



Report
on the
Certificate
Z10 020099 0006 Rev. 01
digsy® fusion S

Manufacturer:

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Testing Laboratory for Safety Components

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Revision

Version	Status	Date	Author	HW ver.	SW ver.	Changed chapters	Reason of change
1.0	replaced	2015-12-09	Guido Neumann	see chapter 2.2.3	-	-	Initial
1.1	replaced	2016-02-05	Jiayi Dong	see chapter 2.2.3	2.2.3, 3.2	2.2.3, 3.2	ECO_IC_P32_ADICREF_UN D_BL
1.2	replaced	2016-08-02	Jiayi Dong	see chapter 2.2.3	2.2.3, 3.2	2.2.3, 3.2	ECO_MS16.3
1.3	replaced	2016-11-10	Adrian Spalinger	see chapter 2.2.3	3.4, 3.7	3.4, 3.7	Update of EN ISO 13849-1:2015
1.4	replaced	2017-07-14	Guido Neumann	see chapter 2.2.3	3.2	3.2	ECO_MS16.9
1.5	replaced	2017-08-01	Guido Neumann	see chapter 2.2.3	3.2	3.2	ECO RM48 Rev D + CAN Kontext
1.6	replaced	2017-09-11	Guido Neumann	see chapter 2.2.3	3.2; 3.4	3.2; 3.4	Add-on of assessment result according to ISO 25119 and EN 16590; new certificate number
1.7	replaced	2017-10-23	Guido Neumann	see chapter 2.2.3	2.2.3 Table 2,6,8 Chapter 3.2	2.2.3 Table 2,6,8 Chapter 3.2	new SW version
1.8	replaced	2018-02-01	Walter Schögl	see chapter 2.2.3			Math Lib + FPU
1.9	replaced	2019-01-31	Jiayi Dong	see chapter 2.2.3	2.2.3, 3.2	2.2.3, 3.2	ECO S-MS2018-1
1.10	replaced	2019-05-20	Thomas Kreten	see chapter 2.2.3	2.2.3, 3.2	2.2.3, 3.2	Fusion S-P
1.11	replaced	2019-06-28	Jiayi Dong	see chapter 2.2.3	1, 2.2.3, 3.2, 3.4, 4.1, 6	1, 2.2.3, 3.2, 3.4, 4.1, 6	ECO digsyFusion_Util_Safety ECO Fusionx01 ECO dfS-P 4GB CF-Karte ISO 25119-x:2018 New certificate number
1.12	replaced	2019-09-09	Jiayi Dong	see chapter 2.2.3	2.2.3, 3.2	2.2.3, 3.2	ECO_Lib-easy280_Safety ECO_FPU_Math_neueGerae teversionen
1.13	replaced	2020-04-01	Guido Neumann	see chapter 2.2.3	3.2	3.2	PowerUp cycle time max. 90 days ECO_S-MS2019-1



						New revisions in 2.2.3 ECO S-MS2020-1
1.14	replaced	2021-05-04	Walter Schlögl	see chapter 2.2.3	2.2.3, 3.2	
1.15	replaced	2022-09-28	G. Neumann	see chapter 2.2.3	2.2.3, 3.2, 3.8	New revisions in 2.2.3 Reformatting of tables in 2.2.3 Chapter 3.8 added formal adaptations to revised template TR_RA_F_04.07 Rev. 16 of TÜV SÜD Rail GmbH
1.16	active	2022-09-30	G. Neumann	see chapter 2.2.3	Table 4	Support system version updated

Table 1: Revision history



1 Target of Evaluation (ToE)

INTER CONTROL Hermann Köhler Elektrik GmbH & Co. KG assigned TÜV SÜD for testing and certifying the digsy® fusion S according to EN ISO 13849-1 Category 3 PL d and according to EN 16590-x, ISO 25119-x AgPL d.

The ToE (in the following named “digsy® fusion S”) is a control system for mobile driven machines, agricultural engineering or other outdoor appliances.

The digsy® fusion S is a modular system composed of the following safety related components:

- Safety Controller Module SCM
- Safety I/O Module SIOM

Each board is based on 2 micro controllers.

