

# Rockwell Automation Functional Safety Data Sheet



LISTEN.  
THINK.  
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**IMPORTANT:** The data given cannot be regarded as valid unless proper account is taken of the relevant \* notes.

Type	Family	Part Number	See Notes	SIL CL	PL	Category per EN ISO 13849-1	PFH <sub>0</sub> Probability of dangerous failure per hour according to EN/IEC 61508 or EN/IEC 62061 (Continuous and High demand mode)	PFD Probability of dangerous failure on demand according to EN/IEC 61508 (Low demand mode)	B10d (Electro-Mechanical products)	B10d Test Criteria	T1 Proof Test Interval – Mission Time – Lifetime Years
Interlock Switches	Elf	440K-E33	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Cadet 3	440K-C21	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Trojan 5, 6, & T15	440K-T11	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	MT-GD2	440K-MT	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	SensaGuard	440N-Z	–	3	e	4	1.12E-09				20 years
	Ferrogard	440N-G	*1, *7, *8, *12			1 (Up to 4 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Sipha Sensors S1, S2, S3, S4	440N-S	*1, *7, *12, *14			N/A (Must only be used with designated monitoring unit- Up to Cat. 4)			2.00E+06	Control unit load	20 years
Guard Locking Switches	440G-MT	440G-MT	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	TLS-GD2	440G-T	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Atlas 5	440G-L	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Spartan	440G-S	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
Hinge Interlocking Switches	Sprite	440H-S	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Ensign 3	440H-E	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Rotacam	440H-R	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
Prosafe Trapped Key Interlocking	Prosafe Key Code Barrel Assembly	440T	*9		d	3 (see note *9)	1.01E-7 (see note *9)		2.00E+05	Mechanical	20 years
Presence Sensing	GuardShield	440L	–	3	e	Type 4 (IEC 61496)	3.17E-9 (IEC 61508, single) 9.51E-9 (IEC 61508, 3 cascaded)				20 years
	GuardShield Safe 2	445L	–	2	d	Type 2 (IEC 61496)	7.93E-9 (worst case figure: 32 modules x 30mm, L=3840 mm)	6.95E-4 (worst case figure: 32 modules x 30mm, L=3840 mm)			20 years
	GuardShield Safe 4	445L	–	3	e	Type 4 (IEC 61496)	7.93E-9 (worst case figure: 32 modules x 30mm, L=3840 mm)	2.58E-4 (worst case figure: 7 modules x mixed, L=840 mm)			20 years
	GuardShield Mirco 400	445L	–	3	e	Type 4 (IEC 61496)	4E-9 (Micro 400 alone, 255 beams) 6E-9 (worst case: Micro 400, MSR42, & MSR45E with 255 beams cascaded)	4E-4 (Micro 400 alone, 255 beams) 5E-4 (worst case: Micro 400, MSR42, & MSR45E with 255 beams cascaded)			20 years
	SafeZone	442L-S	–	2	d	3	4.46E-07	3.91E-03			–

