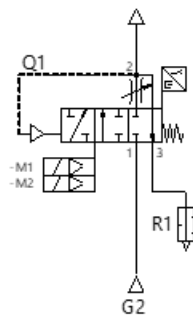
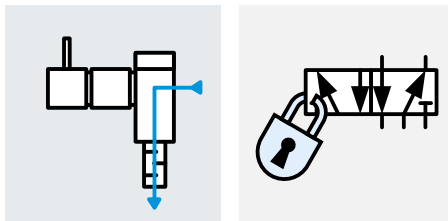


Safety Subfunctions Pneumatics

MS6-SV-...-E

SDE – Safe De-energization – up to cat. 4, up to PL e

PUS – Prevention unexpected start-up – up to cat. 4, up to PL e



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Title Safety Subfunctions Pneumatics - Circuit
Version 1.10
Document number 100530
Original German
Author Festo
Date 2026-08-25

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The values stated in this document are partly assumptions and assessments which do not replace a detailed examination based on ISO 13849, IEC 61508, IEC 62061 and/or IEC 61511.

The actual characteristic values that can be obtained (especially PL, PFH_D, category, DC, MTTF_D, CCF, SIL, HFT, PFH, PFD) depend on the components used, as well as their conditions of use in the actual application.

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This document is only suitable for persons with sufficient expertise for machine safety based on ISO 12100, ISO 13849, IEC 61508, IEC 62061 and IEC 61511. In addition, the following qualifications are required in the project team:

- Specialist in pneumatics
- Specialist in electrical engineering
- Specialist for the programming of control systems and safety switching devices

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1 General

1.1 Objectives of this Document

- This document shows possible example circuits for the safety sub-functions SDE (Safe De-Energization) with up to category 4, up to PL e and PUS (Prevention of Unexpected Startup) with up to category 4, up to PL e with the soft-start / quick exhaust valve MS6-SV-...-E.

1.2 General Notes

- The given circuits are principle circuits which cannot be complete due to clarity and scope. It is a recommendation that does not exclude other possibilities.
- The abbreviations used for the safety subfunctions are based on the definitions in VDMA 24584 for pneumatics. The definitions used and important notes are given in the document ↗ [100381 Safety subfunctions pneumatics – SDE, PUS](#).
- The information given here is based on the information in the operating instructions ↗ [MS6\(N\)-SV-...-E-10V24 Soft start / quick exhaust valve 8176552, 2022-04f, \[8176554\]](#).
- In the product list included here with recommendations for suitable products, we have checked the specified requirements for the pneumatic circuit. However, if further information is available to us, e.g. through our product observation, this data can be changed on a daily basis. Therefore, these data must be checked in the data sheets available online before final use to see if there has been any change.
- Whether a recommended product is suitable for a particular application must be checked by the user and confirmed in his technical documentation.
- For the Sistema project file of this circuit, the document ↗ [100395 Notes on Sistema project files](#) must be taken into account.

1.3 Notes on safety-related features of the partial circuit

- For safety sub-functions with 2-channel architecture of the safety circuit (here category 4), a fault does not lead to a single failure of the safety sub-function.
- The consideration of measures for failures due to common cause (CCF) are to be evaluated depending on the application. Recommendations on possible measures are contained in the document ↗ [100399 Recommendations for the implementation of measures against common cause failures \(CCF\)](#).
- There are two possibilities of determining the PFH value.
 1. Up to an actuation rate $n_{op} \leq 8760 \text{ a}^{-1}$, the PFH value of the operating instructions or the product reliability data sheet can be used.
 2. For an actuation rate $n_{op} > 8760 \text{ a}^{-1}$, the PFH value must be determined from the B_{10} value of the pneumatic part and the PFH value of the electrical part. The actuation rate must be adjusted according to the application.
The B_{10} value of the pneumatic part and the PFH_D value of the electronic part required for this evaluation is contained in table 14 in the operating instructions.
- Both possibilities are given in the enclosed Sistema project file.

