



BSI Standards Publication

Low- voltage switchgear and controlgear

Part 5-1: Control circuit devices and switching elements —
Electromechanical control circuit devices

National foreword

This British Standard is the UK implementation of EN IEC 60947-5-1:2025. It is identical to IEC 60947-5-1:2024. It supersedes BS EN 60947-5-1:2017, which will be withdrawn on 30 April 2028.

The UK participation in its preparation was entrusted to Technical Committee PEL/121/1, Low voltage switchgear and controlgear.

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

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control circuit devices
(IEC 60947-5-1:2024)

Appareillage à basse tension - Partie 5-1: Appareils et
éléments de commutation pour circuits de commande -
Appareils électromécaniques pour circuits de commande
(IEC 60947-5-1:2024)

Niederspannungsschaltgeräte - Teil 5-1: Steuergeräte und
Schaltelemente - Elektromechanische Steuergeräte
(IEC 60947-5-1:2024)

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European Committee for Electrotechnical Standardization
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European foreword

The text of document 121A/585/FDIS, future edition 5 of IEC 60947-5-1, prepared by SC 121A "Low-voltage switchgear and controlgear" of IEC/TC 121 "Switchgear and controlgear and their assemblies for low voltage" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60947-5-1:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2026-04-30
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2028-04-30

This document supersedes EN 60947-5-1:2017 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZZ, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60947-5-1:2024 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 standard indicated:

IEC 60068-2-75:2014	NOTE	Approved as EN 60068-2-75:2014 (not modified)
IEC 60073:2002	NOTE	Approved as EN 60073:2002 (not modified)
IEC 60079 (series)	NOTE	Approved as EN IEC 60079-7 (series)
IEC 60255 (series)	NOTE	Approved as EN 60255 (series)
IEC 60947-5-3:2013	NOTE	Approved as EN 60947-5-3:2013 (not modified)
IEC 60947-5-4:2002	NOTE	Approved as EN 60947-5-4:2003 (not modified)
IEC 61000 (series)	NOTE	Approved as EN IEC 61000 (series)
IEC 61810 (series)	NOTE	Approved as EN 61810 (series)
IEC 61672-1:2013	NOTE	Approved as EN 61672-1:2013 (not modified)

IEC 62246-1:2015	NOTE	Approved as EN 62246-1:2015 (not modified)
IEC 62246-1-1:2018	NOTE	Approved as EN IEC 62246-1-1:2018 (not modified)
IEC 62246-4:2023	NOTE	Approved as EN IEC 62246-4:2023 (not modified)
IEC 62443 (series)	NOTE	Approved as EN IEC 62443 (series)
IEC/TR 63201:2019	NOTE	Approved as CLC IEC/TR 63201:2020 (not modified)
ISO 7731:2003	NOTE	Approved as EN ISO 7731:2008 (not modified)

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-6	2007	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2008
IEC 60068-2-14	2023	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN IEC 60068-2-14	2023
IEC 60068-2-27	2008	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-30	2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60068-2-78	2012	Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state	EN 60068-2-78	2013
IEC 60695-2-10	2021	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN IEC 60695-2-10	2021
			+ AC	2024
IEC 60695-2-11	2021	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products (GWEPT)	EN IEC 60695-2-11	2021
IEC 60695-2-12	2021	Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials	EN IEC 60695-2-12	2021
IEC 60730-1	2022	Automatic electrical controls - Part 1: General requirements	EN 60730-1	2016
			+ A1	2019
			+ A2	2022

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60947-1	2020	Low-voltage switchgear and controlgear - Part 1: General rules	EN IEC 60947-1	2021
			+ AC	2023
			+ AC	2024
IEC 60947-4-1	2018	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters	EN IEC 60947-4-1	2019
			+ AC	2020
			+ AC	2021
IEC 60947-5-2	2019	Low-voltage switchgear and controlgear - Part 5-2: Control circuit devices and switching elements - Proximity switches	EN IEC 60947-5-2	2020
IEC 60947-5-5	1997	Low-voltage switchgear and controlgear -- Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function	EN 60947-5-5	1997
+ A1	2005		+ A1	2005
-	-		+ A11	2013
+ A2	2016		+ A2	2017
IEC 60999-1	1999	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units -- Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm ² up to 35 mm ² (included)	EN 60999-1	2000
IEC 61000-4-2	2008	Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009
IEC 61000-4-3	2020	Electromagnetic compatibility (EMC) -- Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN IEC 61000-4-3	2020
IEC 61000-4-4	2012	Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	2012
IEC 61000-4-5	2014	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	2014
+ A1	2017		+ A1	2017
IEC 61000-4-6	2023	Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN IEC 61000-4-6	2023
IEC 61000-4-8	2009	Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8	2010