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E-Stop and Operator Interface	800F E-Stop	800FD-MT	*1, *7, *8, *12, *17, *19, *20			1 (Higher with monitoring unit)			1.11E+05	Mechanical and Control unit load	20 years
	800F E-Stop	800FP-MT_800FM-MT_	*1, *7, *8, *12, *17, *18, *20			1 (Higher with monitoring unit)			7.36E+05	Mechanical and Control unit load	20 years
	800F E-Stop	800FP-LMT_800FM-LMT_	*1, *7, *8, *12, *17, *18, *19, *20			1 (Higher with monitoring unit)			2.06E+05	Mechanical and Control unit load	20 years
	800F E-Stop	800FP-MK_800FM-MK_	*1, *7, *8, *12, *17, *18, *20			1 (Higher with monitoring unit)			7.36E+05	Mechanical and Control unit load	20 years
	800F E-Stop	800FP-MP_800FM-MP_800FP-LMP_800FM-LMP_	*1, *7, *8, *12, *17, *18, *19, *20			1 (Higher with monitoring unit)			2.43E+05	Mechanical and Control unit load	20 years
	800H E-Stop	800H-FRX_800HC-FRX_	*1, *7, *8, *12, *17, *18, *20			1 (Higher with monitoring unit)			1.82E+06	Mechanical and Control unit load	20 years
	800T E-Stop	800T-FX_800TC-FX_	*1, *7, *8, *12, *17, *18, *20			1 (Higher with monitoring unit)			1.95E+06	Mechanical and Control unit load	20 years
	LifeLine 3, 4	440E-L/D	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
Limit Switches	440P-C, 440P-M	440P-C 440P-MD/MM/ MR/MS	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	802T	802T	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
	Imp 1, 2	440P-M1	*1, *7, *8, *12, *16			1 (Up to 3 with monitoring unit)			2.00E+06	Mechanical only or minimal load	20 years
Safety Logic	MSR117	440R	*5	3	e	4	2.31E-10	4.05E-05			20 years
	MSR5	440R	*5	3	e	4	2.31E-10	4.05E-05			20 years
	MSR121	440R	*5	3	e	4	1.45E-09	2.53E-04			20 years
	MSR122	440R	*5	3	e	4	2.82E-10	4.94E-05			20 years
	MSR124	440R	*5	3	e	4	2.00E-09	3.51E-04			20 years
	MSR125	440R	*5	3	e	4	1.44E-09	2.52E-04			20 years
	MSR126	440R	*5	3	e	4	1.45E-09	2.54E-04			20 years
	MSR127	440R	*7	3	e	4	1.45E-09	2.54E-04			20 years
	MSR131	440R	*5	3	e	4	1.67E-09	2.93E-04			20 years
	MSR132E	440R	*5	3	e	4	2.34E-10	4.10E-05			20 years
	MSR132ED	440R	*5	2	d	3	2.34E-10	4.10E-05			20 years
	MSR138	440R	*5, *10	3/4	d/e	2/3	2.38E-09	4.17E-04			20 years

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Safety Logic	MSR142	440R	*5	3	e	4	1.92E-09	3.36E-04			20 years
	MSR144	440R	*5	3	e	4	1.67E-09	2.93E-04			20 years
	MSR178	440R	*5	3	e	4	2.74E-09	4.80E-04			20 years
	MSR210	440R	*5	3	e	4	3.44E-09	6.03E-04			20 years
	MSR211	440R	*5	3	e	4	3.49E-09	6.11E-04			20 years
	MSR220	440R	*5	3	e	4	3.70E-10	6.48E-05			20 years
	MSR221	440R	*5	3	e	4	3.70E-10	6.48E-05			20 years
	MSR230	440R	*5	3	e	4	2.30E-10	4.03E-05			20 years
	MSR238	440R	*5	2	d	3	7.70E-10	1.35E-04			20 years
	MSR30	440R	*5	3	e	4	9.20E-10	1.61E-04			20 years
	MSR310	440R	*5	3	e	4	3.15E-09	5.52E-04			20 years
	MSR312	440R	*5	3	e	4	3.15E-09	5.52E-04			20 years
	MSR320	440R	*5	3	e	4	3.10E-10	5.43E-05			20 years
	MSR329	440R	*5	3	e	4	3.80E-10	6.66E-05			20 years
	MSR33	440R	*5	3	e	4	9.20E-10	1.61E-04			20 years
	MSR330	440R	*5	3	e	4	2.30E-10	4.03E-05			20 years
	MSR338	440R	*5	2	d	3	7.70E-10	1.35E-04			20 years
	MSR35	440R	*5	3	e	4	9.20E-10	1.61E-04			20 years
	MSR38	440R	*5	3	e	4	9.20E-10	1.61E-04			20 years
	MSR42	440R-P	–	3	e	4	9.00E-10	8.00E-05			20 years
	MSR45E	440R-P	–	3	e	4	3.00E-10	2.00E-05			20 years
	MSR57 Safe Speed Monitor - single encoder mode - Pulse test OFF	440R-S	*5, *24, *26	3	e	3	1.48E-08	2.59E-3			20 years
	MSR57 Safe Speed Monitor - single encoder mode - Pulse test ON	440R-S	*5, *24	3	e	4	7.04E-09	1.23E-04			20 years
	MSR57 Safe Speed Monitor- dual encoder mode - Pulse test OFF	440R-S	*5, *25, *26	3	e	3	1.11E-08	1.95E-03			20 years
	MSR57 Safe Speed Monitor- dual encoder mode - Pulse test ON	440R-S	*5, *25	3	e	4	3.38E-09	5.93E-04			20 years
	CU2	440R	*5	1	b	1	1.58E-07	2.80E-02			20 years
	CU3	440R	–	1	b	1					20 years
CU4	440R	*5	2	d	3	2.31E-10	4.05E-05			20 years	
MatManager	440F-C	*5	2	d	3	2.59E-09	4.54E-04			20 years	

