



exida Certification S.A.
2 Ch. de Champ-Poury
CH-1272 Genolier
Switzerland

Tel.: +41 22 364 14 34
email: info@exidaCert.ch

Results of the IEC 61508 Functional Safety Assessment

Project:

Solenoid driver

KFD0-SD2-(Ex)*.*****

KCD0-SD-(Ex)1.**(.SP)**

HiC2871

Customer:

Pepperl+Fuchs GmbH

Mannheim

Germany

Contract No.: P+F 1109-099-C

Report No.: 1109-099-C R028

Version 1, Revision 0, May 2012

Audun Opem, Peter Söderblom

Management summary

The Functional Safety Assessment of the Pepperl+Fuchs GmbH, performed by *exida* Certification S.A. consisted of the following activities:

- *exida* Certification S.A. assessed the setup of the development process used by Pepperl+Fuchs GmbH for development projects against the relevant requirements of IEC 61508:2000 parts 1 and 2. Special focus was put on the change process and to the adherence to this, as planned by [D101].
 Subject to this assessment were the Functional Safety Planning activities, the tailoring of the Verification and Validation activities and the realization of the technical safety aspects using the KCD0-SD / KFD0-SD2 / HiC2871 development project.
- *exida* Certification S.A. audited the results from the detailed audit of the development process, performed during the initial assessment, which investigated the compliance with IEC 61508:2000 of the processes, procedures and techniques as implemented for the Pepperl+Fuchs GmbH KCD0-SD / KFD0-SD2 / HiC2871 development project. The investigation was executed using subsets of the IEC 61508 requirements tailored to the work scope of the development team.
- *exida* Certification S.A. assessed the Safety Case prepared by Pepperl+Fuchs GmbH against the technical requirements of IEC 61508:2000.


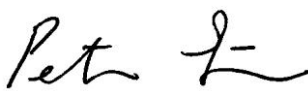

The above stated assessment activities were performed via a review of the previous assessment reports with related arguments and the assessment of the activities and documents related to the modification project as specified by the "Impact Analysis for change in devices with functional safety according to IEC 61508 – (.SP)-versions of KCD*... DDE-2165"

The result of the Functional Safety Assessment can be summarized by the following statements:

The audited development process as tailored and implemented by the Pepperl+Fuchs GmbH Type A KCD0-SD / KFD0-SD2 / HiC2871 development project, complies with the relevant safety management requirements of IEC 61508:2000 SIL 3.

The assessment of the FMEDA, which was performed according to IEC 61508, has shown that the KCD0-SD / KFD0-SD2 / HiC2871 have a PFH / PFD_{AVG} within the allowed range for SIL 3 (HFT = 0) according to table 2 of IEC 61508-1 and a Safe Failure Fraction (SFF) of more than 90%.

This means that the KCD0-SD-(Ex)1(.vcc)(.SP) with hardware version 251-5064B, the KFD0-SD2-(Ex)1(.vcc) with the hardware version 251-5059A, the KFD0-SD2-(Ex)2(.vcc) with hardware version 251-5056A and the HiC2871 with the hardware version 251-5065B are capable for use in SIL 3 applications in low and high demand mode, when properly designed into a Safety Instrumented Function per the requirements in the Safety Manual.

		
Assessor Audun Opem	Assessor Peter Söderblom	Review Dipl.-Ing. (FH) Peter Müller

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1 Purpose and Scope

This document describes the results of the

Full Functional Safety Assessment according to IEC 61508

of the product development processes according to the safety lifecycle phase 9 of IEC 61508-1. The purpose of the assessment was to investigate the compliance of:

- the KCD0-SD / KFD0-SD2 / HiC2871 with the technical IEC 61508-2 requirements for SIL 3 and the derived product safety property requirements

and

- the KCD0-SD / KFD0-SD2 / HiC2871 development processes, procedures and techniques as implemented for the safety-related deliveries with the managerial IEC 61508-1 and -2 requirements for SIL 3.

