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CENELEC

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Foreword

This document (CLC/TS 50131-2-10:2014) has been prepared by CLC/TC 79 "Alarm systems".

EN 50131-2 is currently composed of the following parts:

- EN 50131-2-2, *Alarm systems — Intrusion and hold-up systems — Part 2-2: Intrusion detectors — Passive infrared detectors*;
- EN 50131-2-3, *Alarm systems — Intrusion and hold-up systems — Part 2-3: Requirements for microwave detectors*;
- EN 50131-2-4, *Alarm systems — Intrusion and hold-up systems — Part 2-4: Requirements for combined passive infrared and microwave detectors*;
- EN 50131-2-5, *Alarm systems — Intrusion and hold-up systems — Part 2-5: Requirements for combined passive infrared and ultrasonic detectors*;
- EN 50131-2-6, *Alarm systems — Intrusion and hold-up systems — Part 2-6: Opening contacts (magnetic)*;
- CLC/TS 50131-2-8, *Alarm systems — Intrusion and hold-up systems — Part 2-8: Intrusion detectors — Shock detectors*;
- CLC/FprTS 50131-2-9, *Alarm systems — Intrusion and hold-up systems — Part 2-9: Intrusion detectors — Active infrared beam detectors*;
- CLC/TS 50131-2-10, *Alarm systems — Intrusion and hold-up systems — Part 2-10: Intrusion detectors — Lock state contacts (magnetic)* [the present document];
- EN 50131-2-7-1, *Alarm systems — Intrusion and hold-up systems — Part 2-7-1: Intrusion detectors — Glass break detectors (acoustic)*;
- EN 50131-2-7-2, *Alarm systems — Intrusion and hold-up systems — Part 2-7-2: Intrusion detectors — Glass break detectors (passive)*;
- EN 50131-2-7-3, *Alarm systems — Intrusion and hold-up systems — Part 2-7-3: Intrusion detectors — Glass break detectors (active)*.

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Introduction

This Technical Specification applies to lock state contacts (magnetic) used as part of intrusion and hold-up alarm systems (I&HAS) installed in buildings. It includes four security grades and four environmental classes.

Lock state contacts are installed in windows or doors and windows or doorframes to allow to monitor the lock/unlock status only or the lock/unlock status combined with the open/close status of a window/door simultaneously and are as such located in supervised premises.

The scope for lock state contacts (magnetic) and the number and types of generated signals or messages will be more comprehensive for systems that are specified at the higher grades.

This Technical Specification is only concerned with the requirements and tests for lock state contacts (magnetic). Other types of detectors are covered by other documents identified in the EN 50131 series and in the EN 50131-2 series.

1 Scope

This Technical Specification provides for security grades 1 to 4, (see EN 50131-1) specific or non-specific wired or wire-free lock state contacts, and includes the requirements for four environmental classes covering applications in internal and outdoor locations as specified in EN 50130-5.

The purpose of a lock state contact (magnetic) is to detect the lock/unlock state only or the lock/unlock state combined with the opening status/displacement from the defined closed position of a window or door simultaneously. The lock state contact comprises two separate contact-less units, the active connection between these units is at least one magnetic or electromagnetic based field. Separating the two units disturbs the connection and produces an intruder signal or message.

A detector will fulfil all the requirements of the specified grade.

Functions additional to the mandatory functions specified in this Technical Specification may be included in the detector, providing they do not influence the correct operation of the mandatory functions.

The combination of the two separate units of the lock state contact is referred to in the body of this Technical Specification as the detector.

This Technical Specification does not apply to system interconnections.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10130, *Cold rolled low carbon steel flat products for cold forming — Technical delivery conditions*

EN 50130-4, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder, hold up, CCTV, access control and social alarm systems*

EN 50130-5, *Alarm systems — Part 5: Environmental test methods*

EN 50131-1:2006,[1)] *Alarm systems — Intrusion and hold-up systems — Part 1: System requirements*

EN 50131-6, *Alarm systems — Intrusion and hold-up systems — Part 6: Power supplies*

EN 60068-1:1994, *Environmental testing — Part 1: General and guidance (IEC 60068-1:1988 + A1:1992 + corrigendum Oct. 1988)*

EN 60068-2-52, *Environmental testing — Part 2: Tests — Test Kb: Salt mist, cyclic (sodium chloride solution) (IEC 60068-2-52)*

EN 60404-5, *Magnetic materials — Part 5: Permanent magnet (magnetically hard) materials — Methods of measurement of magnetic properties (IEC 60404-5)*

EN 60404-14, *Magnetic materials — Part 14: Methods of measurement of the magnetic dipole moment of a ferromagnetic material specimen by the withdrawal or rotation method (IEC 60404-14)*

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1) This document is currently impacted by EN 50131-1:2006/A1:2009.

EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3)*

IEC 60404-8-1, *Magnetic materials — Part 8-1: Specifications for individual materials — Magnetically hard materials*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50131-1:2006 and the following apply.

3.1.1
connecting field
one or more generated magnetic or electromagnetic field(s) (e.g. magnetic, inductive, RFID, NFC) connecting actively the two units of the detector

Note 1 to entry: Separating the two units disturbs the connection and produces an intrusion signal or message.

3.1.2
prohibited area
mounting arrangement, as stated by the manufacturer, of the two units of the detector in which the detector no longer meets the requirements of this Technical Specification

3.1.3
incorrect operation
physical condition that causes an inappropriate signal or message from a detector

3.1.4
wire free detector
detector connected to convey information to the control and indicating equipment without using wires, such as radio frequency signals

3.1.5
approach distance/make distance
separation distance between the two units of a detector that are being brought together at which an intrusion signal or message is reversed

3.1.6
removal distance/break distance
separation distance between the two units of a detector that are being moved apart at which an intrusion signal or message is generated

3.1.7
corresponding unit
part of the detector, comprising one or more components, to act and/or react via one or more connecting field(s) and is as such related to the process unit of the detector

3.1.8
process unit
part of the detector, comprising one or more components, analysing the connecting field(s) and/or their content(s) towards the corresponding unit and which generates an appropriate signal or message

3.1.9
lock state contact
detector which consists usually out of two separate units, where each of the units (process unit and corresponding unit) is mounted within one of the two parts of the monitored object (fixed and moving parts) while allowing to monitor the lock state only or the lock and the open state simultaneously

Note 1 to entry: The active connection between the two units is at least one connecting field. Separating the two units disturbs the connection and produces an intrusion signal or message.