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Safety Logic	MatGuard controller	440F-C	*5	2	d	3	2.90E-08	5.08E-03			20 years
	Safe Edge Controller	440F-C	*5	2	d	3	3.99E-09	6.99E-04			20 years
	Sipha 2 Controller	440N	*5	2	d	3	7.27E-09	1.27E-03			20 years
	GuardPLC 1200	1754-L28	–	3	N/A	3/4	3.09E-09	1.45E-04			10 years
	GuardPLC 1600	1753-L28	–	3	N/A	3/4	3.93E-09	4.16E-05			10 years
	GuardPLC 1800	1753-L32	–	3	N/A	3/4	5.67E-09	5.46E-05			10 years
	GuardPLC 2000	1755-L1	–	3	N/A	3/4	4.37E-09	4.88E-05			10 years
	GuardPLC I/O	1753-IB16	–	3	e	4	2.77E-09	3.68E-05			10 years
	GuardPLC I/O	1753-OB16	–	3	e	4	3.90E-09	3.63E-05			10 years
	GuardPLC I/O	1753-IB20XOB8	–	3	e	4	4.25E-09	5.11E-05			10 years
	GuardPLC I/O	1753-IB8XOB8	–	3	e	4	6.58E-09	4.60E-05			10 years
	GuardPLC I/O	1753-IB16XOB8	–	3	e	4	6.19E-09	6.66E-05			10 years
	GuardPLC I/O	1753-IF8XOF4	–	3	e	4	5.16E-09	8.58E-05			10 years
	GuardPLC I/O	1753-OW8	–	3	e	4	1.73E-09	2.24E-05			10 years
	DeviceNet Safety Scanner	1753-DNSI	–	3	N/A	4	5.61E-10	9.30E-06			10 years
	SmartGuard 600 DeviceNet	1752-L24BBB	–	3	e	4	3.89E-10	3.42E-05			20 years
	SmartGuard 600 EtherNet/IP	1752-L24BBBE	–	3	e	4	3.89E-10	3.42E-05			20 years
	GuardLogix	1756	–	3	e	4	2.00E-10	1.20E-05			20 years
	Compact GuardLogix	1768	–	3	e	4	2.10E-10	1.20E-05			20 years
	CompactBlock Guard I/O (DeviceNet Safety)	1791DS-IB12	–	3	e	4	6.84E-11	6.01E-06			20 years
	CompactBlock Guard I/O (DeviceNet Safety)	1791DS-IB8XOB8	–	3	e	4	6.84E-11	6.01E-06			20 years
	CompactBlock Guard I/O (DeviceNet Safety)	1791DS-IB4XOW4	*5	3	e	4	4.07E-09	7.68E-04			20 years
	CompactBlock Guard I/O (DeviceNet Safety)	1791DS-IB8XOBV4	–	3	e	4	2.00E-10	1.75E-05			20 years
	CompactBlock Guard I/O (DeviceNet Safety)	1791DS-IB16	–	3	e	4	1.94E-10	1.70E-05			20 years
	ArmorBlock Guard I/O (DeviceNet Safety)	1732DS-IB8	–	3	e	4	1.94E-10	1.70E-05			20 years
	ArmorBlock Guard I/O (DeviceNet Safety)	1732DS-IB8XOBV4	–	3	e	4	2.00E-10	1.75E-05			20 years
	CompactBlock Guard I/O (EtherNet/IP Safety)	1791ES-IB8XOBV4	–	3	e	4	2.00E-10	1.75E-05			20 years
CompactBlock Guard I/O (EtherNet/IP Safety)	1791ES-IB16	–	3	e	4	1.89E-10	1.65E-05			20 years	
POINT Guard I/O	1734-IB8S	–	3	e	4	1.34E-10	5.90E-06			20 years	
POINT Guard I/O	1734-OB8S	–	3	e	4	1.38E-10	6.10E-06			20 years	