The SCM is capable of running a safe and an unsafe runtime system simultaneously. In variant digsy® fusion S-P, the unsafe runtime system runs on a separate board (GCM-P), which is connected to the SCM by a serial data bus. Due to suitable measures concerning Hardware and Software it is assured that the unsafe application cannot influence the safe application.

As application programming environment and runtime system for the PLC the pre-certified product “CODESYS Safety SIL2” of the manufacturer 3S is integrated into the digsy® fusion S.

2 System overview

2.1 Description

The digsy® fusion S Modules have a two channel architecture.

Channel 1 is based on a RM48Lxxx MCU (based on the ARM Cortex-R) from TI. The safe PLC application is executed on this MCU on the SCM.

Channel 2 is based on a STM32F207 MCU (based on the ARM Cortex-M3 series) from STMicroelectronics.

The two micro controllers are supervising each other via a fast inter-process communication (IPC).

A system overview of the digsy® fusion S series is depicted in Figure 1.

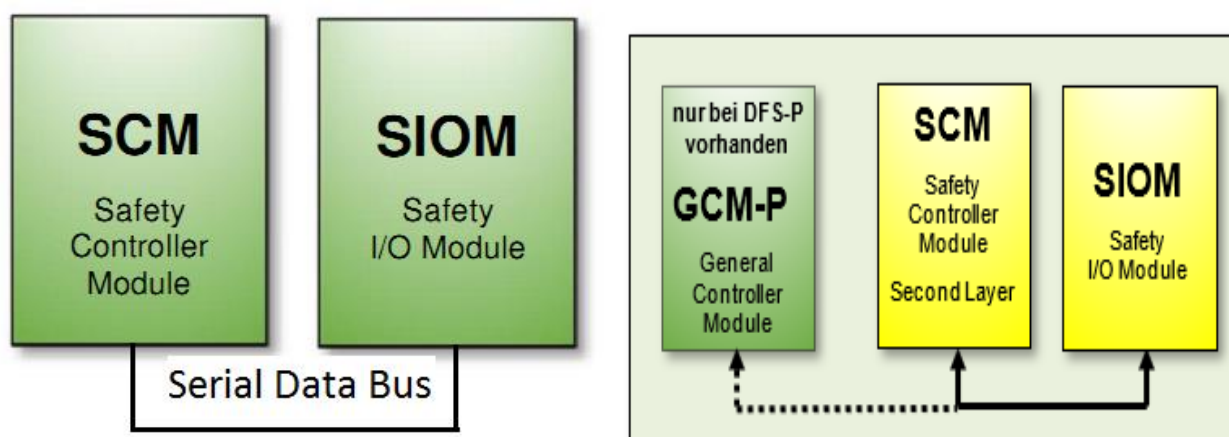


Figure 1: System overview of the digsy® fusion S / fusion S-P

The difference between digsy® fusion S and digsy® fusion S-P is that the unsafe runtime system runs on a separate (unsafe) board (GCM-P) which is connected to the SCM by a separate serial data bus.

2.2 Test specimen

2.2.1 Safety Controller Module SCM

The SCM runs the PLC application. Inputs and Outputs exist in different variants (type A – type E). Certain input/output types are independently configurable. It is also possible to configure certain inputs/outputs as non safe. Additional inputs/outputs can be integrated via SIOM. A maximum of 4 additional boards is supported. The communication between the SCM and the additional boards is done via an internal bus system based on serial Data Bus.

The SCM is available in two variants: SCM-Ethernet and SCM-Ethernet SL (SL = second layer). The difference is that the SCM-Ethernet SL is mounted on the second layer and used in conjunction with a GCM-P.



2.2.2 Safety I/O Module SIOM

The differences between SCM and SIOM are:

- The PLC application runs only on the SCM
- The SIOM has no external communication interfaces

2.2.3 Nomenclature of digsy® fusion S

The two boards as described in chapters 2.2.1 and 2.2.2 exist in different variants. The differences are mainly the memory capacity and the number of I/Os, representing different levels of computing power and application size.