3.1.10
sealed contact
type of detector construction, whereby there is no direct access to the internal components or connections, e.g. a "potted" unit usually supplied with integral connecting cable

3.1.11
reverse signal
signal or message generated by a detector to indicate that there is no longer an intrusion event, e.g. change of state or cancellation of an intrusion signal or message

3.1.12
intrusion event
abnormal condition indicating the presence of a hazard

3.1.13
low supply voltage
supply voltage level below which the operation of the detector can no longer be guaranteed

3.1.14
interference test unit
unit(s) (e.g. magnet(s), RFID tag(s)) - similar to the corresponding unit - used for verifying the behaviour of the detector in the presence of external connecting field(s), at least one of which is identical to the corresponding unit supplied with the detector, whereas technology-depending internal different states are valid

3.1.15
external connecting field
deliberately induced connecting field generated by a source other than the corresponding or process unit (e.g. sabotage magnet, RFID Tag)

3.1.16
immunity
characteristic of a detector such that only a limited change in its detection performance is permitted in the presence of one of the interference test unit(s)

3.1.17
pure interference test magnet
unsealed magnetic field generating component (pure magnet) of the corresponding unit not mounted or build into the corresponding unit housing which is used for mounting or installation

3.2 Abbreviations

For the purposes of this document, the abbreviations given in EN 50131-1:2006 and the following apply.

— AC Alternative Current;

— BTD Basic Test of Detection capability;

— DC Direct Current;

— EMC Electromagnetic Compatibility;

— RFID Radio Frequency Identification.

4 Functional requirements

4.1 Events

The detector shall respond to events in accordance with Table 1 and as defined in this Clause 4.

Table 1 — Events to be processed and main functions to be provided by grade

Event to be processed and functions to be provided	Grade			
	1	2	3	4
Break distance exceeded	M	M	M	M
Inside make distance	M	M	M	M
Remote enable of detection indication [a]	Op	Op	M	M
Connecting field interference	Op	Op	M	M
Prevention and detection of access to the inside of the detector	Op [b]	M [c]	M [c]	M [c]
Removal from the mounting surface [d]	Op	M	M	M
Low power supply voltage [e]	Op	Op	M	M
Total loss of external power [f]	M	M	M	M
Matched pairs, coding and encryption	Op	Op	M [g]	M [g]

Key
M = Mandatory
Op = Optional

[a] Only required if detection indicator present.

[b] Generation of a tamper signal for opening by normal means is not required.

[c] Not required for sealed lock state contacts according to 4.5.2.

[d] Mandatory for wire-free at grades 2, 3 and 4; mandatory for all grade 4 types, optional for wired grades 1, 2 and 3.

[e] See 4.6.7.

[f] See 4.6.6.

[g] See 4.5.5.

4.2 Signals or messages

The response to the signals or messages generated by the detector is determined by the I&HAS. The detector shall generate signals or messages in accordance with Table 2, based on the events listed in Table 1. Signals or messages shall be generated within 10 s of the event occurring. The response of a detector to events defined as optional in Table 1 shall be in accordance with Table 2.

Table 2 — Generation of signals or messages

Event	Signals or messages		
	Intrusion	Tamper	Fault
Break distance exceeded	M	NP	NP
Inside make distance	NP	NP	NP
Magnetic interference grade 3 [a]	Op	Op	Op
Magnetic interference grade 4 [b]	M	Op	M
Detection of access to the inside of the detector	NP	M	NP
Removal from the mounting surface	NP	M	NP
Low power supply voltage [c]	Op	Op	M
Total loss of external power [d]	M	Op	Op

Key
M = Mandatory
NP = Not Permitted
Op = Optional

[a] Required only if the make and break distances are greater than twice the distances specified by the manufacturer (see 6.6.4); at least one of these signals or messages (Intrusion or/and Tamper or/and Fault) shall be generated or an independent signal or message shall be generated.

[b] Required only if the make and break distances are greater than twice the distances specified by the manufacturer (see 6.6.4); either intrusion AND fault signals or messages, OR an independent signal or message shall be generated.

[c] See 4.6.7.

[d] See 4.6.6.

4.3 Detection

4.3.1 Detection performance

4.3.1.1 Generalities

The operating parameters of the detector shall be verified as specified by the manufacturer for the axes of movement shown in Annex D. The operating parameters shall be defined under the condition that a successful locking position is ensured.

The manufacturer shall clearly state in the product documentation all removal/break and approach/make distances including their tolerance range for each distance in order to specify all potential variances due to product design and manufacturing.

Furthermore, the manufacturer shall clearly state as well in the product documentation any special limitation concerning installation e.g. a prohibited area between a surface on the detector and the minimum make distance.

4.3.1.2 Removal/break distance

The detector shall generate an intrusion signal or message at the removal/break distance specified by the manufacturer. This distance shall be specified for all normal operating axes. If the detector is designed for installation on ferromagnetic surfaces or in ferromagnetic material, the removal/break distance shall also be specified for all normal operating axes when the detector is mounted using the material as specified in Annex E.

4.3.1.3 Approach/make distance

The detector shall generate a reverse signal or message at the minimum separation distance(s) specified by the manufacturer. This distance(s) shall be specified for all normal operating axes. If the detector is designed for installation on ferromagnetic surfaces or in ferromagnetic material, the approach/make distance shall be specified for all normal operating axes when the detector is mounted using the material as specified in Annex E.

