

**Reguleeritava kiirusega  
elektriajamisüsteemid. Osa 5-2:  
Ohutusnõuded. Funktsionaalsus**

Adjustable speed electrical power drive systems  
-- Part 5-2: Safety requirements - Functional

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<p>Käesolev Eesti standard EVS-EN 61800-5-2:2007 sisaldab Euroopa standardi EN 61800-5-2:2007 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 23.11.2007 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on .</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 61800-5-2:2007 consists of the English text of the European standard EN 61800-5-2:2007.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 23.11.2007 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text .</p> <p>The standard is available from Estonian standardisation organisation.</p>
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ICS 13.110, 29.200

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**Adjustable speed electrical power drive systems -  
Part 5-2: Safety requirements -  
Functional  
(IEC 61800-5-2:2007)**

Entraînements électriques de puissance  
à vitesse variable -  
Partie 5-2: Exigences de sécurité -  
Fonctionnalité  
(CEI 61800-5-2:2007)

Elektrische Leistungsantriebssysteme  
mit einstellbarer Drehzahl -  
Teil 5-2: Anforderungen an die Sicherheit -  
Funktionale Sicherheit  
(IEC 61800-5-2:2007)

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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.

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 22G/179/FDIS, future edition 1 of IEC 61800-5-2, prepared by SC 22G, Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC TC 22, Power electronic systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61800-5-2 on 2007-10-01.

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) 2008-07-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2010-10-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directives 98/37/EC and 2006/42/EC. See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61800-5-2:2007 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60300-3-1	NOTE	Harmonized as EN 60300-3-1:2004 (not modified).
IEC 60664-1	NOTE	Harmonized as EN 60664-1:2003 (not modified).
IEC 60664-3	NOTE	Harmonized as EN 60664-3:2003 (not modified).
IEC 61025	NOTE	Harmonized as EN 61025:2007 (not modified).
IEC 61078	NOTE	Harmonized as EN 61078:2006 (not modified).
IEC 61165	NOTE	Harmonized as EN 61165:2006 (not modified).
IEC 61508-4	NOTE	Harmonized as EN 61508-4:2001 (not modified).
IEC 61511	NOTE	Harmonized in EN 61511 series (not modified).
IEC 61511-1	NOTE	Harmonized as EN 61511-1:2004 (not modified).
IEC 61558	NOTE	Harmonized in EN 61558 series (partially modified).
IEC 61558-1	NOTE	Harmonized as EN 61558-1:2005 (not modified).
IEC 62061	NOTE	Harmonized as EN 62061:2005 (not modified).
ISO 13849-1	NOTE	Harmonized as EN ISO 13849-1:2006 (not modified).
ISO 13849-2	NOTE	Harmonized as EN ISO 13849-2:2003 (not modified).

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60204-1 (mod)	– <sup>1)</sup>	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	2006 <sup>2)</sup>
IEC 61508	Series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	Series
IEC 61508-1 + corr. May	1998 1999	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements	EN 61508-1	2001
IEC 61508-2	2000	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems	EN 61508-2	2001
IEC 61508-3 + corr. April	1998 1999	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements	EN 61508-3	2001
IEC 61508-5	– <sup>1)</sup>	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 5: Examples of methods for the determination of safety integrity levels	EN 61508-5	2001 <sup>2)</sup>
IEC 61508-6	2000	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3	EN 61508-6	2001

<sup>1)</sup> Undated reference.

<sup>2)</sup> Valid edition at date of issue.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61508-7	2000	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 7: Overview of techniques and measures	EN 61508-7	2001
IEC 61800-1	– <sup>1)</sup>	Adjustable speed electrical power drive systems - Part 1: General requirements - Rating specifications for low voltage adjustable speed d.c. power drive systems	EN 61800-1	1998 <sup>2)</sup>
IEC 61800-2	– <sup>1)</sup>	Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable frequency a.c. power drive systems	EN 61800-2	1998 <sup>2)</sup>
IEC 61800-3	– <sup>1)</sup>	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods	EN 61800-3	2004 <sup>2)</sup>
IEC 61800-4	– <sup>1)</sup>	Adjustable speed electrical power drive systems - Part 4: General requirements - Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV	EN 61800-4	2003 <sup>2)</sup>
IEC 61800-5-1	2003	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy	EN 61800-5-1 <sup>3)</sup>	2003
IEC 62280	Series	Railway applications - Communication, signalling and processing systems	–	–

<sup>3)</sup> EN 61800-5-1 is superseded by EN 61800-5-1:2007, which is based on IEC 61800-5-1:2007.