1.4 Select multi-pin socket according to safe output

Important notes

- The signals (sequence, duration, distances) for controlling the inputs EN1 and EN 2 must be controlled and monitored according to the specifications in the operating instructions.
- If these times cannot be met with 1-pole (P-switching) safe outputs, the use of a 2-pole (PM-switching) safe output with the multipole socket NECA-S1G9-P9-MP5 (573695) is recommended.

The following circuits are included, depending on the outputs used.

1. Safe output with electromechanical contacts and 24 VDC switch-off.

- It is recommended to use the multipole socket NECA-S1G9-P9-MP1 (548719).
- The safe output must switch 24 VDC to inputs EN1 and EN2 respectively.
- If short-circuit and cross-circuit monitoring is not possible with the safe output of the safety switching device K1, fault exclusion is required for the wiring inside and outside the control cabinet, e.g. based on IEC 60204-1.
- Circuit according to section → “2 Circuit with mechanic contacts and NECA-...-MP1”.

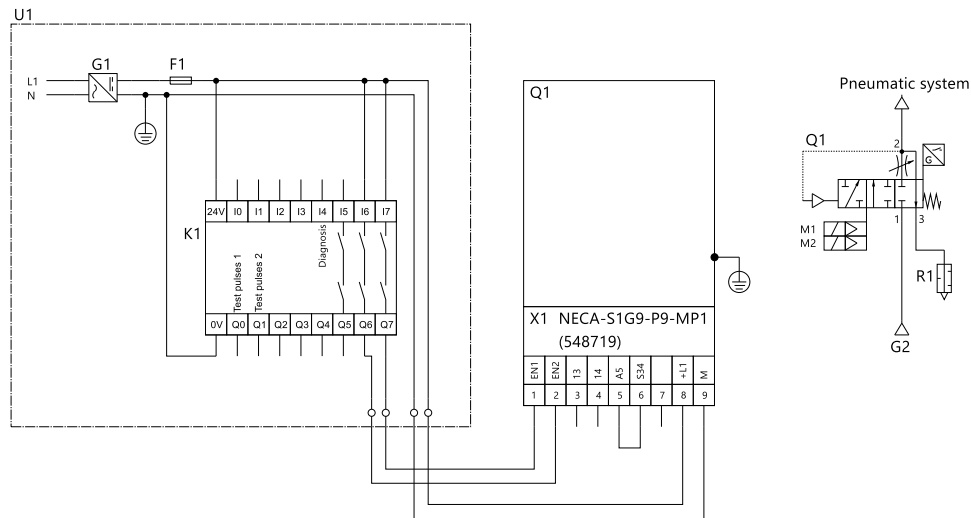
2. Safe semiconductor outputs with 24 VDC switch-off

- It is recommended to use the multipole socket NECA-S1G9-P9-MP1 (548719).
- The safe output must switch 24 VDC to inputs EN1 and EN2 respectively.
- Short-circuit and cross-circuit monitoring by the safe outputs of the safety switching device K1 is required. The duration and spacing of the test pulses must comply with certain times, see section 12.7.1 of the ↗ [MS6\(N\)-SV-...-E-10V24 operating instructions](#).
- Circuit according to section → “3 Circuit with semiconductor output and NECA-...-MP1”.

3. 2-pole semiconductor outputs with 24 VDC and 0 VDC switch-off.

- It is recommended to use the multipole socket NECA-S1G9-P9-MP3 (552703) or NECA-S1G9-P9-MP5 (573695).
- The safe output is an electronic PM-switching output that switches 24 VDC to EN 2 and 0 VDC to EN1.
- Short-circuit and cross-circuit monitoring by the safe outputs of the safety switching device K1 is required. The duration and spacing of the test pulses must comply with certain times, see section 12.7.1 of the ↗ [MS6\(N\)-SV-...-E-10V24 operating instructions](#).
- Circuit according to section → “4 Circuit with PM semiconductor output and NECA-...-MP3 or NECA-...-MP5”.

