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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Electrical equipment for measurement, control and laboratory use – EMC requirements –
Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications

IEC 61326-3-1:2017-05 RLV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 61326-3-1 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

- extension of the frequency range up to 6 GHz for the radio-frequency electromagnetic field test according to IEC 61000-4-3,
- replacement of the performance criterion FS with DS according to the generic standard IEC 61000-6-7,
- adding Table 1 – Aspects to be considered during application of performance criterion DS,
- including immunity tests for devices with current consumption > 16 A according to IEC 61000-4-34,
- updating Table 8 – Frequency ranges of mobile transmitters and ISM equipment,
- updating Figure A.1 and Figure 1 for better readability.

IEC 61326-3-1 is to be read in conjunction with IEC 61326-1.

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

FDIS	Report on voting
65A/819/FDIS	65A/825/RVD

Full information on the voting for the approval of this standard 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 the 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Functional safety is that part of the overall safety relating to the equipment under control (EUC) and the EUC control system which depends on the correct functioning of the electrical safety-related systems. To achieve this, all items of equipment of the safety-related system which are involved in the performance of the safety functions must behave in a specified manner under all relevant conditions.

The IEC basic safety publication for functional safety of electrical/electronic/programmable electronic safety-related systems is IEC 61508. It sets the overall requirements to achieve functional safety. Sufficient immunity to electromagnetic disturbances is one of those requirements.

The concept of IEC 61508 distinguishes between the consideration of the application and the design of safety-related electrical and electronic systems. ~~The interface between both is~~ The overall safety requirements specification ~~(SRS). It~~ specifies all relevant requirements of the intended application, as follows:

a) definition of the safety functions, based on a risk assessment of the intended application (which functions are intended to reduce risk);

b) appropriate safety integrity level (SIL) for each safety-function based on a risk assessment of the intended application;

c) definition of the environment in which the system is intended to work including the electromagnetic environment as required by IEC 61508-2.

The requirements for each safety function are then specified in one or more system safety requirements specifications (SSRS). Hence, with regard to immunity against electromagnetic phenomena, the essential starting point is that the electromagnetic environment and its phenomena are considered in the SSRS, as required by IEC 61508. The safety-related system intended to implement the specified safety function has to fulfil the SSRS, and, from it, corresponding immunity requirements have to be derived for the items of equipment, which results in an equipment requirement specification. With respect to the electromagnetic environment, the SSRS and the equipment requirement specification should be based on a competent assessment of the foreseeable electromagnetic threats in the real environment over the whole operational life of the equipment. Hence, immunity requirements for the equipment depend on the characteristics of the electromagnetic environment in which the equipment is intended to be used.

The equipment manufacturer, therefore, has to prove that the equipment fulfils the equipment requirement specification and the system integrator must prove that the system fulfils the SSRS. Evidence has to be produced by application of appropriate methods. They do not need to consider any other aspects of the application, for example, risk of the application associated to any failure of the safety-related system. The objective is for all equipment in the system to comply with particular performance criteria taking into account functional safety aspects (for example, the performance criterion ~~FS~~ DS) up to levels specified in the SSRS independent of the required safety integrity level (SIL).

For approaches on how to apply IEC 61326-3 series, see Annex A.

There exists meanwhile the generic EMC standard IEC 61000-6-7 dealing with functional safety aspects in industrial environments. Generic EMC standards are designed to apply for a defined electromagnetic environment, to products for which no dedicated product family EMC/product EMC standards exist. However, for the equipment in the scope of this document, the information given in the generic EMC standard was considered not to be sufficient. More detailed information and specifications were needed, for example specific test set-ups, consideration of the functional earth port or the deliberate differentiation between types of electromagnetic environments relevant for the equipment in the scope of this document.

Though historically this product standard was developed several years before the generic EMC standard, this 2nd edition considers the information given in the generic EMC standard and applies it where appropriate.

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

Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications

1 Scope

This part of IEC 61326 covers all equipment within the scope of IEC 61326-1 ~~applies to this part of IEC 61326~~, but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.8 of IEC 61326-1. Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this document.

