TÜV Rheinland Italia Srl
Via Italia, 1
I – 24030 Medolago (BG)
Tel. +39 035 4933147,
e-mail: bergamo@it.tuv.com

TÜVRheinland®

Technical Statement

Assessment no.:	FS 281120162
Applicant :	**SV Sistemi di Sicurezza** Srl Via Cortesi, 1 I – 24020 Villa di Serio (BG)
Subject :	Fire & Gas Application Evaluation of Safety Function SF1 claim to be SIL 3
Project :	The current project is the assessment and the SIL certification of the fire alarm control panel and extinguishing system, **EXFIRE360**, with safety functions implemented for fire detection and estinguishing
Scope :	Object of this Technical Statement is to summarize the content of the Intermediate Report FS 281120159 giving relevant informations to the manufacturer regard to the status of the current project.
Reference standards :	IEC 61508:2010 parts 1 to 7 where applicable

Description :

The EUC is the configuration SF1 type EX6EV-C of the Central Unit EXFIRE360 which operates as fire alarm control panel and as an extinguishing system

The above EUC is configured as follow :

Hardware composition (→ Ref. to the above “Reliability Block Diagram (RBD) - Figure 2”) :

Input element: **EX8SI** Card including its local CPU as logic solver for the input section
- Physical limit: terminal block inside the cabinet input section.
- Logical limit: addresses of digital inputs on board.

Output/Final element: **EX6EV** Card including its local CPU as logic solver for the output section
- Physical limit: terminal block inside the cabinet input section.
- Logical limit: addresses of digital outputs on board.

The redundant CPUs **EX360**, for this specific configuration SF1, act only as system to display information on the main LCD

Block diagram configuration SF1 type EX6EV-C is below represented in Figure 1

By combining the cards **EX8SI** and **EX6EV** the following input output signals become available:

1. 10 supervised inputs,
2. 4 supervised outputs,
3. 2 unsupervised outputs and
4. 14 open collector for signaling purpose.

TÜV Rheinland Italia Srl
Via Italia, 1
I – 24030 Medolago (BG)
Tel. +39 035 4933147,
e-mail: bergamo@it.tuv.com

Within the card are engineered two oscillating driver, that exchange the first four channels with the second four channel every 50ms. When a supervised channel is compromised or faulty, an accurate control is performed automatically, after which it is immediately activated the corresponding spare channel in substitution, ensuring complete and uninterrupted functionality.

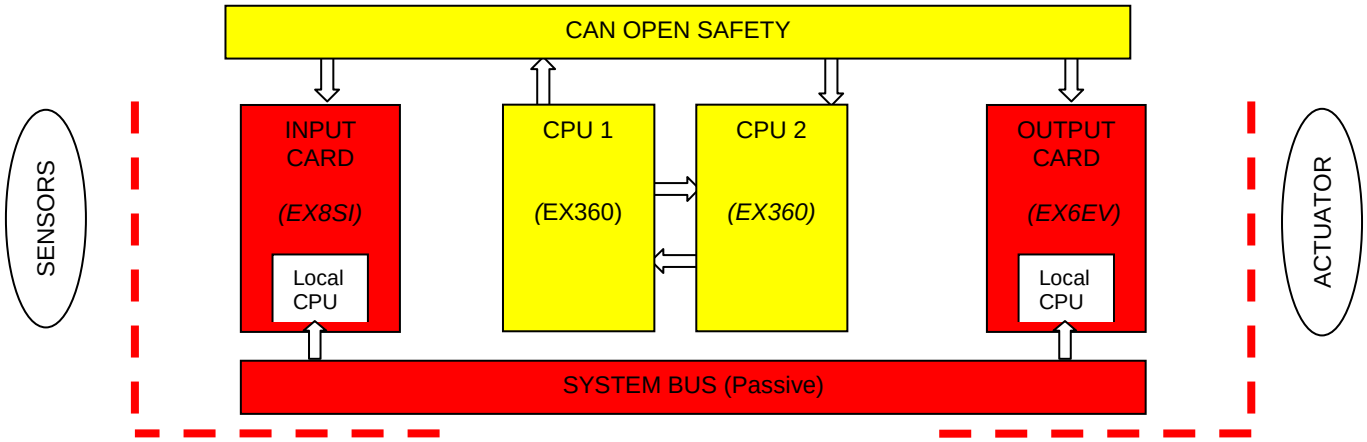

Figure 1

EUC BOUNDARY LIMIT

	→ Safety related path
	→ Monitor related part

The safety related function SF1 has been development by the manufacturer according to the mandatory requirements laid down into the refernce standard EN 12094 – "Fixed firefighting systems - Components for gas extinguishing systems - Part 1: Requirements and test methods for electrical automatic control and delay devices". The safety related function SF1 claims to have an average Probability of Failure on Demand (PFDavg) into the limit of the the SIL 3 range.