EN IEC 60947-5-1:2025 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61000-4-11	2020	Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN IEC 61000-4-11	2020
			+ AC	2020
			+ AC	2022
IEC 61131-9	2022	Programmable controllers - Part 9: Single-drop digital communication interface for small sensors and actuators (SDCI)	EN IEC 61131-9	2022
IEC 61140	2016	Protection against electric shock - Common aspects for installation and equipment	EN 61140	2016
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	2002
			+ A1	2021
IEC 62471	2006	Photobiological safety of lamps and lamp systems	EN 62471	2008
CISPR 11 (mod)	2015	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	2016
+ A1	2016		+ A1	2017
-	-		+ A11	2020
+ A2	2019		+ A2	2021
CISPR 32	2015	Electromagnetic compatibility of multimedia equipment - Emission requirements	EN 55032	2015
			+ AC	2016
+ A1	2019		+ A1	2020
-	-		+ A11	2020
ISO 2859-1	1999	Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit AQL) for lot-by-lot inspection	-	-
ISO 14159	2002	Safety of machinery – Hygiene requirements for the design of machinery	EN ISO 14159	2008

Annex ZZ (informative)

Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered

This European standard has been prepared under a Commission's standardisation request relating to harmonised standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZ.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations.

Table ZZ.1 — Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]

Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
(1)(a)	6.1 d) to w), 6.2, 6.3, 8.1, Annex D, Annex F, Annex H, Annex J, Annex K, Annex L, Annex M, Annex N	
(1)(b)	6.1 d) to w), 6.3, 6.5, Clause 7, 8.1, 8.2, 9.1, 9.2, 9.3, Annex C, Annex D, Annex F, Annex J	
(1)(c)	6.1 d) to w), 6.2, 6.3, 6.5 <i>See also references given in (2)(a) to (2)(d) and (3)(a) to (3)(c) in this Table.</i>	
(2)(a)	6.1 d) to v), 6.3, 6.5, 8.1, 8.2, 9.2, 9.3, Annex D, Annex F	
(2)(b)	8.1, 8.2, 9.2, 9.3, Annex G, Annex H, Annex J	
(2)(c)	6.1 w), 6.3, 6.5, 8.1, 8.2, 9.1, 9.2, 9.3, Annex C, Annex D, Annex J, Annex N	
(2)(d)	6.1 i), j), 6.3, 6.5, Clause 7, 8.1, 8.2, 8.4, 9.2, 9.3, Annex D, Annex F, Annex J	
(3)(a)	6.1 g), m), 6.3, 6.5, Clause 7, 8.1, 8.2, 8.4, 9.1, 9.2, 9.3, Annex C, Annex D, Annex F, Annex G, Annex J	
(3)(b)	6.1 m), n), 6.3, 6.5, Clause 7, 8.1, 8.2, 8.3, 9.3, 9.4, Annex D, Annex F, Annex N, Annex K	

Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
(3)(c)	6.1 e), o), p), 6.3, 6.5, 8.1, 8.2, 9.2, 9.3, Annex D, Annex H, Annex J, Annex K, Annex N	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 5-1: Control circuit devices and switching elements –
Electromechanical control circuit devices**

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IEC 60947-5-1 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. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) update of the scope structure and exclusions;
- b) requirements for control circuits;
- c) update of the normal service conditions (e.g. shock and vibration);
- d) update of information and marking requirements including environmental information requirements referencing IEC TS 63058:2021;

- e) update of the constructional requirements and the corresponding tests considering safety aspects (e.g. artificial optical radiation, security aspects, limited energy source, stored charge energy circuit);
- f) update of the EMC requirements according to the generic documents;
- g) new requirements for reed contact magnetic switches in Annex D;
- h) requirements for class II circuit devices achieved by double or reinforced insulation in Annex F;
- i) update of pull-out tests in Annex G;
- j) information requirements for audible signalling device in Annex J;
- k) insertion of new Annex O.

The text of this International Standard is based on the following documents:

Draft	Report on voting
121A/585/FDIS	121A/598/RVD

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

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

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

This International Standard should be used in conjunction with IEC 60947-1.

The provisions of the general rules, IEC 60947-1, are applicable to this document, 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, Table 4 or Annex A of IEC 60947-1:2020.

The following differing practices of a less permanent nature exist in the countries indicated below.

- 8.2.4.1: Making and breaking capacities (United States of America and Canada).
- 9.3.3.5.2: Test circuits and connections (United States of America and Canada).

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

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices

1 Scope

This part of IEC 60947 applies to control circuit devices and switching elements intended for controlling, signalling, interlocking, etc., of switchgear and controlgear.

It applies to control circuit devices having a rated voltage not exceeding 1 000 V AC (at a frequency not exceeding 1 000 Hz) or 600 V DC.

This document applies to specific types of control circuit devices as contained in the following non exhaustive list:

- manually operated control switches;
- electromagnetically operated control switches, either time-delayed or instantaneous;
- contactor relays;
- pilot switches;
- pressure switches;
- temperature sensitive switches (thermostats);
- programmers;
- position switches;
- control switches operated by part of a machine or mechanism;
- associated control circuit equipment, for example indicator lights;
- control circuit devices incorporating semiconductor switching elements;
- control circuit devices incorporating a built-in single drop digital communication interface.

