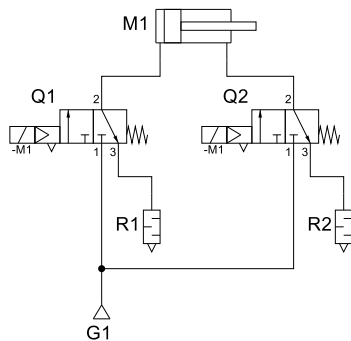
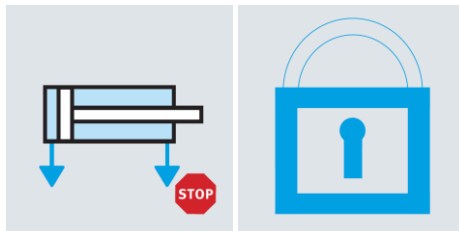


Circuit

Safety Subfunctions Pneumatic

STO – Safe Torque Off – up to Cat. 1, up to PL c

PUS – Prevention of Unexpected Start-up – up to Cat. 1, up to PL c



Our effort – your advantage

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Title Safety Subfunctions Pneumatics - Circuit
Version 1.30
Document number 100386
Original German
Author Festo
Date 2026-07-21

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- 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 a possible example circuit for the safety sub-functions STO (up to category 1, up to PL c) and PUS (up to category 1, up to PL c).
- The most important features for the implementation of safety sub-function are listed.
- Based on these features, suitable products from Festo are listed.

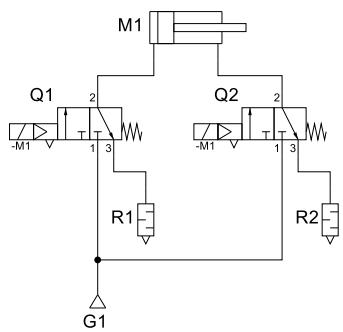
1.2 General Notes

- The given circuit is a principle circuit which cannot be complete due to clarity and scope. It is a recommendation that does not exclude other possibilities.
- The abbreviations used for safety subfunctions are based on the definitions in VDMA 24584 for pneumatics. The definitions used and important notes are given in the document "[100380 Safety subfunctions pneumatics – STO, PUS](#)".
- The requirements for the valve are only considered in the context of the pneumatic circuit. Suggestions for the electrical wiring of individual valves or valve terminals have not been considered in this document.
- For single valves, the document "[100393 Safe electrical switch-off of individually controlled valves](#)" should be considered.
- For valve terminals, the document "[100394 Safe electrical switch-off of valve terminals](#)" should be considered.
- 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 1-channel architecture of the safety circuit (here category 1), a failure can lead to a failure of the safety sub-function.
- The consideration of measures for failures due to common cause (CCF) are not necessary for category 1.
- The calculation of the MTTF₀ characteristics from the B₁₀ values are included in the Sistema project file. The B₁₀ value must be adjusted according to the valves used.

2 Circuit



Parts list

Pos....	Identifi...	Description
1	G1	Operation pressure
2	M1	Double-acting drive
3	Q1	3/2-way valve
4	Q2	3/2-way valve
5	R1	Silencer
6	R2	Silencer

Safety subfunction

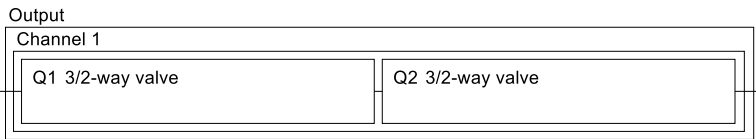
STO - safe torque off

up to category 1, up to PL c can be reached

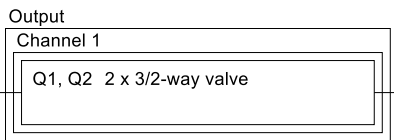
PUS - Prevention unexpected start-up

up to category 1, up to PL c can be reached

Block diagram (single valves)



Block diagram (2 x 3/2 directional control valve)



3 Suitable Products for Valve Q1

- Based on the following features, other suitable 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.
- Additional information on these features can be found in the document “[100396 Notes on features of directional control valves](#)”.