It was not the purpose to assess the fulfillment of the statement of conformance from Pepperl+Fuchs GmbH for the following European Directives;

- EMC Directive
- Pressure Directive
- Low Voltage Directive
- ATEX Directive

The correct execution of all activities that lead to the statement of conformance to these European Directives is in the responsibility of Pepperl+Fuchs GmbH and builds a basis for the certification.

It was not the purpose of the assessment / audits to investigate Company quality management system versus ISO 9001 and ISO 9000-3 respectively.

The assessment has been carried out based on the quality procedures and scope definitions of *exida* Certification S.A.

1.1 Tools and Methods used for the assessment.

This assessment was carried out by using the *exida* Certification S.A. assessment documents, templates and checklists which are derived from the Safety Case DB tool. The expectations for a positive judgment of the assessor are documented within this tool.

The assessment was based on a set of document templates, e.g. for the document review and assessment comments.

2 Project Description

2.1 Description of the Functional Safety Management System

The functional safety management system is implemented by the use of the QM plan [D10], the P+F Development process [D6] and the related planning documents, which describes the activities in detail.

The related planning documents are mainly the Safety Validation Plan [D7], the document plan [D28], the responsibility allocation [D21] and a set of templates and guidelines.

Evidence for the fulfilment of the detailed requirements has been collected in [D6], [D11] and [D12], which was subject to the initial assessment.

2.2 Description of the System

The devices are available as safe area version (KFD0-SD2-*.****, KCD0-SD-1.****(.SP)) where they can be used as a signal conditioner providing isolation for non-intrinsically safe applications. The devices are also available as hazardous area version (KFD0-SD2-(Ex)*.****, KCD0-SD-(Ex)1.****(.SP), HiC2871) allowing use as isolated barriers for intrinsic safety applications.

The safe area versions supply power to solenoids, LEDs, and audible alarms located in a safe area. The hazardous area versions supply power to solenoids, LEDs, and audible alarms located in a hazardous area.

The KC devices are available with screw terminals or spring terminals. The type code of the versions of the KC-devices with spring terminals has the extension ".SP".