2 Circuit with mechanic contacts and NECA-...-MP1



Parts list

Pos...	Identifi...	Description
1	F1	Fuse
2	G1	PELV power supply 24 VDC
3	G2	Operation pressure
4	K1	Safety switching device
5	Q1	Soft-start / quick exhaust valve
6	R1	Silencer
7	U1	Control cabinet
8	X1	Multipin connector

Safety subfunction

SDE - Safe de-energization

up to category 4, up to PL e can be reached

PUS - Prevention unexpected start-up

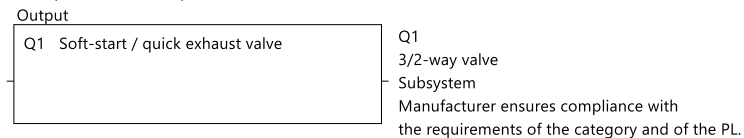
up to category 4, up to PL e can be reached

Block diagram

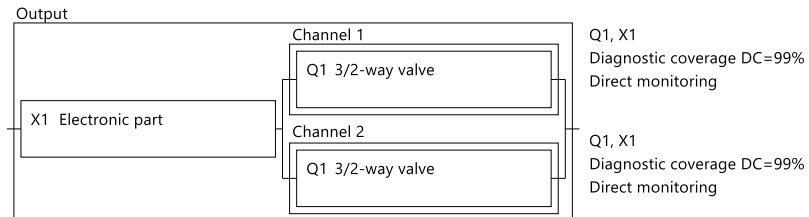
SDE - Safe de-energization

PUS - Prevention unexpected start-up

nop ≤ 8760

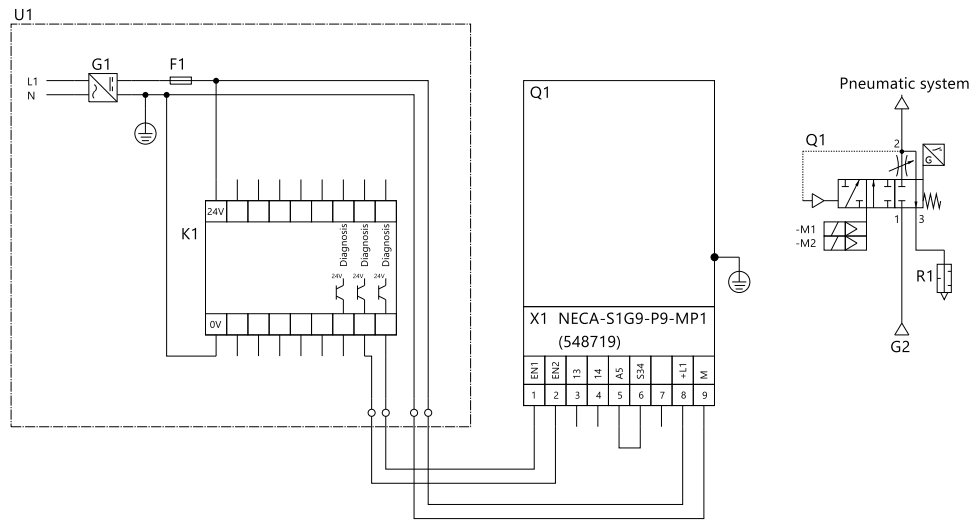


nop > 8760



B10 value of the pneumatic part and PFHD value of the electronic part is specified in table 14 in the operating instructions.

3 Circuit with semiconductor output and NECA-...-MP1



Parts list

Pos...	Identifi...	Description
1	F1	Fuse
2	G1	PELV power supply 24 VDC
3	G2	Operation pressure
4	K1	Safety switching device
5	Q1	Soft-start / quick exhaust valve
6	R1	Silencer
7	U1	Control cabinet
8	X1	Multipin connector

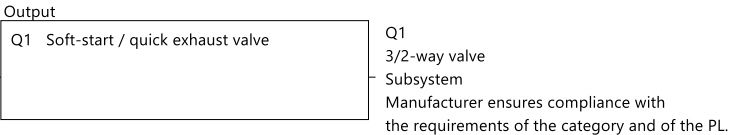
Safety subfunction

SDE - Safe de-energization up to category 4, up to PL e can be reached
PUS - Prevention unexpected start-up up to category 4, up to PL e can be reached

