the following circuits:

- an SELV circuit defined by ECMA-129 or IEC 950 (methods 1 and 2);
- a circuit meeting the requirements of IEC 65 for accessible terminals.

NOTE 3

The electrical installation of the building is expected to be in accordance with IEC 364.

6.2 Design requirements for network segments in installation type B

Installation type B implies that a LAN segment will bridge two or more separate equipotentially bonded zones of the kind described in installation type A, where the continuous and transient potential between the earth connections of the zone is unknown. Installation type B design requirements shall be used for all equipment, except where the supplier or their agent has control of the mains supply and network installations.

6.2.1 Requirements for earth screening

There are no safety requirements to connect the screen (if any) of the trunk cable to earth. However, where this is required for EMC or other reasons, installation instructions shall be provided advising that it shall be connected to the protective earth of the building by one of the following methods, and as acceptable to local building wiring codes:

- a direct connection from earth to any single point in one network segment; or
- a direct connection from earth to each MAU and at appropriate intervals for EMC purposes on untapped trunk cable, the earthing to be independent of the connection to the DTE; or
- indirectly, by voltage limiting devices which limit the voltage to 1500 V peak or less, between earth and any one or more points on the network segment.

6.2.2 Isolation in the MAU

Electrical isolation shall be provided in the MAU between the DTE interface circuits and the trunk cable conductors, and between the drop cable screen and the trunk cable screen (if any). Isolation shall be provided between the trunk cable screen (if any), and the DTE and any exposed surface of the MAU.

The trunk cable screen (if any) may be connected to the equipment PE terminal only in permanently connected Class I equipment.

6.2.3 Connection of metalwork to trunk cable

It shall not be possible to touch any metalwork connected to the trunk cable screen or signal conductors. Compliance is checked in accordance with subclause 2.1.2 or 6.2.2 of IEC 950, as appropriate.

6.2.4 Capacitors installed across insulation

Capacitors connected across safety separation for EMC or other purposes shall be limited in value to 0,01 μF per MAU and shall comply with the requirements of IEC 384-14 for Y2 capacitors tested to 1500 V ac for 1 minute.

6.2.5 Surge arrestors built into the equipment

Equipment may have inter-building surge arrestors included in their design. Such surge arrestors shall be designed to meet CCITT Blue Book Series K Recommendations, and shall be tested with the simulated lightning surge specified in standard IEC 801-5.

6.2.6 Testing of insulation

Insulation provided to comply with the requirements of 6.2.2 or 6.2.3 shall withstand one of the following electric strength tests:

- 1500 V rms for 1 minute (see test procedure in ECMA-129 or IEC 950, 5.3.3)
- 2250 V dc for 1 minute (see test procedure in ECMA-129 or IEC 950, 5.3.3)
- 2400 V impulse test in accordance with annex A.

NOTE 4

The above test voltages are known from experience to be adequate for safety. Occasional overvoltages may exceed these values and cause equipment damage and destruction. To minimise the inconvenience of such a malfunction, which may be permanent and difficult to localise, and may affect the whole LAN, insulation withstanding a higher voltage may be specified. Values corresponding to 2000 V rms have been found to be effective.

6.2.7 Hardware providing 500V isolation

Hardware providing only 500V isolation as described in 6.2.2 may be used in installation type B provided that circuitry in the MAU intended for connection to the DTE has one pole permanently earthed with a separate conductor having a cross sectional area of not less than 1.5 mm² and not contained in any power cord (see also ECMA-129 or IEC 950, 2.5). The equipment shall have a marking stating that safety requirements are not fulfilled, unless the equipment is connected to protective earth by a separate conductor.

NOTE 5

This arrangement may result in malfunction due to earth loops between the MAU and DTE. Uninformed attempts to obtain correct functioning by breaking these loops may create safety hazards. Such earth loops will not occur if the circuits in the DTE intended for connection to the MAU are not earth referenced in the DTE.

6.2.8 Connection to telecommunication network

Equipment or segments intended to be connected directly to private or public telecommunication networks shall be designed to the requirements in ECMA-129, Section III, clause 12, or IEC 950 Section 6, whether or not they share the lines with telecommunication networks.

7 Installation instructions

Installation instructions shall be supplied with the network components, which shall advise that the installation is required to be made according to local wiring codes, and shall call attention to the following points which are relevant to the particular network.

