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# Report

on the

# Certificate

## M6A 20196 0297 Rev. 00

of the

### Safety Encoder

### Series R56, optical

#### Applicant

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## Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	replaced	2017-09-11	K. Leupold	Initial
1.1	replaced	2021-07-20	M. Braun	ECN 1325 und EQN 1337 added Updated formal information to current QM template of TÜV SÜD Rail GmbH
1.2	Active	2022-08-17	Guido Neumann	Review of changes Application of new standard IEC 61800-5-3:2021 Update of type approval certificate Formal update to template revision 16

**Table 1: Modification history**

## 1 Target of Evaluation (ToE)

In March 2022 Dr. JOHANNES HEIDENHAIN GmbH requested TÜV SÜD Rail GmbH to test and certify the Series R56, 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 717524958.

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

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



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## 2 Scope of Testing

### 2.1 Test Specimen

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

### 2.2 Nomenclature and Identification of Series R56, optical

The Series R56, optical tested are listed in the Annex A to this report.

### 3 Certification Requirements

The certification of the Series R56, 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 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

### 3.1 Certification Documentation

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

Document No.	Description	Project No.
HT91496T	Technical Report	717513789

**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.
<b>Reports</b>		
HT96222T	Technical Report of Modifications	717521861
HT96824T	Technical Report of Modifications (ExN 13xx, EnDat 3)	717519485
HT97028T	Technical Report of Modifications (ExN 13xx, EnDat 2.2)	717522515
HT99158T	Technical Report of Modifications / Extension and re-issue of EC-Type Examination Certificate	717524958
HT91542C-A	Annex in the current valid revision	1.4
Safety related requirements, conditions and restrictions can be found in the following user documentation		
596632	Technische Information Sicherheitsbezogene Positionsmesssysteme	
1376384	Produktinformation ROC 3025 ROQ 3037 EnDat22	
1378858	Produktinformation ROC 3000 ROQ 3000 DRIVE-CLiQ	
1378230	Produktinformation ECN 1325 EQN 1337 FS	
1378231	Produktinformation CN 1325 EQN 1337 FS	
1378398	Produktinformation ECN 425 / EQN 437 EnDat	
1378400	Produktinformation ECN 425 EQN 437	
1380308	Produktinformation ROC 425 ROQ 437	
1380310	Produktinformation ROC 424 S ROQ 436 S	
1380387	Produktinformation ECN 425 EQN 437	
1380388	Produktinformation ROC 424 S ROQ 436 S	
1380390	Produktinformation ECN 424 S EQN 436 S	
1380391	Produktinformation ECN 424 S EQN 436 S	
1380392	Produktinformation ECN 1324 EQN 1324	
1380394	Produktinformation ROQ 1332 S	
1381581	Produktinformation ECN 1325 EQN 1337	



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Document No.	Modification Description	Project No.
1381583	Produktinformation ECN 1325 EQN 1337	

**Table 3: Reports on Modifications**

Based on the specified purpose of use of the Series R56, 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
/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 5: Basic safety standards**

### 4.3 Mechanical Compatibility and Environmental Testing

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

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/	IEC 60529:1989/ A2:2013/AC:2019	Degrees of protection provided by enclosures (IP Code)

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 6: Environmental testing standards**

#### 4.4 Electromagnetic Compatibility

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

No.	Reference	Description
/N12/	EN 61800-5-2:2017	Adjustable speed electrical power drive systems – Part 5.2: Safety requirements -Functional

**Table 7: Electromagnetic compatibility standards**

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

No.	Reference	Description
/N13/	EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
/N14/	IEC 61800-5-3:2021	Adjustable speed electrical power drive systems - Part 5-3: Safety requirements - Functional, electrical and environmental requirements for encoders

**Table 8: Safety information standards**

## 4.6 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 9: 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, 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 R56, 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 R56, 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 R56, optical to the certificate:

**M6A 20196 0297 Rev. 00**

Technical Certifier

Name of a Technical Certifier