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Output Actuation	Contactors 100S-C09 to C97at AC3	100S-C09, C12, C16, C23, C30, C37, C40, C43, C60, C72, C85, C90, C97	*3, *13			1			1.33E+06	AC-3	20 years
	Contactors 100S-C09 to C43 - Mechanical	100S-C09...43	*3, *13, *23			1			2.00E+07	Mechanical only (current carrying not breaking)	20 years
	Contactors 100S-C60 to C97 - Mechanical	100S-C60...97	*3, *13, *23			1			1.20E+07	Mechanical only (current carrying not breaking)	20 years
	Contactors 100S-D115 to D300 at AC3	100S-D115...300	*13, *23			1			1.07E+06	AC-3	20 years
	Contactors 100S-D420 at AC3	100S-D420	*13, *23			1			8.00E+05	AC-3	20 years
	Contactor Relays: 700S-CFB at AC15	700S-CFB	*3, *13, *23			1			2.00E+06	AC-15	20 years
	Contactor Relays: 700S-CFB - Mechanical	700S-CFB	*3, *4, *13, *23			1			2.00E+07	Low energy or mechanical only	20 years
	Control Relays	700S-CF	*3, *13, *23			1			2.00E+06	AC-15	20 years
	Reversing Contactor 104S-C	104S-C09 to C97	*3, *13, *23			1			1.33E+06	AC-3	20 years
	PowerFlex 40P with Safe Torque Off	22D	*21, *27	2	d	3	4.43E-10	1.74E-05			20 years
	PowerFlex 70 with Safe Torque Off	20A	*21, *27	2	d	3	1.02E-09	3.40E-05			20 years
	PowerFlex 700S with Safe Torque Off	20D	*21, *27	2	d	3	9.68E-10	5.28E-05			20 years
	PowerFlex 700L with Safe Torque Off	20L	*21, *27	2	d	3	9.68E-10	5.28E-05			20 years
	PowerFlex 700H with Safe Torque Off	20C	*5, -	2	d	3	1.37E-08	1.52E-03			20 years
	PowerFlex 753 with Safe Torque Off	20F	*5, -	3	e	3	1.36E-09	3.29E-05			20 years
	PF753 Safe Speed Monitor, Single Encoder, Pulse Test On	20F	*24	3	e	4	2.68E-09	4.74E-04			20 years
	PF753 Safe Speed Monitor, Single Encoder, Pulse Test Off	20F	*24, *26	3	e	4	3.13E-08	5.44E-03			20 years
	PF753 Safe Speed Monitor, Dual Encoder, Pulse Test On	20F	*25	3	e	4	2.39E-09	4.19E-04			20 years
	PF753 Safe Speed Monitor, Dual Encoder, Pulse Test Off	20F	*25, *26	3	e	4	2.77E-08	4.85E-03			20 years
	PowerFlex 755 with Safe Torque Off	20G	*5	3	e	3	1.36E-09	3.29E-05			20 years
	PF755 Safe Speed Monitor, Single Encoder, Pulse Test On	20G	*24	3	e	4	2.68E-09	4.74E-04			20 years
	PF755 Safe Speed Monitor, Single Encoder, Pulse Test Off	20G	*24, *26	3	e	4	3.13E-08	5.44E-03			20 years
	PF755 Safe Speed Monitor, Dual Encoder, Pulse Test On	20G	*25	3	e	4	2.39E-09	4.19E-04			20 years
	PF755 Safe Speed Monitor, Dual Encoder, Pulse Test Off	20G	*25, *26	3	e	4	2.77E-08	4.85E-03			20 years
	Kinetix 300 with Safe Torque Off	2097	*5, *21	2	d	3	5.90E-09	1.00E-03			20 years
	Kinetix 6000 with Safe Torque Off	2094-S	*5, *21	3	e	3	4.31E-10	2.73E-05			15 years
	Kinetix 7000 with Safe Torque Off	2099	*5, *21	3	e	3	4.31E-10	2.73E-05			15 years
	Kinetix 6200 with Safe Torque Off		*5	3	e	4	1.85E-09	1.62E-04			20 years
	Kinetix 6200 Safe Speed Monitor		*24, *26, *28	3	e	4	5.90E-09	5.20E-04			20 years
	Kinetix 6500 with Safe Torque Off		*5	3	e	4	1.85E-09	1.62E-04			20 years
Kinetix 6500 Safe Speed Monitor		*24, *26, *28	3	e	4	5.90E-09	5.20E-04			20 years	