4.3.2 Indication of detection

When a detection indicator is provided to show when an intrusion signal or message is generated and in normal operation visible (e.g. surface mounted contacts) when installed according to the manufacturer's instructions, this indicator shall be capable of being enabled and disabled.

The adjustment to enable or disable this indication locally within the detector shall only be accessible when the detector is opened by normal means, in case of opening is required.

A detector at grade 3 or grade 4 shall be capable of receiving indication enable and disable commands from the CIE when such an indicator is present, according to clause one of this paragraph.

4.4 Operational requirements

4.4.1 Time interval between intrusion signals or messages

Detectors using wired interconnections shall be able to provide an intrusion signal or message not more than 15 s after the end of the preceding intrusion signal or message.

Detectors using wire free interconnections shall be able to provide an intrusion signal or message after the end of the preceding intrusion signal or message within the following times:

- Grade 1 300 s;
- Grade 2 180 s;
- Grade 3 30 s;
- Grade 4 15 s.

4.4.2 Switch on delay

Where a detector requires an internal or external power supply in accordance with 4.6, the detector shall meet all functional requirements within 180 s of the power supply reaching its nominal voltage.

4.4.3 Fault condition signals

A detector shall generate a fault signal or message in accordance with the manufacturer's specification and the provisions of Table 2 in the presence of a fault condition, according to Table 1, or as a result of an internal self-test, if this feature is provided.

4.5 Tamper security

4.5.1 Tamper security requirements

All terminals and means of mechanical and electronic adjustments shall be located within the detector's housings.

The tamper security requirements for each grade of detector are shown in Table 1.

4.5.2 Prevention and detection of access to the inside of the detector through covers and existing holes

Access holes shall not allow interference with the operation of the detector by probing with commonly available tools. Damage shall not be caused that would prevent normal operation.

If the detector can be opened, a tool shall be required to open the unit. For grades 2, 3 and 4 detectors all covers giving access to components that could adversely affect the operation of the detector shall be fitted with a tamper detection device that shall generate signals or messages in accordance with Table 2. It shall not be possible to gain such access without generating a tamper signal or message or causing visible damage. Sealed contacts do not require the means to detect access to the inside of the detector.

4.5.3 Detection of removal from the mounting surface

Means shall be provided which generates a tamper signal or message in accordance with Table 2 if the detector is removed from the mounting surface. Operation of the tamper detection means shall not be compromised by deliberate tamper actions. The means shall activate before access can be gained to it.

4.5.4 Magnetic or electromagnetic field interference

When the detector is mounted in accordance with the manufacturer's instructions and is subject to the presence of an external field, which is based on the same physical principal as the connecting field (e.g. magnetic or electromagnetic) generated by:

- the interference test unit as specified in Annex A and one interference test unit which is identical to the corresponding unit, each applied to the faces of the detector according to Annex F for purely magnetic field based products (one after one) to generate an external connecting field;

- an interference test unit based on the same physical principal and digital identification means (e.g. tag number provided by a RFID field, if encryption is not provided) applied to the faces of the detector according to Annex F to generate an external connecting field;

the detector shall either:

a) be immune to any influence by each of the interference test units and continue to operate normally with the make and break distances not exceeding twice those specified in accordance with 4.3.1, or

b) generate an intrusion, and/or tamper, and/or fault, and/or other independent signal or message in accordance with Table 2 when the make or break distances exceed twice those specified in accordance with 4.3.1; these signals or messages may be generated either on application of the interference test unit or when the corresponding unit has returned to its original installed position.

NOTE The signals or messages generated by a grade 4 detector are intended to be used by the I&HAS to positively identify an attempt to sabotage the detector through magnetic or electromagnetic field interference.

In case of purely magnetic field based products, a further interference test shall be performed to identify and avoid specific critical points at the process unit where magnetic interference or manipulation could be possible (e.g. to reduce the risk of manipulation which simulates that the window is in a closed and locked state of the process unit of an open window). Therefore, the pure interference test magnet shall be applied at any selected area or point directly to each accessible surface of the process unit, while no other magnetic fields shall have influence (e.g. corresponding unit or interference test unit). In that case, in accordance with Table 2, the detector shall generate a tamper, and/or fault, and/or other independent signal or message; alternatively, for Grade 3 products, the process unit shall stay in the state that represents an intrusion event.

4.5.5 Matched pairs, coding and encryption

If a grade 4 detector is a purely magnetic field based product, it shall consist of a matched pair of switch component and corresponding unit or similar means. The means of matching shall have a minimum of 8 differs. It shall not be possible to determine the specific pair identity by visual inspection of the detector.

If the connection between the process and the corresponding unit relies purely on digital identification means (e.g. tag number provided by a RFID field), it shall not be easily possible to simply read out the digital identification information and to generate a copy of the unit that holds the digital identification information. This applies to grade 3 and grade 4 digital identification means based products.

In such cases, encryption, rolling code or other protection mechanisms shall provide a certain level of security.

4.6 Electrical requirements

4.6.1 Grade dependencies

The requirements of 4.6.2 to 4.6.5 only apply to detectors having external power to operate the components of the detector.

Table 3 — Electrical requirements

Test	Grade 1	Grade 2	Grade 3	Grade 4
Detector current consumption	Required	Required	Required	Required
Input voltage range	Required	Required	Required	Required
Slow input voltage rise	Not required	Required	Required	Required
Input voltage ripple	Not required	Required	Required	Required
Input voltage step change	Not required	Required	Required	Required

4.6.2 Detector current consumption

The detector's quiescent and maximum current consumption shall not exceed the figures claimed by the manufacturer at the nominal input voltage.

4.6.3 Slow input voltage change and input voltage range limits

The detector shall meet all functional requirements when the input voltage lies between ± 25 % of the nominal value, or between the manufacturer's stated values if greater. When the supply voltage is raised slowly, the detector shall function normally at the specified range limits.

