IEC 61326-1

Edition 3.0 2020-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM – Partie 1: Exigences générales

IEC 61326-1:2020-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 1: General requirements

FOREWORD

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International Standard IEC 61326-1 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition, published in 2012. This edition constitutes a technical revision.

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

– the immunity test levels and performance criteria have been reviewed;
– requirements for portable test and measurement equipment have been clarified and amended;

– the description of the electromagnetic environments has been improved.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65A/975/FDIS	65A/985/RVD

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

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

In this document, the following print types are used:

- Terms used throughout this document which have been defined in Clause 3: SMALL CAPITALS

A list of all parts of the IEC 61326 series under the general title *Electrical equipment for measurement, control and laboratory use – EMC requirements*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Instruments and equipment within the scope of this document may often be geographically widespread and hence operate under a wide range of environmental conditions.

The limitation of undesired electromagnetic emissions ensures that no other equipment installed nearby is unduly influenced by the equipment under consideration. The limits are more or less specified by, and therefore taken from, IEC and International Special Committee on Radio Interference (CISPR) publications.

However, the equipment should function without undue degradation in an electromagnetic environment typical for the locations where it is intended to be operated. In this respect, the document specifies three different types of electromagnetic environment and the levels for immunity. More detailed information about issues related to electromagnetic environments are given in IEC TR 61000-2-5. Special risks, involving for example nearby or direct lightning strikes, circuit-breaking, or exceptionally high electromagnetic radiation in close proximity, are not covered.

Complex electric and/or electronic systems should require EMC planning in all phases of their design and installation, taking into consideration the electromagnetic environment, any special requirements, and the severity of failures.

This part of IEC 61326 specifies the EMC requirements that are generally applicable to all equipment within its scope. For certain types of equipment, these requirements will be supplemented or modified by the special requirements of one, or more than one, particular part IEC 61326-2 (all parts). These should be read in conjunction with the IEC 61326-1 requirements.

ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 1: General requirements

1 Scope

This part of IEC 61326 specifies requirements for immunity and emissions regarding electromagnetic compatibility (EMC) for electrical equipment, operating from a supply or battery of less than 1 000 V AC or 1 500 V DC or from the circuit being measured. Equipment intended for professional, industrial-process, industrial-manufacturing and educational use is covered by this part. It includes equipment and computing devices for

– measurement and test;
– control;
– LABORATORY use;
– accessories intended for use with the above (such as sample handling equipment),

intended to be used in industrial and non-industrial locations.

Computing devices and assemblies and similar equipment within the scope of information technology equipment (ITE) and complying with applicable ITE EMC standards can be used in systems within the scope of this part of IEC 61326 without additional testing, if they are suitable for the intended electromagnetic environment.

It is generally considered that this product family standard takes precedence over the corresponding generic EMC standards.

The following equipment is covered by this document.

a) Electrical measurement and test equipment

   This is equipment which, by electrical means, measures, indicates or records one or more electrical or non-electrical quantities, also non-measuring equipment such as signal generators, measurement standards, power supplies and transducers.

b) Electrical control equipment

   This is equipment which controls one or more output quantities to specific values, with each value determined by manual settings, by local or remote programming, or by one or more input variables. This includes industrial process measurement and control (IPMC) equipment, which consists of devices such as:

   – process controllers and regulators;
   – programmable controllers;
   – power supply units for equipment and systems (centralized or dedicated);
   – analogue/digital indicators and recorders;
   – process instrumentation;
   – transducers, positioners, intelligent actuators, etc.

c) Electrical LABORATORY equipment, including In Vitro Diagnostic (IVD) medical equipment

   This is equipment used to prepare or analyse materials, or measure, indicate or monitor physical quantities. This equipment might also be used in areas other than laboratories.

d) Equipment a), b) or c) as above when being equipped with components having radio functionality, for example for wireless communication.

Equipment within the scope of this document might be operated in different electromagnetic environments; depending on the electromagnetic environment different emission and immunity test requirements are applicable.

This document considers three types of electromagnetic environments:

- BASIC ELECTROMAGNETIC ENVIRONMENT;
- INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT;
- CONTROLLED ELECTROMAGNETIC ENVIRONMENT.

Corresponding immunity test requirements are described in Clause 6.

In terms of emission requirements, equipment shall be classified in Class A or Class B equipment, as per the requirements and procedure of CISPR 11. The corresponding emission requirements are described in Clause 7.

