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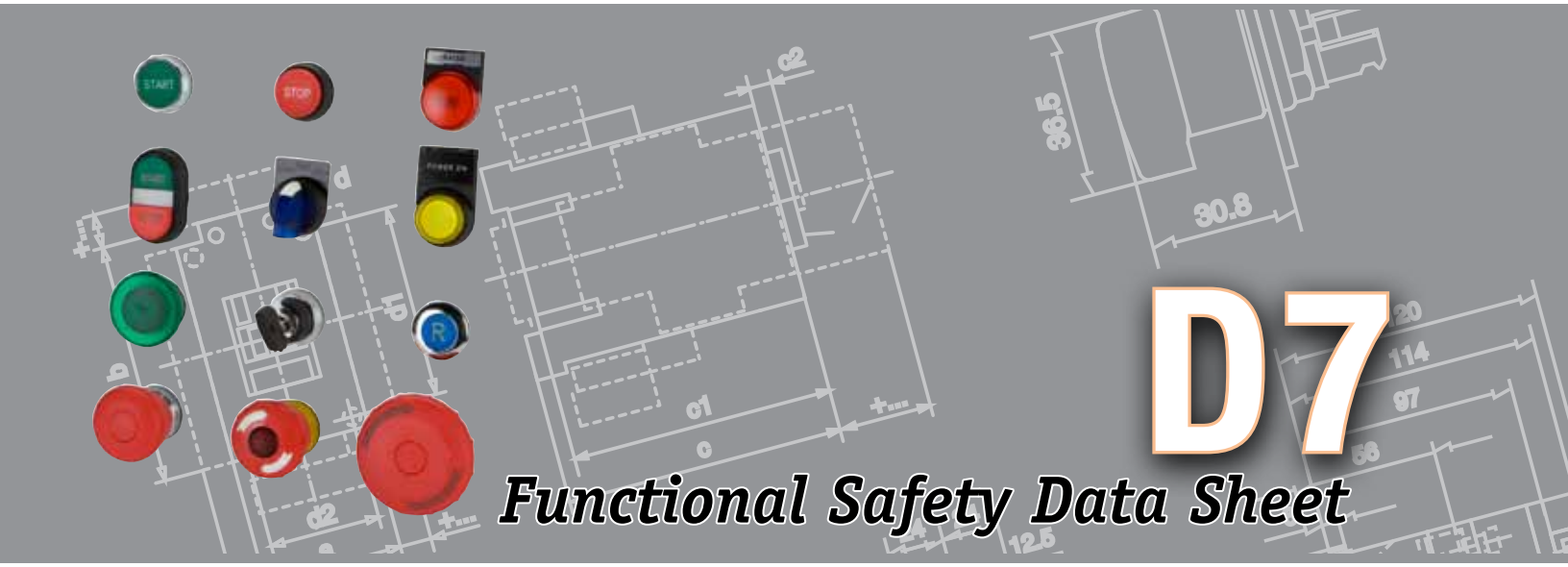

IMPORTANT:	The standards and requirements considered in this document are relatively new. Work is still being conducted by the drafting groups on some aspects especially with regard to clarification and combining some of these standards. Therefore it is possible that there will be some changes to some of the detail given in these pages. For the latest information please refer to http://www.sprecherschuh.com/safety/ or the the Rockwell Automation Safety Solutions website at http://discover.rockwellautomation.com/EN_Safety_Solutions.aspx.

INTRODUCTION TO FUNCTIONAL SAFETY OF CONTROL SYSTEMS

What is Functional Safety?

Functional safety is the part of the overall safety that depends on the correct functioning of the process or equipment in response to its inputs. IEC TR 61508-0 provides the following example to help clarify the meaning of functional safety. "For example, an over-temperature protection device, using a thermal sensor in the windings of an electric motor to de-energize the motor before they can overheat, is an instance of functional safety. But providing specialized insulation to withstand high temperatures is not an instance of functional safety (although it is still an instance of safety and could protect against exactly the same hazard)." As another example, compare hard guarding to an interlocked guard. The hard guarding is not considered "functional safety" although it may protect against access to the same hazard as an interlocked door. The interlocked door is an instance of functional safety. When the guard is opened, the interlock serves as an "input" to a system that achieves a safe state. Similarly, personal protective equipment (PPE) is used as a protective measure to help increase safety of personnel. PPE is not considered functional safety.

Functional safety was a term introduced in IEC 61508:1998. Since then, the term has sometimes been associated with only programmable safety systems. This is a misconception. Functional safety covers a broad range of devices that are used to create safety systems. Devices like interlocks, light curtains, safety relays, safety PLCs, safety contactors, and safety drives are interconnected to form a safety system, which performs a specific safety-related function. This is functional safety. Therefore the functional safety of an electrical control system is highly relevant to the control of hazards arising from moving parts of machinery.

Two types of requirements are necessary to achieve functional safety:

- The safety function
- The safety integrity

Risk assessment plays a key role in developing the functional safety requirements. Task and hazard analysis leads to the function requirements for safety (i.e. the safety function). The risk quantification yields the safety integrity requirements (i.e. the safety integrity or performance level).

Four of the most significant control system functional safety standards for machinery are:

1. IEC/EN 61508 "Functional safety of electrical, electronic and programmable electronic control systems"

   This standard contains the requirements and provisions that are applicable to the design of complex electronic and programmable systems and subsystems. The standard is generic so it can be applicable to all industrial sectors.

2. IEC/EN 62061 "Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems"

   This standard is the machinery specific implementation of IEC/EN 61508. It provides requirements that are applicable to the system level design of all types of machinery safety-related electrical control systems and also for the design of non-complex subsystems or devices. It requires that complex or programmable subsystems should satisfy IEC/EN 61508.