NOTE 1 Control circuit devices and switching elements are referred to as "equipment" or "device" equally in this document.

This document also applies to specific types of control circuit switching elements associated with other devices (whose main circuits are covered by other standards) as contained in the following non exhaustive list:

- auxiliary contacts of a switching device (e.g. contactor, circuit breaker) which are not dedicated exclusively for use with the coil of that device;
- interlocking contacts of enclosure doors;
- control circuit contacts of rotary switches;
- control circuit contacts of overload relays.

This document does not apply to:

- relays covered in the IEC 60255 or IEC 61810 series;
- automatic electrical control devices for household and similar purposes;
- the use of control circuit devices and switching elements with additional measure within explosive atmospheres. These are given in the IEC 60079 series;

This document does not address specific colour requirements or actuating force values.

NOTE 2 Colour requirements can be found in IEC 60073 and also in CIE S004/E-2001.

The object of this document is to state:

- definitions;
- classification;
- characteristics;
- product information;
- normal service, mounting and transport conditions;
- constructional and performance requirements, including electromagnetic compatibility (EMC) and all related product safety measures;
- tests to verify the requirements and the rated characteristics.

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 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14:2023, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60417, *Graphical symbols for use on equipment*,
available at <http://www.graphical-symbols.info/equipment>

IEC 60695-2-10:2021, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2021, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

IEC 60695-2-12:2021, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials*

IEC 60730-1:2022, *Automatic electrical controls – Part 1: General requirements*

IEC 60947-1:2020, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-4-1:2018, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60947-5-2:2019, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and switching elements – Proximity switches*

IEC 60947-5-5:1997, *Low-voltage switchgear and controlgear – Part 5-5: Control circuit devices and switching elements – Electrical emergency stop device with mechanical latching function*

IEC 60947-5-5:1997/AMD1:2005

IEC 60947-5-5:1997/AMD2:2016

IEC 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2020, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

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

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

IEC 61000-4-5:2014/AMD1:2017

IEC 61000-4-6:2023, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2020, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61131-9:2022, *Programmable controllers – Part 9: Single-drop digital communication interface for small sensors and actuators (SDCI)*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 11:2015/AMD1:2016

CISPR 11:2015/AMD2:2019

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

CISPR 32:2015/AMD1:2019

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit AQL) for lot-by-lot inspection*

ISO 14159:2002, *Safety of machinery – Hygiene requirements for the design of machinery*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

3.1.1 General

For the purposes of this document, the terms and definitions given in IEC 60947-1:2020, as well as the following apply.

ISO and IEC maintain terminology 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>

3.1.2 Basic terms and definitions

3.1.2.1

control circuit device

electrical device intended for the controlling, signalling, interlocking, etc., of switchgear and controlgear

Note 1 to entry: Control circuit devices include control switches and associated devices such as indicator lights.

Note 2 to entry: Control circuit devices can also include associated devices dealt with in other standards, such as instruments, potentiometers, relays, in so far as associated devices are used for the purposes specified above.

3.1.2.2

control switch

<control and auxiliary circuits> mechanical switching device which serves the purpose of controlling the operation of switchgear or controlgear, including signalling, electrical interlocking, etc.

Note 1 to entry: A control switch consists of one or more contact elements with a common actuating system.

Note 2 to entry: A control switch may include semiconductor elements or contact elements (see 3.1.5.2 and 3.1.5.3).

[SOURCE: IEC 60050-441:1984, 441-14-46, modified – Addition of a new Note 2 to entry.]

3.1.2.3

control switch suitable for isolation

control switch which, in the open position, complies with the requirements specified for the isolating function (see 3.3.19 and 8.1.7 of IEC 60947-1:2020)

Note 1 to entry: Such control switches are intended to provide a higher degree of safety to personnel when working on the equipment controlled. For this reason, they have to be manually actuated relying on the intelligence of instructed persons to react in case they would fail to operate, for example in case of insufficiently opened contacts.

3.1.2.4 control station

assembly of one or more control switches fixed on the same panel or located in the same enclosure

Note 1 to entry: A control station panel or enclosure may also contain related equipment, for example potentiometers, signal lamps, instruments, etc.

[SOURCE: IEC 60050-441:1984, 441-12-08]

3.1.2.5 limited energy source

source that is designed and protected such that, under both normal operating conditions and single fault conditions, the current that can be delivered is not hazardous with respect to fire hazard

[SOURCE: IEC 60947-4-1:2018, 3.6.4]

3.1.2.6 single fault condition

condition in which there is a fault of a single protection (but not a reinforced protection) or of a single component or a device

Note 1 to entry: If a single fault condition results in one or more other fault conditions, all are considered as one single fault condition.

[SOURCE: IEC Guide 104:2019, 3.8, modified – Deletion of Note 2 to entry.]