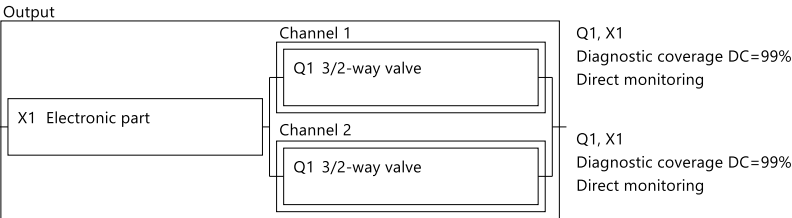
Block diagram

SDE - Safe de-energization
PUS - Prevention unexpected start-up

nop ≤ 8760

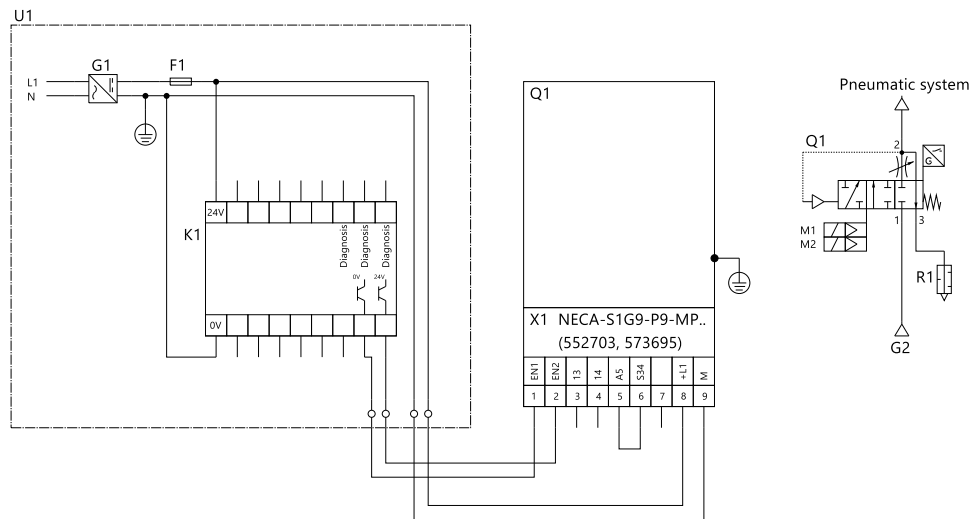


nop > 8760



B10 value of the pneumatic part and PFHD value of the electronic part is specified in table 14 in the operating instructions.

4 Circuit with PM semiconductor output and NECA-...-MP3 or NECA-...-MP5



Parts list

Pos...	Identifi...	Description
1	F1	Fuse
2	G1	PELV power supply 24 VDC
3	G2	Operation pressure
4	K1	Safety switching device
5	Q1	Soft-start / quick exhaust valve
6	R1	Silencer
7	U1	Control cabinet
8	X1	Multipin connector

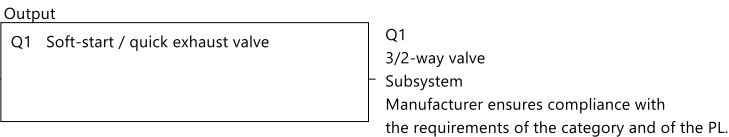
Safety subfunction

SDE - Safe de-energization up to category 4, up to PL e can be reached
PUS - Prevention unexpected start-up up to category 4, up to PL e can be reached

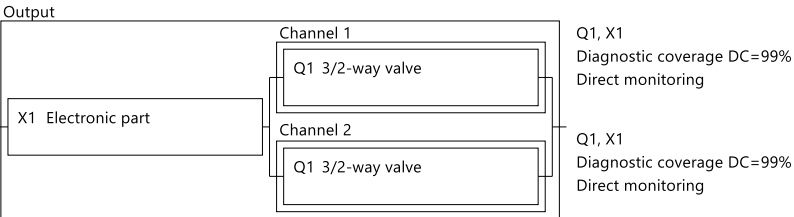
Block diagram

SDE - Safe de-energization
PUS - Prevention unexpected start-up

nop ≤ 8760



nop > 8760



B10 value of the pneumatic part and PFHD value of the electronic part is specified in table 14 in the operating instructions.