4.6.4 Input voltage ripple

The detector shall function during the sinusoidal variation of the input voltage by ± 10 % of nominal, at a frequency of 100 Hz.

4.6.5 Input voltage step change

No signals or messages shall be caused by a step in the input voltage between nominal and maximum and between nominal and minimum.

4.6.6 Total loss of external power

This subclause does not apply to detectors with internal power supplies or detectors in bus systems.

This does not include any applied voltage to a purely mechanical (e.g. pure magnetic field / reed switch) based detector. This test only applies to wired and wire free grade 4 detectors and wire free grade 3 detectors.

An intrusion signal or message shall be generated by the total loss of the supply voltage. No generation of a message or signal is required when this total loss of external power condition is detected by the CIE due to system design, e.g. bus based systems.

4.6.7 Low supply voltage

This subclause applies to detectors that require either internal or external power supplies.

This does not include any applied voltage to a purely mechanical (e.g. pure magnetic field/reed switch) based detector. This test only applies to wired and wire free grade 4 detectors and wire free grade 3 detectors.

A fault signal or message shall be generated when the minimum level of voltage that is required for the detector to operate reliably is compromised according to the specification of the manufacturer. No generation of a message or signal is required when this low power condition is detected by the CIE due to system design, e.g. bus based systems.

4.6.8 Interconnection Integrity

The detector shall provide means to enable the I&HAS to monitor the integrity of the interconnection. Where the interconnecting cable or wire is provided with the detector, means shall be provided to permit the monitoring of this interconnecting cable in accordance with EN 50131-1 (e.g. a tamper loop or end-of line resistor built into the body of the detector).

This requirement may be fulfilled either by the detector itself or by suitable system design.

4.7 Environmental classification and conditions

4.7.1 Environmental classification

The environmental classification is described in EN 50131-1 and shall be specified by the manufacturer.

4.7.2 Immunity to environmental conditions

Detectors shall meet the requirements of the relevant environmental tests described in EN 50130-5 at the severity levels defined in Table 4 and in Table 5.

For all grades, the detector shall not generate or be affected by the EMC conditions and severity levels defined in EN 50130-4 and EN 61000-6-3.

Unless specified otherwise for operational tests, the detector shall not generate unintentional intrusion, tamper, fault or other signals or messages when subjected to the specified range of environmental conditions.

For endurance tests, the detector shall continue to meet the requirements of this Technical Specification after being subjected to the specified range of environmental conditions.

5 Marking, identification and documentation

5.1 Marking and/or identification

Marking and/or identification shall be applied to the product in accordance with the requirements of EN 50131-1.

5.2 Documentation

The product shall be accompanied with clear and concise documentation in accordance with EN 50131-1. The documentation shall additionally state for the corresponding grade dependent functions:

a) a list of all options, functions, inputs, indications, signals or messages and their relevant characteristics;

b) the recommended mounting configuration, details of suitable fixing methods, prohibited areas, mounting location and siting requirements;

c) a statement of the operational Approach/make and Removal/break distances on ferromagnetic and non-ferromagnetic mounting surfaces for all recommended configurations and operational axes including all tolerances as described in 4.3.1.1;

d) the effect of any adjustable controls on the detector's performance;

e) any disallowed field adjustable control settings or combinations of these;

f) the operating voltage range and/or nominal operating voltage and the maximum and quiescent detector current consumption at this nominal voltage, if applicable;

g) the value of supply voltage below which a fault signal is generated, if applicable;

h) if the direct installation in or on ferromagnetic material is supported, this should be mentioned in the product documentation, including all relevant potential material or/and changes to any product characteristics due to that installation environment (e.g. make / break distances, tolerances, etc.).

6 Testing

6.1 Generalities

The tests are intended to be primarily concerned with verifying the correct operation of the detector to the specification provided by the manufacturer. All the test parameters specified shall carry a general tolerance of ± 10 % unless otherwise stated. A list of tests appears as a general test matrix in Annex B.

6.2 General test conditions

6.2.1 Standard laboratory conditions for testing

The general atmospheric conditions in the measurement and tests laboratory shall be those specified in EN 60068-1:1994, 5.3.1, unless stated otherwise:

— temperature: 15 °C to 35 °C;

— relative humidity: 25 % RH to 75 % RH;

— air pressure: 86 kPa to 106 kPa.

6.2.2 General detection testing environment and procedures

The manufacturer's documented instructions regarding mounting and operation shall be read and applied to all tests.

6.2.3 Testing procedures

The intrusion and, where appropriate, tamper, fault and any other signal or message outputs shall be monitored.

Where appropriate, the detector shall be connected to the nominal supply voltage, and allowed to stabilise for 180 s.

6.3 Basic test of detection capability

The general test conditions of 6.2 apply.

Monitor the output of the detector with its corresponding unit within the make distance. Move the corresponding unit to a position beyond the break distance. Record the status of the intrusion signal or message during the test.

Pass/Fail criteria: An intrusion signal or message shall be generated when the corresponding unit is moved beyond the break distance.

6.4 Verification of detection performance

6.4.1 Generalities

The general test conditions of 6.2 shall apply to all tests in this series.

Detection performance shall be tested against the manufacturer's documented claims. Any variable controls shall be set to the values recommended by the manufacturer to achieve the claimed performance.

To allow a proper monitoring of the operating parameters while in lock state, it is required that the underlying lock mechanism, either direct or indirect by reference, can be simulated based on the assumption that a successful lock position is ensured. This shall be taken into account, when the operating parameters will be validated in the test sections.

Whereas performance distances claimed by the manufacturer, tolerances shall be specified in mm or as percentage and be part of the product documentation, if applicable. The general tolerance of ± 10 % mentioned in 6.1 shall be calculated against these mentioned tolerances, if applicable.