Equipment and systems considered as "proven-in-use" according to IEC 61508 or "prior use" according to IEC 61511 are excluded from the scope of this document.

Fire alarm systems and security alarm systems intended for protection of buildings are excluded from the scope of this document.

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, *International Electrotechnical Vocabulary – Part 161: Electromagnetic compatibility* (available at <http://www.electropedia.org/)

IEC 61000-4-2:~~2001~~ 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:~~2004~~ 2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:~~2005~~ 2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:~~2004~~ 2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:~~1993~~ 2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*[1]
~~Amendment 1 (2000)~~

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-16:~~1998~~ 2015, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*
~~Amendment 1 (2001)~~

IEC 61000-4-29:2000, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*
IEC 61000-4-34:2005/AMD1:2009

IEC 61000-6-2:~~2005~~ 2016, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61326-1:~~2005~~ 2012, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

~~IEC 61326-2-1:2005, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-1: Particular requirements – Test configurations, operational conditions and performance criteria for sensitive test and measurement equipment for EMC unprotected applications*~~

~~IEC 61326-2-2:2005, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-2: Particular requirements – Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems*~~

~~IEC 61326-2-3:2006, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular requirements – Test configurations, operational conditions and performance criteria for transducers with integrated or remote signal conditioning*~~

~~IEC 61326-2-4:2006, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-4: Particular requirements – Test configurations, operational conditions and performance criteria for insulation monitoring devices according to IEC 61557-8 and for equipment for insulation fault location according to IEC 61557-9*~~

~~IEC 61326-2-5:2006, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-5: Particular requirements – Test configurations, operational conditions and performance criteria for field devices with interfaces according to IEC 61784-1, CP 3/2*~~

IEC 61326-3-2:~~2008~~ ___[2], *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-2: Immunity requirements for safety-related systems and for*

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[1] ~~There exists a consolidated edition 1.1 (2001) that includes edition 1.0 and its amendment.~~

equipment intended to perform safety-related functions (functional safety) – Industrial applications with specified ~~EM~~ electromagnetic environment

IEC 61508-2:~~2000~~ 2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

~~ISO/IEC Guide 51:1999, *Safety aspects – Guidelines for their inclusion in standards*~~

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61326-1 and 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

NOTE Other definitions, not included in IEC 60050-161 and in this document, but nevertheless necessary for the application of the different tests, are given in the EMC basic publications of the IEC 61000 series.

3.1.1
dangerous failure
failure ~~which has the potential to put the safety-related system in a hazardous or fail-to-function state~~ of an element and/or subsystem and/or system that plays a part in implementing the safety function that:

a) prevents a safety function from operating when required (demand mode) or causes a safety function to fail (continuous mode) such that the EUC is put into a hazardous or potentially hazardous state; or

b) decreases the probability that the safety function operates correctly when required

~~NOTE Whether or not the potential is realised may depend on the channel architecture of the system; in systems with multiple channels to improve safety, a dangerous hardware failure is less likely to lead to the overall dangerous or fail-to-function state.~~

[SOURCE: IEC 61508-4:2010, 3.6.7]

3.1.2
equipment
~~the term equipment as used in this document is extremely general and is applied to a wide variety of possible~~ subsystems, apparatus, appliances and other assemblies of products

3.1.3
equipment under control
EUC
equipment, machinery, apparatus or plant used for manufacturing, process, transportation, medical or other activities

Note 1 to entry: The EUC control system is separate and distinct from the EUC.

[SOURCE: IEC 61508-4:2010, 3.2.1]

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2 Under preparation. Stage at the time of publication: IEC/DIS 61326-3-2:2016.