3.1.2.7 recovery time

time period between disruption and the point in time when the specified function is performed again

3.1.2.8 normal load condition

set of operating parameters for the switching element matching one or more of the utilization categories shown in Table 1, and identified as "normal" for the subject switching element

Note 1 to entry: The normal use of a control switch is to close, maintain and open circuits.

3.1.2.9 abnormal load condition

set of operating conditions resulting in operating parameters that exceed those identified in the relevant utilization category in Table 1 used to identify normal load conditions

Note 1 to entry: Abnormal load conditions may arise, for example, when the coil of a contactor is energized but the device fails to operate correctly.

3.1.2.10 low-current terminal

terminal intended to connect a conductor to a device capable of supplying a current not exceeding 300 mA to the device

Note 1 to entry: This does not apply to special terminal constructions intended to connect to flat or other multiwire cables by performing one "clamping action" only for more than one wire (e.g. bus connections).

[SOURCE: IEC 62873-3-1:2020, 3.6, modified – Deletion of "a voltage signal and/or".]

3.1.2.11

skilled personnel

electrically skilled person

person with relevant education and experience to enable him or her to perceive risks and to avoid hazards that electricity can create

3.1.3 Terms and definitions concerning automatic control switches

NOTE Automatic control switches are operated by automatic control (see 3.6.5 of IEC 60947-1:2020). They are also designated as pilot switches (see 3.4.18 of IEC 60947-1:2020).

3.1.3.1

instantaneous contactor relay

contactor relay operating without any intentional time delay

Note 1 to entry: Unless otherwise stated, a contactor relay is an instantaneous contactor relay.

[SOURCE: IEC 60050-441:1984, 441-14-36]

3.1.3.2

time-delay contactor relay

contactor relay with specified time-delay characteristics

Note 1 to entry: The time-delay may be associated with energization (*e*-delay) or with de-energization (*d*-delay) or both.

Note 2 to entry: A time-delay contactor relay may also incorporate instantaneous contact elements.

[SOURCE: IEC 60050-441:1984, 441-14-37, modified – Addition of a new Note 2 to entry.]

3.1.3.3

position switch

pilot switch the actuating system of which is operated by a moving part of the machine, when this part reaches a predetermined position

[SOURCE: IEC 60050-441:1984, 441-14-49]

3.1.3.4

programmer

control switch having a multiplicity of switching elements which, after initiation, operates in a defined sequence

3.1.4 Terms and definitions concerning manually operated control switches

NOTE Manually operated control switches are operated by manual control (see 3.6.4 of IEC 60947-1:2020).

3.1.4.1

push-button

control switch having an actuator intended to be operated by force exerted by a part of the human body, usually the finger or palm of the hand, and having stored energy (spring) return

[SOURCE: IEC 60050-441:1984, 441-14-53]

3.1.4.2

pull-button

control switch having an actuator intended to be operated by manual pull, and having stored energy (spring) return

3.1.4.3**push-pull button**

control switch having an actuator intended to be operated by manual push and returned to its initial position by manual pull, or vice versa

Note 1 to entry: There are also "push-push" or "push-turn" or other combinations of buttons.

3.1.4.4**rotary button**

combination of push-button type switching elements having an actuator operated by a manual rotation (see also 3.1.4.15 to 3.1.4.18 inclusive)

EXAMPLE Selector switch.

Note 1 to entry: A rotary push-button may have more than two positions; it may or may not have a spring return.

3.1.4.5**latched push-button**

push-button with spring return, but which remains in the actuated position until a latch is released by a separate action

Note 1 to entry: The latching may be released by subsequent actuation (such as pushing, turning, etc.) of the same or of an adjacent push-button or by the action of an electromagnet, etc.

3.1.4.6**locked push-button**

push-button which may be secured in one or more of its positions by a separate action

Note 1 to entry: The locking may be obtained by turning the button, by turning a key, by operating a lever, etc.

3.1.4.7**key-operated push-button**

push-button which can only be operated as long as a key remains inserted

Note 1 to entry: Key withdrawal may be provided at any position.

3.1.4.8**time-delay push-button**

push-button having contacts of which return to the initial position only after a pre-determined interval of time following the release of the actuating force

3.1.4.9**delayed action push-button**

push-button in which the switching operation does not occur until after the force on the button has been maintained for a pre-determined interval of time

3.1.4.10**illuminated push-button**

push-button incorporating a signalling lamp in the button

3.1.4.11**covered push-button**

push-button in which the button is protected against inadvertent operation by a lid or a cover

3.1.4.12**shrouded push-button**

push button in which the button is protected against inadvertent operation in certain directions

3.1.4.13**free push-button**

push-button in which the rotation of the actuator around its axis is not limited

3.1.4.14

guided push-button

push-button in which the rotation of the actuator around its axis is prevented

EXAMPLE Push-buttons the actuators of which are keyed, square or rectangular.

3.1.4.15

rotary control switch

rotary switch

control switch having an actuator intended to be operated by rotation

3.1.4.16

key-operated rotary switch

rotary switch where a key is used as the actuator

Note 1 to entry: Key withdrawal may be provided at any position.

