

Cable networks for television signals, sound signals and interactive services —

Part 11: Safety

The European Standard EN 60728-11:2005 has the status of a British Standard

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National foreword

This British Standard is the official English language version of EN 60728-11:2005. It was derived by CENELEC from IEC 60728-11:2005. It supersedes BS EN 50083-1:1994 which is withdrawn.

The start and finish of each common modification is indicated in the text by tags [C] [C]. Where a common modification has been introduced by amendment, the tags carry the number of the amendment. For example, the common modifications introduced by CENELEC amendment A11 are indicated by [C11] [C11].

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**Cable networks for television signals,
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Part 11: Safety
(IEC 60728-11:2005, modified)

Réseaux de distribution par câbles
pour signaux de télévision, signaux
de radiodiffusion sonore et services
interactifs
Partie 11: Sécurité
(CEI 60728-11:2005, modifiée)

Kabelnetze für Fernsehsignale,
Tonsignale und interaktive Dienste
Teil 11: Sicherheitsanforderungen
(IEC 60728-11:2005, modifiziert)

This European Standard was approved by CENELEC on 2005-04-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of documents 100/847A/FDIS + 100/847B/FDIS, future edition 2 of IEC 60728-11, prepared by Technical Area 5: Cable networks for television signals, sound signals and interactive services, of IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote.

Together with a common modification, prepared by the Technical Committee CENELEC TC 209, Cable networks for television signals, sound signals and interactive services, it was approved by CENELEC as EN 60728-11 on 2005-04-01.

This European Standard supersedes EN 50083-1:1993 + A1:1997 + A2:1997 + corrigenda Jul. 2000.

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2006-01-01 |
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Annexes ZA, ZB and ZC have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60728-11:2005 was approved by CENELEC as a European Standard with agreed common modifications.

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INTRODUCTION

Standards of the IEC 60728 series deal with cable networks including equipment and associated methods of measurement for head-end reception, processing and distribution of television signals, sound signals, interactive multimedia signals, interfaces and their associated data signals, using all applicable transmission media.

This includes

- CATV networks;
- MATV networks and SMATV networks;
- individual receiving networks;

and all kinds of equipment, systems and installations installed in such networks.

The extent of this standardization work is from the antennas, special signal source inputs to the head-end or other interface points to the network up to the terminal input.

The standardization of any user terminals (i.e. tuners, receivers, decoders, terminals, etc.) as well as of any coaxial and optical cables and accessories thereof is excluded.

CABLE NETWORKS FOR TELEVISION SIGNALS, SOUND SIGNALS AND INTERACTIVE SERVICES –

Part 11: Safety

1 Scope

This part of IEC 60728 deals with the safety requirements applicable to fixed sited systems and equipment. As far as applicable, it is also valid for mobile and temporarily installed systems, for example, caravans.

Additional requirements may be applied, for example, referring to

- electrical installations of buildings and overhead lines;
- other telecommunication services distribution systems;
- water distribution systems;
- gas distribution systems;
- lightning systems.

This standard is intended to provide specifically for the safety of the system, personnel working on it, subscribers and subscriber equipment. It deals only with safety aspects and is not intended to define a standard for the protection of the equipment used in the system.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60065:2001, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60364 (all parts), *Electrical installations of buildings*

IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*

IEC 60825-1:2001, *Safety of laser products – Part 1: Equipment classification, requirements and user's guide*

IEC 60825-2:2000, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 60950-1:2001, *Information technology equipment – Safety – Part 1: General requirements*

IEC 61024-1:1990, *Protection of structures against lightning – Part 1: General principles*

ISO 3864:2002, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

EN 50117 (all parts), *Coaxial cables used in cabled distribution networks*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Some terms have been taken from IEC 60050-195 and IEC 60050-826.

3.1.1

amplifier

device to compensate for attenuation

3.1.2

attenuation

decibel ratio of the input power to the output power

3.1.3

cable networks (for television signals, sound signals and interactive services)

general overall term used to define CATV-networks, MATV-networks, SMATV-networks and individual receiving networks; these networks can be used in downstream and upstream directions

3.1.4

CATV network or community antenna television network

network designed to provide sound and television signals as well as signals for interactive services to communities

3.1.5

earthing arrangement

all the electric connections and devices involved in the earthing of a system, an installation and equipment

[IEV 195-02-20]

3.1.6

earthing conductor

protective conductor connecting the main earthing terminal or bar to the earth electrode

[IEV 826-04-07]