3. EN ISO 13849-1 "Safety of machinery — Safety-related parts of control systems"

   This standard is intended to provide a direct transition path from the categories of the previous EN 954-1.

4. IEC 61511 "Functional safety — Safety instrumented systems for the process industry sector"

   This standard is the process sector specific implementation of IEC/EN 61508.

The functional safety standards represent a significant step beyond the familiar existing requirements such as Control Reliable and the Categories system of the previous ISO 13849-1:1999 (EN 954-1:1996).

Note: Recent to the time of publication of this text, CEN (European Committee for Standardization) announced that the final date for presumption of conformity of EN 954-1 will be extended to the end of 2011 to facilitate transition to the later standards. This replaces the original date of December 29, 2009.

For the latest information on the use and status of EN 954-1 visit:http://discover.rockwellautomation.com/EN_Safety_Solutions.aspx. In the meantime, it is advised that the extension of the transition period is used to move over to the use of the later standards (EN ISO 13849-1 or IEC/EN 62061) in a timely manner.

Categories will not disappear completely; they are also used in current EN ISO 13849-1 which uses the functional safety concept and has introduced new terminology and requirements. It has significant additions and differences to the old EN 954-1 (ISO 13849-1:1999). In this section we will refer to the current version as EN ISO 13849-1. (EN ISO 13849-1:2008 has the same text as ISO 13849-1:2006).

E-Stop and Operator Interface


D7D-MT44*


D7_-MT44*


D7_-LMT44*


D7_-MK44*


D7_-MP44*


D7_-LMP44*

Family	Catalog Number	Footnotes	Category per EN ISO 13849-1	B10d (Electro-Mechanical Product)	B10d Test Criteria	T1 ProofTest Interval-Mission Time - Lifetime Years
D7D E-Stop - Twist to Release	**D7D-MT44***	❶ ❷ ❸ ❹ ❺ ❼ ❽ ❾	1 (higher with monitoring unit)	1.38E+05	20mA/24VDC	20 Years
D7D E-Stop - Push to Release	**D7D-MT44***	❶ ❷ ❸ ❹ ❺ ❼ ❽ ❾		1.11E+05	20mA/24VDC	20 Years
D7 E-Stop - Twist to Release	**D7P-MT44*** **D7M-MT44***	❶ ❷ ❸ ❹ ❺ ❻ ❽ ❾		7.36E+05	20mA/24VDC	20 Years
	D7P-LMT44* **D7M-LMT44***	❶ ❷ ❸ ❹ ❺ ❼ ❽ ❾		2.06E+05	20mA/24VDC	20 Years
	D7P-MK44* **D7M-MK44***	❶ ❷ ❸ ❹ ❺ ❻ ❽ ❾		2.01E+06	20mA/24VDC	20 Years
D7D E-Stop - Push to Release	**D7P-MP44*** **D7M-MP44***	❶ ❷ ❸ ❹ ❺ ❼ ❽ ❾		2.43E+05	20mA/24VDC	20 Years
	D7P-LMP44* **D7M-LMP44***					

* Additional letters and numbers are required to complete the catalog number

IMPORTANT: The data given cannot be regarded as valid unless proper account is taken of the relevant footnotes.

❶ Other data may apply when combined into subsystems with other products. The resultant SIL CL and PFHd and can be determined using the methodology of IEC 62061 and the PL can be determined using the methodology of EN ISO 13849-1.

❷ Where the product has two electrical safety switching function channels, the B10d data given is based on a failure of either channel. It can be used to determine the MTTFd of each single channel and will this produce conservative data.

❸ The data given, including fault tolerance, is based on the use of fault exclusion at some single fault mechanical failure points, for example: actuator, cam, contact plunger, lock mechanism.

Because of the inherent strength and simplicity of those parts they have an extremely low likelihood of failure and those faults are excluded in accordance with EN ISO 13849-2: 2008 Clause A.5.2 Table A4.

❹ The DC or SFF value given is for the device used on its own with no additional monitoring/diagnostic equipment.

An increased value for DC and SFF can be achieved by connection to specified external monitoring equipment. The maximum achievable value is based on individual monitoring of the devices in redundant or dual channel configuration. In some cases this will require the use of two devices.

It assumes a maximum diagnostic test interval of 6 months.

It assumes the monitoring all dangerous single fault modes. The maximum value given will not be achievable if it can be foreseen that some single faults will not be detected in , for example, multiple normally closed switches are connected in a series arrangement to the monitoring equipment.

❺ B10d values using actual test results and calculations with a 90% confidence interval and at least 1 NC (normally closed) contact block.

❻ Monitoring includes a Self-Monitoring contact block.

❼ Safe failure = actuating force less than 50% of original.

❽ The Mission Time stated is based on possible time based degradation factors. For usage based degradation factors refer to the calculated T10d value. Always use the lowest value (Mission Time or T10d) for calculation of SIL or PL.

❾ Load conditions - 20mA/24VDC, confidence factor 90%

D7 Functional Safety Data Sheet

TECH-D7-SAFETY_112 5/12

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Sprecher + Schuh has provided reliable control and protection solutions for its customers since 1903.

Today, Sprecher + Schuh offers a wide range of low-voltage industrial control products, including contactors, a variety of relays, starters, push buttons, switches, terminals and controllers, to name a few. All of our products are crafted with precision and tested rigorously for performance — far exceeding industry standards. Moving forward, we continue along the path of constantly seeking innovative ways to provide solutions for our customers. It is by this philosophy that Sprecher + Schuh has come to be the industrial control manufacturer of choice for many customers around the globe seeking quality, reliability, and a name they can trust.