3.1.4.17

limited movement rotary switch

rotary switch with a restricted angular movement of its actuator

3.1.4.18

unidirectional movement rotary switch

rotary switch in which the actuating system allows rotation in one direction only

3.1.4.19

joy stick

control switch having an actuator consisting of a pin or stick projecting essentially at a right angle from the panel or enclosure when in one of its positions and intended to be operated by angular displacement

Note 1 to entry: A joy stick may have more than two positions associated with different directions of the displacement of the stick and operating the contact elements differently: such a joy stick is referred to as a joy stick selector.

Note 2 to entry: The pin or stick may or may not have a spring return.

3.1.4.20

wobble stick

joy stick which operates all contact elements alike, whatever be the direction of the displacement

3.1.4.21

foot switch

pedal

control switch having an actuator intended to be operated by force exerted by a foot

[SOURCE: IEC 60050-441:1984, 441-14-52, modified – Insertion of "force exerted by a".]

3.1.5 Terms and definitions concerning parts of control switches

3.1.5.1

switching element

element designed to close and open a conducting path of a circuit

Note 1 to entry: A switching element may be a semiconductor element (see 3.1.5.2) or a contact element (see 3.1.5.3)

3.1.5.2**semiconductor element**

element designed to switch the current of an electric circuit by means of the controlled conductivity of a semiconductor

3.1.5.3**contact element**

<control switch> parts, fixed and movable, conducting and insulating, of a control switch necessary to close and open one single conducting path of a circuit

Note 1 to entry: The contact element and the actuating system may form an indivisible unit, but frequently one or more contact elements may be combined with one or more actuating system or systems. The actuating systems may be different.

Note 2 to entry: Terms and definitions relating to various kinds of single contact elements of a control switch are given in 3.1.5.4 to 3.1.5.13 inclusive.

Note 3 to entry: This definition does not include control coils and magnet systems.

3.1.5.4**single gap contact element**

contact element which opens or closes the conducting path of its circuit on one location only

SEE: Figure 3 a) and Figure 3 c).

3.1.5.5**double gap contact element**

contact element which opens or closes the conducting path of its circuit in two locations in series

SEE: Figure 3 b), Figure 3 d) and Figure 3 e).

3.1.5.6**make-contact element****normally open**

contact element which closes a conducting path when the control switch is actuated

3.1.5.7**break-contact element****normally closed**

contact element which opens a conducting path when the control switch is actuated

3.1.5.8**change-over contact elements**

contact element combination which includes one make-contact element and one break-contact element

SEE: Figure 3 c), Figure 3 d) and Figure 3 e).

3.1.5.9**pulse contact element****fleeting contact element**

contact element which opens or closes a circuit for a part of the travel during the transition of the actuator from one position to another

3.1.5.10**electrically separated contact elements**

contact elements belonging to the same control switch, but adequately insulated from each other so that they can be connected into electrically separated circuits, which can be either same polarity or opposite polarity

[SOURCE: IEC 60050-441:1984, 441-15-24, modified – Supplemented by polarity statement.]

3.1.5.11**independent action contact element****snap action contact element**

contact element of a manual or automatic control device in which the velocity of contact motion is substantially independent of the velocity of motion of the actuator

3.1.5.12**dependent action contact element**

contact element of a manual or automatic control device in which the velocity of contact motion depends on the velocity of motion of the actuator

3.1.5.13**contact unit**

contact element or contact element combination which can be combined with similar units operated by a common actuating system

3.1.5.14**button**

external end of the actuator of a push-button, to which the actuating force is applied

3.1.5.15**flush-button**

button which is substantially levelled with the adjacent fixed surrounding surface when in its initial position and is below this surface when it is operated

3.1.5.16**recessed button**

button which is below the adjacent fixed surrounding surface in both its initial and operated positions

3.1.5.17**extended button**

button which protrudes above the adjacent fixed surrounding surface both in its initial position and in its operated position

3.1.5.18**mushroom button**

button, the protruding end of which has an enlarged diameter

3.1.5.19**locating mechanism**

<rotary switch> part of the actuating system which retains the actuator and/or the contact elements in their positions

Note 1 to entry: Other devices (e.g. a push-button with two positions, or an emergency stop) can also have such a function.

3.1.5.20**end stop**

device that limits the travel of a moving part

Note 1 to entry: An end stop may relate either to the actuator or to the contact element.

3.1.5.21**mechanically linked contact elements**

combination of n make-contact element(s) and m break-contact element(s) designed in such a way that they cannot be in closed position simultaneously under conditions defined in L.9.5

Note 1 to entry: One control circuit device may have more than one group of mechanically linked contact elements.

Note 2 to entry: See also L.8.1.9.

3.1.6 Terms and definitions concerning operation of contactor relays**3.1.6.1****e-delay**

<contact element> delay in the operation of a contact element of a contactor relay, following the energization of the coil of the electromagnet of this contactor relay

EXAMPLE Delay to close make-contacts (ON delay).