**Annex ZZ**  
(informative)

**Coverage of Essential Requirements of EC Directives**

**Annex ZZA**  
(informative)

**Coverage of Essential Requirements of Directive 98/37/EC**

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers the following essential requirements out of those given in Annex I of the EC Directive 98/37/EC:

- 1.2.1;
- 1.2.7.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

**Annex ZZB**  
(informative)

**Coverage of Essential Requirements of Directive 2006/42/EC**

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers the following essential requirements out of those given in Annex I of the EC Directive 2006/42/EC:

- 1.2.1.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

# INTERNATIONAL STANDARD

**IEC**  
**61800-5-2**

First edition  
2007-07

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**Adjustable speed electrical power drive systems –**

**Part 5-2:  
Safety requirements –  
Functional**



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# INTERNATIONAL STANDARD

**IEC**  
**61800-5-2**

First edition  
2007-07

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## **Adjustable speed electrical power drive systems –**

### **Part 5-2: Safety requirements – Functional**



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ADJUSTABLE SPEED ELECTRICAL  
POWER DRIVE SYSTEMS –****Part 5-2: Safety requirements –  
Functional****FOREWORD**

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International Standard IEC 61800-5-2 has been prepared by subcommittee 22G: Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC technical committee 22: Power electronic systems and equipment.

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

FDIS	Report on voting
22G/179/FDIS	22G/182/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 parts of the IEC 61800 series, published under the general title *Adjustable speed electric drive systems*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site 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.

A bilingual version of this publication may be issued at a later date.

## INTRODUCTION

As a result of automation, demand for increased production and reduced operator physical effort, control systems of machinery and plant items play an increasing role in the achievement of overall safety. These control systems increasingly employ complex electrical/electronic/programmable electronic devices and systems.

Prominent amongst these devices and systems are adjustable speed electrical power drive systems (PDS) that are suitable for use in safety-related applications (PDS(SR)).

Examples of industrial applications are:

- machine tools, robots, production test equipment, test benches;
- papermaking machines, textile production machines, calendars in the rubber industry;
- process lines in plastics, chemicals or metal production, rolling-mills;
- cement crushing machines, cement kilns, mixers, centrifuges, extrusion machines;
- drilling machines;
- conveyors, materials handling machines, hoisting equipment (cranes, gantries, etc);
- pumps, fans, etc.

This standard can also be used as a reference for developers using PDS(SR) for other applications.

Users of this standard should be aware that some type C standards for machinery currently refer to ISO 13849-1 for safety-related control systems. In this case, PDS(SR) manufacturers may be requested to provide further information (e.g. category and/or performance level) to facilitate the integration of a PDS(SR) into the safety-related control systems of such machinery.

NOTE "Type C standards" are defined in ISO 12100-1 as machine safety standards dealing with detailed safety requirements for a particular machine or group of machines.

Previously, in the absence of standards, there has been a reluctance to accept electronic, and in particular programmable electronic, devices and systems in safety-related functions because of uncertainty regarding the safety performance of such technology.

There are many situations where control systems that incorporate a PDS(SR) are employed, for example as part of safety measures that have been provided to achieve risk reduction. A typical case is guard interlocking in order to exclude personnel from hazards where access to the danger zone is only possible when rotating parts have attained a safe condition. This part of IEC 61800 gives a methodology to identify the contribution made by a PDS(SR) to identified safety functions and to enable the appropriate design of the PDS(SR) and verification that it meets the required performance.

Measures are given to co-ordinate the safety performance of the PDS(SR) with the intended risk reduction taking into account the probabilities and consequences of its random and systematic faults.



## ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

### Part 5-2: Safety requirements – Functional

#### 1 Scope and object

This part of IEC 61800 specifies requirements and makes recommendations for the design and development, integration and validation of PDS(SR)s in terms of their functional safety considerations. It applies to adjustable speed electric drive systems covered by the other parts of the IEC 61800 series of standards.

NOTE 1 The term “integration” refers to the PDS(SR) itself, not to its incorporation into the safety-related application.

This International Standard is only applicable where functional safety of a PDS(SR) is claimed and the PDS(SR) is operating in the high demand or continuous mode (see 3.10). For low demand applications, see IEC 61508.

This part of IEC 61800, which is a product standard, sets out safety-related considerations of PDS(SR)s in terms of the framework of IEC 61508, and introduces requirements for PDS(SR)s as subsystems of a safety-related system. It is intended to facilitate the realisation of the electrical/electronic/ programmable electronic (E/E/PE) elements of a PDS(SR) in relation to the safety performance of safety function(s) of a PDS.

Manufacturers and suppliers of PDS(SR)s by using the normative requirements of this part of IEC 61800 will indicate to users (control system integrators, machinery and plant designers, etc.) the safety performance for their equipment. This will facilitate the incorporation of a PDS(SR) into a safety-related control system using the principles of IEC 61508, and possibly its specific sector implementations (for example IEC 61511, IEC 61513, IEC 62061) or ISO 13849.

Conformity with this part of IEC 61800 fulfils all the requirements of IEC 61508 that are necessary for a PDS(SR).