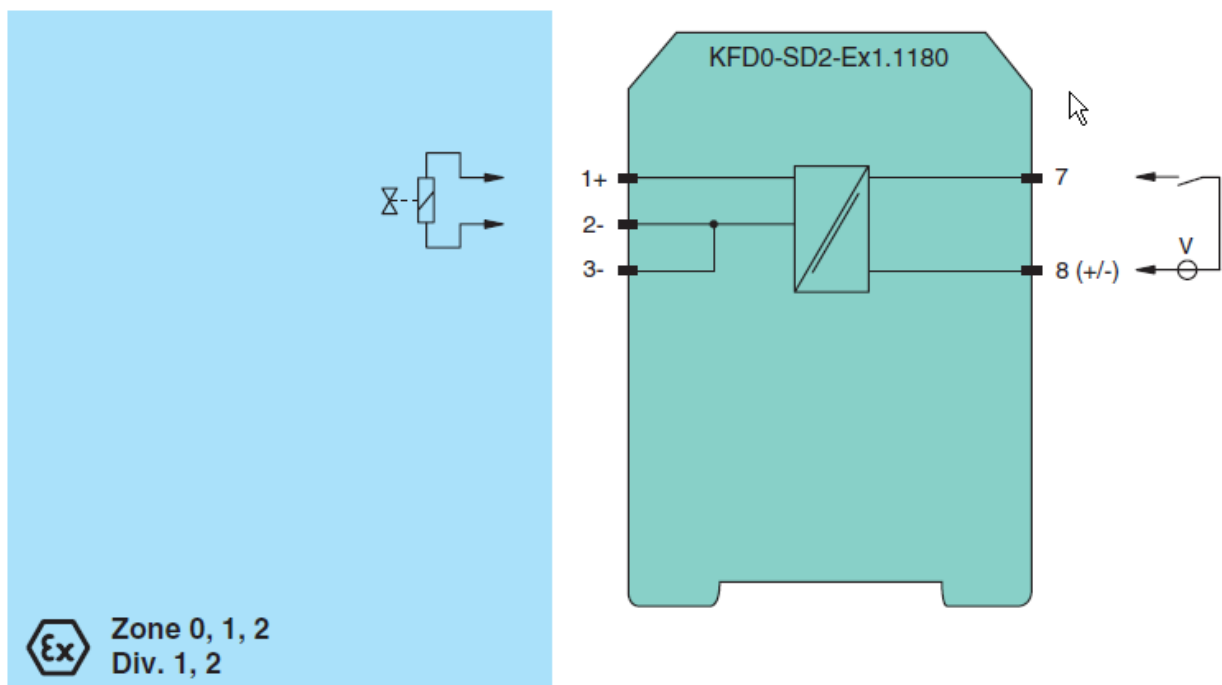


Figure 1: Block diagram of KFD0-SD2-Ex1.1180

Note: The pinout is identical for all versions of KFD0-SD2-(Ex)*.****(.SP).

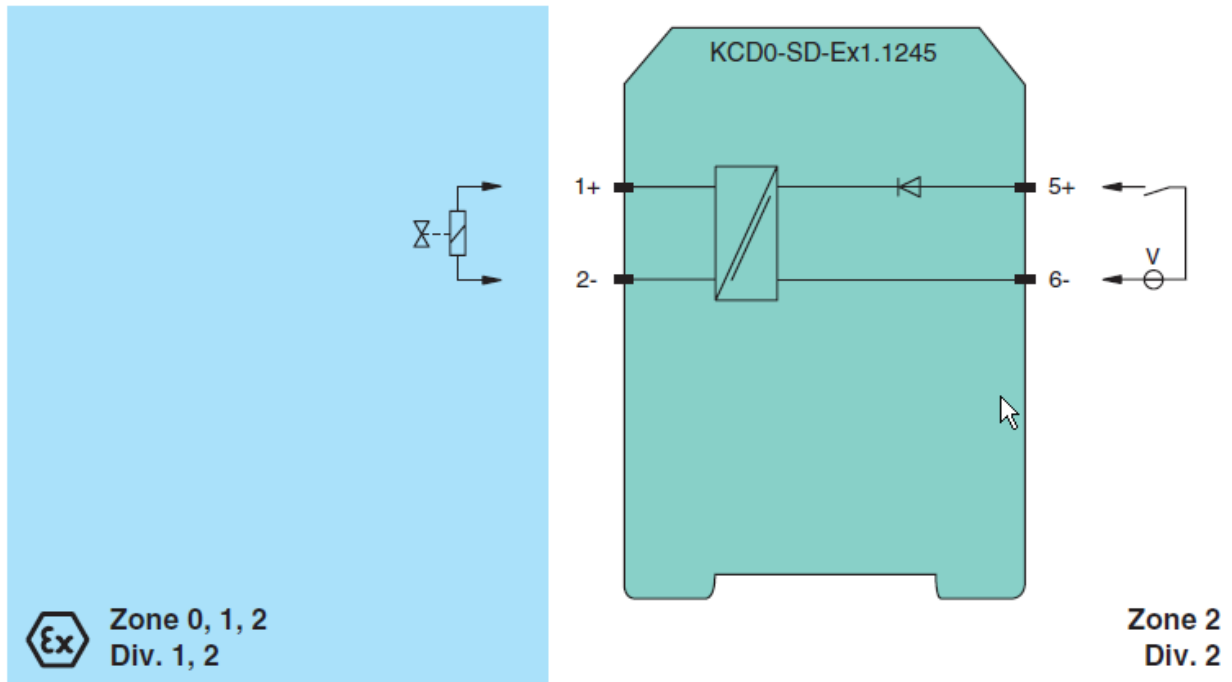


Figure 2: Block diagram of KCD0-SD-Ex1.1245

Note: The pinout is identical for all versions of KCD0-SD-(Ex)*.****(.SP)

3 Project management

3.1 Assessment of the development process

exida Certification S.A. assessed the development process used by Pepperl+Fuchs GmbH for the development project and the modification project against the objectives of IEC 61508 parts 1 and 2 by a review of the previous assessment and by assessment of the modification project as specified by the Impact Analysis [D101].

