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Interested committees:

Title: Draft BS EN IEC 60947-5-7 Low-voltage switchgear and controlgear. Part 5-7: Control circuit devices and switching elements
- Requirements for proximity devices with analogue output.

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- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



121A/460/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:
IEC 60947-5-7 ED2

DATE OF CIRCULATION:
2021-12-17

CLOSING DATE FOR COMMENTS:
2022-02-11

SUPERSEDES DOCUMENTS:
121A/433/CD, 121A/445A/CC

IEC SC 121A : LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR	
SECRETARIAT: France	SECRETARY: Mr Michaël LAHEURTE
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 65B	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☒ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☒ SAFETY	

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TITLE:

Low-voltage switchgear and controlgear - Part 5-7: Control circuit devices and switching elements - Requirements for proximity devices with analogue output

NOTE FROM TC/SC OFFICERS:

SC121A Officers support circulation of CD2 for project IEC 60947-5-7 ED2.

Secretary Note: NC experts are kindly requested to refer their comments to line number.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 5-7: Control circuit devices and switching elements –
Proximity devices with analogue output**

FOREWORD

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International Standard IEC 60947-5-7 has been prepared by subcommittee 121A: Low-voltage switchgear and controlgear, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage.

A list of all the parts in the IEC 60947 series, under the general title *Low-voltage switchgear and controlgear*, can be found on the IEC website.

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

Draft	Report on voting
121A/XX/FDIS	121A/XX/RVD

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

The main changes with respect to the previous Edition 1 are the followings:

- New structure;

- 188 – Update and expansion of definitions on analogue output properties;
- 189 – Expanded performance requirements on analogue output;
- 190 – Update and new normative references;
- 191 – Update of EMC requirements;
- 192 – Harmonization with IEC 62828 series;
- 193 – Harmonization with IEC 62683 definitions;
- 194 – Harmonization with IEC 61131-2 requirements;
- 195 – Update of the annexes

196 The language used for the development of this International Standard is English.

197 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
198 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
199 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
200 described in greater detail at www.iec.ch/standardsdev/publications.

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

- 204 • reconfirmed,
- 205 • withdrawn,
- 206 • replaced by a revised edition, or
- 207 • amended.

208

209

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 5-7: Control circuit devices and switching elements – Proximity devices with analogue output

1 Scope

This part of IEC 60947 states the requirements for proximity devices with analogue output (PDAO) and/or a digital output to transmit a corresponding digital value representing the detected sensing input. These devices can provide additional parameters. Figure 1 shows the schematic principle of such a device. They may consist of one or more parts.

The requirements of IEC 60947-5-2 (proximity switches) apply with the additions and modifications as stated in this document. The clause numbering in this document follows the clause numbering of IEC 60947-5-2, modified where necessary.

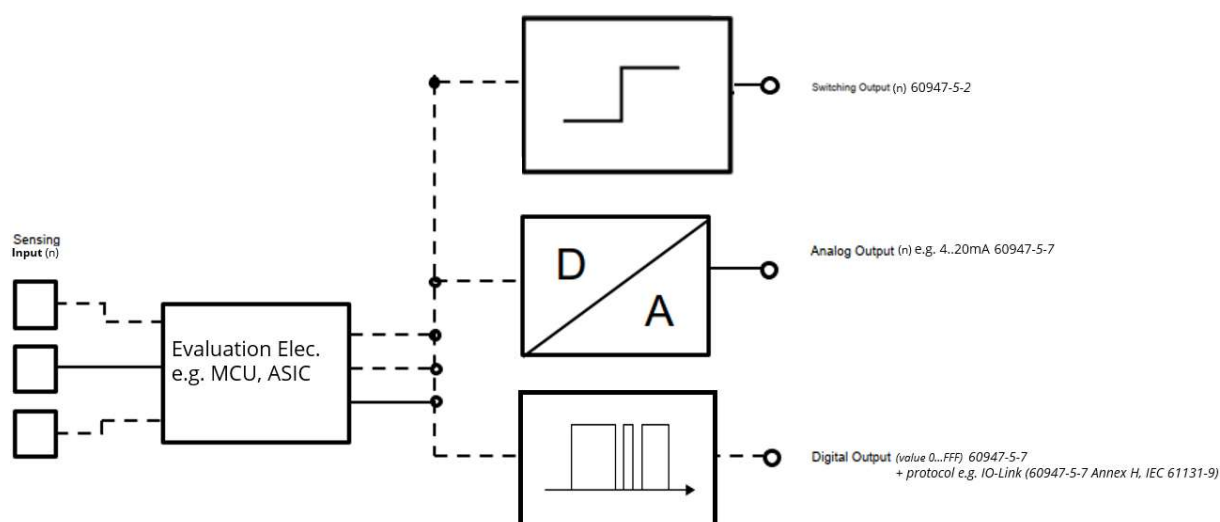


**Figure 1 – Proximity device with analogue output (PDAO),
schematic block diagram structure**

This document does not apply to industrial process measurement transmitters according IEC 62828 series.