The specified emission and immunity requirements aim at achieving electromagnetic compatibility between equipment covered in this document and other equipment that might operate at locations with electromagnetic environments considered in this document. Guidance for an assessment concerning the risk for achieving EMC is given in Annex B.

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 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility*
IEC 60050-161:1990/AMD1:1997
IEC 60050-161:1990/AMD2:1998
IEC 60050-161:1990/AMD3:2014
IEC 60050-161:1990/AMD4:2014
IEC 60050-161:1990/AMD5:2015
IEC 60050-161:1990/AMD6:2016
IEC 60050-161:1990/AMD7:2017
IEC 60050-161:1990/AMD8:2018
(available at <http://www.electropedia.org>)

IEC 61000-3-2:2018, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 A per phase)*

IEC 61000-3-3:2013, *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 61000-3-3:2013/AMD1:2017

IEC 61000-3-11:2017, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤75 A and subject to conditional connection*

IEC 61000-3-12:2011, *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 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2020, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
CISPR 11:2015/AMD1:2016
CISPR 11:2015/AMD2:2019

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 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

3.1.1
basic electromagnetic environment
environment existing at locations characterized by being supplied directly at low voltage from the public mains network

EXAMPLES

– residential properties, for example houses, apartments;

– retail outlets, for example shops, supermarkets;

– business premises, for example offices, banks;

– areas of public entertainment, for example cinemas, public bars, dance halls;

– outdoor locations, for example petrol stations, car parks, amusement and sports centres;

– light-industrial locations, for example workshops, laboratories, service centres.

3.1.2
class A equipment
equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

[SOURCE: derived from CISPR 11:2015, 5.2]

3.1.3
class B equipment
equipment suitable for use in locations in residential environments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

[SOURCE: derived from CISPR 11:2015, 5.2]

3.1.4
controlled electromagnetic environment
environment usually characterized by recognition and control of EMC threats by users of the equipment or by design of the installation

3.1.5
enclosure port
physical boundary of equipment through which electromagnetic fields may radiate or impinge

3.1.6
functional performance
operational performance characteristics defining the ability of equipment to achieve the intended functions

Note 1 to entry: Characteristics can be based on the related technical documentation.

3.1.7
industrial electromagnetic environment
environment existing at locations characterized by a separate power network, in most cases supplied from a high- or medium-voltage transformer, dedicated for the supply of installations feeding manufacturing or similar plants with one or more of the following conditions:

– frequent switching of heavy inductive or capacitive loads;

– high currents and associated magnetic fields;

– presence of Industrial, Scientific and Medical (ISM) equipment (for example, welding machines)

3.1.8
laboratory
test and measurement area that is specifically used for analysis, testing and servicing and where equipment is operated by trained personnel

3.1.9
long-distance lines
lines within a building which are longer than 30 m, or which leave the building (including lines of outdoor installations)

3.1.10
port
any particular interface of the specific equipment or system with the external electromagnetic environment

EXAMPLE See Figure 1 for an example of Equipment Under Test (EUT).

Note 1 to entry: I/O PORTS are input, output or bi-directional, measurement, control, or data PORTS.

Note 2 to entry: Within this document, PORTS intended to be connected with earth potential for functional reasons (functional earth PORTS) are considered as I/O PORTS.

Note 3 to entry: Within this document, the protective earth PORT (if any) is considered as part of the POWER PORT.

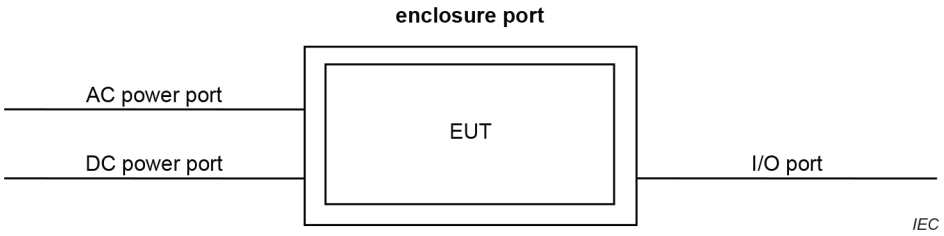

Figure 1 – Examples of ports

3.1.11
power port
port at which a conductor or cable, carrying the electrical input/output power needed for the operation (functioning), is connected to the equipment

3.1.12
portable test and measurement equipment
test and/or measuring equipment designed to be easily carried by hand and to be connected and disconnected by the user

3.1.13
type test
conformity test made on one or more items representative of the production

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

3.1.14
auxiliary equipment
equipment necessary to provide the equipment under test (EUT) with the signals required for normal operation and equipment to verify the performance of the EUT

3.1.15
performance level
specified operation of equipment under conditions of intended use

3.1.16
degradation (in performance)
an undesired departure in the operational performance of any device, equipment or system from its intended performance

Note 1 to entry: The term "degradation" can apply to temporary or permanent failure.

