

Low-voltage switchgear and controlgear —

Part 5-9: Control circuit devices and switching elements — Flow rate switches

ICS 29.130.20

National foreword

This British Standard is the UK implementation of EN 60947-5-9:2007. It is identical to IEC 60947-5-9:2006.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear, controlgear, and HV-LV co-ordination, to Subcommittee PEL/17/2, Low voltage switchgear and controlgear.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Low-voltage switchgear and controlgear -
Part 5-9: Control circuit devices and switching elements -
Flow rate switches
(IEC 60947-5-9:2006)**

Appareillage à basse tension -
Partie 5-9: Appareils et éléments
de commutation pour circuit
de commande -
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Niederspannungsschaltgeräte -
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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 17B/1500/FDIS, future edition 1 of IEC 60947-5-9, 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 60947-5-9 on 2007-09-01.

This standard is to be used in conjunction with EN 60947-1:2004 and EN 60947-5-2:1998.

The provisions of the general rules, EN 60947-1, are applicable to this part of EN 60947, where specifically called for. General rules clauses and subclauses thus applicable, as well as tables, figures and annexes are identified by a reference to IEC 60947-1, for example 1.2.3 or Annex A of IEC 60947-1.

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) | 2008-06-01 |
| – latest date by which the national standards conflicting
with the EN have to be withdrawn | (dow) | 2010-09-01 |

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 Directive EMC (2004/108/EC). See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60947-5-9:2007 was approved by CENELEC as a European Standard without any modification.

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 5-9: Control circuit devices and switching elements – Flow rate switches

1 General

1.1 Scope and object

This part of IEC 60947 applies to flow rate switches that sense the rate of flow of a gas, a liquid or a granular solid. These switches change their output state if a pre-set value for the speed of flow is exceeded.

These flow rate switches are self-contained, have semiconductor switching element(s) and are intended to be connected to circuits, the rated voltage of which does not exceed 250 V 50 Hz/60 Hz a.c. or 300 V d.c.

This standard does not specify the additional measures that are necessary for flow rate switches used in conjunction with explosive sensing materials and/or in an explosive location.

This standard is not intended to cover devices with analogue outputs.

The object of this standard is to state for flow rate switches:

- definitions;
- classifications;
- characteristics;
- product information;
- normal service, mounting and transport conditions;
- constructional and performance requirements;
- tests to verify rated characteristics.

1.2 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.

IEC 60446:1999, *Basic and safety principles for man-machine interface, marking and identification – Identification of conductors by colours or numerals*

IEC 60947-1:2004, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-5-2:1997, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and switching elements – Proximity switches*

Amendment 1 (1999)

Amendment 2 (2003)

IEC 61000-3-2:2005, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-3-3:1994, *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*

Amendment 1 (2001)

Amendment 2 (2005)

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

Amendment 1 (1998)

Amendment 2 (2000)

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

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

IEC 61000-4-6:2003, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

Amendment 1 (2004)

Amendment 2 (2006)

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

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 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low-frequency immunity tests*

IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*

Amendment 1 (2004)

IEC 61558-2-6, *Safety of power transformers, power supply units and similar – Part 2: Particular requirements for safety isolating transformers for general use*

CISPR 11:2003, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*

Amendment 1 (2004)

2 Terms and definitions

For the purposes of this document, the relevant definitions given in Clause 2 of IEC 60947-1 and Clause 2 of IEC 60947-5-2 apply with the following additional definitions.