The overall system version (Artikel-Nummer/order number) for digsy® fusion S is 4888.02.x0x or 4888.03.3xx digsy® fusion S-P

or

4888.04.3xx for digsy® fusion S-PL.

INTER CONTROL Hermann Köhler Elektrik GmbH & Co. KG sells several sets of pre-defined combinations with different order numbers as depicted in the safety manual 04-68490_DIGSYfusion_Safetymanual chapter 1.3.

Product No. / Produkt-Nr.	Item / Artikel	HW-Version		Module / Modul	FW-Version		
V01.09.XX 4888.04.301 4888.04.302 4888.04.304	digsy® fusion S-PL	GCM-PL:	V01.03.XX	GCM-Performance Linux	UBOOT (GCM-PL):	V11.06.27	
					Bootloader (GCM-PL):	V01.00.00	
					Bootloader 2 (GCM-PL):	V01.00.00	
					Firmware (GCM-PL):	V01.00.03	
		SCM:	V06.35.XX	SCM-Eth-SL	Fork (CPU0):	V01.01.00	
					Bootloader (CPU0):	V05.01.00	
					Firmware safe (CPU0):	V02.08.02	
					Fork (CPU1):	V01.01.01	
					Bootloader (CPU1):	V05.01.00	
					Firmware (CPU1):	V01.15.00	
		SIOM:	V04.35.XX	SIOM-Basic	Fork (CPU0):	V01.01.00	
					Bootloader (CPU0):	V05.01.00	
					Firmware (CPU0)	V01.24.00	
					Fork (CPU1):	V01.01.01	
					Bootloader (CPU1):	V05.01.00	
					Firmware (CPU1):	V01.15.00	
						Usage of FPU/Math. Library Requires CODESYS V3.5 SP11	
V01.08.XX 4888.04.301 4888.04.302 4888.04.304	digsy® fusion S-PL	GCM-PL:	V01.03.XX	GCM-Performance Linux	UBOOT (GCM-PL):	V11.06.27	
					Bootloader (GCM-PL):	V01.00.00	
					Bootloader 2 (GCM-PL):	V01.00.00	
					Firmware (GCM-PL):	V01.00.01	
		SCM:	V06.35.XX	SCM-Eth-SL	Fork (CPU0):	V01.01.00	
					Bootloader (CPU0):	V04.01.01	
					Firmware safe (CPU0):	V02.07.00	
					Fork (CPU1):	V01.01.01	
					Bootloader (CPU1):	V04.00.05	
					Firmware (CPU1):	V01.15.00	



Product No. / Produkt-Nr.	Item / Artikel	HW-Version		Module / Modul	FW-Version	
4888.03.301 4888.03.302 4888.03.304 4888.03.321 4888.03.322 4888.03.324	<i>digsy</i> [®] _{fusion} S-P	SCM:	V06.35.XX	SCM-Eth-SL	Fork (CPU0): Bootloader (CPU0): Firmware safe (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V04.00.05 V02.04.00 V01.01.01 V04.00.05 V01.12.00
SIOM:		V04.35.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V04.00.05 V01.22.00 V01.01.01 V04.00.05 V01.12.00	
				Usage of FPU/Math. Library Requires CODESYS V3.5 SP11		
V01.00.XX 4888.03.301 4888.03.302 4888.03.304 4888.03.321 4888.03.322 4888.03.324	<i>digsy</i> [®] _{fusion} S-P	GCM-P:	V01.02.XX	GCM- Performance	UBOOT (GCM-P): Bootloader (GCM-P): Firmware (GCM-P):	V11.06.27 V01.00.00 V01.00.00
SCM:		V06.35.XX	SCM-Eth-SL	Fork (CPU0): Bootloader (CPU0): Firmware safe (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V04.00.03 V02.03.00 V01.01.01 V04.00.01 V01.11.00	
SIOM:		V04.35.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V04.00.01 V01.21.00 V01.01.01 V04.00.01 V01.11.00	
				Usage of FPU/Math. Library Requires CODESYS V3.5 SP11		
V03.36.XX 4888.02.001 4888.02.002 4888.02.004 4888.02.005 4888.02.007 4888.02.101 4888.02.102 4888.02.104 4888.02.105 4888.02.107 4888.02.201 4888.02.202 4888.02.204	<i>digsy</i> [®] _{fusion} S	SCM:	V06.30.XX V06.35.XX	SCM-Ethernet	Fork (CPU0): Bootloader (CPU0): Firmware safe (CPU0): Firmware std (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V05.01.00 V02.08.02 V01.07.02 V01.01.01 V05.01.00 V01.15.00
<i>digsy</i> [®] _{fusion} S T2		SIOM:	V04.30.XX V04.35.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V05.01.00 V01.24.00 V01.01.01 V05.01.00 V01.15.00
<i>digsy</i> [®] _{fusion} S T3	GIOM	V04.35.XX	GIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V02.00.00 V05.01.00 V04.02.00 V02.00.00 V05.01.00 V04.02.00	



