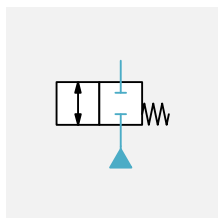


Definition

Safety Subfunctions Pneumatics

SC – Safe Closing



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Title Safety Subfunctions Pneumatics - Circuit
Version 1.10
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Original German
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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

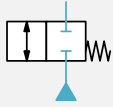
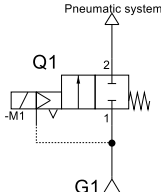
1.1 Objectives of this Document

- This document defines the reaction and the safe states of the safety subfunction “Safe Closing (SC)” for pneumatics.
- Additional notes are provided for practical implementation that should be considered depending on the application.
- Examples are given to show how the possible diagnostic measures from ISO 13849-1, Table E.1, can be implemented.

Important notes

- The circuits shown are schematic principle circuits and are not complete for reasons of scope and clarity.
- The information provided are recommendations and do not exclude other options.
- The abbreviation used and the designation of the safety subfunction are derived from the VDMA 24584 definition for pneumatics. The safety subfunction SC is based on SSC, where only the interruption of the compressed-air supply is evaluated.

2 SC – Safe Closing

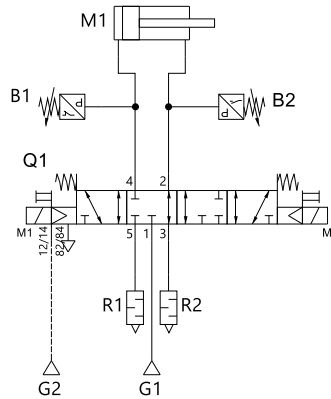
Abbreviation	SC
Designation	Safe Closing
Symbol	
Principle Circuit	
Reaction on Request	The compressed-air supply to the downstream pneumatic system is interrupted. Important notes The safety subfunction SC only assesses the interruption of port 1 of a valve (compressed-air supply). Any additional valve functions that may be performed are not assessed.
Safe State	The compressed-air supply to the downstream pneumatic system is interrupted, and the downstream pneumatic system may either enclose the compressed air or exhaust it.
Warnings	CAUTION - The safety subfunction SC is implemented by interrupting the compressed-air supply. However, this interruption does not include the isolation from the compressed-air supply as defined in ISO 14118, clause 3.3. Therefore, additional measures are required for maintenance work. This can be a manually operated, lockable on/off valve with 3/2-way function; see Application Note 100512, section 4.2 Manual switch-on valve. - It is not specified whether the downstream pneumatic system will enclose or exhaust the compressed air. It must be assessed whether interrupting the compressed-air supply sufficiently reduces any potential hazards posed by the downstream pneumatic system. - For pneumatic actuators, it is not specified whether a motion will be stopped or performed. In the worst-case scenario, a motion may be initiated when the safety subfunction SC is requested.
Remarks	- In the safe state, the compressed-air supply to the downstream pneumatic system is interrupted. The state of the downstream pneumatic system is not assessed. - If pressurized air can be enclosed, it should be identified. The ISO 7000-1320 warning symbol can be used for this purpose: 

	- Depending on the application, it must be assessed whether the following measures are required: - A means of exhausting any enclosed compressed air must be provided; and / or - A means of retaining the compressed air should be provided, e.g., a manually operated 2/2-way valve. - The safety subfunction SC can be used for valves with special functions where only the behavior related to port 1 can be assessed from a safety perspective.
Possible Diagnostics	Notes - The application of these diagnostic measures in circuits from category 2 onward is referenced in the circuit examples. Diagnostic coverage DC = 99% To achieve a diagnostic coverage of DC = 99% for the safety subfunction SC, the switching element of the directional control valve must be monitored directly (assessment according to ISO 13849-1, Table E.1). For directional control valves there are two implementation options: - Monitoring the spool of a valve by a limit switch The safety subfunction is carried out when the valve is in its normal position. This normal position is monitored by a limit switch. When changing from the normal position to the actuated position, the normally closed contact of the limit switch must open before the flow path through the valve changes. Conversely, when changing from the actuated position back to the normal position, the normally closed contact must not close until the flow path through the valve can no longer change. - Monitoring a flow path using a pressure switch If a valve's 3/2-way function is to be monitored, the normal position can alternatively be monitored with a pressure switch. In that case a 5/2-way valve is used, where the open flow path is monitored by a pressure switch. A directional control valve with positive overlap must be used to ensure the following behavior: when leaving the normal position, the flow path monitored by the pressure switch must be closed and exhausted so that the pressure switch contact opens before the flow path to the pneumatic system is pressurized.

Diagnostic coverage DC = 90%

To achieve a diagnostic coverage of DC = 90% for the safety subfunction SC, the switching element of the directional control valve should be monitored indirectly (assessment according to ISO 13849-1, Table E.1). For directional control valves there is only one implementation option:

1. Monitoring the pressure at the valve output

**Notes on valve Q1**

- Valve Q1 is a special-function valve. If a solenoid M1 or M2 is controlled, the valve shifts to the corresponding end position. If no solenoid is energized, the valve shifts to the nearest middle switching position and traps compressed air to hold the actuator's last position.

The pressurized and unpressurized conditions at the directional control valve output can be monitored with a pressure switch. For the pressurized condition, the pressure to be monitored should be the pressure required for the application or the pressure at which the pneumatic actuator reliably reaches its end position, e.g., 4.5 bar (to be determined per application). For unpressurized conditions, set the pressure switch to the lowest possible switching pressure (recommended ± 0.5 bar). This allows the valve switching position to be monitored indirectly.

3 References to Example Circuits

Safety Application Notes with possible assessments based on ISO 13849 for basic circuits with different valve functions are available in the Support Portal.

Channel 1: Valve function Monitoring	Channel 2: Valve function Monitoring	SC	Link
Valve VUVX-P54E	–	up to Category 1, up to PL c	↗ 100611
Valve VUVX-P54E Limit switch drive	3/2-way valve, monostable Pressure switch	up to Category 3, up to PL d	↗ 100612

4 Used Literature

4.1 Cited Documents from Festo

- [1] [100512](#) Service Units
- [2] [100611](#) Ventil VUVX-P54E, Kat. 1, PL c
- [3] [100612](#) Ventil VUVX-P54E, Kat. 3, PL d

4.2 Standards

- [4] 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
- [5] ISO 5598:2020-01 – Fluid power systems and components – Vocabulary
- [6] DIN ISO 7000:2008-12 – Graphical symbols for use on equipment - Index and synopsis (ISO 7000:2004 + ISO 7000 Database:2008 up to ISO 7000-2750)
- [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] VDMA 24584:2022-06 – Safety functions of regulated and unregulated (fluid) mechanical systems; German Version
- [11] DIN EN 61508:2011-02 - Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508:2010); German version EN 61508:2010
- [12] 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
- [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

4.3 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)

5 Information about the Document

5.1 General Information

Document Number	100607
Safety Subfunction	Definition: SC – Safe Closing

5.2 Revision History

Ver.	Date	Ed.	Chapter	Description of Change/Impact
1.10	19.08.2026	JKHL	All	Creation of document

5.3 Approval/Release of the Document

Role	Signature
Release	

5.4 Period of Validity

Document is valid until 2031-08-19 or until one of the documents used or the required relevant base are changed.



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