Note 1 to entry: The terms "e-delay" and "d-delay" may be applied to any kind of contact elements (see 3.1.5.3).

3.1.6.2**d-delay**

<contact element> delay in the operation of a contact element of a contactor relay, following the de-energization of the coil of the electromagnet of this contactor relay

EXAMPLE Delay to open make-contacts (OFF delay).

Note 1 to entry: The terms "e-delay" and "d-delay" may be applied to any kind of contact elements (see 3.1.5.3).

3.1.6.3**fixed delay**

<contact element> delay in the operation of a contact element of a contactor relay, which is not intended to be adjusted in value

3.1.6.4**adjustable delay**

<contact element> delay in the operation of a contact element of a contactor relay, which is intended to be adjusted to different values after the installation of the contactor relay

3.1.7 Terms and definitions concerning operation of pilot switches**3.1.7.1****actuating quantity**

physical quantity, the value of which is decisive for the actuation or non-actuation of a pilot switch

3.1.7.2**operating value**

value of the actuating quantity which is sufficient to cause a pilot switch to be actuated

3.1.7.3**return value**

value of the actuating quantity which has to be re-established in order to cause an actuated pilot switch to return to its position of rest

3.1.7.4

differential value

difference between the operating value and the return value

3.1.8 Terms and definitions concerning operation of rotary switches

3.1.8.1

definite position

<rotary switch> position into which the locating mechanism pulls the rotary switch and retains it as long as the actuating torque does not exceed a certain value

3.1.8.2

position of rest

stable (definite) position into which the locating mechanism tends to move back and retain the rotary switch by stored energy

3.1.8.3

transit position

(definite) position in which the locating mechanism produces an intended marked change in the operating torque, but in which the actuator cannot remain by itself

3.1.8.4

biased position

(definite) position of a rotary switch in which the actuator is pulled against a stop from which it will return to a position of rest by means of stored energy (for example, by means of a spring)

Note 1 to entry: During the transfer from a biased position to the adjacent position of rest, the rotary switch may pass through one or more transit positions.

3.1.8.5

latched position

biased position in which the return mechanism is held by a latching arrangement

Note 1 to entry: The latching arrangement may be released manually or otherwise.

3.1.8.6

locked position

(definite) position in which a rotary switch is secured by separate action

Note 1 to entry: The locking may be obtained by turning a key, operating a lever, etc.

3.1.8.7

operating diagram

representation of the intended order in which the contact elements of a rotary switch operate as a result of actuation

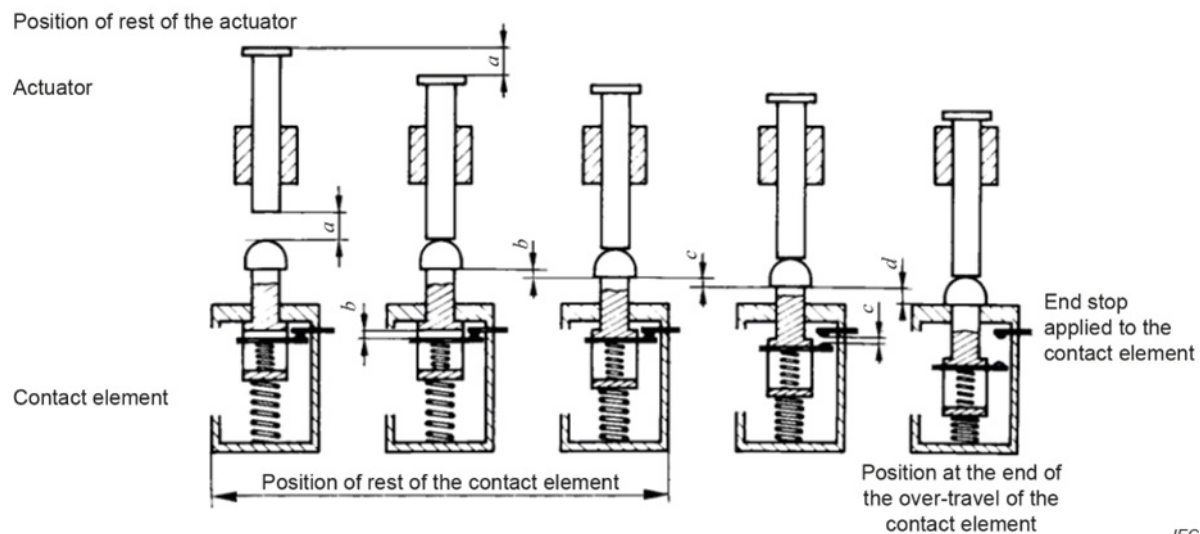
3.1.9 Terms and definitions concerning operation of mechanically operated control switches

3.1.9.1

pre-travel of the actuator

maximum travel of the actuator which causes no travel of the contact elements

Note 1 to entry: See dimension *a* in Figure 1.