The assessment was planned by *exida* Certification S.A and agreed with Pepperl+Fuchs GmbH.

The initial assessment did assess the development process used by Pepperl+Fuchs GmbH Mannheim for the development project against the objectives of IEC 61508 parts 1 and 2. The development audit was closely driven by requirements subsets filtered from the IEC 61508 content of the *exida* SafetyCaseDB database. That means that the Functional Safety Management related requirements were taken out of the database and then selected according to the assessment steps carried out before (IEC 61508 Objectives and Document reviews).

The following IEC 61508 objectives were subject to detailed auditing at Pepperl+Fuchs GmbH:

- FSM planning, including
 - Safety Life Cycle definition
 - Scope of the FSM activities
 - Documentation
 - Activities and Responsibilities (Training and competence)
 - Configuration management
- Safety Requirement Specification
- Change and modification management
- Hardware architecture design - process, techniques and documentation
- Hardware design / probabilistic
- Hardware and system related V&V activities including documentation, verification
- System Validation
- Hardware-related operation, installation and maintenance requirements

The project teams, not individuals were audited.

The assessment was based on documents provided by Pepperl+Fuchs GmbH Mannheim in April 2008. The documents were generated during the development of the Solenoid drivers KCD0-SD-(Ex)1, KFD0-SD2-(Ex)1, KFD0-SD2-(Ex)2 and HiC2871 and are listed in section “6 Reference documents”.

Open topics regarding the provided documents were clarified with the safety manager Mr. Eschelbach by email.

The independent review of the initial assessment and update of the report according to the changes as specified by the Impact Analysis [D101] was performed by *exida* Certification S.A. 14-15-Feb-2012.

3.2 Roles of the parties involved

Pepperl+Fuchs GmbH

Represents the designer of the safety related KCD0-SD / KFD0-SD2 / HiC2871 and the investigated organization. The following teams / responsible persons were audited:

- Project Management
- Hardware Designer
- Safety Manager
- Validation and Verification

exida Certification S.A.

As this assessment is based on the already successfully performed assessment [R5], special focus was put on the change process and to the adherence to this as planned by the Impact Analysis [D101]

The activities were done by *exida* Certification S.A. as an independent organization. The assessment was performed by Audun Opem and Peter Söderblom who were not involved in the execution of the audited activities.

4 Results of the Functional Safety Assessment

exida Certification S.A. assessed the development process used by Pepperl+Fuchs GmbH for this development project against the objectives of IEC 61508 parts 1 and 2 by spot inspections of the previous assessment and by assessment of the modification project. The result of the review is documented in [A1].

All objectives have been successfully considered in the Pepperl+Fuchs GmbH development processes for the KCD0-SD / KFD0-SD2 / HiC2871 development.

exida Certification S.A. assessed the safety case prepared by Pepperl+Fuchs GmbH, including a set of documents, against the functional safety management requirements of IEC 61508. This was done by a review of the completeness of the related requirements through the arguments presented in the previous assessment, and then a spot inspection of certain requirements related to the modification.

The safety case demonstrated the fulfillment of the functional safety management requirements of IEC 61508-1 and 2.

The detailed development audit [R5] and [A2] investigated the compliance with IEC 61508 of the processes, procedures and techniques as implemented for the Pepperl+Fuchs GmbH KCD0-SD / KFD0-SD2 / HiC2871 development project.

The investigation was executed using subsets of the IEC 61508 requirements tailored to the work scope of the development team.

The result of the assessment shows that the KCD0-SD-(Ex)1(.vcc) (.SP) with hardware version 251-5064B, the KFD0-SD2-(Ex)1(.vcc) with the hardware version 251-5059A, the KFD0-SD2-(Ex)2(.vcc) with hardware version 251-5056A and the HiC2871 with the hardware version 251-5065B are capable for use in SIL 3 applications in low and high demand mode, when properly designed into a Safety Instrumented Function per the requirements in the Safety Manual.