3.1.7

earth electrode

conductive part or a group of conductive parts in intimate contact with and providing an electrical connection with earth

[IEV 826-04-02]

3.1.8

earthing terminal

connection point by means of which the earthing or grounding of a conducting part of an equipment is accomplished

3.1.9

electric shock

pathophysiological effect resulting from an electric current passing through a human or animal body

[IEV 826-03-04]

3.1.10

equipotential bonding

electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential

[IEV 826-04-09]

3.1.11

equipotential bonding bar

bar to which, for example, extraneous conductive parts (see IEV 826-03-03), metal sheet of electrical power and telecommunication cables and other cables can be bonded

3.1.12

equipotential bonding conductor

protective conductor for ensuring equipotential bonding

[IEV 826-04-10]

3.1.13

feeder

transmission path forming part of a cable network. Such a path may consist of a metallic cable, optical fibre, waveguide or any combination of them. By extension, the term is also applied to paths containing one or more radio links

3.1.14

galvanic isolator

device providing electrical isolation below a certain frequency range.

3.1.15

hazardous voltage

electrical condition of an object from which a hazardous touch current (electric shock) could be drawn

[IEC 60065:2001, definition 2.6.10]

3.1.16

head-end

equipment, which is connected between receiving antennas or other signal sources and the remainder of the cable network, to process the signals to be distributed

3.1.17

individual receiving network

network designed to provide sound and television signals as well as signals for interactive services to an individual household

3.1.18

lightning protection system (LPS)

complete system used to protect a space against the effects of lightning consisting of both external and internal lightning protection systems

NOTE In particular cases, an LPS may consist of an external LPS or an internal LPS only (see IEC 61024-1).

3.1.19

main earthing terminal; main earthing bar

terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors and conductors for functional earthing, if any, to the means of earthing

[IEV 826-04-08]

3.1.20**MATV network or master antenna television network**

network designed to provide sound and television signals as well as signals for interactive services to households in one or more buildings

3.1.21**metal installation**

extended metal items in the space to be protected which may form a path for lightning current, such as pipe-work, staircases, elevator guide rails, ventilation, heating and air conditioning ducts, and interconnected reinforcing steel

[IEC 61024-1:1990, definition 1.2.18]

3.1.22**"natural" component of an LPS**

component which performs a lightning protection function but is not installed specifically for that purpose

NOTE Some examples of the use of this term are as follows:

- "natural" air-termination;
- "natural" down-conductor;
- "natural" earth electrode.

[IEC 61024-1:1990, definition 1.2.17]

3.1.23**network interface unit (NIU)**

interface between the cable network and the network inside an apartment

NOTE The network interface unit can contain an over-voltage protective element and/or a galvanic isolation.

3.1.24**neutral conductor (symbol N)**

conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy

[IEV 826-01-03]

3.1.25**PEN conductor**

earthed conductor combining the functions of both protective conductor and neutral conductor.

NOTE The acronym PEN results from the combination of both symbols PE for the protective conductor and N for the neutral conductor.

[IEV 826-04-06]

3.1.26**protective conductor (symbol PE)**

conductor required by some measures for protection against electric shock for electrically connecting any of the following parts:

- exposed conductive parts;
- extraneous conductive parts;
- main earthing terminal;
- earth electrode;
- earthed point of the source or artificial neutral

[IEV 826-04-05]

3.1.27

receiver lead

lead, which connects the system outlet to the subscriber equipment

3.1.28

receiving antenna

device with proper electrical characteristics that intercepts desired signals in the atmosphere and transfers these to the remainder of the cable network

3.1.29

remote power feeding voltage

voltage for supplying power to network equipment via the cable network or a separate line

3.1.30

safety distance

minimum distance between two conductive parts within the space to be protected between which no dangerous sparking can occur

[IEC 61024-1:1990, definition 1.2.23]

3.1.31

SMATV network or satellite master antenna television network

network designed to provide sound and television signals as well as signals for interactive services, received by satellite receiving antenna eventually combined with terrestrial TV and/or radio signals, to households in one or more buildings

3.1.32

splitter (spur unit)

device in which the signal power at the (input) port is divided equally or unequally between two or more (output) ports

NOTE Some forms of this device may be used in the reverse direction for combining signal energy.

