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Report

on the

Certificate

M6A 020196 0308 Rev. 00

of the

Safety Encoder Series R35, optical

Applicant

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Testing Laboratory for Safety Components

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Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	Replaced	2018-01-23	K. Leupold	Initial, project number 717516054
1.1	Active	2023-01-16	Martin Braun	Review of changes Application of new standard IEC 61800-5-3:2021 Update of type exemption certificate Formal update to template revision 17

Table 1: Modification history

1 Target of Evaluation (ToE)

TÜV SÜD Rail GmbH has been contracted by Dr. JOHANNES HEIDENHAIN GmbH to certify the Safety Encoder Series R35, optical.

The report on the certificate is a set of the user-related results of all steps made during verification and validation of the Series R35, optical. It is based on the standards and guidelines listed in clause 4 and documented in the documents listed in clause 3.1.

In May 2022 Dr. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and re-certify the Series R35, optical according to the standard listed in clause 4 of this report in order to update the EC type approval. The project number related to this Technical Report is 717525479.

The ToE is a product used in safety related applications. The Series R35, optical is a Safety Encoder approved for

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

The resulting version of this Report on the Certificate is v1.1.



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2 Scope of Testing

2.1 Test Specimen

The safety functions of the Series R35, optical covered by this certificate are listed in the Annex A to this report.

2.2 Nomenclature and Identification of Series R35, optical

The Series R35, optical tested is identified as listed in the Annex A to this report.

3 Certification Requirements

The certification of the Series R35, optical 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 structure / architecture (Block-Diagram-FMEA)
 - Analysis of the hardware (FMEDA on component or block level, quantitative analysis)
 - Verification and validation procedures/activities
 - Fault simulations
 - 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

3.1 Certification Documentation

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

Document No.	Description	Project No.
HT91864T	Technical Report Series R35, optical	717516054

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 v1.1		
HT93683T	Technical Report of Modifications - New encoder with DQ Interface	717516062
DT94941T	Technical Report of Modifications (Mechanics) - Aluminium as additional customer shaft material option	717520334
HT99883T	Technical Report of Modifications - Extension and re-issue of EC-Type Examination Certificate	717525479
Safety related requirements, conditions and restrictions can be found in the following user documentation		
1390321	Operating Instructions ECN 1123, EQN 1135 EnDat22 Shaft 1KA FS	
1390318	Operating Instructions ECN 1123, EQN 1135 EnDat22 Shaft 1KC FS	
1390322	Operating Instructions ECN 1123S, EQN 1135S DRIVE-CliQ FS	

Table 3: Reports on Modifications

Based on the specified purpose of use of the Series R35, optical 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 2006/24/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/	IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
/N3/	IEC 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/	ISO 13849-1:2015	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

Table 6: Associated 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 7: Other product related 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 8: 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 9: 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 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 10: Electromagnetic compatibility standards

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

No.	Reference	Description
/N15/	ISO 13849-1:2015	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 11: Safety information standards

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-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 12: 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 R35, optical 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 61508 and
- category 3 PL d according to ISO 13849-1.

6 Implementation Conditions and Restrictions

The use of the Series R35, optical 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 R35, optical 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 Series R35, optical to the certificate:

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Technical Certifier