6.4.2 Measurement of make / break distances

By moving the corresponding unit relative to the process unit, measure the make and break distances where the process unit generates intruder and reverse signals or messages. Record the response of the process unit. Note the make and break distances for all the configurations claimed in the manufacturer's documentation.

Pass/Fail criteria: An intrusion signal or message shall be generated when the break distance is exceeded and shall generate a reverse signal or message when the make distance is reached as claimed in the manufacturer's documentation.

6.5 Switch-on delay, time interval between signals, and indication of detection

The general test conditions of 6.2 apply.

Switch on the detector's power supply (if available and required) with the indicator enabled (if provided), and allow 180 s for stabilisation. Carry out the BTD. Note the response. Carry out the BTD again, after the grade-dependant time interval between signals according to 4.4.1. Note the response again. Disable the intrusion indicator (if provided). Repeat the BTD.

Pass/Fail criteria: The detector shall generate an intrusion signal or message in response to the BTD. The intrusion signal or message and the intrusion indicator shall respond at the same time. A second intrusion signal or message shall be generated after the grade-dependant time interval specified in 4.4.1 has elapsed. With the indicator disabled (if provided), the detector shall still generate an intrusion signal or message.

6.6 Tamper security

6.6.1 Generalities

The general test conditions of 6.2 apply.

The tests of this subclause shall be applied to the detector at the grade in accordance with Table 1.

6.6.2 Prevention and detection of access to the inside of the detector through covers and existing holes

Attempt to overcome the tamper detection device by deliberate attack with normally available objects as listed in Annex C, by distorting the housing or by attempting to access the connections or components within the process unit without causing visible external damage. Grade dependency appears in Table 1. Monitor the outputs of the detector.

Pass/Fail criteria: Where there is no physical damage to the detector, a tamper signal or message shall be generated before access is gained to any circuit connection or control that can adjust the performance of the process unit.

6.6.3 Detection of removal from the mounting surface

The object of this test is to confirm the operation of the tamper device by removing the process unit from the mounting surface.

Place the process unit on the mounting surface without the fixing screws, unless they form a part of the tamper detection device.

Slowly prise the process unit away from the mounting surface and attempt to prevent the tamper device from operating by inserting a strip of steel between 100 mm and 200 mm long by 10 mm to 20 mm wide, and 1 mm thick between the rear of the detector and its mounting surface. Attempt to gain access to the circuit connections or controls. Monitor the outputs of the process unit.

Pass/Fail criteria: A tamper signal or message shall be generated before the tamper device can be inhibited or access is gained to any circuit connection or control that can adjust performance, according to Table 1 and Table 2.

6.6.4 Resistance to magnetic field interference

This test shall be performed for grade 3 and grade 4 products only.

The process unit and the corresponding unit shall be installed according to the manufacturer's description with a separation distance calculated as 50 % of the specified make distance on the y-axis. If a prohibited area is described by the manufacturer, the distance of this area will be added to the previously calculated separation distance.

The test environment/installation shall allow reproducible adding and removal of the corresponding unit without any changes to the original installation distance, to simulate the locking and, for combined products, the opening and closing of the monitored object. The interference test unit shall be applied onto all exposed and accessible housing surfaces when mounted normally.

For detectors designed for installation in a ferromagnetic environment, the tests shall be performed in such an environment following the installation instructions and using the installation material (if required) by the manufacturer. For lock state contacts mounted on ferromagnetic material directly, the test shall be undertaken with the process unit placed on a steel mounting plate based on the material defined in Annex E, having dimensions of (600 x 600 x 1,6) mm. For lock state contacts mounted flush in ferromagnetic material directly, the test shall be undertaken using 2 steel mounting plates based on the material defined in Annex E, having dimensions of (200 x 200 x 1,6) mm.

The interference test unit shall be applied on all exposed surfaces reference Annex F. If due to the size of the surface it is possible to position the interference test unit on more than one position, then the test should be repeated at several randomly chosen points. Monitor the outputs of the process unit, and measure the make and break distances in accordance with 4.3.1. In case the connecting field is purely magnetic, both polarisation directions shall be tested parallel and perpendicular on each chosen point.

Pass/Fail criteria: Signals or messages shall be generated in accordance with Table 2 in the presence of the interference test unit or the detector shall continue to work normally if the make and break distances do not exceed twice the specified values.

In case of purely magnetic field based products, a further interference test shall be performed. The pure interference test magnet shall be applied at any selected area or point directly to each accessible surface of the process unit, while no other magnetic fields shall have influence (e.g. corresponding unit or interference test unit).

Pass/Fail criteria: Signals or messages shall be generated in accordance with Table 2 in the presence wherever the pure interference test magnet is; alternatively, for grade 3 products, the process unit shall stay in the state that represents an intrusion event.

6.6.5 Matched pairs, coding and encryption

For grade 4 detectors purely based on magnetic fields, the manufacturer shall supply a minimum of eight differs of coded pairs or similar means (e.g. enrol and calibration mechanism for pairing) for each detector. One process unit shall be chosen randomly and will be either tested against eight different corresponding units, alternatively the means of matching (e.g. pairing mechanism) between the process unit and the corresponding unit will be performed and the process unit will be tested with seven additional corresponding units, which had not been paired.

Pass/Fail criteria: The process unit shall only work with its corresponding unit and it shall not be possible to determine the specific pair identity by visual inspection of the detector. In case the pairing relies on a position related pairing mechanism between the process and corresponding unit, eight differs of relative positions between the units shall be supported and it shall not be possible to determine the specific pair identity by visual inspection of the detector.

If the connection between the process and the corresponding unit relies purely on digital identification means (e.g. tag number provided by a RFID field), the manufacturer shall describe the basic technology used for pairing of the process and the corresponding unit and the fundamentals of the encryption of the communication process between the paired components. Based on this information, tests shall be performed

to break the communication process between the paired components and to simulate the corresponding unit or to create a copy of the corresponding unit by reading itself out and copy the content onto a similar object.