3.1.33

spur feeder

feeder to which splitters, subscriber taps or looped system outlets are connected

3.1.34

subscriber equipment

equipment at the subscriber premises such as receivers, tuners, decoders, video recorders, multimedia terminals

3.1.35

subscriber feeder

feeder connecting a subscriber tap to a system outlet or, where the latter is not used, direct to the subscriber equipment

3.1.36

subscriber tap

device for connecting a subscriber feeder to a spur feeder

3.1.37

surge suppressor

device designed to limit the surge voltage between two parts within the space to be protected, such as spark gap, surge diverter or semiconductor device

[IEC 61024-1:1990, definition 1.2.24]

3.1.38**system outlet**

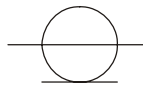
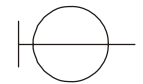
device for interconnecting a subscriber feeder and a receiver lead

3.1.39**transfer point**

interface between the cable network and the building's internal network, each of which may be separately owned and which may contain a voltage-dependent device and/or galvanic isolator

3.2 Symbols

The following graphical symbols are used in the figures of this standard.

	Coaxial conductor [S00011]		Amplifier [S01240]
	System outlet		Galvanic isolator
	Over-voltage protective device		Coaxial over-voltage protective device

3.3 Abbreviations

a.c.	alternating current
AM	amplitude modulation
CATV	community antenna television (network)
d.c.	direct current
IT	isolated earth
LPS	lightning protection system
MATV	master antenna television (network)
N	neutral (conductor)
NIU	network interface unit
PE	protective conductor
PEN	PEN conductor
r.f.	radio frequency
r.m.s	root mean square
SMATV	satellite master antenna television (network)
TV	Television

4 General requirements**4.1 General**

The cable network shall be so designed, constructed and installed as to present no danger, either under normal condition or abnormal (any single fault) condition, to subscribers, personnel working on, or externally inspecting, the system, or to any other person, providing particularly

- personal protection against electric shock;
- personal protection against physical injury;
- protection against fire.

For further details, see the IEC 60364 series.

NOTE The above does not apply to skilled persons working on the equipment, who may be exposed to live parts of the equipment by the removal of protective covers.

4.2 Mechanical requirements

All parts of the system shall be so constructed that there is no danger of physical injury from contact with sharp edges or corners.

4.3 Accessible parts

Access to hazardous parts shall not be possible to the general public without first removing a protective cover by use of a tool. IEC 60065 defines accessible parts and test procedures.

4.4 Laser radiation

If equipment embodying laser products is used, special attention shall be paid to radiation safety. Refer to IEC 60825-1 and IEC 60825-2 for requirements and recommendations.

5 Protection against environmental influences

All system parts, taking into account external influences to which they might be exposed, have to be selected and set up in such a way that, when used properly, the effectiveness of the required protective measures is ensured.

NOTE Special measures are required, for example, for protection against corrosive atmosphere, temperature and humidity.

6 Equipotential bonding and earthing

6.1 General requirements

The cable network shall be designed and constructed in accordance with the requirements of the IEC 60364 series so that no hazardous voltages can be present on the outer conductors of any cable or accessible metalwork of any equipment, including passive items. The requirements for the system outlet are specified in Clause 10; the requirements for bonding and lightning protection of antenna systems are given in Clause 11.

These bonding requirements are intended to protect only the cable network and shall not be considered to provide protection against electric shock currents from electrical installations.

Earthing arrangements and protective conductors shall be designed and constructed in accordance with the requirements of IEC 60364-5-54.

Where cable networks are installed outdoors on the same poles as those of the electric supply, a common earthing may be used.

6.2 Equipotential bonding mechanisms

- a) In order to prevent potential differences between a cable network and other extraneous conductive parts, which might do harm to persons or cause damage, for example, by arcing, the cable network shall be included in the equipotential bonding system of the building.

NOTE Equipotential bonding between metal installations and electrical systems in and on the building is generally carried out at the equipotential bonding bar of the building. Multiple, meshed equipotential bonding increases its effectiveness.

- b) Equipotential bonding can be achieved by means of equipotential bonding conductors, cable shielding or conductive housings or system parts. Heating pipes, water pipes, gas pipes shall not be used because they do not guarantee permanent equipotential bonding efficiency.
- c) The equipotential bonding conductors connected to earthing terminals shall be mechanically stable and shall have a minimum cross-sectional area of 4 mm² Cu. They shall comply with IEC 60364-5-54.
- d) Metallic enclosures for mains-supplied equipment shall be bonded if they are located outside buildings. An example of an equipotential bonding connection is shown in Figure 1.
- e) Where direct connection to an earthing system is not suitable because high balancing currents are expected to flow in the outer conductor, for example, in extensive cable networks, special protection shall be provided.