3.1.4
functional safety
part of the overall safety relating to the EUC and the EUC control system that depends on the correct functioning of the E/E/PE safety-related systems~~, other technology safety-related systems and external risk reduction facilities~~ and other risk reduction measures

[SOURCE: IEC 61508-4:2010, 3.1.12]

3.1.5
harm
physical injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO/IEC Guide 51:2014, 3.1, modified – "physical" has been added]

3.1.6
hazard
potential source of harm

Note 1 to entry: The term includes short-term or immediate danger ~~to persons arising within a short time scale~~ (such as from fire or explosion) and ~~also those that have a~~ long-term effects on ~~a person's~~ health (such as from release of a toxic substance).

[SOURCE: ISO/IEC Guide 51:2014, 3.2, modified – the note to entry has been added]

3.1.7
safe failure
failure ~~which does not have the potential to put the safety-related system in a hazardous or fail-to-function state~~ of an element and/or subsystem and/or system that plays a part in implementing the safety function that:

a) results in the spurious operation of the safety function to put the EUC (or part thereof) into a safe state or maintain a safe state; or

b) increases the probability of the spurious operation of the safety function to put the EUC (or part thereof) into a safe state or maintain a safe state

~~NOTE Whether or not the potential is realised may depend on the channel architecture of the system; in systems with multiple channels to improve safety, a safe hardware failure is less likely to result in an erroneous shut-down.~~

[SOURCE: IEC 61508-4:2010, 3.6.8]

3.1.8
safety function
function to be implemented by an E/E/PE safety-related system~~, other technology safety-related system or external risk reduction facilities~~ or other risk reduction measures, that is intended to achieve or maintain a safe state for the EUC, in respect of a specific hazardous event ~~(see 3.4.1)~~

EXAMPLE Examples of safety functions include:

– functions that are required to be carried out as positive actions to avoid hazardous situations (for example switching off a motor); and

– functions that prevent actions being taken (for example preventing a motor starting).

[SOURCE: IEC 61508-4:2010, 3.5.1]

3.1.9
programmable electronic
PE
based on computer technology which may be comprised of hardware, software and of input and/or output units

EXAMPLE The following are all programmable electronic devices:

– microprocessors;

– micro-controllers;

– programmable controllers;

– application specific integrated circuits (ASICs);

– programmable logic controllers (PLCs);

– other computer-based devices (for example, smart sensors, transmitters, actuators).

Note 1 to entry: This term covers microelectronic devices based on one or more central processing units (CPUs) together with associated memories, etc.

[SOURCE: IEC 61508-4:2010, 3.2.12]

3.1.10
electrical/electronic/programmable electronic
E/E/PE
based on electrical (E) and/or electronic (E) and/or programmable electronic (PE) technology

EXAMPLE Electrical/electronic/programmable electronic devices include

– electro-mechanical devices (electrical);

– solid-state non-programmable electronic devices (electronic);

– electronic devices based on computer technology (programmable electronic); see 3.2.5 (of IEC 61326-1:2012).

Note 1 to entry: The term is intended to cover any and all devices or systems operating on electrical principles.

[SOURCE: IEC 61508-4:2010, 3.2.13, modified – the reference in the last dash is modified]

3.1.11
DC distribution network
local DC electricity supply network in the infrastructure of a certain site or building intended for connection of any type of equipment

Note 1 to entry: Connection to a local or remote battery is not regarded as a DC distribution network if such a link comprises ~~only~~ the power supply for only a single piece of equipment.

~~**3.1.12**~~
~~**system** (in the context of this document)~~
~~combination of apparatus and/or active components constituting a single functional unit and intended to be installed and operated to perform (a) specific task(s)~~

~~NOTE "Safety-related systems" are specifically "designed" equipment that both~~

~~– implement the required safety functions necessary to achieve or maintain a safe state for a controlled equipment;~~

~~– are intended to achieve on their own or with other safety-related equipment or external risk reduction facilities, the necessary safety integrity for the safety requirements.~~

~~[IEC 61508-4, 3.4.1, modified]~~

3.1.12
safety-related system
designated system that both

- implements the required safety functions necessary to achieve or maintain a safe state for the EUC; and
- is intended to achieve, on its own or with other E/E/PE safety-related systems and other risk reduction measures, the necessary safety integrity for the required safety functions