PD ISO/TR 24119:2015

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Safety of machinery — Evaluation of fault masking serial connection of interlocking devices associated with guards with potential free contacts

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

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TECHNICAL REPORT

ISO/TR 24119

First edition
2015-11-15

Safety of machinery — Evaluation of fault masking serial connection of interlocking devices associated with guards with potential free contacts

Sécurité des machines — Évaluation du masquage de fautes dans les connexions en série des dispositifs d'interverrouillage associés aux contacts sans potentiel

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Foreword

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The committee responsible for this document is ISO/TC 199, *Safety of machinery*.

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Safety of machinery — Evaluation of fault masking serial connection of interlocking devices associated with guards with potential free contacts

1 Scope

This Technical Report illustrates and explains principles of fault masking in applications where multiple interlocking devices with potential free contacts (B1 to Bn) are connected in series to one logic unit (K) which does the diagnostics (see Figures 1 to 7). It further provides a guide how to estimate the probability of fault masking and the maximum DC for the involved interlocking devices. This Technical Report only covers interlocking devices in which both channels are physical serial connections.

This Technical Report does not replace the use of any standards for the safety of machinery.

The goals of this Technical Report are the following:

— guidance for users for estimation of the maximum DC values;

— design guidance for SRP/CS.

NOTE 1 Interlocking devices with integrated self-monitoring are not included in the scope of this Technical Report.

NOTE 2 Limitation is also given by the diagnostic means implemented in the logic unit.

NOTE 3 This Technical Report is not restricted to mechanical actuated position sensors.

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.

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100, ISO 13849-1, ISO 14119 and the following apply.

3.1
fault masking
unintended resetting of faults or preventing the detection of faults in the SRP/CS by operation of parts of the SRP/CS which do not have faults

3.2
series connected devices
devices with potential free contacts (B1 to Bn) are connected in series to one logic unit (K) which does the diagnostics

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3.3
signal evaluation of redundant channels with same polarity
technique where the logic unit of the safety function evaluates redundant signals which have the same supply voltage

3.4
signal evaluation of redundant channels with inverse polarity
technique where the logic unit of the safety function evaluates redundant signals in which the second channel has the ground polarity

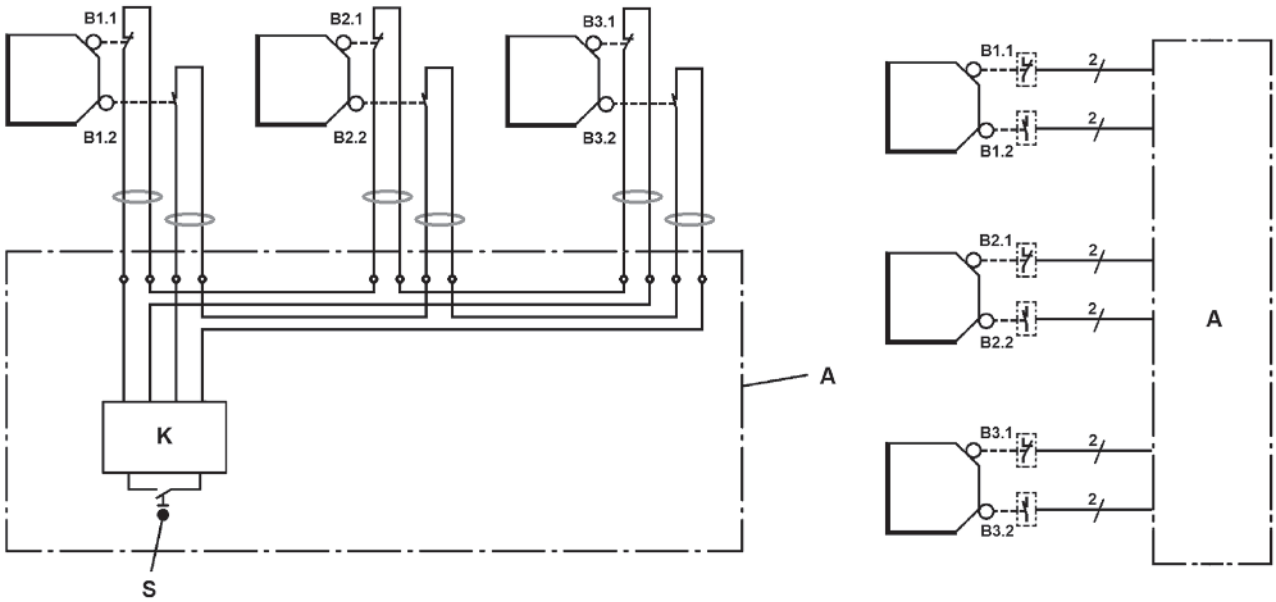
Note 1 to entry: See IEC 60204-1:2005, 9.4.3.1, method a).

