Manufacturer’s Declaration Functional Safety

Functional safety of termination boards acc. to EN/IEC 61508:2010

1 Safety Evaluation

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declares as manufacturer that for the H-System termination boards, types mentioned below, the functional safety assessment according to EN/IEC 61508:2010 allows the use within SIL3 applications.

From the standpoint of systematic failures, the complexity of the circuit directly within the safety path is very low so the possibilities for safety relevant errors are limited sufficiently, also ensured by following certified functional safety development processes and involving an independent department for the functional safety assessment.

From the probabilistic viewpoint, the components in the signal path of the termination boards only consume a very small part of the PFD_{avg} or PFH budgets allowed for SIL3 safety applications according to EN/IEC 61508-1:2010 tables 2 and 3. It is possible to neglect the contribution of the termination boards to the safety loop, however if there is the wish to include the safety characteristic values they are given in the tables below. In SFF calculations, the values would be included into the values of the mounted interface device or combined with attached periphery.

2 Products

Termination boards to mount H-System devices, see product list below. See the data sheet for the special pin assignment.

Part No.	Product Name
70146723	HiCTB16-TRX-RAS-PL-IO16
70159655	HiCTB16-TRX-RAS-PL-AI16

3 Safety Function

The safe state considered depends on the safety function implemented. The safety characteristic values are calculated by evaluation of use within digital input (DI) and analog input (AI) applications. As numbers are very low, the worst case values are given within the tables below.
Expectancy is that de-energize-to-safe (DTS) applications are in focus that evaluate the off (energyless) state as safe state, making many component failures uncritical.

4 Safety Characteristic Values

The following table shows safety characteristic values for DTS use

Parameter	Symbol	Condition	Value	Unit
Systematic Capability	*SC*		3	
Dangerous Undetected Failure Rate	λ_{du}		0.3	FIT
Average Probability of Failure on Demand	PFD_{avg}	T_1 = 1 year	1.31E-06	
Average Probability of Failure on Demand	PFD_{avg}	T_1 = 2 years	2.63E-06	
Average Probability of Failure on Demand	PFD_{avg}	T_1 = 5 years	6.57E-06	
Probability of Dangerous Failure per Hour	*PFH*		3.0E-10	1/h

5 Conditions and Assumptions

The following assumptions have been made during the Failure Mode Effect and Diagnostic Analysis:

- The board is operated within the limits given in its datasheet.
- The evaluation to the different applications (DI, DO, AI, AO, TI) was confirmed with the recommended interface devices as given within the board documentation.
- The periphery attached is not part of this declaration.
- Failure rates are based on the Siemens standard SN 29500.
- Failure rates are constant, wear is not included.
- Propagation of failures is not relevant.
- All component failure modes are known (Type A).
- PFD and PFH values are calculated for use in a 1oo1 structure, HFT=0.
- The repair time after a safe failure is 8 hours.
- The average temperature over a long period of time is 40 °C.
- The stress levels are average for an industrial environment and can be compared to the stationary mounted classification of MIL-HDBK-217F. Alternatively, the assumed environment is similar to IEC 60654-1, Class C (sheltered location) with an average temperature over a long period of time of 40 ºC. For a higher average temperature of 60 ºC, the failure rates must be multiplied by a factor of 2.5 based on experience. A similar factor must be used if frequent temperature fluctuations are expected.
- The products are designed for a useful lifetime of 20 years regarding constant failure rates of its components. Nonetheless, this can be reduced if the device is driven under harsh working conditions with either excessive mechanical stress (vibration), higher average ambient temperature than assumed or prevalent substantial temperature cycles.

6 Proof Test

A suitable proof test is done by testing all mounted modules on the termination board. Additionally it is recommended to check the redundant power supply circuit by disconnecting each connected supply one after the other and see whether the mounted modules are still supplied.

7 Definitions

The following definitions for the failure of the product were considered.

Safe State	OFF (energyless) state for DTS, ON (energy available) state for ETS functions.
Safe Failure	Failure that introduces the defined safe state without a demand from the process.
Dangerous Failure	Failure that prevents the defined safe state to be reached although introduced.

Although the safety characteristic values of the termination board are within the allowed range for SIL3 according to EN/IEC 61508:2010 it depends on the failure rates of the other devices in the safety loop whether a SIL 3 safety function can be implemented.

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