Product No. / Produkt-Nr.	Item / Artikel	HW-Version		Module / Modul	FW-Version	
4888.02.101 4888.02.102 4888.02.104 4888.02.201 4888.02.202 4888.02.204	<i>digsy</i> [®] _{fusion} S T2 <i>digsy</i> [®] _{fusion} S T3	SIOM:	V04.24.XX V04.30.XX V04.35.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.08.00 V01.09.01 V01.01.01 V01.07.00 V01.09.01
					Usage of FPU/Math. Library Requires CODESYS V3.5 SP5	
V02.16.XX 4888.02.001 4888.02.002 4888.02.004 4888.02.101 4888.02.102 4888.02.104 4888.02.201 4888.02.202 4888.02.204	<i>digsy</i> [®] _{fusion} S <i>digsy</i> [®] _{fusion} S T2 <i>digsy</i> [®] _{fusion} S T3	SCM:	V06.24.XX V06.30.XX	SCM-Ethernet	Fork (CPU0): Bootloader (CPU0): Firmware safe (CPU0): Firmware std (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.09.00 V01.08.01 V01.05.00 V01.01.01 V01.07.00 V01.08.01
		SIOM:	V04.24.XX V04.30.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.08.00 V01.08.01 V01.01.01 V01.07.00 V01.08.01
					Usage of FPU/Math. Library Requires CODESYS V3.5 SP5	
V02.10.XX 4888.02.001 4888.02.002 4888.02.004 4888.02.101 4888.02.102 4888.02.104 4888.02.201 4888.02.202 4888.02.204	<i>digsy</i> [®] _{fusion} S <i>digsy</i> [®] _{fusion} S T2 <i>digsy</i> [®] _{fusion} S T3	SCM:	V06.24.XX V06.30.XX	SCM-Ethernet	Fork (CPU0): Bootloader (CPU0): Firmware safe (CPU0): Firmware std (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.06.01 V01.06.06 V01.03.04 V01.01.01 V01.06.00 V01.06.06
		SIOM:	V04.24.XX V04.30.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.06.00 V01.06.06 V01.01.01 V01.06.00 V01.06.06
V02.08.XX 4888.02.001 4888.02.002 4888.02.004 4888.02.101 4888.02.102 4888.02.104	<i>digsy</i> [®] _{fusion} S <i>digsy</i> [®] _{fusion} S T2	SCM:	V06.24.XX	SCM-Ethernet	Fork (CPU0): Bootloader (CPU0): Firmware safe (CPU0): Firmware std (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.06.00 V01.05.01 V01.02.01 V01.01.01 V01.06.00 V01.05.01
		SIOM:	V04.24.XX	SIOM-Basic	Fork (CPU0): Bootloader (CPU0): Firmware (CPU0): Fork (CPU1): Bootloader (CPU1): Firmware (CPU1):	V01.01.00 V01.06.00 V01.05.01 V01.01.01 V01.06.00 V01.05.01