NOTE Analogue proximity devices are not necessarily linear devices.

2 Normative references

The following documents are referred 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 60947-5-2:2019, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and switching elements – Proximity switches*

IEC 62683-1:2017, *Low-voltage switchgear and controlgear – Product data and properties for information exchange – Part 1: Catalogue data*

IEC 61131-2:2017, *Industrial-process measurement and control – Programmable controllers – Part 2: Equipment requirements and tests*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60947-5-2:2019 and the following apply.

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

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

3.1 Basic definitions

3.1.1

proximity device with analogue output (PDAO)

device producing an output signal which varies continuously depending on the physical quantity (e.g. distance, speed, rpm...) detected/calculated by the proximity device in relation to its target object(s)

3.1.2

lower range value

minimum stated input value above which the output signal varies continuously

3.1.3

upper range value

maximum stated input value below which the output signal varies continuously

3.1.4

range of input values

defined by lower range value and upper range values of the sensing element detection capability, or calculated value (e.g. distance, speed, rpm...), within which the limits of uncertainty of the proximity device are specified

Note 1 to entry: A principle diagram describing the terms of 3.1.2 to 3.1.4 is given in Figure 3.

3.1.5

span

synonymous: range of input values

algebraic difference between the values of the upper and lower limits of the measuring range

Note 1 to entry: Limit has not to be intend as physical limits regarding the capabilities of the device, rather the upper and lower values defined for the relevant application.

Note 2 to entry: The CDD code of this entry for Electronic Data Exchange is ABB785, modified ("other variables" removed).

[SOURCE: IEC 60050-311:2001, 311-03-13, modified: Notes added]

3.2 Operation of a proximity device

3.2.1

linearity

ability of a proximity device to provide an indication having a linear relationship with a defined quantity other than an influence quantity

Note 1 to entry: The method of expression of lack of linearity is different for different kinds of device and is established in each particular instance.

[SOURCE: IEC 60050-311:2001, 311-06-05]

3.2.2**conformity of the output signal curve**

ability of a proximity device to provide an indication having a specified characteristic curve which can be linear, logarithmic, parabolic, etc.

3.2.3**non-linearity**

deviation from ideal behaviour for devices that have a linear input/output relationship, determined from the curve plotted using the overall average of corresponding upscale and downscale errors

Note 1 to entry: Non-linearity can be calculated and expressed in one of three ways: – independent: line positioned so as to minimize the maximum deviation; – terminal-based: line positioned so as to coincide with the actual characteristic curve at the upper and lower range-values; – zero-based: line positioned so as to coincide with the actual characteristic curve at the lower range-value.

Note 2 to entry: The corresponding properties can be found in the CDD.

Note 3 to entry: Linearity is defined in IEC 60050(300), definition 311-06-06.

Note 4 to entry: Non-linearity does not include hysteresis.

Note 5 to entry: Conformity is often used in conjunction with non-linear curves.

[SOURCE: IEC 61987-13:2016, modified: Notes added]

3.2.4**non-conformity of the output signal curve**

deviation from ideal behaviour for devices that have a non-linear input/output relationship, determined from the curve plotted using the overall average of corresponding upscale and downscale errors

Note 1 to entry: The non-conformity is defined as the closeness with which a calibration curve approximates to a specified characteristic curve (which can be linear, logarithmic, parabolic, etc.).

3.2.5**true value (of a physical quantity value)**

value consistent with the definition of a given particular quantity

Note 1 to entry: This term is used in the "true value" approach.

Note 2 to entry: Value that would be obtained by a perfect measurement.

Note 3 to entry: True values are by nature indeterminate.

Note 4 to entry: The indefinite article "a", rather than the definite article "the", is used in conjunction with "true value" because there can be many values consistent with the definition of a given particular quantity.