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2.1 Basic definitions

2.1.1

flow rate switch

device consisting of a flow rate sensor and a switching element which, in accordance with an increasing or decreasing flow of a defined medium (flow medium), changes the output signal at a predetermined value

2.1.2**flow rate sensor**

transducer which detects the rate of flow of a medium in an active area

2.1.3**semiconductor switching element**

element designed to switch the current in an electric circuit by controlling conductivity of a semiconductor

2.1.4**medium**

gaseous, liquid, or fine granular solid, or a combination thereof

2.1.5**reference medium**

medium with which measurements according to this standard are made

2.1.6**flow direction**

direction from which the medium flows towards the sensor

2.1.7**homogenization zone**

zone in front of and behind the sensor with undisturbed flow necessary to homogenize the flow of the medium in order to obtain correct measurement results

2.2 Characteristics of a flow rate switch**2.2.1****active zone**

zone in which a flow rate is detected

NOTE This can be, for example the surface of the sensor tip or inner surface of a sensor tube.

2.2.2**sensor tip**

tip which is surrounded by the medium to sense the flow speed

2.2.3**submersion depth**

minimum length of the sensor tip that needs to be surrounded by the medium to obtain correct measurement results

2.2.4**adjuster (for a flow rate switch)**

part of a flow rate switch used to set the operating parameters

NOTE This may be a potentiometer, a push-button and/or a data interface.

2.2.5**set point**

s_s

rate of flow of the medium at which the switching element changes its state

2.2.6**sensing range**

range between a minimum and a maximum rate of flow within which the set point can be adjusted

2.2.7

repeat accuracy

R

value of variation of the set point under specified conditions

2.2.8

hysteresis

H

difference between the set points at which the switching element turns on and turns off

2.2.9

maximum temperature gradient

maximum specified value of a temperature change of the medium at constant rate within a specified time that does not lead to a change of state of the switching element

2.3 Delay times

2.3.1

turn-on time

time required for the semiconductor switching element to respond after the measured input variable has exceeded the set point under specified conditions

2.3.2

turn-off time

time required for the semiconductor switching element to respond after the measured input variable has fallen below the set point under specified conditions

2.3.3

time delay before availability

t_v

time between the switching on of the supply voltage and the instant at which the flow rate switch becomes ready to operate correctly

3 Classification

3.1 General

Flow rate switches are classified according to various general characteristics as shown in Table 1.

Table 1 – Classification of flow rate switches

1 st position/ 1 digit	2 nd position/ 1 digit	3 rd position/ 1 digit	4 th position/ 1 digit	5 th position/ 1 digit
Sensing means	Construction form	Switching element function (output)	Type of output	Method of connection
3.2	3.3	3.4	3.5	3.6
F Flow	1 One sensor tip 2 Two sensor tips 3 Flush with tube	A NO (make) B NC (break) C Changeover (make – break) P Programmable by user S Other	P PNP output, 3 or 4 terminal d.c. N NPN output, 3 or 4 terminal d.c. A 3 or 4 terminal a.c. B Bus interface S Other	1 Integral leads 2 Integral connector 3 Screw terminal 9 Other

3.2 Classification according to sensing means

In this standard the sensing means is designated by a capital letter placed in the first position.

3.3 Classification according to the construction form

The construction form is designated by a one-digit number placed in the second position.

3.4 Classification according to the switching element function

The switching element function is designated by a capital letter placed in the third position.

3.5 Classification according to the type of output

The type of output is designated by a capital letter placed in the fourth position.

3.6 Classification according to the method of connection

The method of connection is designated by a one-digit number placed in the fifth position.

4 Characteristics

4.1 Summary of characteristics

4.1.1 General

The characteristics of flow rate switches shall be stated in the following terms:

- Operating conditions (4.2)
- Rated and limiting values (4.3)
 - Rated voltages (4.3.1)
 - Currents (4.3.2)
 - Rated supply frequency (4.3.3)
 - Normal load and abnormal load characteristics (4.3.4)
 - Short-circuit characteristics (4.3.5)
- Utilisation categories for the switching element (4.4)

4.1.2 Operation of a flow rate switch

The output state is determined by

- the rate of flow in the active zone of the flow sensor, and
- the set point(s).

4.2 Operating conditions

4.2.1 Operating points of a flow rate switch

The relationship between the operating points is shown in Figure 1.