

Funktionale Sicherheit nach IEC 61508 / IEC 61511
Functional Safety according to IEC 61508 / IEC 61511

Wir erklären, dass die Geräte
We declare, that the devices

244LD LevelStar
244LVP LevelStar

für den Einsatz in einer sicherheitsgerichteten Anwendung entsprechend der IEC 61511-1
geeignet sind, wenn die Sicherheitshinweise und die nachfolgenden Parameter beachtet werden:
are suitable for use in a safety related application according IEC 61511-1,
if the safety instructions and the following parameters are observed:

Produkt / Product	244LD LevelStar	244LVP LevelStar
SIL	2	2
Prüfintervall / Proof test interval	≤ 5 Jahre / Years	
Gerätetyp / Device Type	B	B
HFT	0 ¹⁾ (einkanalige Verwendung / single channel using)	
SFF	92%	91%
PFD _{avg}	1,02x10 ⁻³	9,85x10 ⁻⁴
PFH ²⁾	< 0,44 x 10 ⁻⁷	< 0,42 x 10 ⁻⁷
λ _{du}	44 FIT	42 FIT
λ _{dd}	509 FIT	457 FIT
λ _{su}	0 FIT	0 FIT
λ _{sd}	0 FIT	0 FIT
MTTF ³⁾	206 Jahre / Years	228 Jahre / Years
DC _D	92%	91%

¹⁾ gemäß Kapitel / according to chapter 11.4.4 of IEC 61511-1

²⁾ Diagnosezeit / Error response time < 5min

³⁾ für / for MTTR = 8h



Karl-Heinz Neher
Managing Director
Foxboro Eckardt GmbH



Martin Piltz
Quality Manager
Foxboro Eckardt GmbH



Dr. Joachim Seckler
Development Manager
Foxboro Eckardt GmbH



Failure Modes, Effects and Diagnostic Analysis

Project:

Intelligent Buoyancy Transmitter 244LVP LevelStar

Customer:

Foxboro Eckardt GmbH
Stuttgart
Germany

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Stephan Aschenbrenner



Management summary

This report summarizes the results of the hardware assessment carried out on the Intelligent Buoyancy Transmitter 244LVP LevelStar with software version V6.270.5 and hardware versions as listed in the circuit diagrams referenced in section 2.4.1.

The hardware assessment consists of a Failure Modes, Effects and Diagnostics Analysis (FMEDA). A FMEDA is one of the steps taken to achieve functional safety assessment of a device per IEC 61508. From the FMEDA, failure rates are determined and consequently the Safe Failure Fraction (SFF) is calculated for the device. For full assessment purposes all requirements of IEC 61508 must be considered.

For safety applications only the described configurations of the device were considered. All other possible output variants or electronics are not covered by this report.

Failure rates used in this analysis are basic failure rates from the Siemens standard SN 29500. For mechanical components experience-based *exida* data and field failure evaluations from Foxboro Eckardt GmbH were used.

Foxboro Eckardt GmbH and *exida* did a qualitative analysis (see [R1]) of the (electro-)mechanical components of the Intelligent Buoyancy Transmitter 244LVP LevelStar. This analysis was used to calculate the failure rates of the (electro-)mechanical components of the Intelligent Buoyancy Transmitter 244LVP LevelStar using experience-based *exida* data and field failure evaluations from Foxboro Eckardt GmbH.

A user of the Intelligent Buoyancy Transmitter 244LVP LevelStar can utilize these failure rates in a probabilistic model of a safety instrumented function (SIF) to determine suitability in part for safety instrumented system (SIS) usage in a particular safety integrity level (SIL). A full table of failure rates is presented in section 4.3.1 along with all assumptions.

The Intelligent Buoyancy Transmitter 244LVP LevelStar is considered to be a Type B¹ element with a hardware fault tolerance of 0.

¹ Type B element: "Complex" element (using micro controllers or programmable logic); for details see 7.4.4.1.3 of IEC 61508-2.

Table 1 Summary – IEC 61508 failure rates

Failure category	SN29500 [FIT]
Fail Safe Detected (λ_{SD})	0
Fail Safe Undetected (λ_{SU})	0
Fail Dangerous Detected (λ_{DD})	457
Fail Dangerous Detected (λ_{dd}), detected by internal diagnostics	287
Fail Annunciation Detected (λ_{AD}), detected by internal diagnostics	23
Fail High (λ_H), detected by safety logic solver	9
Fail Low (λ_L), detected by safety logic solver)	138
Fail Dangerous Undetected (λ_{DU})	42
Fail Annunciation Undetected (λ_{AU})	0
No effect	128
No part	267
Total failure rate of the safety function (λ_{Total})	499
Safe failure fraction (SFF) ²	91%
DC_D	91%
SIL AC ³	SIL 2

The failure rates are valid for the useful life of the Intelligent Buoyancy Transmitter 244LVP LevelStar (see Appendix 2).

² The complete sensor subsystem will need to be evaluated to determine the overall Safe Failure Fraction. The number listed is for reference only.

³ SIL AC (architectural constraints) will need to be evaluated on sensor subsystem level. The indicated value is for reference only and means that the calculated values are within the range for hardware architectural constraints for the corresponding SIL but does not imply all related IEC 61508 requirements are fulfilled.