Safety related function SF1 type EX6EV-C				
TI	**Description**	**SIL claim**	**PFDavg. Calculated**	**Range Result**
1 yr	Fire estinguishing system with analog input trigger type EX6EV-C	SIL 3	3,24E-04	SIL 3 (*)
2 yr	Fire estinguishing system with analog input trigger type EX6EV-C	SIL 3	6,47E-04	SIL 3 (*)

(*):
According to the figuras laid down into the above Table, the safety function under assessment (SF 1) could be considered into the SIL 3 range, nevertheless the referenced standard requires the assessment of other relevant parameters to declare the level of safety integrity reached by the safety function.

TÜV Rheinland Italia Srl
Via Italia, 1
I – 24030 Medolago (BG)
Tel. +39 035 4933147,
e-mail: bergamo@it.tuv.com

In general these are :

From design and development

Architecture designed : HFT
Safe Failure Fraction : SFF
Hardware and Software Systematic Capability : SC
Dangerous failure rate : λdu

From Safety Requirement Specification

Test Interval : TI
Mean Time To Restoration : MTTR

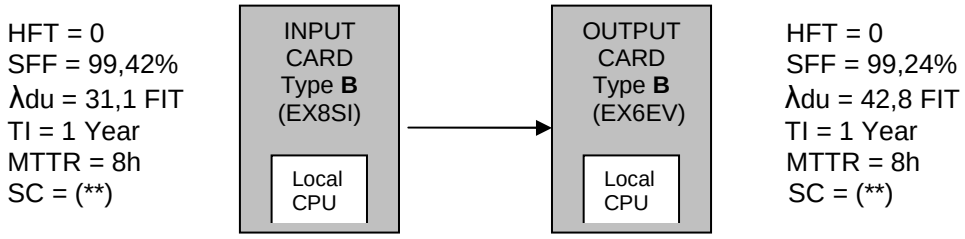

Figure 2

(**)
The Systematic Capability is the measure (expressed on a scale of SC 1 to SC 4) of the confidence that the systematic safety integrity of an element meets the requirements of the specified SIL, in respect of the specified element safety function, when the element is applied in accordance with the instructions specified in the compliant item safety manual for the element

For the assessment of the safety related function SF1, subject of this Intermediate Report, investigations are on going to confirm Systematic Capability level as SC 3.

The a.m investigations refer in detail to the following :

- Assessment of the planned measures to avoid systematic faults both hardware and software during the development process
- Inspection and assessment of the planned measures for the detection and control of faults (diagnostic measures)

The power supply section of the Central Unit EXFIRE 360 is based on 3 redundant DC24V power supply with a suitable system of battery backup. Power feeder is AC230V which supplies the redundand system of DC24V feeder. Each one of the three DC24 feeder has been designed to be able to drive the full load of the Central Unit EXFIRE 360.

From relevant section of IMQ technical report 44AK00039 results that the Radiated Radiofrequency EM field Immunity Test has been carried with a strenght of 10V/m.
This value deviates from the requirements laid out into the standard IEC 61326-3-1 or in the Annex E of EN 62061 which are the base standard used by the test institute to accept safety system with SIL level >= SIL 2.

TÜV Rheinland Italia Srl
Via Italia, 1
I – 24030 Medolago (BG)
Tel. +39 035 4933147,
e-mail: bergamo@it.tuv.com

Test Sample and Test Location

Test sample used for the test was the EXFIRE 360 Central Unit s/n: 38.10

Tests have been carried out according to the content of documents Annex [A} and Annex [B] and according to the checks list included into the document [D8].

Tests have been carried out at the following location:

SV Sistemi di Sicurezza Srl
Via Cortesi, 1
I – 24020 – Villa di Serio (BG)

Test have been carried out at the following date :

Tests				
Id.	**Date**	**Type of test**	**Note**	**Result**
1	Feb. 2nd 2012	Functional tests and functional tests with fault insertion simulation on EX8SI card	Adjustments has been required	Pass
2	Feb. 4th 2012	Functional tests with fault insertion simulation on EX8SI and EX6EV cards	None	Pass
3	Feb. 7th 2012	Functional tests with fault insertion simulation on EX6EV card	Diagnostic messages should be improved for completeness	Pass

General

The aim of the tests is the verification of the behaviour of the Central Unit EXFIRE 360 when faults, which could lead to a fail of the safety function (SF1) implemented, occur to affect the process/environment controlled by the Central Unit EXFIRE 360 itself.

Tests have been performed according to the FMEDA carried out on relevant cards (→ ref to docs [C] and [D]) and the available Safety Validation Planning document (→ ref to doc [D8]).