Pass/Fail criteria: With moderate effort, it shall not be possible to simulate successfully the communication process without corresponding unit or to create a copy of the corresponding unit that will work with the process unit. Furthermore, it shall not be possible to determine the specific pair identity by visual inspection of the detector.

6.7 Electrical tests

6.7.1 Generalities

The tests of 6.7.2 to 6.7.6 shall only be applied to detectors that require an external power supply and at the grade specified in Table 3.

The BTD given in 6.3 shall be used for verification. Connect the detector to a variable voltage stabilised power supply and allow the detector to stabilise for at least 180 s.

6.7.2 Detector current consumption

Connect the detector in series with a current measuring meter and connect a voltmeter across the detector's power input terminals. Set the voltage to the nominal value. Enable the intrusion indicator if provided. Measure the current consumption whilst applying the BTD.

Pass/Fail criteria: The current consumption shall not exceed the manufacturer's stated value by more than 20 %.

6.7.3 Slow input voltage change and input voltage range limits

Connect the detector to a suitable variable, stabilised power supply.

Raise the supply voltage from zero by 100 mV every 1 s until the nominal voltage V - 25 % is reached, or the minimum level specified by the manufacturer, whichever is less. Allow the detector to stabilise for 180 s, carry out the BTD, and monitor the intrusion, tamper and fault signals or messages.

Reset the supply voltage to the nominal V. Raise the voltage from V by 100 mV every 1 s until the nominal voltage V + 25 % is reached, or the maximum level specified by the manufacturer, whichever is greater. Allow the detector to stabilise for 180 s, carry out the BTD, and monitor the intrusion, tamper and fault signals or messages.

Reset the supply voltage to the nominal V. Lower the voltage by 100 mV every 1 s until the nominal voltage V - 25 % is reached, or the minimum level specified by the manufacturer, whichever is less. Allow the detector to stabilise for 180 s, carry out the BTD, and monitor the intrusion and fault signals or messages.

Pass/Fail criteria, slow power supply change: There shall be no signals or messages generated by the detector during the test apart from those generated by the BTD.

Pass/Fail criteria, voltage at the range limits: There shall be no signals or messages generated by the detector during the test apart from those generated by the BTD.

6.7.4 Input voltage ripple

Connect the detector to a signal generator with appropriate output impedance capable of generating a sinusoidal voltage of V ± 10 % superimposed on the detector nominal voltage V at a frequency of 100 Hz. Allow at least 180 s for the detector to stabilise. Apply the sinusoidal voltage for 180 s at 100 Hz.

Carry out the BTD. Observe whether any intrusion or fault signals or messages are generated.

Pass/Fail criteria: There shall be no signals or messages generated by the detector during the test apart from those generated by the BTD.

6.7.5 Input voltage step change

Connect the detector to a square wave generator limited to a maximum current of 1 A capable of switching from the nominal supply voltage V to the nominal voltage V ± 25 % in 1 ms.

Begin the test at the nominal voltage, and allow at least 180 s for the detector to stabilise. Carry out the BTD. Monitor intrusion, tamper, fault and any other signals or messages. Apply ten successive square wave pulses from the nominal supply voltage V to V + 25 %, of duration 5 s at intervals of 10 s. Observe whether any intrusion or fault signals or messages are generated. Repeat the BTD. Repeat the step change test for the voltage range V to V - 25 %.

Pass/Fail criteria: There shall be no signals or messages generated by the detector during the test apart from those generated by the BTD.

6.7.6 Total loss of power supply

This test is not applicable to detectors with internal power supplies or detectors in bus systems.

Disconnect the detector from the power supply. Monitor the outputs of the detector.

Pass/Fail criteria: An intrusion signal or message shall be generated by the detector.

6.7.7 Low power supply voltage

This test is applied to detectors that require either internal or external power supplies. Detectors having an internal battery shall be tested with the battery replaced by a variable voltage DC power supply.

Set the power supply to the nominal operating voltage of the detector. Slowly reduce the voltage below the low voltage detection point as defined by the detector manufacturer. Monitor the outputs of the detector.

Signals or messages shall be generated in accordance with Table 2.

Pass/Fail criteria: Signals or messages shall be generated in accordance with Table 1 and Table 2, by the detector at the low voltage value defined by the manufacturer. No generation of a message or signal is required when the low power condition is detected by the CIE due to system design, e.g. bus based systems.

6.7.8 Interconnection

This test shall be performed by inspection of the product and the design specifications of the product as provided by the manufacturer.

Pass/Fail criteria: The requirements defined in 4.6.8 shall be met.

6.8 Environmental classification and conditions

6.8.1 General

Unless stated otherwise the general test conditions of 6.2 apply.

Detectors shall be subjected to the environmental conditioning described in EN 50130-5 and the EMC Product Family Standard EN 50130-4. See Table 4 and Table 5.

Detectors subjected to the operational tests are always powered and tests shall be performed at maximum settings. Detectors subjected to the endurance tests are always unpowered. Detectors that have more than one recommended mounting position shall be separately tested in each position for mechanical shock, and impact.

During the operational tests, monitor the detector for unintentional signals or messages. Due to the functional nature of the detector, unintentional signals or messages may be generated during the shock, impact and vibration tests. Generation of these signals or messages during the test shall not be considered as a test failure.

6.8.2 Special conditions

After the tests and any recovery period prescribed by the environmental test standard, carry out the BTD, and visually inspect the detector both internally and externally for signs of mechanical damage.

After the water ingress test, wipe any water droplets from the exterior of the enclosure, dry the detector, and carry out the BTD.

After the SO_2 test, detectors shall be washed and dried in accordance with the procedure prescribed in EN 60068-2-52. The BTD shall be performed immediately after drying. Carry out the access to interior test of 6.6.2.

