

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Low-voltage switch mode power supplies –
Part 3: Electromagnetic compatibility (EMC)

Alimentations à découpage basse tension –
Partie 3: Compatibilité électromagnétique (CEM)

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Low-voltage switch mode power supplies –
Part 3: Electromagnetic compatibility (EMC)**

**Alimentations à découpage basse tension –
Partie 3: Compatibilité électromagnétique (CEM)**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCH MODE POWER SUPPLIES –

Part 3: Electromagnetic compatibility (EMC)

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International Standard IEC 61204-3 has been prepared by subcommittee 22E: Stabilized power supplies, of IEC technical committee 22: Power electronic systems and equipment.

IEC 61204-3 has the status of a product family standard.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the title has been changed by deleting the wording "DC output-" from the title and adding "switch mode" in the title;
- b) changes in the scope: 1.1.1 Equipment covered by this document;
- c) update of the normative references to the latest editions or dated references;

- d) change of wording or/and notes regarding the requirements of CENELEC Guide 24 and IEC Guide 107;
- e) revision of the emission limits to align with the latest editions of the applicable normative references;
- f) revision of the immunity requirements to align with the latest editions of the applicable normative references;
- g) correction of typographical errors.

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

FDIS	Report on voting
22E/174/FDIS	22E/176/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 61204 series, under the general title *Low-voltage power supplies, d.c. output*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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- amended.

LOW-VOLTAGE SWITCH MODE POWER SUPPLIES –

Part 3: Electromagnetic compatibility (EMC)

1 Scope and object

1.1 Scope

1.1.1 Equipment covered by this document

This part of IEC 61204 specifies the electromagnetic compatibility (EMC) requirements for switch mode power supply (SMPS) units supplied by source voltages up to 1 000 V AC or 1 500 V DC providing AC and/or DC output(s), except inverter output(s) establishing AC mains (see exceptions under 1.1.3.)

NOTE 1 This document by definition covers DC/DC converters.

NOTE 2 Power supplies can provide accessory AC mains socket outlets, when such outputs are supplied from the AC mains.

NOTE 3 Ringing generators used in telecoms applications are covered by this document.

This product standard covers both stand alone and component power supply (PSU) units as defined in this document. It covers PSU units for use in or with IT equipment normally covered by IEC 60950-1 and/or IEC 62368-1; PSU units for use in or with measurement, control and laboratory equipment normally covered by IEC 61010-1; PSU units for use in or with medical equipment – normally covered by IEC 60601-1; PSU units for use in or with audio, video and similar electronic apparatus – normally covered by IEC 60065 and/or IEC 62368-1. It also covers DC power and distribution equipment and DC/DC converters.

Where no standard exist, use of this document for other applications is not precluded.

1.1.2 Additional requirements

Requirements additional to those specified in this document may be necessary for

- PSUs intended for operation in special environments (for example, extremes of temperature; excessive dust, moisture or vibration; flammable gases; and corrosive or explosive atmospheres);
- PSUs intended to be used in vehicles, on board ships or aircraft, or in tropical countries;
- PSUs intended for use where ingress of water is possible.

NOTE Attention is drawn to the fact that authorities in some countries impose additional requirements for health, environmental and similar reasons.

1.1.3 Exclusions

This document does not apply to

- motor-generator sets;
- uninterruptible power supplies (UPS) to IEC 62040-1;
- PSUs covered by IEC 61558-1 (i.e. power supply units incorporating safety isolating transformers providing SELV or PELV output(s) in accordance with IEC 60364-4-41) and PSUs for use with household and other consumer products, except those covered by IEC 60065 and IEC 60950-1 and/or IEC 62368-1;
- transformers covered by IEC 61558-1;

- step-down converters covered by IEC 60146-1-1;
- PSUs and converters intended for DC supplied bulb lamps, halogen lamps or LED lamps covered by CISPR 15.

1.1.4 Types of power supply

Two types of power supplies are covered by this document:

a) stand alone (or end-product) power supplies

Power supplies intended for free-standing operation (individual apparatus).

This part of IEC 61204 is applicable to PSUs developed as a unit with a direct function and sold on the market as a stand alone unit.

b) component power supplies

These can be divided into two categories:

1) component power supplies considered as equivalent to stand alone power supplies (apparatus)

This part of IEC 61204 is applicable to this category of component PSUs. These PSUs are considered to be apparatus with respect to their EMC requirements, for example those PSUs intended for use in installations or sold to the general public, cases where no further EMC tests are anticipated. This does not include PSUs sold as spares for repair which have been tested as part of an overall equipment.