[SOURCE: IEC 60050-161:1990, 161-01-19]

3.1.17
loss of performance
operation of equipment outside a specified PERFORMANCE LEVEL

3.1.18
loss of function
operation of equipment with one (or more) of the equipment's function unusable

3.2 Abbreviations

AE	AUXILIARY EQUIPMENT
EMC	electromagnetic compatibility
ESD	electrostatic discharge
EUT	equipment under test
I/O	input/output
RF	radio frequency
UPS	uninterruptable power supply

4 General

Equipment and systems within the scope of this document can be subjected to various kinds of electromagnetic disturbances, sources of which include power, measurement or control lines or those radiated from the environment. The types and levels of disturbances depend on the particular conditions in which the systems, subsystems or equipment are installed and operated.

Equipment within the scope of this document can also be a source of electromagnetic disturbances over a wide frequency range. These disturbances can be conducted through power and signal lines, or be directly radiated, and can affect the performance of other equipment, or influence the external electromagnetic environment.

For emissions, the objective of the requirements given in this document is to ensure that the disturbances generated by the equipment and systems, when operated normally, do not exceed a level which could prevent other systems from operating as intended. The emission limits are considered in 7.2.

NOTE 1 Higher immunity levels than those specified can be necessary for particular applications (for example, when reliable operation of the equipment is essential for safety) or when the equipment is intended for use in harsher electromagnetic environments. Also, additional tests and different performance criteria can be necessary for particular applications.

NOTE 2 In special cases, for example when highly susceptible equipment is being used near the EUT, additional mitigation measures could have to be employed to reduce the influencing electromagnetic emission further below the specified limits.

The manufacturer may select to perform all tests on either a single EUT or divide the tests among multiple EUTs. If the latter, each test result shall be traceable to the EUT tested. The testing sequence is optional.

5 EMC test plan

5.1 General

An EMC test plan shall be established prior to testing. At a minimum, it shall contain the elements defined in 5.2 to 5.5.

It may be determined from consideration of the electrical characteristics and usage of a particular item of equipment that some tests are inappropriate and therefore unnecessary. In such cases, the decision not to test shall be recorded in the EMC test plan.

5.2 Configuration of EUT during testing

5.2.1 General

Measurement, control and LABORATORY equipment often consists of systems with no fixed configuration. The kind, number and installation of different subassemblies within the equipment may vary from system to system. Thus, it is reasonable, and also recommended, not to test every possible arrangement.

To realistically simulate EMC conditions (related both to emission and immunity), the equipment assembly shall represent a typical installation as specified by the manufacturer. Such tests shall be carried out as TYPE TESTS under normal conditions as specified by the manufacturer.

5.2.2 Composition of EUT

All equipment, racks, modules, boards, etc. significant to EMC and belonging to the EUT shall be documented. If relevant, the software version shall be documented.

5.2.3 Assembly of EUT

If an EUT has a variety of internal and external configurations, the TYPE TESTS shall be made with one or more typical configurations that represent normal use in the intended environment. All types of modules shall be tested at least once. The rationale for this selection shall be documented in the EMC test plan.

5.2.4 I/O PORTS

Where there are multiple I/O PORTS, which are all of the same type, connecting a cable to just one of those PORTS is sufficient, provided that it can be shown that the additional cables would not affect the results significantly.

5.2.5 AUXILIARY EQUIPMENT

When a variety of equipment is provided for use with the EUT, at least one of each type of equipment shall be selected to simulate actual operating conditions. AUXILIARY EQUIPMENT may be simulated.

5.2.6 Cabling and earthing (grounding)

The cables and earth (ground) shall be connected to the EUT in accordance with the manufacturer's specifications. There shall be no additional earth connections.

5.3 Operation conditions of EUT during testing

5.3.1 Operation modes

A selection of representative operation modes shall be made, taking into account that not all functions, but only the most typical functions of the electronic equipment can be tested. The estimated worst-case operating modes for normal application shall be selected.