Product No. / Produkt-Nr.	Item / Artikel	HW-Version		Module / Modul	FW-Version	
V02.07.XX		SCM:	V06.24.XX	SCM-Ethernet	Fork (CPU0):	V01.01.00
4888.02.001	<i>digsy</i> [®] fusionS				Bootloader (CPU0):	V01.00.00
4888.02.002					Firmware safe (CPU0):	V01.05.00
4888.02.004					Firmware std (CPU0):	V01.02.01
4888.02.101	<i>digsy</i> [®] fusionS T2				Fork (CPU1):	V01.01.00
4888.02.102					Bootloader (CPU1):	V01.00.00
4888.02.104		SIOM:	V04.24.XX	SIOM-Basic	Firmware (CPU1):	V01.05.00
					Fork (CPU0):	V01.01.00
					Bootloader (CPU0):	V01.00.00
					Firmware (CPU0):	V01.05.00
					Fork (CPU1):	V01.01.00
					Bootloader (CPU1):	V01.00.00
					Firmware (CPU1):	V01.05.00

Table 2: Nomenclature digsy[®] fusion S

Note: The following firmware versions shall not be used:

FW (V02.15.XX)	SCM CPU0: V1.8.0 SCM CPU1: V1.8.0 SIOM CPU0: V1.8.0 SIOM CPU1: V1.8.0
FW (V03.25.XX)	SCM CPU0: V2.1.0 SCM CPU1: V1.9.0 SIOM CPU0: V1.9.0 SIOM CPU1: V1.9.0

Table 3: Withdrawn firmware versions



SW Library Name	Revision No.	MD5	Support system version
Fusionx01.compiled-library	V1.0.0.0	d004b3dcef7745a1b822884e02f10dc5	4888.02.x0x / V03.26.XX 4888.02.x0x / V03.30.XX 4888.02.x0x / V03.35.XX 4888.02.x0x / V03.36.XX 4888.03.3xx / V01.00.XX 4888.03.3xx / V01.05.XX 4888.03.3x5 / V01.06.XX 4888.03.3xx / V01.09.XX 4888.04.3xx / V01.08.XX 4888.04.3xx / V01.09.XX
lib_digsyfusion_Util_Safety.compiled-library	V1.4.0.0	45874c0f19e7a27399d4808aa5c66db0	4888.02.x0x / V03.26.XX 4888.02.x0x / V03.30.XX 4888.02.x0x / V03.35.XX 4888.02.x0x / V03.36.XX 4888.03.3xx / V01.00.XX 4888.03.3xx / V01.05.XX 4888.03.3x5 / V01.06.XX 4888.03.3xx / V01.09.XX 4888.04.3xx / V01.08.XX 4888.04.3xx / V01.09.XX
lib_Easy280_Safety.compiled-library	V1.0.1.1	706891970684b8aa44d7a9a145a2a887	4888.02.x0x / V03.26.XX 4888.02.x0x / V03.30.XX 4888.02.x0x / V03.35.XX 4888.02.x0x / V03.36.XX 4888.03.3xx / V01.00.XX 4888.03.3xx / V01.05.XX



			4888.03.3x5 / V01.06.XX 4888.03.3xx / V01.09.XX 4888.04.3xx / V01.08.XX 4888.04.3xx / V01.09.XX
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Table 4: Nomenclature of libraries



3 Certification Requirements

3.1 Basis of Certification

The certification of the digsy® fusion S is based on the regulations and standards listed in clause 3.3 to 3.6 of this document. This includes the successful completion of the following test segments:

- I. Functional safety
 - Analysis of the system structure (FMEA system)
 - Analysis of the hardware (FMEA component, quantitative analysis)
 - Analysis of the software
 - Fault simulations and software tests
 - Test of the fault prevention measures
 - Functional test
- II. Electrical safety
- III. Susceptibility to environmental errors
 - Climate and temperature
 - Mechanical effects
- IV. Electromagnetic compatibility
- V. Safety information in the product documentation (safety manual, operating instructions)
- VI. Product-related Quality Management in manufacturing and product care.

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.



3.2 Certification Documentation

- Technical Report by TÜV SÜD Rail GmbH
Report No. IN87732T Rev. 1.16 of 2021-05-03
- Technical Report of Modifications by TÜV SÜD Rail GmbH
Report No. IN99322T Rev. 1.1 of 2022-09-27
- User and safety manuals with related errata sheets (04-68490_digsy-fusion-S)

Based on the specified purpose of use of the digsy® fusion S in safety critical applications, the certification is based on the following set of standards. The issuance of the certificate states compliance with these references unless specifically noted otherwise.