7.1 Site design considerations

Equipment designed for installation type A or installation type B shall be chosen for the particular installation, dependant on the particular conditions which exist in the installation.

Installation type A equipment may be used under the limitations of:

- use in a single building or closely located group of buildings;
- a single commonly grounded power system;
- no outdoor cable runs;
- no exposure of network to high voltage wiring.

The use of installation type B equipment is required in segments where isolation is needed due to the presence of:

- poor grounding practices within the network environment,
- more than one electrical system or service,
- exposure of the network to potential faults involving mains wiring within the building in mixed wiring spaces such as ceilings or subfloors,
- outdoor, aerial or underground lines installation type B equipment may be used in installation type A network segments.

The network designer should document as part of the network design:

- the location and extent of mains power systems, if more than one;
- the nature of any earthing connections between power systems;
- circuits running between buildings;
- circuits running in service tunnels;
- circuits running in close proximity to mains service conductors;
- circuits running outdoors;
- location and specifications of protective devices;
- location of earthing points of the network;
- requirements for installation type A or B equipment,
- Segment isolation points.

7.2 Maintenance and network modification

Maintenance instructions and, where relevant, user instructions, shall call attention to the following points, which are relevant to the particular network. These are concerned with minimising any risk to maintenance personnel arising from unusual voltages which may occasionally exist on the trunk cable screen when it is earthed at a remote point.

When work (e.g. addition of terminal devices or cable re-routing) is necessary on a trunk cable which has been installed and earthed in accordance with this Standard:

- the work should be carried out by qualified electricians, technicians or other suitably trained personnel;
- no work should be undertaken while there is a likelihood of an inter-building section of the cable being struck by lightning;
- prior to work on the cable, a check should be made on the voltage existing between the cable screen and the earth. If it exceeds 30 V rms this indicates an electrical fault which should first be investigated;

- either the screen of the trunk cable should be temporarily earthed locally in two places, one on each side of the intended cut or disconnection, or these two places should be joined by a temporary strap, the temporary connection being removed after normal continuity is restored;
- personnel should not contact the trunk screen and any locally earthed part simultaneously unless the screen has been earthed locally.

Annex A

(normative)

Impulse test

Electric strength test using 10 impulses having the peak voltage specified, applied at intervals of not less than 1 s, the polarity being reversed after each impulse. The waveform shall be 1,2/50 μ s (see IEC Publication 60). After application of the impulses, the part under test shall have a resistance of at least 2 M Ω , measured at 500 V dc.

Annex C

(informative)

Equipotential Bonding

(Extract from IEC Publication 364, Chapter 41)

413.1.2 Main Equipment Bonding

In each building, a main equipotential bonding conductor, complying with IEC 364 chapter 54, shall interconnect the following conductive parts:

- main protective conductor;
- main earth-continuity conductor;
- main water pipes;
- main gas pipes;
- risers of central heating and air conditioning systems.

NOTE

The additional interconnection of metallic parts of the building structure and other metal pipework is recommended.

413.1.6 Supplementary Equipotential Bonding

413.1.6.1 If an installation or part of an installation, the specified conditions for protection against indirect contact, resulting in automatic disconnection of supply, cannot be fulfilled, it is necessary to provide local bonding, known as supplementary equipotential bonding.

NOTE

Supplementary equipotential bonding may involve the entire installation, a part of the installation, an item of apparatus, or a location.

413.1.6.2 Supplementary equipotential bonding shall include all simultaneously accessible exposed conductive parts of fixed equipment and extraneous conductive parts, including, where practicable, the main metallic reinforcement of constructional reinforced concrete.

The equipotential system shall be connected to the protective conductors of all equipment including those of socket outlets.

413.1.6.3 Supplementary equipotential bonding connection shall be made by protective conductors satisfying the conditions specified in Chapter 54.

413.1.6.4 Where doubt exists regarding the effectiveness of supplementary equipotential bonding, it shall be confirmed that the impedance Z between simultaneously accessible exposed conductive parts and extraneous conductive parts fulfils the following condition:

$$Z \leq U/I_a$$

where:

U = prospective touch voltage limit

I_a = operating current of the protective device in the appropriate disconnecting time stated in IEC 364-4-41, section 413.1.1.

