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Report

on the

Certificate

M6A 020196 0312 Rev. 01

of the

Safety Encoder
Series R56, inductive

Applicant:

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Report No.: HT92173C

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Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	Replaced	2018-03-28	Klaus Leupold	initial
1.1	Replaced	2020-12-01	Guido Neumann	ExI13xx GEN.4 added EN 61800-5-2:2017 added Updated formal information to current QM template of TÜV SÜD Rail GmbH
1.2	Replaced	2023-03-06	Martin Braun	Review of changes Application of new standard IEC 61800-5-3:2021 Update of type examination certificate Formal update to template revision 17
1.3	Replaced	2024-01-25	Martin Braun	ExI 13xx Gen.5 G187 - EnDat22 added Formal update to template revision 19
1.4	Active	2025-01-27	Martin Braun	ExI 13xx Gen.5 G187 – EnDat3 (SIL 3) added Update to EN ISO 13849-1:2023 Formal update to template revision 21

Table 1: Modification history

1 Purpose and Scope

In November 2017 Dr. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and certify the Safety Encoder Series R56, inductive according to the standard listed in clause 4 of this report. The related project number is 717516056.

In May 2022 Dr. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and re-certify the Series R56, inductive according to the standard listed in clause 4 of this report in order to update the EC type approval with project number 717525667.

In April 2023 Dr. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and certify the variant ExI 13xx Gen.5 G187 – EnDat 2.2 according to the standard listed in clause 4 of this report. The related project number is 717527721.

In November 2024 Dr. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and certify the variant ExI 13xx Gen.5 G187 – EnDat 3 according to the standard listed in clause 4 of this report. The related project number is 717531227.

The ToE is a product used in safety related applications. The Series R56, inductive is a Safety Encoder approved for

- SIL 2,3 according to EN 61508
- PL d, e, Cat. 3 according to EN ISO 13849-1

The resulting version of this Report on the Certificate is v1.4.

2 Scope of Testing

2.1 Test Specimen

The safety functions of the Series R56, inductive covered by this certificate are listed in the Annex A to this report.

2.2 Nomenclature and Identification of Series R56, inductive

The certified variants of the Series R56, inductive covered by this certificate are listed in the Annex HT92173C-A to this report.

3 Certification Requirements

The certification of the Series R56, inductive is according to the regulations and standards listed in clause 4 of this document. This certifies 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 architecture (Block-Diagram FMEA)
   - Hardware analysis (quantitative analysis)
   - 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
   - Immunity

V. Safety information in the product documentation (safety manual, user manual, installation and operating instructions).

3.1 Certification Documentation

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

Document No.	Description	Project No.
HT84759T	Technical Report ExI 13xxS Gen.3	717516056
HT93258T	Technical Report of Modifications ExI 13xxS Gen3.1 and ExI 13xx Gen.3.1	717516060
HT95888T	Technical Report of Modifications ExI 13xx Gen.4	717519971

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 v1.2		
DT95925T	Technical Report of Modifications (Mechanics) - Flange with 2 ears (0YB) and Shaft (44H)	717520336
HT100242T	Technical Report of Modifications - Extension and re-issue of EC-Type Examination Certificate	717525667
Report on the Certificate v1.3		
HT101939T	Technical Report of Modifications - ExI 13xx Gen.5 G187 - EnDat22	717527721
Report on the Certificate v1.4		
HT104233T	Technical Report of Modifications - ExI 13xx Gen.5 G187 – EnDat 3 (SIL3)	717531227
Safety related requirements, conditions and restrictions can be found in the following user documentation		
1384976	Operating Instructions ECI 1319, EQI 1331, EBI 1335 EnDat22 0YA FS	
1385208	Operating Instructions ECI 1319, EQI 1331 EnDat22 0YB FS	
1385206	Operating Instructions ECI 1319, EQI 1331 EnDat22 0YA FS	
1386376	Operating Instructions ECI 1319S, EQI 1331S DRIVE-CLiQ 0YB FS	
1386379	Operating Instructions ECI 1319S, EQI 1331S DRIVE-CLiQ 44A/44C 0YA FS	
1363197	Operating Instructions ECI 1319, EQI 1331 E30-R2 44A/44C 0YA FS	
1408906	Operating Instructions ECI 1323, EQI 1335 EnDat22 0YA FS	
1429532	Operating Instructions ECI 1323, EQI 1335 E30-R2 44C 0YA FS	

Table 3: Reports on Modifications

Based on the specified purpose of use of the Series R56, inductive 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 2006-05-17 on machinery

Table 4: Guidelines and directives

4.2 Functional Safety

No.	Reference	Description
/N2/	EN 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
/N3/	EN 61508-2:2010	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 EN ISO 13849-1:2023	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design

Table 5: Basic safety standards

No.	Reference	Description
/N5/	EN 61800-5-2:2017	Adjustable speed electrical power drive systems – Part 5.2: Safety requirements -Functional
/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: Associated safety standards

4.3 Electrical Safety

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

No.	Reference	Description
/N7/	EN 61800-5-1:2007 / A1:2017	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy

Table 7: Electrical safety standards

4.4 Mechanical Compatibility and Environmental Testing

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

No.	Reference	Description
/N8/	Functional Safety_Mechanical components_2.0_2020-12	Grundsätzliche Vorgehensweise für die Bewertung mechanischer und mechatronischer Systeme im Umfeld der „Funktionalen Sicherheit“
/N9/	FKM Richtlinie: 2020	Rechnerischer Festigkeitsnachweis für Maschinenbauteile
/N10/	VDI 2230 / Blatt 1: 2015	Systematische Berechnung hochbeanspruchter Schraubenverbindungen
/N11/	IEC 60529:1989/ AMD2:2013/COR1:2019	Degrees of protection provided by enclosures (IP Code)
/N12/	EN 61800-5-1:2007 / A1:2017	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy

Table 8: Mechanical Compatibility and Environmental testing standards

4.5 Electromagnetic Compatibility

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

No.	Reference	Description
/N13/	EN 61800-5-2:2017 [1] Annex E	Adjustable speed electrical power drive systems – Part 5.2: Safety requirements -Functional
/N14/	IEC 61800-3:2017	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

Table 9: Electromagnetic compatibility standards

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

No.	Reference	Description
/N15/	EN ISO 13849-1:2015 EN ISO 13849-1:2023	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design
/N16/	IEC 61800-5-3:2021	Adjustable speed electrical power drive systems - Part 5-3: Safety requirements - Functional, electrical and environmental requirements for encoders

Table 10: Safety information standards

[1] The ExI 13xx Gen.3 product versions have been tested in accordance to EMC requirements of EN 61800-5-2:2007. ExI 13xx Gen.3.1 and higher have been tested in accordance to EMC requirements of EN 61800-5-2:2017

4.7 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-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 Series R56, inductive Safety Encoder 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 2,3[2] in accordance with EN 61508[3]
- category 3 PL d, e[2] according to EN ISO 13849-1[3].

6 Implementation Conditions and Restrictions

The use of the Series R56, inductive 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 Series R56, inductive 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.

[2] As listed in Annex HT92173C-A to this report

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

7 Certificate Number

This report specifies technical details and implementation conditions required for the application of Series R56, inductive to the certificate:

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Technical Certifier

Peter Weiß
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