



Rail

Add value.
Inspire trust.

Report

on the

Certificate

M6A 020196 0278 Rev. 00

of the

Safety Components

ExI 4xxx / ExI 4xxxS

Applicant

DR. JOHANNES HEIDENHAIN GmbH
Dr. Johannes Heidenhain Str. 5
83301 Traunreut
Germany

Report No.: HT98231C

Version 1.0 of 2022-02-09

Testing Laboratory for Safety Components

TÜV SÜD Rail GmbH
Rail Automation
Barthstraße 16
D-80339 München

Certification Body

TÜV SÜD Product Service GmbH
Ridlerstraße 65
D-80339 München

(Page 1 of 10)

This report may be represented only in full wording. The use for promotion needs written permission. This report contains the result of a unique investigation of the product being tested and places no generally valid judgment about characteristics out of the running fabrication. Official translations of this technical report are to be authorised by the test and certification body.

Table of Contents

page

1	Target of Evaluation (ToE)	4
2	Scope of Testing	4
2.1	Test Specimen.....	4
2.2	Nomenclature and Identification of Exl 4xxx / Exl 4xxxS	4
3	Certification Requirements	5
3.1	Certification Documentation	6
4	Standards and Guidelines	7
4.1	Guidelines and Directives.....	7
4.2	Functional Safety Standards	7
4.3	Susceptibility to Environmental Errors	8
4.3.1	Mechanical Compatibility and IP Code testing	8
4.3.2	Basic Safety, Environmental testing	8
4.3.3	Electromagnetic Compatibility.....	8
4.4	Safety Information in the Product Documentation (safety manual, operating instructions, labelling)	8
4.5	Quality Management System	9
5	Results	9
5.1	Functional Safety.....	9
6	Implementation Conditions and Restrictions	10
7	Certificate Number	10

List of Tables

page

Table 1:	Modification history	3
Table 2:	Technical Report	6
Table 3:	Reports on Modifications	6
Table 4:	Directives	7
Table 5:	Functional safety standards	7
Table 6:	Other product related standards	7
Table 7:	Mechanical Compatibility and IP Code testing standards	8
Table 8:	Basic Safety, Environmental testing standards	8
Table 9:	Electromagnetic compatibility standards.....	8
Table 10:	Safety information standards	8
Table 11:	Quality Management System	9

Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	Active	2022-02-09	Martin Braun	Initial

Table 1: Modification history

1 Target of Evaluation (ToE)

In October 2021 DR. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and certify the ExI 4xxx / ExI 4xxxS according to the standard listed in clause 4 of this report. The project number related to this Technical Report is 717524181.

The ToE is a product used in safety related applications. The ExI 4xxx / ExI 4xxxS is a Safety Encoder approved for SIL 2 according to IEC 61508 and Category 3 / PL d according to ISO 13849-1.

2 Scope of Testing

2.1 Test Specimen

The safety functions of the ExI 4xxx / ExI 4xxxS covered by this certificate are listed in the Annex A to this report.

2.2 Nomenclature and Identification of ExI 4xxx / ExI 4xxxS

The certified variants of the ExI 4xxx / ExI 4xxxS covered by this certificate are listed in the Annex A to this report.

3 Certification Requirements

The certification of the ExI 4xxx / ExI 4xxxS will be according to the regulations and standards listed in clause 4 of this document. This will certify the successful completion of the following test segments.

- I. Functional Safety including
 - Functional safety management (FSM) and safety lifecycle
 - Applied safety development process
 - Analysis of the product structure / architecture (Block-Diagram-FMEA)
 - Analysis of the hardware (FMEDA on component or block level, quantitative analysis)
 - Analysis of the software
 - Verification and validation procedures/activities
 - Fault simulations and software tests
 - Approval of fault avoidance measures
 - Functional tests
- II. Electrical Safety
- III. Susceptibility to environmental errors including
 - Climate and temperature
 - IP degree of protection
 - Mechanical effects
- IV. Electromagnetic compatibility (EMC)
 - Immunity
- V. Safety information in the product documentation (safety manual, user manual, installation and operating instructions).
- VI. Product-Related Quality Assurance in Manufacture and Product Development

Certification is dependent on successful completion of all above listed test segments. The testing follows the basic certification scheme for Safety Components of TÜV SÜD Rail GmbH.

3.1 Certification Documentation

The detailed technical evaluation is documented in the most recent version of the Technical Report:

Document No.	Description	Project No.
HT86351T, Rev. 1.1	Technical Report Exl 4xxx	717513565
HT86219T	Technical Report Mechanics Exl 4xxx	717509410
HT90290T, Rev. 1.3	Technical Report Exl 4090S	717516058
DT90425T	Technical Report Mechanics AE Exl 4010 / ECI 4090S / TTR EXI 4000 (90 mm)	717511250
HT84061T, Rev. 1.2	Technical Report Concept of SIL 3 safety functions with Heidenhain measurement instruments	717518371
HT98231C-A	Annex in the current valid revision.	717524181

Table 2: Technical Report

Modifications have been evaluated and tested and are documented in the most recent version of the Technical Report of Modifications (TRM):

Document No.	Modification Description	Project No.
Report on the Certificate v1.0		
HT90525T	Technical Report of Modifications ECI 4010 / EBI 4010	717513565
HT98224T	Technical Report of Modifications	717524181

Table 3: Reports on Modifications

Based on the specified purpose of use of the Exl 4xxx / Exl 4xxxS in safety critical process applications, the certification is based on the set of standards listed in clause 4 of this document. The issuance of the certificate states compliance with these references unless specifically noted otherwise.

