Example Circuits Functional Safety

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Date

14/04/2018

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Version

1.0

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Application Pneumatic System

Element Safety Function Safe De-energization (SDE)

 “Dissipation Energy”, PL c, Cat. 1

 “Separation Energy Supply”, PL c, Cat. 1

 Prevention Unexpected Start-up, PL c, Cat. 1



Costs

2 hours engineer for functional safety (at 200 €) = 400 €

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The values stated in the Example circuit are partly assumptions and assessments which do not replace a detailed examination based on EN ISO 13849 part 1 and 2.

The actual characteristic values that can be obtained (especially PL, PFHD, category, DC, MTTD, CCF) depend on the components used, as well as their conditions of use in the actual application.

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**Intended Use**

This example circuit are schematic diagrams showing element safety functions with the necessary and relevant components for this purpose. For reasons of scale and clarity necessary measures are not shown, for example, EMC measures, fault considerations, component features.

This document only considers the output (subsystem valves) of the safety-related parts of the control system. Inputs and logic are only to illustrate the relationships.

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

**Reasonable Foreseeable Misuse**

This example circuit is not realized with the described components.

Element safety functions are realized, which are not declared in this description.

This document is used by persons without sufficient expertise.

The requirements of the machine directive 2006/42/EC and the related harmonised standards are not considered.

# Circuit Diagram



# Components

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Type** | **Description / Part Number / Remarks** | **Qty.** | **Mssr.** |
| Q20 |  | 3/2 directional control valve | 1 | Festo |
| S1 |  | Acknowledge push button | 1 |  |
| S2 |  | Safety commanding device, e.g. emergency stop switch | 1 |  |
| T1 |  | Safety switching device | 1 |  |
| S20 |  | Switch functional control | 1 |  |

# Description

|  |  |
| --- | --- |
| Application | Pneumatic system |
| Triggering event | Safety request, e.g. by emergency stop switch, safety gate |
| Reaction(Element safety function) | **Safe De-energization (SDE)** |
| Partial function “separation energy”,PL c, category 1 | Partial function “dissipation energy”,PL c, category 1 |
| **Prevention of unexpected start-up, PL c, category 1** |
| Safe state | The directly following pneumatic system is exhausted and energy-free.It is assumed that the exhausted state of the directly downstream pneumatic system is the safe state. |
| Function | The safety requirement (S1):* Interrupts the input circuit of the safety switching device (T1).
* Switch off the safe output of the safety switching device (T1).
* The valve solenoid of the valve (Q20) is no longer controlled.
* Valve (Q20) moves to its normal position, separate the power supply and exhaust the downstream pneumatic system.
 |
| Manual reset function | The manual reset function is performed by resetting the safety request, e.g. by mechanically unlocking the emergency stop switch or by closing the safety gate. |
| Start/Restart | When the safety request is reset, the start can be allowed by the actuation of the acknowledgment button (S1). |

# Safety Considerations

|  |  |
| --- | --- |
| Input | The safety commanding device (S2) is designed according to the relevant product standards and is a proven component according to DIN EN ISO 13849-1.The signal is monitored by an input that has at least category 1. |
| Logic | The safety switching device has a certificate as a safety component, which confirms at least PL c, category 1. |
| Output | The valve manufacturer confirms that the valve (Q20) is a well-tried component according to DIN EN ISO 13849-1. |