Table 4 — Environmental tests, operational

Test	Class I	Class II	Class III	Class IV
Dry heat	Required	Required	Required	Required
Cold	Required	Required	Required	Required
Damp heat (steady state)	Required	Not required	Not required	Not required
Damp heat (cyclic)	Not required	Required	Required	Required
Water ingress	Not required	Not required	Required	Required
Mechanical shock [a]	Required	Required	Required	Required
Vibration [a]	Required	Required	Required	Required
Impact [a]	Required	Required	Required	Required
Electromagnetic compatibility	Required	Required	Required	Required
[a] These tests may produce unavoidable interference that results in unwanted signals or messages.				

Pass/Fail criteria: No unintentional signals or messages shall be generated during the tests except those of the BTD. There shall be no signs of mechanical damage after the tests and the detector shall continue to meet the requirements of the BTD.

Table 5 — Environmental tests, endurance

Test	Class I	Class II	Class III	Class IV
Damp heat (steady state)	Required	Required	Required	Required
Damp heat (cyclic)	Not required	Not required	Required	Required
$S0_2$ corrosion	Not required	Required	Required	Required
Vibration (sinusoidal)	Required	Required	Required	Required

Pass/Fail criteria: There shall be no signs of mechanical damage after the tests and the detector shall continue to meet the requirements of the BTD.

6.9 Marking, identification and documentation

6.9.1 Marking and/or identification

Examine the detector visually to confirm that it is marked and/or identified either internally or externally in accordance with the requirements of EN 50131-1.

Pass/Fail criteria: The marking and/or identification shall be in accordance with EN 50131-1.

6.9.2 Documentation

Examine the documentation supplied with the detector.

Pass/Fail criteria: The detector shall be supplied with clear and concise documentation meeting the requirements of this Technical Specification and EN 50131-1.

Annex A
(normative)

Dimensions & requirements of standardized interference test magnets

A.1 Normative references

The interference test magnets shall comprise a magnet identical to the corresponding magnet supplied with the detector and one of the following specified independent test magnets according to whether the detector is surface or flush mounted.

The following standards will form the base for the selection of the independent test magnet:

- EN 60404-5;
- EN 60404-14;
- IEC 60404-8-1.

A.2 Requirements

The field strength of the magnet determined by the magnetic material, by remanence (B_r) in mT and the product of energy $(BH)_{max}$ in kJ/m³, which are material dependent as the values describe the full saturation of that material and will be measured before any calibration took place. The actual field strength of the test magnet finally needs to be adjusted at the polarisation of the working point in mT as defined.

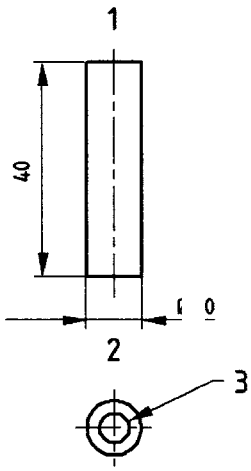
The relevant value, dimensions and measurement point for the test magnet can be found in the following drawings and tables. For calculations, measurements and calibration of the test magnets, the norms cited above shall be used.

The independent test magnet for surface mount opening magnetic contacts is described in Figure A.1.

To get the magnets in question adjusted to the proper values and calibrated (e.g. polarisation in working point), it is strongly suggested to perform adjustments of the magnetic values for ordered magnets performed by an accredited test house for magnetic fields. One potential source could be the following:

MAGNET-PHYSIK
Dr. Steingroever GmbH
Emil-Hoffmann-Strasse 3
50966 Cologne, Germany
www.magnet-physik.de

Dimensions in millimetres



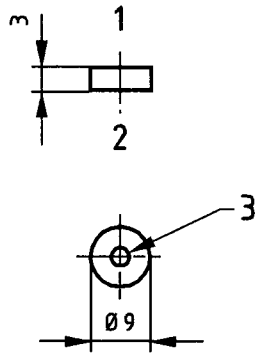
Key
1 North pole
2 South pole
3 North pole

Material	NdFeB N40 (REFeB 310/130 - Code number R5-1-11)
Remanence B_r min	1 275 mT ± 2 %
Product of energy $(BH)_{max}$	310 kJ/m^3 ± 3 %
Polarisation of working point	0,835 T ± 2 %

Figure A.1 — Test magnet for surface mount opening magnetic contacts

The independent test magnet for flush mount opening magnetic contacts is described in Figure A.2.

Dimensions in millimetres



Key
1 North pole
2 South pole
3 North pole

Material	NdFeB N38 (REFeB 280/120 - Code number R5-1-7)
Remanence B_r min	1 240 mT
Product of energy $(BH)_{max}$	280 kJ/m³
Polarisation of working point	1 240 mT - 5 %

Figure A.2 — Test magnet for flush mount opening magnetic contacts

Annex B
(normative)

General testing matrix

Table B.1 — General testing matrix

Main test title	Task to be performed in conjunction with main test			Sample no.
	Before main test	During main test	After main test	
Verification of detection performance				
Approach/removal distance	None	Monitor	None	1
Switch-on delay, time interval, and Indication of detection	None	Monitor	None	1
Tamper security				
Resistance to access to the inside of the detector	None	Monitor	None	9
Removal from the mounting surface	None	Monitor	None	9
Magnetic field interference resistance	None	6.6.4	None	9
Electrical tests				
Detector power consumption	BTD	Monitor	BTD	1
Slow input voltage rise and input voltage range limits	BTD	Monitor	BTD	1
Input voltage ripple	BTD	Monitor	BTD	1
Input voltage step change	BTD	Monitor	BTD	1
Total loss of power supply	BTD	Monitor	BTD	1
Environmental tests – Operational				
Dry heat	BTD	BTD	BTD	2
Cold	BTD	BTD	BTD	2
Damp heat (steady state)	BTD	BTD	BTD	3
Damp heat (cyclic)	BTD	BTD	BTD	3
Water ingress	BTD	Monitor	BTD	4
Mechanical shock	BTD	Monitor	BTD	5
Vibration	BTD	BTD	BTD	6
Impact	BTD	None	BTD	5
EMC	BTD	Monitor	BTD	7
Environmental tests – Endurance				
Damp heat (steady state)	BTD	None	BTD	3
Damp heat (cyclic)	BTD	None	BTD	3
SO_2 corrosion	BTD	None	BTD	8
Vibration	BTD	None	BTD	6
Marking, identification and documentation				
Marking	None	None	None	1
Documentation	None	None	None	1
Key None = No test or other operation is performed. Monitor = Monitor the outputs of the detector during main test.				
The numbered samples are a recommendation for sequential testing where no failure occurs. If a sample fails a test, it may be substituted with a new one.				