5 Suitable Products for Soft-start/Quick Exhaust Valve

- Based on the following features, other suitable soft start / quick exhaust valves from Festo can also be selected using the features in the data sheets available online.
- Depending on the application, it must be evaluated whether this list of features needs to be added.

Feature	Value
Product category	Soft-Start/Quick Exhaust Valve
Valve function	3/2-way, closed, monostable, soft-start function
Type of actuation	Electric
Type of piloting	pilot actuated
Type of reset	mechanical spring
Duty cycle	100 %
Service-life value B ₁₀	Specified
Performance Level (PL)	PL e specified

Other values for the features may be possible and must be considered separately.

Note: These products were selected as examples from different series and sizes.

No.	Material	Designation/Type (Sorting ↑)	Link Data Sheet	Link Data Sheet Product Reliability
1.	548715	Soft-Start/Quick Exhaust Valve MS6-SV-1/2-E-10V24-AG	↗	↗
2.	548717	Soft-Start/Quick Exhaust Valve MS6-SV-1/2-E-10V24-SO-AG	↗	↗

Required multipin connector X1

No.	Material	Designation/Type (Sorting ↑)	Link Data Sheet	Circuit according section
1.	548719	NECA-S1G9-P9-MP1	↗	2, 3
2.	552703	NECA-S1G9-P9-MP3	↗	4
3.	573695	NECA-S1G9-P9-MP5	↗	4

6 Used Literature

6.1 Cited Documents from Festo

- [1] [MS6\(N\)-SV-...-E-10V24 Soft start / quick exhaust valve 8176552, 2022-04f, \[8176554\]](#)
- [2] [100381 Safety subfunctions pneumatics – SDE, PUS](#)
- [3] [100395 Notes on Sistema project files](#)
- [4] [100399 Recommendations for the implementation of measures against common cause failures \(CCF\)](#)

6.2 Standards

- [5] DIN EN ISO 4414:2011-04 – Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010); German version EN ISO 4414:2010
- [6] ISO 5598:2020-01 – Fluid power systems and components - Vocabulary
- [7] DIN EN ISO 12100:2011-03 - Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010); German version EN ISO 12100:2010
- [8] DIN EN ISO 13849-1:2023-12 - Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2023); German version EN ISO 13849-1:2023
- [9] DIN EN ISO 13849-2:2013-02 – Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012); German version EN ISO 13849-2:2012
- [10] ISO 19973-1:2015-08 - Pneumatic fluid power - Assessment of component reliability by testing - Part 1: General procedures
- [11] VDMA 24584:2022-06 – Safety functions of regulated and unregulated (fluid) mechanical systems; German Version
- [12] DIN EN 61508:2011-02 - Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508:2010); German version EN 61508:2010
- [13] DIN EN 61511:2019-02 - Functional safety - Safety instrumented systems for the process industry sector - (IEC 61511:2016); German version EN 61511:2017
- [14] DIN EN IEC 62061:2023-02 - Safety of machinery - Functional safety of safety-related control systems (IEC 62061:2021); German version EN IEC 62061:2021

6.3 Legal regulations

- [15] Machinery Directive: Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)
- [16] Machinery Regulation: Regulation (EU) 2023/1230 of the European Parliament and of the Council of 14 June 2023 on machinery and repealing Directive 2006/42/EC of the European Parliament and of the Council and Council Directive 73/361/EEC

7 Information about the Document

7.1 General Information

Document number	100530	
Safety subfunction	SDE	PUS
Category	up to category 4 can be reached	up to category 4 can be reached
PL	up to PL e can be reached	up to PL e can be reached

7.2 Revision History

Ver.	Date	Ed.	Chapter	Description of change/impact
1.10	2026-08-25	JKHL	All	Creation of the document

7.3 Approval/Release of the Document

Role	Signature
Release	

7.4 Period of Validity

Document is valid until 2031-08-25 or until one of the documents used or the required relevant base are changed.



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