Results of the functional and fault insertion testing

Functional testing and fault insertion testing have been carried out using the Black-box testing modality.
A “walk throught inspection” into the software code has been carried out before to start with the functional testing.
The aim was to check if the code written reflected the behavoiur defined :

1. into the C&E matrix document (→ ref to doc [D30]),
2. into the logic function designed document (→ ref to doc [Q])
3. into the finite state machine document (→ ref to Annex [P])

During the tests have been selected valid and invalid inputs to the SF1 to determines and assess the correctness of its outputs.
Test and test results, carried-out up to now (feb 7th 2012) on SF1 - type EX6EV-C are included into the document [T1] and gave a positive results.

TÜV Rheinland Italia Srl
Via Italia, 1
I – 24030 Medolago (BG)
Tel. +39 035 4933147,
e-mail: bergamo@it.tuv.com

TÜVRheinland®

Summary

The general structure of the safety case under assessment (safety related function SF1 type EX6EV-C) has been basically designed and development in such a way to satisfy the requirements for SIL 3 application.

Deviation from the standard requirements regards the results of the Radiated Radiofrequency EM field immunity test. Manufactuer will re-consider appropriate tests with additional safety margin (→ ref to IEC 61326-3-1) or with increased immunity levels suitable for safety related application (→ ref to EN 62061 – Annex E).

Investigations are still on going to confirm systematic capability SC3 and fulfils the requirements concerning the hardware and software structure according to the recomandations for SIL 3 class set out into the reference standard in all of those parts where can be applied.

The project contains plausible and comprehensible statements to the individual aspects with reference to the standard, and gives a good overview of the application of the Safety Plan and of the V&V process for the Central Unit EXFIRE 360.

The assessor is confident to get the targeted results during the next assessments

Note : This Tecnical Statement FS 281 120162 is a synthesis of :

TÜV Rheinland Intermediate Report FS 281120159 dated February 8th 2012

Milan, 2012-02-10

Gianluca Marradi
TÜV Rheinland Italia Expert
Industrial Service dpt

TÜV Rheinland Italia - Industrie Service - TÜV Rheinland Group

TÜV Rheinland Italia Srl
Via Italia, 1
I – 24030 Medolago (BG)
Tel. +39 035 4933147,
e-mail: bergamo@it.tuv.com

TÜVRheinland®

Attachment 1 to
Technical Statement No. : FS 281120162

Relevant documents :

According to the manufacturer document "FS-001-EN – Document List" , the following documents :

Documents				
Id.	**Description**	**Document No.**	**Rev.**	**Date**
[D1]	Project Plan	FS-002-EN	0	2011-12-05
[D2]	Concept	FS-003-EN	0	2011-12-06
[D3]	Overall Scope definition	FS-004-EN	0	2011-12-06
[D4]	Hazard & Risk Analysis	FS-005-EN	0	2012-01-04
[D5]	Overall Safety requirements	FS-006-EN	0	2012-01-04
[D6]	SIL Allocation	FS-007-EN	0	2012-01-04
[D7]	Operational & Maintenance Planning	FS-008-EN	0	2011-12-05
[D8]	Safety Validation Planning	FS-009-EN	0	2011-12-06
[D10]	System Safety requirements Specification	FS-011-EN	0	
[D18]	Software safety requirements specification	FS-012.7-EN	0	
[D30]	EX-FIRE360_C&E_CHART_26012012	Number	rev	2012-01-26
Annex Id.	**Description**	**Annexed to document No.**	**Rev.**	**Date**
[B],[B1]	EX8SI Card FMEDA & PFDavg calculation	FS-005-EN	0	2011-12-27
[C],[C1]	EX6EV Card FMEDA & PFDavg calculation	FS-005-EN	0	2011-12-27
[G]	CPU360 Card Block Diagram	FS-011-EN	0	2012-01-16
[H]	EX8SI Card Block Diagram	FS-011-EN	0	2012-01-16
[I]	EX6EV Card Block Diagram	FS-011-EN	0	2012-01-16
[P]	Finite State Machine Diagram (SF1)	FS-011-EN	0	2012-01-16
[Q]	EX6EV-C_LOG – Diagramma Logico Funzionale	FS-011-EN	0	2012-01-16

The following documents, produced by the manufacturer itself or on its behalf have to be revieweded by the TÜV Rheinland Italia.

Documents				
Id.	**Description**	**Document No.**	**Rev.**	**Date**
[R1]	IMQ Technical Report according to EN54-2:2007	44AK00039	==	==
[R2]	IMQ Technical Report according to EN54-4:2007	44AK00040	==	==
[R3]	IMQ Technical Report according to EN12094-1:2004	44AK00042	==	==
[R4]	SV Sistemi di Sicurezza Technical Report according to EN60439-1:2004 (→ LV Directive)	==r	==	Dec 3rd 2010