Annex C
(informative)

List of small tools suitable for testing immunity of casing to unauthorised access

Penknife	Pen
Steel ruler	Paper
Wire	Pliers
Matches	Small screwdriver set
Paper clip	Stiff wire as EN 60529 IP4X

Annex D
(normative)

Axes of movement

Up to three axes of movement may be defined for a detector: X, Y, Z.

The orientation of these axes for common styles of detector is shown in Figure D.1 and in Figure D.2 below. The manufacturer shall indicate in the product documentation the physical orientation of all axes for which functional performance is declared.

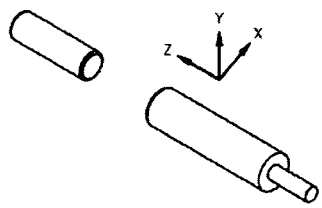


Figure D.1 — Flush mount style

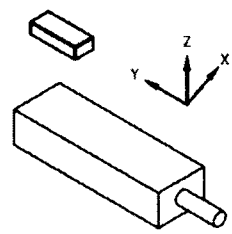


Figure D.2 — Surface mount style

Annex E
(normative)

Test surfaces for ferromagnetic material

Low carbon steel conforming to EN 10130; Type DC03-A-m.

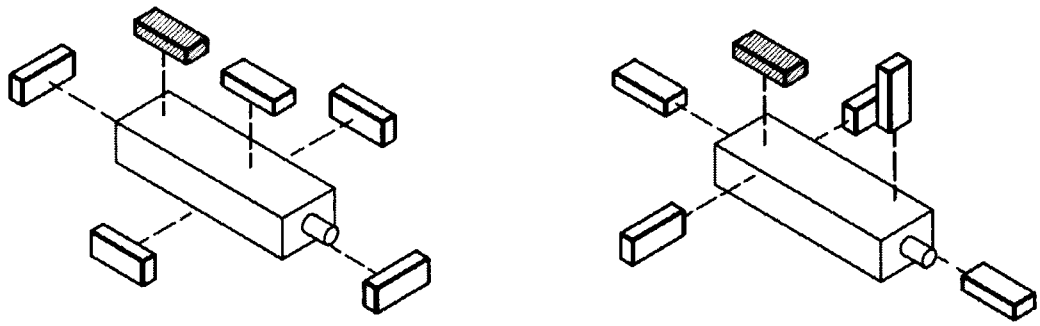
Annex F
(normative)

Test faces for interference test units

F.1 Surface mounted detector

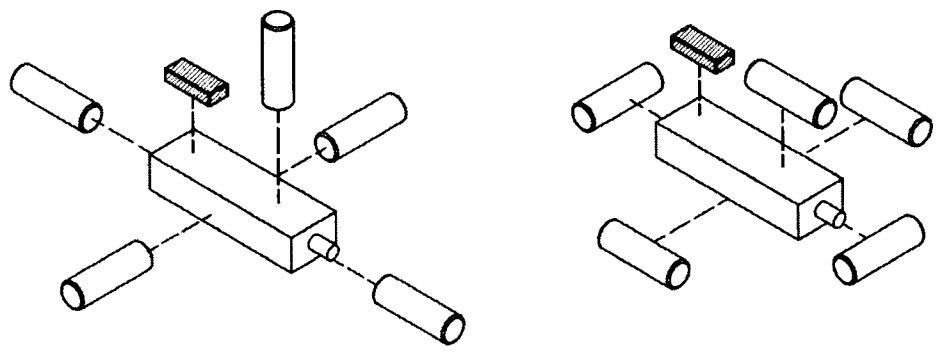
Apply the interference test unit perpendicular and parallel to each non-operating face, in case of products which rely on purely magnetic fields only, in both polarity directions; furthermore apply the pure interference test unit according to the corresponding test section.

In case of electromagnetic field based products, any potential point that could impact the detector according to the corresponding test section, the used technology and the dimension of the detector itself should be evaluated using the interference test units.



Interference test unit (unshaded) = corresponding unit (shaded)

Figure F.1 — Surface mount interference test, interference test unit



Interference test unit / purely magnetic (unshaded) / corresponding unit (shaded)

Figure F.2 — Surface mount interference test, interference test unit / purely magnetic

F.2 Flush mounted detector

Apply the interference test unit detailed in A.2 parallel to accessible face of detector, in both polarity directions in case of products which rely on purely magnetic fields only, in both polarity directions; furthermore apply the pure interference test magnet according to the corresponding test section.

In case of electromagnetic field based products, any potential point that could impact the detector according to the corresponding test section, the used technology and the dimension of the detector itself should be evaluated using the interference test units.

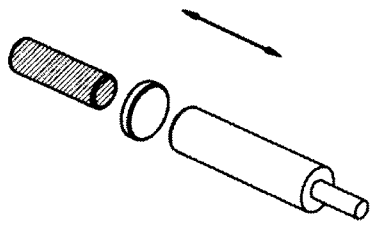


Figure F.3 — Flush mount interference test, interference test unit (unshaded), corresponding unit (shaded)

Bibliography

[1] EN 50131 (all parts), *Alarm systems — Intrusion and hold-up systems*

[2] EN 50131-2 (all parts), *Alarm systems — Intrusion and hold-up systems*

[3] EN 60529, *Degree of protection provided by enclosures (IP Code) (IEC 60529)*