Some areas of improvement were nevertheless identified. The recommended improvements given are generally required to formally show the compliance to IEC 61508. However, Pepperl+Fuchs GmbH was able to demonstrate with respect to the size of the project (limited number of people) and the specific complexity of the product that the objectives of the related areas have been successfully met. More details can be found in the chapter below.

4.1 Technical aspects of the KCD0-SD / KFD0-SD2 / HiC2871

The KCD0-SD / KFD0-SD2 / HiC2871 supply power to solenoids, LEDs and audible alarms in hazardous / non-hazardous areas.

The devices are loop powered, so the available energy at the output is received from the input signal. The output signal has a resistive characteristic. As a result the output voltage and current are dependent on the load and the input voltage.

The safe state is a low / de-energized output, 0V / 0mA.

This is a single channel Type A (HFT=0) system with low complexity.

4.2 Functional Safety Management.

Objectives of the Functional Safety Management

The main objectives of the related IEC 61508 requirements are to:

- Structure, in a systematic manner, the phases in the overall safety lifecycle that shall be considered in order to achieve the required functional safety of the E/E/PE safety-related systems.
- Structure, in a systematic manner, the phases in the E/E/PES safety lifecycle that shall be considered in order to achieve the required functional safety of the E/E/PE safety-related systems.
- Specify the management and technical activities during the overall, E/E/PES and software safety lifecycle phases which are necessary for the achievement of the required functional safety of the E/E/PE safety-related systems.
- Specify the responsibilities of the persons, departments and organizations responsible for each overall, E/E/PES and software safety lifecycle phase or for activities within each phase.
- Specify the necessary information to be documented in order that the management of functional safety, verification and the functional safety assessment activities can be effectively performed.
- Document all information relevant to the functional safety of the E/E/PE safety-related systems throughout the E/E/PES safety lifecycle.
- Document key information relevant to the functional safety of the E/E/PE safety-related systems throughout the overall safety lifecycle.
- Select a suitable set of tools, for the required safety integrity level, over the whole safety lifecycle which assists verification, validation, assessment and modification.

4.2.1 Safety Life Cycle

The development process as described in the P+F Development process [D6] and in the QM Plan [D10] is structured such that all relevant phases of the overall Safety Life Cycle are identified and that different phases are defined with the necessary activities, inputs and outputs.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.2.2 FSM planning

The P+F Development process [D6] together with QM Plan [D10] defines for all the different work steps the required input and output documents. Phases are sorted in the subchapters of the plan. Document [D21] defines the different roles and responsibilities of the development team members.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.2.3 Documentation

A set of templates and guidelines which controls the common layout of documents together with basic properties as document name or number, revision and approval identification exists and is part of the normal quality system of Pepperl+Fuchs GmbH.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.2.4 Training and competence recording

The different training courses / seminars that were part of the competence record of each individual for the Pepperl+Fuchs GmbH Mannheim project [D24] and [D25] was documented in a separate record which were maintained and stored by each project member.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.2.5 Configuration Management

All version information is stored in the EDM system and in EWAPlan under project number DDE-0513 and DDE-0514. Previous releases can always be retrieved. Newer versions get a new index of the same document number.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.3 Safety Requirement Specification

Objectives of the Safety Requirement Specification

The main objective of the related IEC 61508 requirements is to:

- Specify the requirements for each E/E/PE safety-related system, in terms of the required safety functions and the required safety integrity, in order to achieve the required functional safety.

4.3.1 Safety Requirement Specification and traceability into design

The Safety Requirement Specification [D4] is written in Microsoft Word.

The limited size of the system allows for tracking of the requirements even though no specific method is implemented for requirements tracking except tracking of the safety requirements by their ID in the validation tests. This is supported by the limited number / size of the applicable documents.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.4 Change and modification management

Objectives of change and modification management

The main objective of the related IEC 61508 requirements is to:

- Ensure that the required safety integrity is maintained after corrections, enhancements or adaptations to the E/E/PE safety-related systems.