As shown in Figure 2, this protection can be achieved by

- mounting the equipment within a non-metallic enclosure; or
- connecting an over-voltage protective element between the metallic enclosure and the earthing connection that hazardous voltages shall be removed from the outer conductor and accessible metal parts of the system.

The safety sign “Warning about hazardous electrical voltage”  according to sign B.3.6 of ISO 3864 shall be attached to the enclosure.

If balancing currents are expected to exceed the maximum current allowed by the manufacturer of the cable and/or of the cable connectors, a galvanic isolation may be used as described hereafter.

- f) Where galvanic isolation is provided between sections of the network, to eliminate balancing currents due to local potential differences, the outer conductors of each isolated section shall be connected to an earthing system.

NOTE 1 Galvanic isolators, in case of improper design, can radiate or pick up inadmissible high-frequency energy. Therefore, compliance with the requirements of IEC 60728-2 should be checked carefully.

NOTE 2 Galvanic isolators can be damaged by over-voltages.

- g) The outer conductors of coaxial cables entering or leaving a building shall be included in the equipotential bonding system of the building, either at the equipment or separately. The subscriber feeder cables need not be bonded if a galvanic isolator or fully isolated outlets (see Clause 10) or transfer points each with a galvanic isolation for the inner and the outer conductor are used. Examples are shown in Figures 3, 4 and 5.
- h) Where equipotential bonding is not possible and to avoid balancing currents between the cable network and the building installation, a galvanic isolator shall be used. An example is shown in Figure 5.

NOTE 1 Galvanic isolators, in case of improper design, can radiate or pick up inadmissible high-frequency energy. Therefore, compliance with the requirements of IEC 60728-2 should be checked carefully.

NOTE 2 Galvanic isolators can be damaged by over-voltages.

- i) When changing or removing equipment or coaxial cable, care shall be taken to avoid hazardous voltages between the interrupted parts (inner and/or outer conductors) by opening the loop caused by leakage currents from subscriber equipment. Provision shall be made to maintain continuity of the outer conductor system while units are changed or removed to avoid electric shock (shock currents). An example is shown in Figure 6. In addition, the inner conductors shall be safeguarded against contact.
- j) Every connection of an equipotential bonding conductor or an earthing conductor to an earthing terminal shall be readily accessible and soundly made by the use of crimps, clamps, weld or hard-soldered joints.
- k) All metallic enclosures, housings, mounting bays, racks and mains-supplied equipment, shall be provided with an external earthing terminal as shown in Figures 7 and 8 complying with IEC 60065 or IEC 60950-1.

NOTE Line-powered amplifiers, taps, splitters and transfer points should also be fitted with earthing terminals.

- l) For antennas, which, according to Clause 11, do not have to be grounded, it is strongly recommended that at least the outer conductor of the coaxial cable connected to the antenna should be included in the equipotential bonding. Furthermore, all interconnected, conductive, accessible parts of the installation should be included in the equipotential bonding. For these connections, either of the following solutions is permitted.
 - Connection to an equipotential bonding terminal by means of a bonding conductor (cross-section $\geq 4 \text{ mm}^2 \text{ Cu}$).
 - Connection by means of the shielding of the coaxial cable. The d.c. resistance to the nearest point of equipotential bonding (or PE) shall be lower than 5Ω . The connection of the shield of the coaxial cable to the protective conductor shall only be disconnectable by means of a tool.

6.3 Equipotential bonding in meshed systems

6.3.1 References to other standards

Equipotential bonding shall comply with IEC 60364-5-54, EN 50174-2, EN 50310 and CENELEC R 064-004.

6.3.2 General on a.c. mains

Due to the varying load, locally and versus time, of the individual phases of the a.c. mains supply in a building, high balancing currents can occur in the neutral conductors. The neutral conductor currents are even increased by harmonic currents, which are emitted by certain electric loads like switching power supplies, energy-saving lights, etc.

NOTE For example, the third harmonic currents of the mains frequency in the three phases add linearly in the neutral conductor.

6.3.3 AC power distribution and connection of the protective conductor

In low-voltage installations, different systems are distinguished by the type of earthing connection on the one hand and by the exposed conductive part otherwise (IEC 60364-1 or EN 50310).

a) TN systems

- 1) TN-S system: Separate neutral and protective conductors throughout the system connected at the earthing point of the system.

NOTE No neutral conductor currents flow in the protective conductor.

- 2) TN-C system: Neutral and protective functions combined in a single conductor throughout the system.
- 3) TN-C-S system: Neutral and protective functions combined in a single conductor in part of the system.