IEC

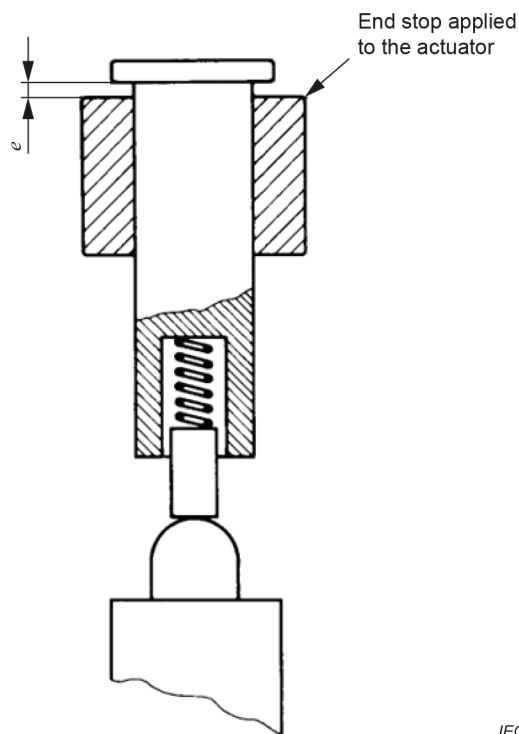
Key

- a* Pre-travel of the actuator
- b* Pre-travel of the contact element
- c* Minimum value required to give adequate contact gap
- d* Over-travel of the contact element

NOTE $b + c + d$ is the total travel of the contact element and $a + b + c + d + e$ the total travel of the actuator. Because of a possible resilient connection between the actuator and the contact element (for example, see Figure 2), the over-travel of the actuator can exceed the over-travel of the contact element by a length e .

Figure 1 – Operation of push-buttons**3.1.9.2****over-travel of the actuator**

travel of the actuator after all the contacts have reached their closed (open) position



IEC

Figure 2 – Difference e between the over-travel of the actuator and that of the contact element

3.1.9.3

direct drive

connection between actuator and contact element that excludes any pre-travel of the actuator

3.1.9.4

positive drive

connection between actuator and contact element such that the force applied to the actuator is directly transmitted to the contact element

3.1.9.5

limited drive

connection between actuator and contact element that limits the force transmitted to the contact element

3.1.9.6

actuating torque

torque applied to an actuator necessary to complete the intended operation

[SOURCE: IEC 60050-441:1984, 441-16-18, modified – Replacement of "moment" with "torque".]

3.1.9.7

restoring torque

torque provided to restore an actuator or a contact element to its initial position

[SOURCE: IEC 60050-441:1984, 441-16-20, modified – Replacement of "moment" with "torque".]

3.1.9.8

minimum starting force

smallest value of force initiating the pre-travel of the actuator

3.1.9.9

minimum starting torque

smallest value of torque initiating the pre-travel of the actuator

3.1.9.10

minimum actuating force

minimum value of the force to be applied to the actuator that will cause all contacts to reach their closed (open) position

3.1.9.11

minimum actuating torque

minimum value of the torque to be applied to the actuator that will cause all contacts to reach their closed (open) position

3.1.9.12

pre-travel of the contact element

relative movement which occurs within the contact element before the contacts make (break)

Note 1 to entry: See dimension *b* on Figure 1.

3.1.9.13

over-travel of the contact element

relative movement which occurs within the contact element after the contacts have reached the make (break) position

Note 1 to entry: See dimension *d* on Figure 1.

3.1.9.14**bounce time**

<contact which is closing/opening its circuit> time interval between the instant when the contact circuit first closes/opens and the instant when the circuit is finally closed/opened

[SOURCE: IEC 60050-444:2002, 444-05-04, modified – Figure 1 deleted.]

3.1.10 Terms and definitions concerning reed contact magnetic switches**3.1.10.1****reed contact magnetic switch**

control circuit device incorporating one or more reed contact switching element(s) operated by a magnetic actuator

EXAMPLES Reed contact proximity switch, reed contact float switch.

Note 1 to entry: Reed contact magnetic switch is called "reed contact magnetic proximity sensor" or "magnetic sensing device" in IEC 62246-4.

3.1.10.2**coded magnetic switch**

control circuit device incorporating two or more reed contact switching element(s) operated by a separate coded magnetic actuator, when this actuator reaches a predetermined position

EXAMPLE Magnetic actuator embedding coded permanent magnets.

3.1.10.3**rated operating distance**

s_n

conventional quantity used to designate the operating distances

Note 1 to entry: The rated operating distance does not consider either manufacturing tolerances or variations due to external conditions such as voltage and temperature.

[SOURCE: IEC 60947-5-2:2019, 3.3.1.1, modified – Note 2 to entry deleted.]

3.1.10.4**assured operating distance**

s_{ao}

distance from the sensing face within which the presence of the magnetic actuator is correctly detected under all specified environmental conditions and manufacturing tolerances

[SOURCE: IEC 60947-5-3:2013, 2.6.4, modified – "Specified target" replaced by "magnetic actuator".]