4.4.1 Change and modification procedure

A modification procedure is defined in section 1.3 “Change Management (P02.03.1.3)” of the FSM-Plan [D6]. In addition the Pepperl+Fuchs process description describes in section P02.05.2.1 [D6] and [D3] the required steps for carrying out a modification. The conducted impact analysis [D26] shows the adherence to this procedure.

The defined modification procedure in combination with the generic development model is in accordance to the objectives of IEC 61508.

A minor change of the products during the re-assessment was documented in an Impact Analysis [D101] as agreed in later safety projects. This Impact Analysis addresses all relevant aspect of a change, i.e. reason for change, description, safety relevance, affected documents and applicable verification steps including testing. This Impact Analysis is then used as a V&V Plan for the change project.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.5 Hardware Design

Objectives of hardware design

The main objectives of the related IEC 61508 requirements are to:

- Create E/E/PE safety-related systems conforming to the specification for the E/E/PES safety requirements (comprising the specification for the E/E/PES safety functions requirements and the specification for the E/E/PES safety integrity requirements).
- Ensure that the design and implementation of the E/E/PE safety-related systems meets the specified safety functions and safety integrity requirements.

Objectives of hardware design / probabilistic properties

The main objective of the related IEC 61508 requirements is to:

- Ensure that the design and implementation of the E/E/PE safety-related systems meets the specified safety functions and safety integrity requirements.

4.5.1 Hardware architecture design

The system and hardware architectures are specified in the document [D23]. The hardware design follows the rules of modularization, the use of well known components and de-rating [D11].

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.5.2 Hardware Design / Probabilistic properties

As required by IEC 61508 FMEDA, probabilistic calculations have been carried out for the isolated switch amplifiers KCD0-SD / KFD0-SD2 / HiC2871; [R1]. The calculated SFF and the related PFD is due to the fact that a demand on these devices is an interruption of the complete supply (loop) power and thus, there are no possibilities for a dangerous failure.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.5.2.1 KCD0-SD / KFD0-SD2 / HiC2871

The Safe Failure Fraction was confirmed additionally by the Fault insertion tests. The PFD_{AVG} listed below shows SIL 3 capability.

Table 1 Failure rates according to IEC 61508

λ_s ¹	λ_{dd}	λ_{du}	SFF
114 FIT	0 FIT	0 FIT	100 %

Table 2 PFD_{AVG} values

	T[Proof] = 1 year
PFH = 0²	$PFD_{AVG} = 0^2$

¹ Note that the S category includes failures that do not cause a spurious trip

² As the λ_D failure rate is 0 FIT, the PFD calculation yields a PFD of zero, independent from the proof test interval as well as a PFH of zero.

4.6 Verification & Validation

Objectives of HW related verification & validation activities

The main objectives of the related IEC 61508 requirements are to:

- Demonstrate, for each phase of the overall, E/E/PES and software safety lifecycles (by review, analysis and/or tests), that the outputs meet in all respects the objectives and requirements specified for the phase.
- Test and evaluate the outputs of a given phase to ensure correctness and consistency with respect to the products and standards provided as input to that phase.
- Integrate and test the E/E/PE safety-related systems.
- Ensure that the design and implementation of the E/E/PE safety-related systems meets the specified safety functions and safety integrity requirements.
- Plan the validation of the safety of the E/E/PE safety-related systems.
- Validate that the E/E/PE safety-related systems meet, in all respects, the requirements for safety in terms of the required safety functions and the safety integrity.

4.6.1 HW related V&V activities

The FSM-Plan [D6] together with [D10] and the safety validation plan [D7] define the required verification activities related to hardware and system including documentation, verification planning, and integration test and requirements tracking to validation test.

FMEDA and validation tests were carried out.

All system and hardware validation activities are documented [D9] to [D20]. All relevant system validation tests are linked to the safety requirement stated in the safety requirements specification.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

4.7 Safety Manual

Objectives of the Safety Manual

The main objective of the related IEC 61508 requirements is to:

- Develop procedures to ensure that the required functional safety of the E/E/PE safety-related systems is maintained during operation and maintenance.