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Notes
*1 – Other data may apply when combined into subsystems with other products. The resultant SIL CL and PFH <sub>d</sub> can be determined using the methodology of IEC 62061 and the PL can be determined using the methodology of EN ISO 13849-1.
*2 – The maximum rating shown here assumes the monitoring of all dangerous single fault modes and a maximum diagnostic test interval of 6 months.
*3 – B10d value assuming a failure to open is considered a dangerous failure. If in the application a failure to close is considered a dangerous failure, in this case: 100S-C: B10d=4.00E+06, 700S-CFB: B10d=8.6E+05
*4 – For low energy switching, the contact reliability is expressed as "Assessed constant failure rate". The assessment method is given in IEC60947-5-4.
*5 – Some aspects of the diagnostic testing of electromechanical inputs or outputs are initiated by usage. Therefore the Diagnostic Test Interval is equal to the time period between the operations of the device safety function. For devices with electromechanical inputs or outputs the Diagnostic Test Interval (operating interval) should not exceed 6 months. See IEC61508-4 3.8.7 Diagnostic Test interval and EN13849-1 3.1.29 Test rate.
*6 – Not used.
*7 – 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.
*8 – 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.
*9 – Separate subsystems should be entered for each Prosafe key code barrel assembly that are included in the safety function. <ul style="list-style-type: none"><li>• This Prosafe data is based on the existing conservative assumptions given below. New test procedures for determination of PL for trapped key systems are being developed. This data will be updated accordingly as soon as possible.</li><li>• Data is provided for the Key code barrel assembly according to the following: The key code barrel assembly follows the behavior requirements for Category 3 because there are four separate code clips. Detection via process provides a DC of 60% (low). On the basis of a tested B10d value of 200000 and a maximum operation rate of 8760 operations per year a conservative PFH of 1.01E-7 can be used. This is in the range of PLd. Fault exclusion is used for some single fault mechanical failure points of the key code barrel assembly in accordance with EN ISO 13849-2: 2008 Clause A.5.2 Table A4 and the use of oriented failure mode techniques designed into the code operating key.</li><li>• The key code barrel is directly mechanically connected to a variety of parts that form the Prosafe system. Because of the inherent strength and simplicity of those parts they have an extremely low likelihood of failure and for the purposes of calculation those faults are excluded in accordance with EN ISO 13849-2: 2008 Clause A.5.2 Table A4 for the mechanical aspects and Clause D 5.3 Table D8 for the electrical aspects of the rotary key switch.</li><li>• In some system configurations it may be necessary to consider the possibility of a failure of the solenoid driven plunger to engage in the locking cam when the solenoid is energized. Based on the operating life information provided by the solenoid manufacturer it is reasonable to assume a conservative B10d value of 250,000 for the solenoid unit. The engagement of the solenoid driven plunger is monitored via two monitoring switches. If these switches are connected in a dual channel configuration to a suitable monitoring device then a 90%DC can be used (according to EN ISO 13849-1 Annex E Table E1) for the monitoring of the solenoid driven plunger engagement.</li></ul>
*10 – The delayed acting contacts are CAT 3, SIL CL 2, PLd.
*11 – Safety mats are only applied for CAT3 SIL 2.
*12 – 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.
*13 – Category 1 applies where the combination of the usage rate and the B10d value results in an MTTFd equal to or greater than 30 years.
*14 – This product must not be used in a safety related system unless it is connected to a suitable monitoring device.
*15 – Sipa control units are applied for EN 60947-5-3 as control devices of a PDF system together with sensors and OSSDs. The safety classifications referred in EN 60947-5-3 take into account the general principles of ISO 13849-1, but they are not directly equivalent to the categories defined in clause 6 of that standard.

