100229

 

Safety Sub-functions

SSC Category 1, up to PL c

PUS Category 1, up to PL c



Application Note

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This document is only suitable for persons with sufficient expertise for machine safety based on EN ISO 12100 and EN ISO 13849. 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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# Example Circuits

* The circuits specified in this document are principle circuits which cannot be complete due to their clarity and scope.
* The abbreviations used for the safety sub-functions refer to the definitions in VDMA 24584 [1] for pneumatics:
	+ SSC: Safe Stopping and Closing

The safety sub-function SSC only stops the pneumatic drive before the end position if the stroke length is significantly greater than the diameter of the piston of the pneumatic drive.

* + PUS: Prevention of unexpected start-up
* Category 1, up to PL c according EN ISO 13849-1 [2]
* The circuits and the procedure described are recommendations which do not exclude other possibilities.
* Due to the wide variety of possible valves, no valve type and part numbers can be given in this document. When selecting valves, make sure that the selected valves have the following characteristics:
	+ Type of actuation: electrical
	+ Type of reset: mechanical spring
	+ Sealing principle: soft
	+ Type of piloting: piloted
	+ Pilot air supply: internal or external
	+ Duty cycle: 100%.
	+ Well-tried components according to EN ISO 13849-1 and the relevant basic and well-tried safety principles have been observed.
	+ B10 value required for the calculation of the MTTFD value must be available.

 Important note

* + In addition, further design features and requirements may exist, which must be determined depending on the application.

## SSC and PUS with 5/3 Directional Control Valve, Category 1, up to PL c (100229)

SSC and PUS according VDMA 24584 [1] and category 1, up to PL c according EN ISO 13849-1 [2].

### Circuit Diagram



### Components

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Type** | **Description / Part Number / Remarks** | **Qty.** | **Mssr.** |
| M20 |  | Pneumatic drive | 1 | Festo |
| Q20 |  | 5/3 directional control valve, monostable | 1 | Festo |
|  |  | Silencer, if necessary | 2 | Festo |
| S1 |  | Acknowledge push button | 1 |  |
| S2 |  | Safety commanding device, e.g. emergency stop switch | 1 |  |
| S20 |  | Switch functional control | 1 |  |
| S21, S22 | HAB-… | 2/2 directional control valve, manual actuated | 2 | Festo |
| T1 |  | Safety switching device | 1 |  |

### Description

|  |  |
| --- | --- |
| Application | Double acting pneumatic drive |
| Triggering event | Safety request (S2), e.g. by emergency stop switch, safety gate |
| Reaction(Safety Sub-function) | **Safe stopping and closing (SSC), category 1, PL c** |
|  |
| **Prevention of unexpected start-up, category 1, PL c** |
| Safe state | In the pneumatic drive compressed air is enclosed to hold the last position. Slow movements are possible by leakage that cannot be stopped. It is presumed, that this can be a possible safe state. It must be evaluated whether this may cause a hazard. By actuating the valves (S21, S22), the exhausted state of the pneumatic drive can be possible.Notes:* According to EN 13736 [3], the movement possible due to leakage must not exceed a value of 5 mm/s. This must be checked at regular intervals, e.g. in the maintenance interval of the machine.
* If pneumatic axes with external forces, e.g. vertical axes, are exhausted with the valves (S21, S22), a dangerous movement may result. To reduce the risk, additional protective measures may be required for this hazard.
 |
| Function | The safety requirement (S2):1. Interrupts the input circuit of the safety switching device (T1).
2. Switch off the safe outputs of the safety switching device (T1).
3. The solenoids of the valve (Q20) are no longer controlled.
4. Valve (Q20) moves to its normal position, separates the compressed air supply and closes the pneumatic flow paths out of the pneumatic drive (M20). This stops the pneumatic drive (M20).

Note:* The safety sub-function SSC only stops the pneumatic drive before the end position if the stroke length is significantly greater than the diameter of the piston of the pneumatic drive (M20).
 |
| Manual reset function | 1. After resetting the safety request (S2), e.g. by mechanically unlocking the emergency stop switch or closing the safety guard, the start or restart can be made possible by pressing the acknowledge push button (S1).
2. The safety switching device (T1) can then allow the solenoids of the valve (Q20) to be controlled so that normal operation is possible.

In normal operation the manually actuated valves (S21, S22) must not be used. They are only used to release blockages in the SSC state. |

### Safety Considerations

|  |  |
| --- | --- |
| Input | Safety considerations must be carried out in accordance with the selected safety commanding device (S2). |
| Logic | Safety considerations must be carried out in accordance with the selected safety switching device (T1). |
| Output | The valves (Q20, S21, S22) are a well-tried components according to EN ISO 13849-1 and the relevant basic and well-tried safety principles have been observed. B10 values required for the calculation of the MTTFD must be available.  |

# Literature

[1] VDMA 24584:2016-08 - Safety functions of regulated and unregulated (fluid) mechanical systems (German edition)

[2] DIN EN ISO 13849-1:2016-06 - Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015); German version EN ISO 13849-1:2015

[3] DIN EN 13736:2009-11 - Safety of machine tools - Pneumatic presses; German version EN 13736:2003+A1:2009