This part of IEC 61800 does not specify requirements for:

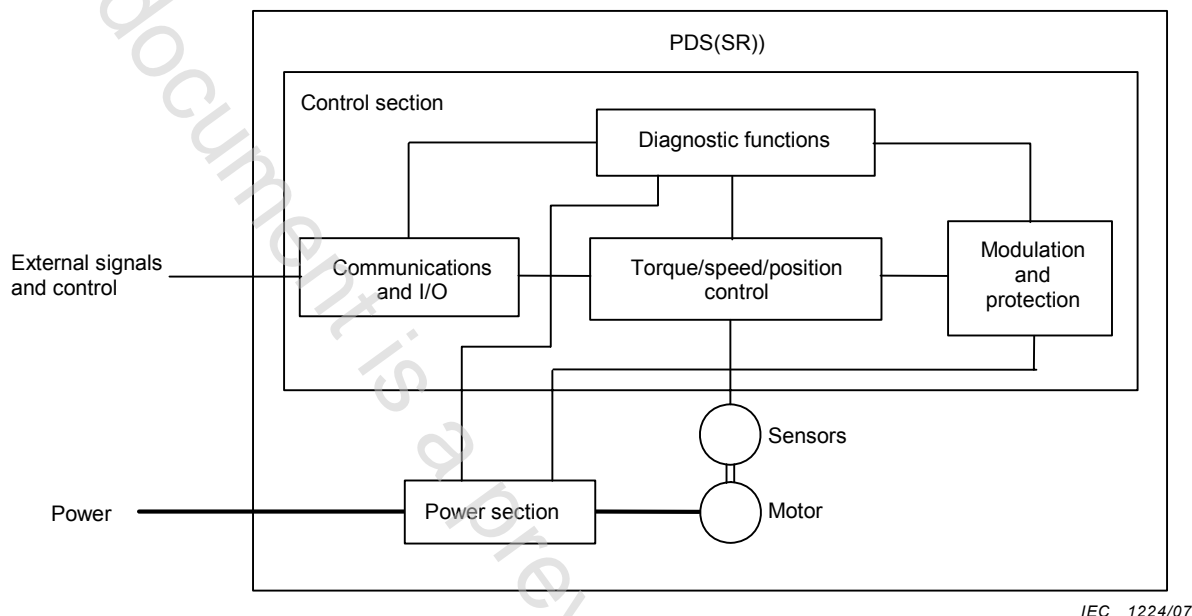
- the hazard and risk analysis of a particular application;
- the identification of safety functions for that application;
- the initial allocation of SILs to those safety functions;
- the driven equipment except for interface arrangements;
- secondary hazards (for example from failure in a production or manufacturing process);
- the electrical, thermal and energy safety considerations, which are covered in IEC 61800-5-1;
- the PDS(SR) manufacturing process;
- the validity of signals and commands to the PDS(SR).

NOTE 2 The functional safety requirements of a PDS(SR) are dependent on the application, and must be considered as a part of the overall risk assessment of the installation. Where the supplier of the PDS(SR) is not also responsible for the driven equipment, the installation designer is responsible for the risk assessment, and for specifying the functional and safety integrity requirements of the PDS(SR).

NOTE 3 Even though malevolent actions can influence the functional safety of PDS(SR), security aspects are not considered in this standard.

This part of IEC 61800 only applies to PDS(SR)s implementing safety functions with a SIL not greater than SIL 3.

Figure 1 shows the functional elements of a PDS(SR) that are considered in this part of IEC 61800.



**Figure 1 – Functional elements of a PDS(SR)**

NOTE Figure 1 shows a logical representation of a PDS(SR) rather than its physical description.

## 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.

NOTE 1 This does not mean that compliance is required with all clauses of the referenced documents, but rather that this document makes a reference that cannot be understood in the absence of the referenced documents.

NOTE 2 References to various parts of IEC 61508 are undated, except where specific clauses are indicated.

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61508-1:1998, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*

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

IEC 61508-3:1998, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements*

IEC 61508-5, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 5: Examples of methods for the determination of safety integrity levels*

IEC 61508-6:2000, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*

IEC 61508-7:2000, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 7: Overview of techniques and measures*

IEC 61800-1, *Adjustable speed electrical power drive systems – Part 1: General requirements – Rating specifications for low voltage adjustable speed d.c. power drive systems*

IEC 61800-2, *Adjustable speed electrical power drive systems – Part 2: General requirements – Rating specifications for low voltage adjustable frequency a.c. power drive systems*

IEC 61800-3, *Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods*

IEC 61800-4, *Adjustable speed electrical power drive systems – Part 4: General requirements – Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV*

IEC 61800-5-1:2003, *Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy*

IEC 62280 (all parts), *Railway applications – Communication, signalling and processing systems*

### **3 Terms and definitions**

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

NOTE 1 For an alphabetical list of definitions, see Table 1.