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

Notes
*16 – The data given is based on the use of fault exclusion at some single fault mechanical failure points. Therefore subsystems intended to achieve Category 4, PL <sub>e</sub> or SIL 3 require the use of two separate devices. This is in accordance with the latest ISO and IEC Joint Technical Reports ISO TR 23849 and IEC TR 62061-1.
*17 – B10d values using actual test results and calculations with a 90% confidence interval and at least 1 NC (normally closed) contact block.
*18 – Monitoring includes a Self-Monitoring contact block.
*19 – Safe failure = actuating force less than 50% of original.
*20 – 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.
*21 – External monitoring equipment required – See product manual.
*22 – The data given based on a 20 year mission time (proof test interval) applies only to product with a manufacturing date code of 2009/01/01 (January 1, 2009) or later. See the product label for the date code.
*23 – The DC 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 direct monitoring i.e. connection of the mechanically linked auxiliary contacts to external monitoring equipment. In most cases redundant devices or a second switch-off path this will be required. 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.
*24 – The encoder input(s) must be added as a separate subsystem. Encoder Input 1 performs feedback signal monitoring to achieve a DC of 90% or 99% depending on encoder type (see product manual for details). Mechanical constraints can limit single encoder applications to PL <sub>d</sub> , SIL2 for the encoder input(s) subsystem. By using a certified SIL3 encoder under specific conditions to ensure no loss of the feedback and with justifiable fault exclusions for shaft slippage and shaft breakage a SIL3 rating is feasible.
*25 – The encoder input(s) must be added as a separate subsystem. Encoder Inputs perform feedback signal monitoring to achieve a DC of 90% or 99% depending on encoder type (see MSR57 product manual for details).
*26 – When pulse-testing of ALL used safety outputs is disabled, safety outputs and a power supply are only tested upon demand (at reset) or at a machine cycle (when motion starts). This has an effect on the PFHD. Enabled test pulses for at least one safety output can ensure main power supply testing. The diagnostic test interval is set to the demand rate of at least 0.5 years.
*27 – The data values given are based on a maximum usage rate of 500,000 switching operations per year of the Safe-Off board.
*28 – For the determination of the safety parameters a “worst case” configuration has been assumed (standalone, all inputs, all outputs, single encoder mode). Improved data can be achieved by use of dual encoders.

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