Where fuses are used, it is sufficient to confirm that the condition is fulfilled for the conventional voltage limit U_L and for the current ensuring the operation of the fuse within 5 s.

Annex D

(informative)

Prospective Touch Voltage Duration

(Extract from IEC Publication 364, Chapter 41)

Maximum disconnecting time	Prospective touch voltage	
	a.c., r.m.s.	d.c.
(s)	(V)	(V)
infinite	<50	<120
5	50	120
1	75	140
0,5	90	160
0,2	110	175
0,1	150	200
0,05	220	250
0,03	280	310

Table 41A

NOTE 1

The d.c. column of Table 41A is related to ripple-free d.c., for example from batteries. If the source of supply is rectified a.c. the a.c. column figures would apply. Specific values for rectified a.c. are under consideration.

NOTE 2

The prospective touch voltage on d.c. equipment can be of different waveform from the system voltage and is dependent on the fault circuit parameters.

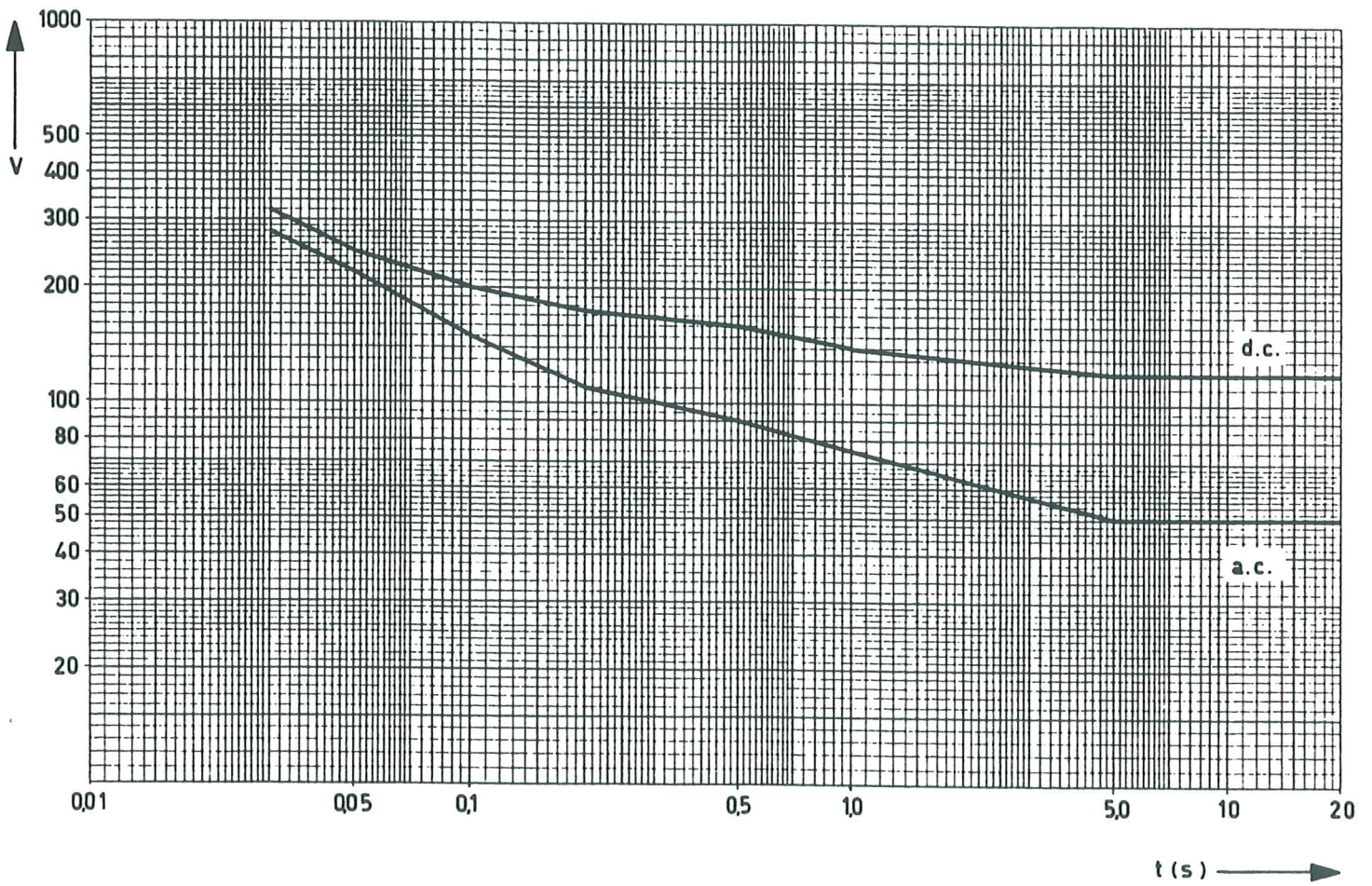


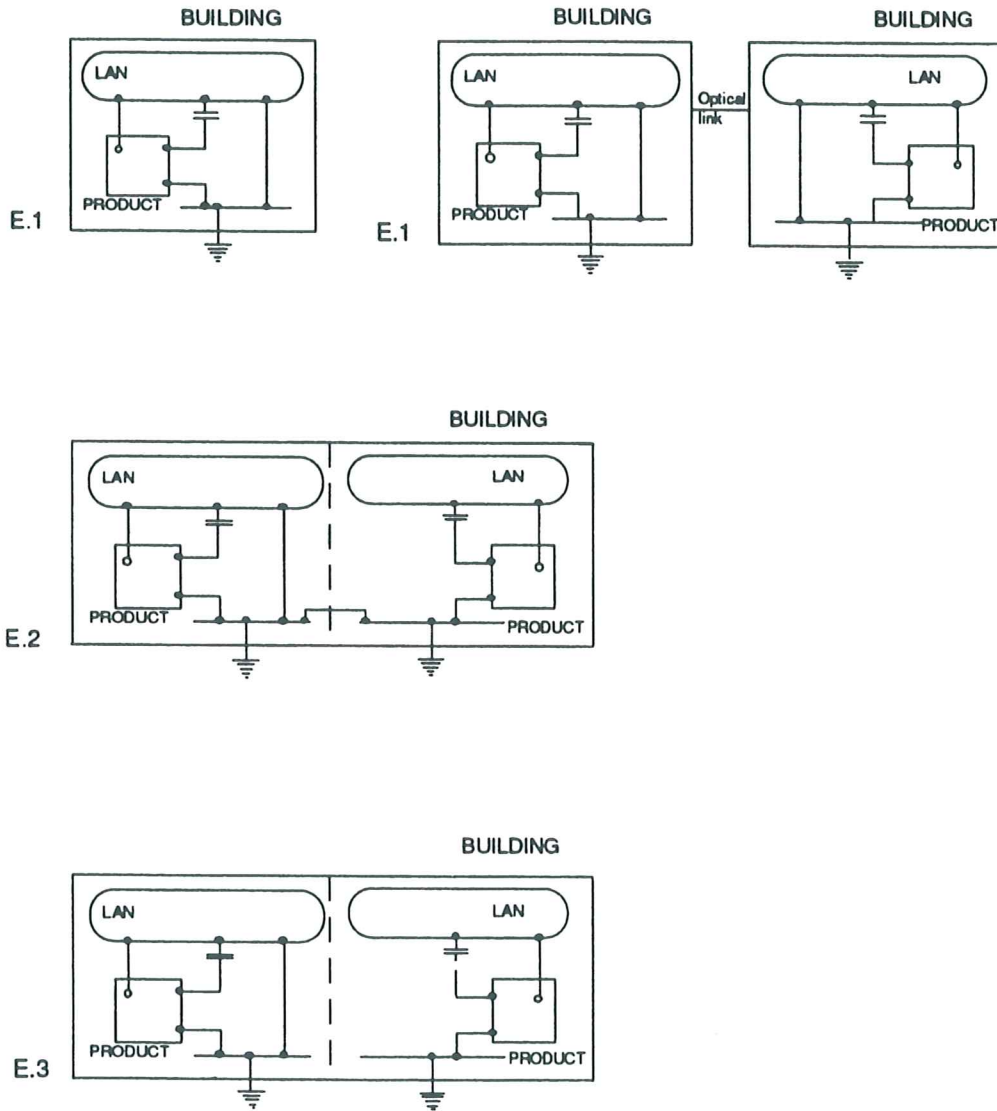
Figure 41B - Maximum prospective touch voltage duration curves according to table 41A

Annex E

(informative)

Examples of situations in and around buildings

Situation A



Situation B