4.7.1 Operation, installation and maintenance requirements

The responsibility of P+F is to provide the end-users with a Safety Manual [D102], with all necessary product information in order to enable a correct and safe engineering of the product in a safety instrumented function. Additionally, the provided information enables the end-user to perform the required verification analysis steps of a safety instrumented function, e.g. SFF, PFD, proof test interval and procedure, etc. The Safety Manual partly also refers the data sheets which are available of the official web-site for details regarding environmental conditions and other approvals of the product.

Conclusion: The objectives of the standard are fulfilled by the Pepperl+Fuchs GmbH functional safety management system.

5 Agreement for future assessment

Areas of possible improvements have been identified during the assessment. However, these are not assessed to be in contradiction to an overall positive judgment of the subject.

Recommendations have been given by *exida* Certification S.A. to Pepperl+Fuchs GmbH as confidential information for the following lifecycle phases / sub-phases:

- Configuration Management
- Safety requirement specification and traceability into design

6 Reference documents

The services delivered by *exida* Certification S.A. were performed based on the following standards.

N1	IEC 61508-1:1998	Functional Safety of E/E/PES; General requirements
N2	IEC 61508-2:2000	Functional Safety of E/E/PES; Hardware requirements
N3	IEC 61508-3:1998	Functional Safety of E/E/PES; Software requirements

The initial assessment was based on the audit of the following documents as provided by Pepperl+Fuchs GmbH.

D1	2515065b.pdf	Circuit diagram "HIC 2871 – 251 - 5065B" of 07.07.06
D2	2515064b.pdf	Circuit diagram "KCD0-SD-Ex1.1245 – 251 - 5064B" of 07.07.06
D3	P02.05 Produktpflege.pps	Product change process description, Version 0 of 05.06.02
D4	fs0004ea-28.pdf	Safety Requirement Specification KCD0-SD-EX1.1245 / HIC2871 Binary Output Modules (BO); Date 12.05.2006
D5	fs0004ea-34a.pdf	Safety manual for KCD0-SD-Ex1.1245 and HIC 2871; Date 29.05.2008
D6	fs0004ea-23a.pdf	P+F Development Process Description for KCD0-SD-Ex1.1245 / HIC2871 including arguments –written in blue- on the fulfillment of the requirements (FSM-Plan); Date 29.05.2008
D7	fs0004ea-29a.pdf	Safety Validation Plan KCD0-SD-Ex1.1245 and HIC2871; Date 29.05.2008
D8	fs0004ea-30a.pdf	Safety Validation Results KCD0-SD-Ex1.1245 / HIC2871; Date: 20.05.2008
D9	fs0004ea-35a.pdf	Safety Validation of user information KCD2-SD-Ex1.1245 / HIC2871
D10	fs0004ea-23_2.pdf	QM-Plan for DDE-0513 / 514, 03.08.2003
D11	fs0004ea-24.pdf	Safety case for Analog In/Out Slimline series (C-BO) against the technical requirements of IEC 61508 of January 2008
D12	fs0004ea-24_2.pdf	Fulfillment of the Requirements acc. Tables A16, A17, A18 of IEC 61 508-2; of March 2007
D13	prde4760a.pdf	Test Report - Electromagnetic Compatibility: KCD0-SD-EX1.1245
D14	prde4797a.pdf	Test Report - Electromechanical and Environmental: KCD0-SD-Ex1.1245