Feature	Value
Product category	Electrically actuated valves
Valve function	3/2 closed monostable 2 x 3/2 closed monostable
Type of actuation	Electric
Type of piloting	Pilot actuated
Pilot air supply	Internal or external
Type of reset	Mechanical spring
Duty cycle	100 % OR 100 % with holding current reduction
Service-life value B ₁₀	Specified
Basic safety principles	Yes
Well-tried safety principles	Yes
Well-tried component	Yes

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

Note: This list of suitable products does not claim to be complete.

No.	Material	★	Designation/Type (Sorting ↑)	Code ¹	Link Data Sheet	Link Data Sheet Product Reliability
<i>Single valves</i>						
1.	574348		Solenoid valve VUVG-L10-T32C-MT-M5-1P3		↗	↗
2.	574352		Solenoid valve VUVG-L10-T32C-MZT-M5-1P3		↗	↗
3.	575274	★	Solenoid valve VUVS-L20-M32C-MD-G18-F7-1C1		↗	↗
4.	575273	★	Solenoid valve VUVS-L20-M32C-MZD-G18-F7-1C1		↗	↗
<i>Valve for valve terminals</i>						
5.	556838		Solenoid valve VMPA1-M1H-KS-PI	KS	↗	↗
6.	573413		Solenoid valve VUVG-B10-T32C-MZT-F-1T1L	VK	↗	↗
7.	8187061	★	Solenoid valve VUVX-BK10-T32C-MZH-F-1T1L	K	↗	↗

★•Core program

¹ Code of the valve for the configurator or in the order code of the valve terminal.

4 Used Literature

4.1 Cited Documents from Festo

- [1] [100380 Safety subfunctions pneumatics – Definition – STO, PUS](#)
- [2] [100393 Safe electrical switch-off of individually controlled valves](#)
- [3] [100394 Safe electrical switch-off of valve terminals](#)
- [4] [100395 Notes on Sistema project files](#)
- [5] [100396 Notes on features of directional control valves](#)

4.2 Standards

- [6] 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
- [7] ISO 5598:2020-01 – Fluid power systems and components - Vocabulary
- [8] 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
- [9] 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
- [10] 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
- [11] ISO 19973-1:2015-08 - Pneumatic fluid power - Assessment of component reliability by testing - Part 1: General procedures
- [12] VDMA 24584:2022-06 – Safety functions of regulated and unregulated (fluid) mechanical systems; German Version
- [13] DIN EN 61508:2011-02 - Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508:2010); German version EN 61508:2010
- [14] DIN EN 61508-4:2011-02 - Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 4: Definitions and abbreviations (IEC 61508-4:2010); German version EN 61508-4:2010
- [15] DIN EN 61511:2019-02 - Functional safety - Safety instrumented systems for the process industry sector - (IEC 61511:2016); German version EN 61511:2017
- [16] 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

4.3 Legal Regulations

- [17] 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)
- [18] 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

5 Information about the Document

5.1 General Information

Document number	100386	
Safety subfunction	STO	PUS
Category	up to category 1 can be reached	up to category 1 can be reached
PL	up to PL c can be reached	up to PL c can be reached

5.2 Revision History

Ver.	Date	Ed.	Chapter	Description of Change/Impact
1.10	2023-09-08	JKHL	All	Creation of the document
1.20	2024-04-15	JKHL	1, 3, 4	Links updated
			2	Block diagram added
			3	Valve VUVX added
1.30	2026-07-21	JKHL	All	Layout changed
			2	Circuit updated
			4.3	Machinery Regulation (EU) 2023/1230 added

5.3 Approval/Release of the Document

Role	Signature
Release	

5.4 Period of Validity

Document is valid until 2031-07-21 or until one of the documents used or the required relevant base are changed.



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