2) component power supplies intended for a professional installer

This part of IEC 61204 is applicable to this category of power supplies only as an aid to specify relevant EMC requirements in order that various end-product standards may be met.

These are component power supplies that are intended for incorporation into a final product by a professional installer. These products may be sold to a professional installer or placed on the market for specialized distribution and use. Further EMC tests of the assembly are assumed.

1.1.5 Configurations and combinations of power supplies

1.1.5.1 Modular PSUs

A PSU with a single primary circuit or module and separate output modules forming a single unit, synchronized or not, meets the requirements defined in this document as a single component or apparatus type of PSU.

1.1.5.2 Power supply systems

An easily relocatable system containing several PSUs in parallel, in series or combination with a single input connection complies with this document as a single component or apparatus type of PSU. It is the responsibility of the system supplier to ensure EMC compliance with this document or with a specific EMC standard of the end product.

1.1.5.3 Power supply installations

When a number of PSUs are used in an installation and are supplied by a distributed AC or DC network, then this is a power installation. This type of arrangement is not easily relocatable. Each individual PSU complies with this document and this is the responsibility of the PSU manufacturer who also provides information on the correct installation of his product. The EMC considerations of the final installation are the responsibility of the professional installer.

1.1.5.4 Distributed power supplies

This is a power installation where the input AC or DC supply is distributed to individual power conversion units or modules which are installed locally to the circuitry to be supplied. This document applies to the individual products as appropriate. The EMC performance of the overall system or installation is the responsibility of the professional installer.

1.1.5.5 Power supplies in parallel or in series

Where PSUs are sold to be connected in parallel or in series, their documentation shall include information relating to the expected EMC performance for such arrangements.

1.2 Object

The object of this part of IEC 61204 is to define EMC limits and test methods for PSUs. It includes limits for electromagnetic emissions which may cause interference to other electronic equipment (e.g. radio receivers, measuring and computer devices), as well as electromagnetic immunity limits for continuous and transient conducted and radiated disturbances including electrostatic discharges.

This part of IEC 61204 defines the minimum electromagnetic compatibility requirements for PSUs.

To comply with this part of IEC 61204, no additional EMC tests are required or necessary beyond those stated here.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-121, *International Electrotechnical Vocabulary – Part 121: Electromagnetism*

IEC 60050-151, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

IEC 60050-161, *International Electrotechnical Vocabulary – Part 161: Electromagnetic compatibility*

IEC 60050-551, *International Electrotechnical Vocabulary – Part 551: Power electronics*

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

IEC 60146-1-1, *Semiconductor converters – General requirements and line commutated converters – Part 1-1: Specification of basic requirements*

IEC 60601-1, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

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

IEC 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measuring techniques – Voltage dips, short interruptions and voltage variations immunity tests*

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IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 16-1 (all parts), *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

CISPR 16-1-2:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Coupling devices for conducted disturbance measurements*

CISPR 16-1-3, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-3: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Disturbance power*

CISPR 16-2-1:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*

CISPR 16-2-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-2: Methods of measurement of disturbances and immunity – Measurement of disturbance power*

CISPR 16-2-3, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-121, IEC 60050-151, IEC 60050-161, IEC 60050-551, IEC 60146-1-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

environment

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3.1.1

residential, commercial and light industrial environment

environment encompassed by the generic standard IEC 61000-6-3

Note 1 to entry: An indication of the locations included by this environment is given in Annex G.

3.1.2

industrial environment

environment encompassed by the generic standard IEC 61000-6-4

Note 1 to entry: An indication of the locations included by this environment is given in Annex G.

3.2

protection distance

distance for an electronic or electrical apparatus beyond which the interference levels shall not impair the use of other electronic or electrical equipment, for example broadcast radio and television receivers

3.3

distributed power system

system of localized power converters supplied from a distributed power bus

3.4

port

particular interface of a product with the external electromagnetic environment

Note 1 to entry: Examples of ports are given in Figure 1.