3.1.10.5**assured release distance**

s_{ar}

distance from the sensing face beyond which the absence of the magnetic actuator is correctly detected under all specified environmental conditions and manufacturing tolerances

[SOURCE: IEC 60947-5-3:2013, 2.6.5, modified – "Specified target" replaced by "magnetic actuator".]

3.1.10.6**magnetic actuator**

separate (or built-in) metal component, solenoids or other magnetic sources activating the reed contacts of the magnetic switch by changing the magnetic field value within the sensing zone

EXAMPLES Permanent magnets, ferromagnetic plates.

3.1.11 Terms and definitions concerning Class II control circuit devices

3.1.11.1

encapsulation

process by which all components, conductors and ends of integral cables are encased in an insulating compound by suitable means such as embedding or potting

3.1.11.2

embedding

process of completely encasing electrical device(s) by pouring a compound over it (them) in a mould, and removing the encased device(s) from the mould after solidification of the compound

3.1.11.3

potting

embedding process in which the mould remains attached to the encased electrical device(s)

3.1.11.4

compound

thermosetting, thermoplastic, catalytically cured and elastomeric materials with or without fillers and/or additives, after their solidification

3.1.11.5

double insulation

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-195:2021, 195-06-08]

3.1.11.6

reinforced insulation

insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation

Note 1 to entry: Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation.

[SOURCE: IEC 60050-195:2021, 195-06-09, modified – Addition of the words "of hazardous-live-parts".]

3.1.12 Terms and definitions concerning control circuit devices with integrally connected cables

3.1.12.1

cable connected control circuit device

control circuit device having integrally connected leads for electrical connection to other equipment and/or to the power source

3.1.12.2

cable entrance sealing means

sealing means between the cable and device enclosure providing the required protection from cable abrasion and which may provide required sealing of enclosure and cable anchorage

3.1.12.3

cable anchorage

means to relieve mechanical stress from the cable termination so as to prevent damage to the electrical connection between the device and the cable

3.1.13 Terms and definitions concerning semiconductor switching elements

3.1.13.1 voltage drop

U_d

voltage measured across the semiconductor switching element when carrying the operational current under specified conditions

3.1.13.2 minimum operational current

I_m

current that is necessary to maintain ON-state conduction of the semiconductor switching element

3.1.13.3 OFF-state current

I_r

current which flows through the load circuit when the switching element is in the OFF-state

3.1.14 Terms and definitions concerning indicator lights, indicating towers and audible signalling devices

3.1.14.1 indicator light

light signal giving information either by lighting or extinguishing

3.1.14.2 lens of an indicator light

visible part, removable or not, constituting the surface intentionally made transparent or translucent

3.1.14.3 bezel

holder of a lens

3.1.14.4 indicator light with a built-in voltage-reducing device

indicator light, the body of which contains a device (transformer, resistor, etc.) intended to supply, at the terminals of a lamp, a voltage different from the rated operational voltage of the light

3.1.14.5 indicating tower

assembly including one or more signalling units giving information by visible or audible signals

Note 1 to entry: Other elements, for example network interface elements, can be added.

3.1.14.6 panel mounted audible signalling device

single hole mounted device, illuminated or not, giving information by an auditory signal

Note 1 to entry: According to definition 3.2 of ISO 7731:2003, panel mounted audible devices are commonly used to give auditory warning signals, but they are not intended for emergency signals.

3.1.14.7**sound pressure level**

ten times the logarithm to the base 10 of the ratio of the time-mean-square of a sound pressure signal to the square of the reference value

Note 1 to entry: Sound pressure level is expressed in decibels (dB).

Note 2 to entry: The reference value is 20 µPa.

[SOURCE: IEC 61672-1:2013, 3.2]

3.1.15 Terms and definitions concerning control switches with direct opening action**3.1.15.1****control switch with direct opening action**

control switch having one or more break-contact elements coupled to the switch actuator via non-resilient members so that full contact opening of the break-contact element(s) is obtained when the actuator is moved through the direct opening travel by applying the force stated by the manufacturer

3.1.15.2**direct opening action**

<contact element> achievement of contact separation as the direct result of a specified movement of the switch actuator through non-resilient members (for example not dependent upon springs)

3.1.15.3**direct opening travel**

travel from the beginning of actuation of the actuator and the position when the direct opening action of the opening contacts is completed

3.1.15.4**direct opening force**

actuation force applied to the actuator for the direct opening action

3.1.15.5**direct opening torque**

actuating torque, for a rotary control switch, applied to the actuator for the direct opening action

3.1.16 Terms and definitions concerning digital communication interface**3.1.16.1****single drop digital communication interface****SDCI**

digital communication interface for switching 24 V devices (e.g. IO-Link™¹) defining a point-to-point communication link for connecting sensors and actuators to a master unit

¹ IO-Link™ is a trade name of the "IO-Link Consortium". This information is given for the convenience of users of this publication and does not constitute an endorsement by IEC of the trade name holder or any of its products. Equivalent products may be used if they can be shown to lead to the same results.

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