D15	prde4862.pdf	Results of Immunity Tests to NE 21; KCD0-SD-EX1.1245
D16	prde5081a.pdf	Test Report - Inspection Order to locate hotspots: KCD2-SD-EX1.1245
D17	prde4761a.pdf	Test Report - Electromagnetic Compatibility: HiC2871
D18	prde4798a.pdf	Test Report - Electromechanical and Environmental: HiC2871
D19	prde4863.pdf	Results of Immunity Tests to NE 21; HiC2871
D20	prde5081a.pdf	Test Report - Inspection Order to locate hotspots: HiC2871
D21	contact list.xls of 17.02.06	List of project members, their roles and responsibilities
D22	fs0004ea-31.pdf	Circuit Description / Block Diagram K*D0-SD-Ex series Solenoid Drivers
D23	fs0004ea-31_2.pdf	Block Diagram K*D0-SD-Ex series Solenoid Drivers
D24	AW Schulung Training.msg of 28.02.07	Training record
D25	fs0004ea-23_3.pdf	Competence / Schulungs – Nachweis, Hr. Eschelbach; Date 30.05.2008
D26	fs0004ea-25.pdf	Impact Analysis DCN 300-5620A K-D0 series solenoid drivers
D27	fs0004ea-26	FMEDA results printout of KND0-SD-Ex1.1245 V1R1, Date 21.09.2005
D28	fs0004ead.doc	Overview Functional Safety Documents KCD0- SD-Ex1.1245 / HIC2871, Date 09.07.2008
D29	AW Assessment_Ventiltrenner SD und SD2.msg	Email H. Eschelbach, Date 08.05.2008
D30	WG Assessment_Ventiltrenner SD und SD2.msg	Email H. Eschelbach, Date 02.06.2008
D31	fs0004ea-25_1.doc	Impact Analysis: Impact of the circuit variations on the FMEDA, Date: 09.07.2008
D32	251-5049b.pdf	Circuit diagram, KFD0-SD2-Ex* 1045/1245/1065, Ref.: 251-5049b
D33	251-5056a.pdf	Circuit diagram, KFD0-SD2-Ex2.1045/1245, Ref.: 251-5056a
D34	251-5059a.pdf	Circuit diagram, KFD0-SD2-Ex1.1180/10100, Ref.: 251-5059a

The following documents were additionally provided by Pepperl+Fuchs GmbH for the modification project.

- D101 FS-0002EA-25, dated 02-Feb-2012 Impact Analysis for change in devices with functional safety according to IEC 61508 – (.SP)-versions of KCD*... DDE-2165
- D102 TDOCT-1906A ENG dated 02/2012 Revised Safety Manual Solenoid Driver – KFD0-SD2-(Ex)*.*****, KCD0-SD-(Ex)1.****, HiC2871

The initial assessment, were documented by the following documents / databases.

- R1 FMEDA V7 KND0-SD-Ex1 V1R1.xls, Date 21.09.2005
- R2 P+F_Assessment KCD0-SD-Ex1.esc, Date 13.05.2008
- R3 AW Assessment_Ventiltrenner SD und SD2.msg, Date 13.05.2008
- R4 AW Assessment_Ventiltrenner_slim_erste_Fragen.msg, Date 08.05.2008
- R5 P+F 05-07-10a R030 V1R2 – Results of the IEC 61508 Functional Safety Assessment – Solenoid Drivers KCD0-SD-(Ex)1(.vcc), KFD0-SD2-(Ex)1(.vcc), KFD0-SD2-(Ex)2(.vcc) and HiC2871

This assessment was documented by the following documents.

- A1 P+F 1109-099-C R025 Assessment & Review comments V0R2
- A2 P+F 1109-099-C R028 Assessment Report KCD0-SD, KFD0-SD2 and HiC2871 V0R1 (this document)
- A3 P+F 0905-35R1-C R004 Assessment Recommendations V7R0

7 Status of the document

7.1 Releases

Version History: V0R1 Initial version 15-Feb-2012. The report is based on the P+F 05-07-10a R030 V1R4 assessment report. Additionally, the report is updated with changes related to the Impact Analysis for change in devices with functional safety according to IEC 61508 – (.SP)-versions of KCD*... DDE-2165

V0R2 Updated after review by Peter Müller.

V1R0 Updated 11-May-2012 after review by P+F GmbH

Author: Audun Opem, Peter Söderblom

Review: V0R1 Peter Söderblom
V0R2 Peter Müller and P+F GmbH

Release status: Released