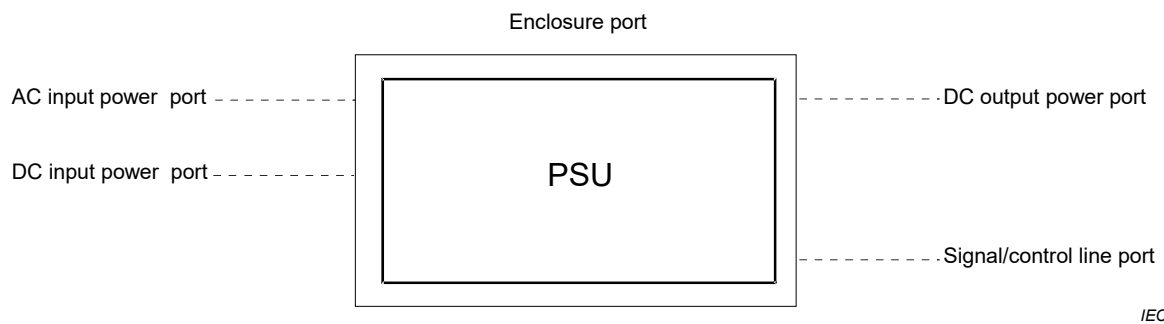


Figure 1 – Examples of ports

3.4.1

enclosure port

physical boundary of the PSU product through which and on which electromagnetic fields may radiate or impinge

3.4.2

signal port

low energy level input or output port providing diagnostic or control information

3.4.3

DC input power port
external DC energy source connection point

3.4.4

DC output power port
external connection point for providing output DC energy

3.4.5

AC input power port
external AC energy source connection point

3.5

power supply PSU

electrical or electronic device which transforms energy from an input source into a single or multiple output energy source

3.5.1

component power supply

modular PSU
sub-unit PSU

assemblies of electrical and/or electronic devices designed to provide or modify energy

Note 1 to entry: They are intended for incorporation into end-products by a professional installer. They are not intended for free-standing applications.

3.5.2

stand alone power supply

intended for use in laboratories, workshops and other areas in free-standing applications

Note 1 to entry: They are end-products, completely enclosed with full protection against electrostatic discharge and contact with hazardous parts which are accessible to the end-user. Typical examples include adjustable or fixed output bench-top units, plug-top units, free-standing and wall-mounted units.

3.5.3

bench-top power supply

supply intended for laboratory or similar use

Note 1 to entry: They are stand alone PSUs, sometimes with monitoring and measuring facilities.

3.5.4

open card power supply

frameless PSU

printed circuit board devoid of a metal mounting bracket

Note 1 to entry: It is a component PSU intended for use by a installer.

3.5.5

open frame power supply

supply that generally uses a printed circuit board mounted on a metal bracket for attachment to the professional installer's equipment chassis

Note 1 to entry: This bracket provides heat transfer for the cooling of power semiconductors. Optionally, a cover may be used for safety reasons and/or to reduce radiated interference.

3.5.6

plug-in card power supply

supply intended to be plugged into a subrack

Note 1 to entry: The design may be "open-card", "open-frame" or "cased". A plug-in card PSU is generally intended for use by a professional installer.

3.5.7

cased power supply

enclosed power supply

supply fully enclosed, cased or housed PSU

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Note 1 to entry: The design uses the housing as a heat sink or employs fan(s) for forced air cooling.

3.5.8

plug-top power supply

direct plug-in power supply

power supply built into a mains voltage plug top

3.5.9

uninterruptible power supply

UPS

supply intended to provide a source of energy secure against mains failure

Note 1 to entry: This type of product would normally be free-standing.

3.6

end-product

finished unit which is designed to stand alone, useable by an end-user and having a direct function for the end-user

Note 1 to entry: It is intended to be placed on the market and/or taken into service as a single unit or as part of a system or installation.

3.7

system

localized group of interconnected products which is easily relocatable

Note 1 to entry: Typical examples of this would be a computer, including mouse, keyboard, printer and monitor, or a hi-fi system, TV and video recorder.

3.8 installation

collection of interconnected products which is not easily relocatable

Note 1 to entry: Typical examples of this include an industrial process installation or a power plant control installation.

3.9 professional installer

technically competent person or organization capable of correctly assembling/installing components and subassemblies into an end-product, or end-products into a system or installation, and, in so doing, fully complying with the technical and legal requirements of the end-product, system or installation

3.10 full rated load

maximum continuous or average power a product is marked to supply

3.11 mains supply

3.11.1 industrial mains supply

source of electrical energy provided solely for industrial use

3.11.2 private mains supply

localized source of electrical energy (e.g. generator or UPS) which is not directly connected to the public network

3.11.3 public mains supply

source of electrical energy provided for general public use in domestic, commercial or light industrial environments

3.12 critical frequency of a PSU

the frequency, the wavelength of which is equal to four times the longest side length of the PSU

3.13 residual voltage

<voltage dip> minimum value of RMS voltage recorded during a voltage dip or short interruption

Note 1 to entry: The residual voltage may be expressed as a value in volts, or as a percentage or per unit value relative to the reference voltage.

3.14 type test

conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

4 Applicability of tests to different PSU technologies

Guidance on this issue is given in Annex A.