3.5
signal evaluation of redundant channels with dynamic signals
technique where the logic unit of the safety function evaluates redundant dynamic signals

Note 1 to entry: Dynamic signals can be generated with test pulses, frequency modulation, etc.

3.6
star cabling
cabling structure where every interlocking device is wired with a single cable to the electric cabinet or enclosure

Note 1 to entry: Figure 1 shows a star cabling.



Key

A	electrical cabinet
B1.1, B1.2, B2.1, B2.2, B3.1, B3.2	interlocking devices with potential free contacts
K	logic unit
S	manual reset function reset device

Figure 1 — Star cabling

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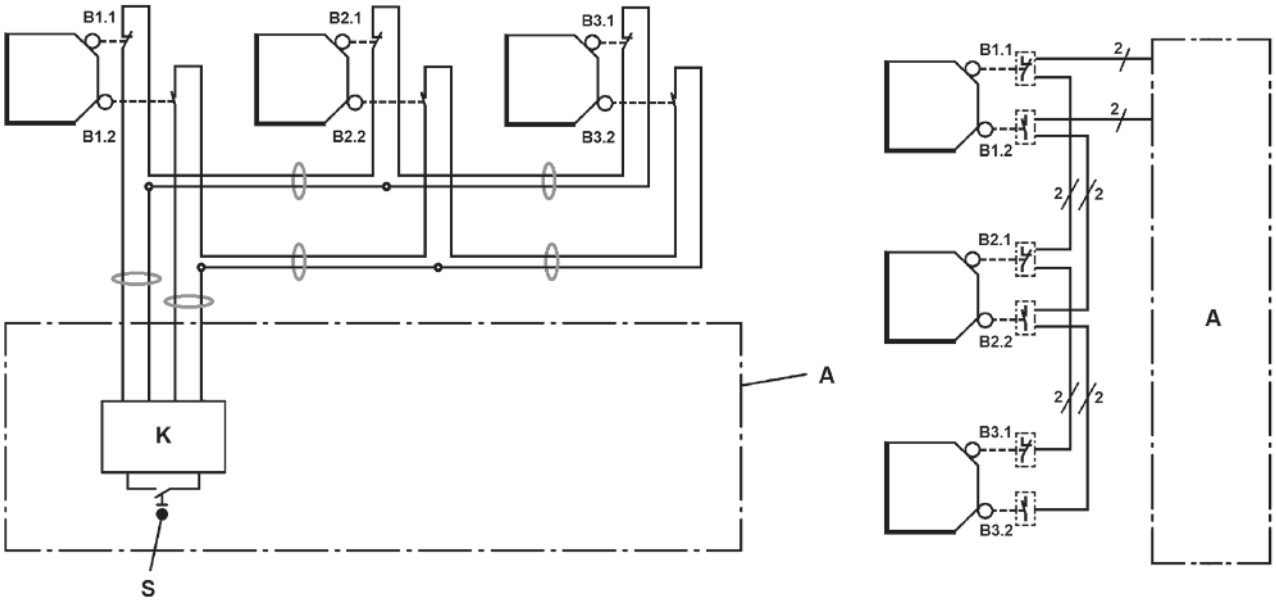
3.7
branch cabling
trunk cabling
cabling structure where a single cable from the electric cabinet is wired to the first interlocking device and from this interlocking device to the next, and so on, until the last interlocking devices and the resulting signals are wired the same way back to the electric cabinet

Note 1 to entry: Figure 2 shows a branch (trunk) cabling.



Key

A	electrical cabinet
B1.1, B1.2, B2.1, B2.2, B3.1, B3.2	interlocking devices with potential free contacts
K	logic unit
S	manual reset function reset device

Figure 2 — Branch (trunk) cabling

3.8
loop cabling
cabling structure where a single cable from the electric cabinet is wired to the first interlocking device and from this interlocking devices to the next, and so on, until the last interlocking device while the signals return to the electric cabinet in a separate cable

Note 1 to entry: Figure 3 shows a loop cabling.

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