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Low-voltage switchgear and controlgear - Part 5-6: Control circuit devices and switching amplifiers (NAMUR)

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English version

**Low-voltage switchgear and controlgear  
Part 5-6: Control circuit devices and switching elements  
DC interface for proximity sensors and switching amplifiers (NAMUR)  
(IEC 60947-5-6:1999)**

Appareillage à basse tension  
Partie 5-6: Appareils et éléments  
de commutation pour circuits de  
commande  
Interface à courant continu pour  
capteurs de proximité et amplificateurs  
de commutation (NAMUR)  
(CEI 60947-5-6:1999)

Niederspannungsschaltgeräte  
Teil 5-6: Steuergeräte und  
Schaltelemente  
Gleichstrom-Schnittstelle für  
Näherungssensoren und  
Schaltverstärker (NAMUR)  
(IEC 60947-5-6:1999)

This European Standard was approved by CENELEC on 2000-01-01. 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  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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

### Foreword

The text of document 17B/1011/FDIS, future edition 1 of IEC 60947-5-6, prepared by SC 17B, Low-voltage switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60947-5-6 on 2000-01-01.

This European Standard supersedes EN 50227:1997.

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) 2000-10-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2003-01-01

Annexes designated "normative" are part of the body of the standard.  
In this standard, annex ZA is normative.  
Annex ZA has been added by CENELEC.

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### Endorsement notice

The text of the International Standard IEC 60947-5-6:1999 was approved by CENELEC as a European Standard without any modification.

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## Annex ZA (normative)

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

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE 1: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2: Where a standard cited below belongs to the EN 50000 series, this European Standard applies instead of the relevant International Standard.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60079-11	1999	Electrical apparatus for explosive gas atmospheres Part 11: Intrinsic safety "i" <sup>1)</sup>	EN 50020	1994
IEC 60947-1 (mod)	1999	Low-voltage switchgear and controlgear Part 1: General rules	EN 60947-1 + corr. October	1999 1999
IEC 60947-5-2 (mod)	1997	Part 5-2: Control circuit devices and switching elements - Proximity switches	EN 60947-5-2	1998

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1) The title of EN 50020 is: Electrical apparatus for potentially explosive atmospheres - Intrinsic safety 'i'.

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Appareillage à basse tension –

Partie 5-6:

Appareils et éléments de commutation  
pour circuits de commande –

Interface à courant continu pour capteurs de  
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Low-voltage switchgear and controlgear –

Part 5-6:

Control circuit devices and switching elements –  
DC interface for proximity sensors and switching  
amplifiers (NAMUR)

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International Electrotechnical Commission  
Telefax: +41 22 919 0300

e-mail: [inmail@iec.ch](mailto:inmail@iec.ch)

3, rue de Varembe Geneva, Switzerland  
IEC web site <http://www.iec.ch>



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International Electrotechnical Commission  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 5-6: Control circuit devices and switching elements –  
DC interface for proximity sensors and  
switching amplifiers (NAMUR)**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60947-5-6 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

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

FDIS	Report on voting
17B/1011/FDIS	17B/1030/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 3.

The committee has decided that this publication remains valid until 2003.

At this date, in accordance with the committee's decision, the publication will be

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

## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 5-6: Control circuit devices and switching elements – DC interface for proximity sensors and switching amplifiers (NAMUR)

#### 1 Scope

This International Standard applies to proximity sensors connected for operation by a two-wire connecting cable to the control input of a switching amplifier. The switching amplifier contains a d.c. source to supply the control circuit and is controlled by the variable internal resistance of the proximity sensor.

These devices can be used in an explosive atmosphere if they also comply with IEC 60079-11.

NOTE These devices have been defined by the German organization "Normenausschuß für Meß- und Regelungstechnik (NAMUR)" (Office for Standardization of Measurement and Regulation Techniques).

#### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60079-11:1999, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*

IEC 60947-1:1999, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-5-2:1999, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and switching elements – Proximity switches*

#### 3 Definitions

For the purpose of this International Standard the following definitions apply.

##### 3.1

##### **proximity sensor**

device which converts the travel of an influencing body relative to it into an output signal

NOTE 1 The proximity sensor is preferably contactless (e.g. inductive, capacitive, magnetic, photoelectric).

NOTE 2 The proximity sensor may be operated with or without mechanical contact.

##### 3.2

##### **switching amplifier**

device which converts the signal from the proximity sensor presented at the control input into a binary output signal which may be produced e.g. by an electromagnetic relay or a semiconductor switching element

### 3.3

#### **control circuit**

system comprising the proximity sensor, the control input of the switching amplifier and the two-wire connecting cable

### 3.4

#### **output signal of the proximity sensor**

output current as a function of the variable internal resistance

### 3.5

#### **distance/current characteristic of the proximity sensor**

relationship of the output signal (the current value) in the steady state to the distance of the influencing body relative to the sensor. Both continuous and discontinuous characteristics are permitted (see 5.3 and 5.4, and figures 1 and 2)

### 3.6

#### **actuating range ( $\Delta I_1$ )**

range defined by four straight lines in the current-voltage graph of the control input of the switching amplifier to which is assigned a switching function of the switching amplifier.

There are three actuating ranges covered by the current-voltage characteristic of the control input (see figure 3, a, b and d)

### 3.7

#### **slope**

change in the continuous characteristic of a proximity sensor in the actuating range ( $\Delta I_1$ ) (see figure 1)

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NOTE The slope can assume different values within the control span.

### 3.8

#### **maximum-operating frequency of the proximity sensor**

maximum switching frequency achieved through periodic influencing at which the limits of the actuating range ( $\Delta I_1$ ) are reached (see figures 1 and 2)

### 3.9

#### **switching current difference**

change in control current within the actuating range ( $\Delta I_1$ ) at which the switching amplifier changes its output signal (see figures 1, 2 and 3)

### 3.10

#### **switching travel difference**

travel of the influencing body which changes the output signal of the switching amplifier. With a discontinuous characteristic of the proximity sensor, the switching travel difference is identical to the control span  $\Delta s$

### 3.11

#### **line resistance**

effective resistance of the two-wire connecting cable between the switching amplifier and the proximity sensor