[SOURCE: VIM 1.19, IEV 311-01-04]

3.2.6**conventional true value (of a physical quantity value)**

value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose

Note 1 to entry: This term is used in the "uncertainty" approach.

Note 2 to entry: The "conventional true value" is sometimes called "assigned value", "best estimate of the value", "conventional value" or "reference value". The term "reference value", in this sense, should not be confused with "reference value" in the sense used in 311-07-01.

Note 3 to entry: Frequently, a large number of results of measurement of a quantity are used to establish a conventional true value.

3.2.7**inaccuracy**

maximum positive and negative deviation from the specified characteristic curve observed in testing a device under specified conditions and by a specified procedure

Note 1 to entry: Accuracy is defined in IEC 60050-300, definition 311-06-08.

[SOURCE: IEC 61298-1:2008]

3.2.8**long term drift**

drift in output monitored for 30 days at 90 % of span

[SOURCE: IEC 61987-1:2008, 3.22]

3.2.9**long term stability**

drift of zero output signal in percent of full scale limit after a given period of normal operating conditions

Note 1 to entry: The long term stability can be evaluated over a different period of time, e.g. 6 months, 1, 2 or 5 years. Sometime manufacturers declare a life-time stability.

Note 2 to entry: Depending the type of a proximity device, the drift can be referred to an upper range limit, a fixed value, a full scale, etc.

3.2.10**repeatability**

value of variation of the output signal under specified conditions expressed as a percentage of the upper limit

Note 1 to entry: This definition is more general and not equal to the definition in IEC 60947-5-2:2019

3.2.11**resolution value**

resolution of the value of the physical quantity

Note 1 to entry: The resolution value from the digital output value and the analogue output value can be different

3.2.12**error**

discrepancy between a computed, observed or measured value or condition, and the true, specified or theoretically correct value or condition

Note 1 to entry: An error within a system may be caused by failure of one or more of its components, or by activation of a systematic fault.

[SOURCE: IEC 60050-192:2015, 192-03-02]

3.2.13**linearity error of the digital output**

maximum deviation between the real and the ideal curve of the digital output

3.2.14**linearity error of the analogue output**

maximum deviation between the real and the ideal curve of the analogue output

3.2.15**reference base for linearity error**

basis for stating the linearity error for analogue output

Note 1 to entry: The reference base can be output span, full scale or definition by the manufacturer.

3.2.16**upscale error**

arithmetic mean of the errors at each value of each measurement cycle with increasing input value

3.2.17**downscale error**

arithmetic mean of the errors at each value of each measurement cycle with decreasing input value

3.2.18**average error**

arithmetic mean of all upscale and downscale readings at each value

3.2.19**maximum measured error**

largest positive or negative value of errors of the average upscale or downscale values at each point of measurement

[SOURCE: IEC 61298-1:2008]

3.2.20**Total Probable Error TPE**

number obtained by taking the square root of the total sum of the squares of the individual error factors, adopted to consistently compare the performances of two (or more) devices

Note 1 to entry: It is assumed that the variables of the individual errors are independent of each other

Note 2 to entry: When combining all the error factors, the units of measure must all be the same.

3.3 Output element characteristics**3.3.1****analogue current signal**

current signal which varies in a continuous manner within its range

3.3.2**analogue voltage signal**

voltage signal which varies in a continuous manner within its range

3.3.3**range of an analogue signal**

all values of the signal between and including defined limits

3.3.4**lower limit output signal**

specified minimum value of the range

Note 1 to entry: The lower limit may be either zero or a finite value; when zero is used, this is called "true zero"; when a finite value is used, this is called "live zero".

3.3.5**upper limit output signal**

specified maximum value of the range

3.3.6**load impedance (maximum load (current), minimum load (voltage))**

impedance or impedances for which the output characteristics of the proximity device are specified

3.3.7**ripple content**

ratio between the peak-to-peak value of the AC component and the upper limit of the signal value

3.3.8**recovery time**

time taken, following the removal of an external influence for the output signal to return to its previous value within the limits of repeatability as defined in 3.2.10.