3.3 European guidelines and national laws and regulations

2006/42/EC	European Directive on Safety of Machinery Council Directive of 17 May 2006 on the harmonisation of the laws of the Member States relating to machinery
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As a supplement to and to lend greater precision to legal requirements as well as the EC directives named "Basic Health and Safety Requirements", the test was performed based on the following additional standards and technical rules.



3.4 Functional Safety

The testing for functional safety is to be performed using the following standards and guidelines:

EN ISO 13849-1/ ISO 13849-1: 2015 (Cat. 3 PL d)	Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design
ISO 25119-1:2010 AgrPI corresponding to Cat. 3 PL d of EN ISO 13849-1	Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 1: General principles for design and development
ISO 25119-2:2010	Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 2: Concept phase
ISO 25119-3: 2010	Checklist for Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 3: Series development, hardware and software
ISO 25119-4:2010	Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 4: Production, operation, modification and supporting processes
EN 16590-1:2014	Tractors and machinery for agriculture and forestry – Safety-related parts of control systems – Part 1: General principles for design and development (ISO 25119-1:2010 modified)
EN 16590-2:2014	Tractors and machinery for agriculture and forestry – Safety-related parts of control systems – Part 2: Concept phase (ISO 25119-2:2010 modified);
EN 16590-3:2014	Tractors and machinery for agriculture and forestry – Safety-related parts of control systems – Part 3: Series development, hardware and software (ISO 25119-3:2010 modified);
EN 16590-4:2014	Tractors and machinery for agriculture and forestry – Safety-related parts of control systems – Part 4: Production, operation, modification and supporting processes (ISO 25119-4:2010 modified);
ISO 25119-1:2018	Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 1: General principles for design and development
ISO 25119-2:2018	Tractors and machinery for agriculture and forestry — Safety-related parts of control systems —



	Part 2: Concept phase
ISO 25119-3:2018	Checklist for Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 3: Series development, hardware and software
ISO 25119-4:2018	Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 4: Production, operation, modification and supporting processes

3.5 Basic Safety and Environmental Safety

To complete and to specify the technical requirements resulting from the essential requirements of the directives listed above the testing of Basic Safety is to cover the following standards:

EN 50178: 1997	Electronic equipment for use in power installations
DIN EN 61131-2:2008-04	Programmable controllers — Part 2: Equipment requirements and tests
DIN EN 60068-2-1:2008	Cold (storage)
DIN EN 60068-2-2:2008	Dry heat (storage)
DIN EN 60068-2-2:2008	Dry heat (in use)
DIN EN 60068-2-1:2008	Cold (in use)
DIN EN 60068-2-14 :2010	Change of temperature (in use)
DIN EN 60068-2-30:2006	Damp heat, cyclic (in use)
DIN EN 60068-2-27:2010-02	Shock
DIN EN 60068-2-64:2009-04	Vibration, broad-band random
DIN EN 60068-2-6 :2008-10	Vibration (sinusoidal)
DIN EN 60068-2-31:2009-04	Rough handling shocks
DIN IEC 60068-2-52:1996	Environmental testing – Part2: Tests, Tests Kb: Salt mist, cyclic (sodium chloride solution) Test Degree 2
EN 60529/A1: 2000	Degrees of protection provided by enclosures (IP Code)



3.6 Electromagnetic Compatibility

To complete and to specify the technical requirements resulting from the essential requirements of the directives listed above, the testing of Electromagnetic Compatibility is to cover the following standards:

EN 61326-3-1:2008	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications
ISO 7637-2:2011 (Ed.3)	Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only
ISO 7637-3:2007(Ed.2)	Road vehicles — Electrical disturbance from conduction and coupling — Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines

3.7 Safety information in the product documentation (safety manual, operating instructions)

EN ISO 13849-1/ ISO 13849-1: 2015 (Cat. 3 PL d)	Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design
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3.8 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	



4 Results

4.1 Functional Safety

The tests performed and quality assurance measures implemented by the manufacturer have shown that the digsy® fusion S complies with the testing criteria specified in clause 3 subject to the conditions defined in clause 5 and its subsections, and is suitable for safety-related use in applications up to category 3 PL d according to ISO13849-1 and up to AgPL d according to EN 16590-x and ISO 25119-x.