4 Standards and Guidelines

The regulations and guidelines which form the basis of the type testing are listed below.

4.1 Guidelines and Directives

No.	Reference	Description
/N1/	2006/42/EC	DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery

Table 4: Directives

4.2 Functional Safety Standards

No.	Reference	Description
/N2/	EN 61508-1:2010 (SIL 2)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
/N3/	EN 61508-2:2010 (SIL 2)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/ programmable electronic safety-related systems
/N4/	EN ISO 13849-1:2015 (Cat. 3, PL d)	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
/N5/	EN 61800-5-2:2017	Adjustable speed electrical power drive systems – Part 5.2: Safety requirements -Functional

Table 5: Functional safety standards

No.	Reference	Description
<i>Remark: The following standards were approved by other testing services.</i>		
/N6/	IEC 61800-5-3:2021	Adjustable speed electrical power drive systems - Part 5-3: Safety requirements - Functional, electrical and environmental requirements for encoders

Table 6: Other product related standards

4.3 Susceptibility to Environmental Errors

Remark: The following standards were approved by other testing services.

4.3.1 Mechanical Compatibility and IP Code testing

No.	Reference	Description
/N7/	Functional Safety_Mechanical components_2.0_2020-12	Grundsätzliche Vorgehensweise für die Bewertung mechanischer und mechatronischer Systeme im Umfeld der „Funktionalen Sicherheit“
/N8/	FKM Richtlinie: 2020	Rechnerischer Festigkeitsnachweis für Maschinenbauteile
/N9/	VDI 2230 / Blatt 1: 2015	Systematische Berechnung hochbeanspruchter Schraubenverbindungen
/N10/	EN 60529:1989/A2:2013/ AC:2019	Degrees of protection provided by enclosures (IP Code)

Table 7: Mechanical Compatibility and IP Code testing standards

4.3.2 Basic Safety, Environmental testing

No.	Reference	Description
/N11/	EN 61800-5-1:2007/ A1:2017	Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy

Table 8: Basic Safety, Environmental testing standards

4.3.3 Electromagnetic Compatibility

No.	Reference	Description
/N12/	EN IEC 61800-3:2018	Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods
/N13/	EN 61800-5-2:2017	Adjustable speed electrical power drive systems – Part 5.2: Safety requirements -Functional

Table 9: Electromagnetic compatibility standards

4.4 Safety Information in the Product Documentation (safety manual, operating instructions, labelling)

No.	Reference	Description
/N14/	EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

Table 10: Safety information standards

4.5 Quality Management System

No.	Reference	Description
[M1]	QMS	Quality Management System TÜV SÜD Rail GmbH
	TR_RA_P_04.50	Test Program Functional Safety TR_RA_P_04.51 Definition Scope of testing TR_RA_P_04.07 Product Modification TR_RA_P_04.52 Concept Phase & Safety Lifecycle TR_RA_P_04.53 Detail Phase Hardware TR_RA_P_04.54 Detail Phase Software TR_RA_P_04.55 Safety Manual TR_RA_P_04.56 Result of Testing
[M2]	D-IS-11190-01-00	DAkkS accreditation according to DIN EN ISO/IEC 17020:2012; inspection body type A
[M3]	D-PL-11190-08-00	DAkkS accreditation according to DIN EN ISO 17025:2018 / EN ISO/IEC 17025:2017

Table 11: Quality Management System

5 Results

5.1 Functional Safety

The tests performed and quality assurance measures implemented by the DR. JOHANNES HEIDENHAIN GmbH have shown that the ExI 4xxx / ExI 4xxxS complies with the testing criteria specified in clause 4 subject to the conditions defined in clause 6 and is suitable for safety-related use in applications up to

- SIL 2 in accordance with IEC 61508¹ and
- category 3 PL d according to ISO 13849-1¹.

¹ With additional measures suitable for safety-related applications up to SIL 3, category 4 PL e, see HT84061T

6 Implementation Conditions and Restrictions

The use of the ExI 4xxx / ExI 4xxxS shall comply with the current version of the safety parts of the user manual, and the following implementation and installation requirements have to be followed, if the ExI 4xxx / ExI 4xxxS is used in safety-related installations.

- The guidelines and requirements specified in the user documentation shall be followed. Only modules certified for safety-related operation shall be used for safety-critical functions.
- Timing aspects like reaction times, test intervals or test execution times have to be considered by the implementation of the final Safety function.
- The operating conditions like lifetime or operating temperature as specified in the user documentation shall be met.

7 Certificate Number

This report specifies technical details and implementation conditions required for the application of ExI 4xxx / ExI 4xxxS to the certificate:

M6A 020196 0278 Rev. 00

Munich, 2022-02-09

Peter Weiß
(Technical Certifier)