3.3.9**warm-up time**

duration between the instant when the power supply is energized and the instant when the device can be used, as specified by the manufacturer

[SOURCE: IEC 61987 DB: Identifier IECABB026, see Figure 2]

3.3.10**settling time**

time interval between the step change of an input signal and the instant when the resulting variation of the output of the signal does not deviate more than 1 % from its final steady state value

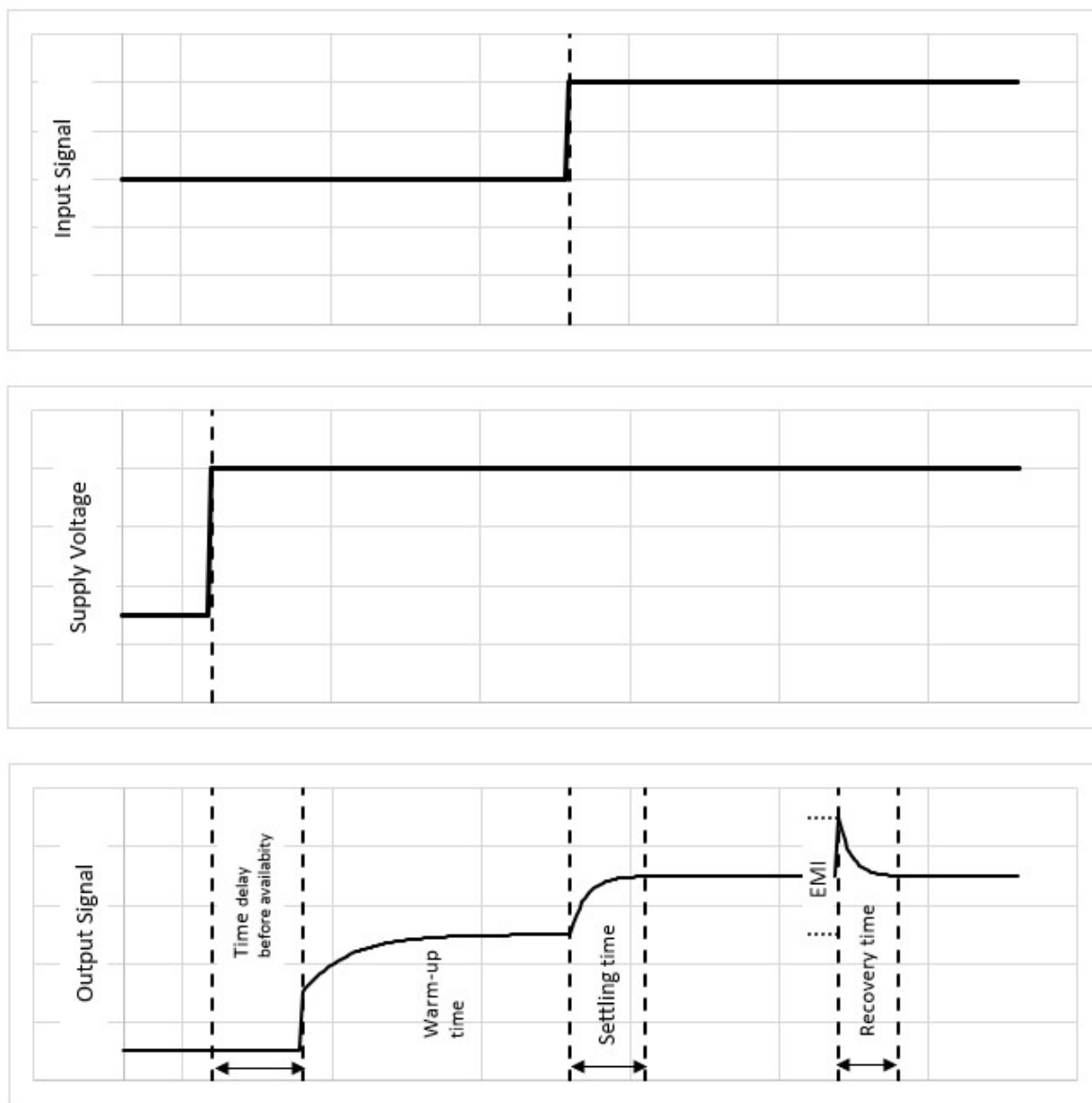
[SOURCE: IEC 61987 DB: Identifier IECABA999, see Figure 2]

3.3.11**output signal**

analogue or digital representation of the physical quantity value produced by a transducer

Note 1 to entry: A transmitter is a transducer with standardized output, see IEV 351-56-29.

[SOURCE: IEV 314-04-06, modified measurand replaced by physical quantity value]



Key

t time

Figure 2 – Principle diagram of time values and their meanings