4.1.1 Fault Reaction and Timing

Fault detection in the digsy® fusion S is assured by means of following basic techniques:

- self test at power up and during operation
- two channel control logic with cross check
- redundancy
- dynamic signals
- de - energizing in case of over – and under-voltage
- de - energizing by watch dog monitoring

4.1.2 Evaluation of fault prevention measures

For the avoidance of failures the following techniques and measures were used:

- Project management
- Documentation
- Structured specification
- Inspection of the specification or walk-through of the specification
- Observance of relevant guidelines and standards
- Structured design
- Modularization
- Use of well-tried components
- Inspection of the hardware
- Functional testing (also under environmental conditions)
- Operational and maintenance instructions
- User- and maintenance friendliness

The individual measures for the avoidance of failures provide the required degree of effectiveness and are specified in the relevant documents



4.1.3 Analysis of the hardware safety integrity and hardware fault simulations (FIT)

The Failure Mode Effect and Diagnostic Analysis (FMEDA) showed that the occurrence of a single fault does not lead to loss of the safe function. The individual architectural constraints are sufficient and their corresponding degree of fault detection provide the required degree of effectiveness.

The response time has to be determined based on the information given in the safety manual and fulfills the specification.

4.2 Basic Safety and Electromagnetic Compatibility

4.2.1 Electrical Safety

The results about the electrical safety are documented by the certificates and test reports of an accredited test center. The documentation of the tests has been reviewed for completeness.

These certificates show that the standards specified in clause 3 are covered.

4.2.2 Environmental Testing

The environmental stress tests are documented by the certificates of accredited test centers.

The above mentioned certificates and tests and the quality assurance measures implemented by the manufacturer have shown that the digsy® fusion S complies with the testing criteria specified in clause 3 subject to the conditions defined in clause 5 and its subsections.

4.2.3 Electromagnetic Compatibility

The tests of the electromagnetic compatibility are documented by the certificates and test reports of an accredited test center. The documentation of the tests has been reviewed for completeness.

These certificates show that the standards specified in clause 3 are covered.

4.3 Product Specific Quality Assurance and Control

The software and hardware components developed and manufactured in course of the safety evaluation are governed by an ISO 9001 certified quality assurance and control system.

As part of the certification process TÜV Product Service also performs a procedure that is tailored to the assessed product in order to assess the consistency of product quality while accounting for product modifications and their identifiability (follow-up service).



5 Implementation Conditions and Restrictions

The use of the digsy® fusion S 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 digsy® fusion S is used in safety-related installations.

5.1 General Application Conditions

- The guidelines specified in the instruction manuals and errata sheets shall be followed.
- Only modules certified for safety-related operation shall be used for safety-critical functions.
- The fault tolerance period of the process controlled by the system shall be greater than the worst-case response time of the system.
- The digsy® fusion S can be used in applications up to category 3 PL d according to ISO13849-1.
- The power supply has to fulfil the requirements of SELV according to EN 61140.

5.2 General Commissioning Conditions

- The guidelines and the instructions for commissioning, described in the instruction manual, have to be followed.

5.3 General Run-time Conditions

- The operating conditions as specified in the instruction manuals shall be met.
- The system is designed for intermitted operation. The maximum run-time is 24 hours.
- The procedures of modification of safety related data and components described in the user manual have to be followed.
- The maintenance and repair instructions described in the instruction manual of the digsy® fusion S have to be followed.



6 Certificate Number

This report specifies technical details and implementation conditions required for the application of digsy® fusion S to the certificate:

Z10 020099 0006 Rev. 01

Munich, 2022-09-30

TÜV SÜD Rail GmbH
Rail Automation

Jiayi Dong
(Technical Certifier)