



# Confirmation

Manufacturer: Siemens AG

Product category: Fail-safe function blocks for storage and retrieval machines

Type: F\_SAFE\_POS  
F\_SLP\_MONITOR  
F\_ENDZONE  
F\_BRAKE\_TEST  
F\_LOAD\_MONITOR  
F\_MIN\_MAX  
F\_SBR\_MONITOR  
F\_SCALE\_DINT  
SCALE\_DINT

Application: Control and monitoring of storage and retrieval machines in conjunction with the safety-related automation systems SIMATIC S7 Distributed Safety and SIMATIC STEP 7 Safety Advanced of the company Siemens AG

Test report no.: E-F-2039-01-14 dated 2014-06-23

Test regulations: DIN EN 528: 2008  
DIN EN ISO 13849-1: 2008  
DIN EN ISO 13849-2: 2013  
DIN EN 62061: 2005

Result: The function blocks meet the applicable requirements as set out in the product and application standards. The applicable requirements are described in specifications and in the functional requirements outlined in the Manual. In line with the requirements, no retroactive effect was detected on the protection system which, depending on the type of the plant, must be composed of the blocks to control and monitor the storage and retrieval machines F\_SAFE\_POS, F\_SLP\_MONITOR, F\_ENDZONE, F\_BRAKE\_TEST, F\_LOAD\_MONITOR, F\_MIN\_MAX, F\_SBR\_MONITOR, F\_SCALE\_DINT and SCALE\_DINT. The conditions set out in the Test Report and in the relevant Manual shall be observed and adhered to.

TÜV SÜD Industrie Service GmbH  
Elektro- und Gebäudetechnik  
Niederlassung Regensburg

  
Matthias Graf

Regensburg, 2014-06-23



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## Report

on the safety-related and functional test of fail-safe function blocks to control and monitor storage and retrieval machines in conjunction with the safety-related automation systems SIMATIC S7 Distributed Safety and SIMATIC STEP 7 Safety Advanced of the company Siemens AG

**Testing Body** TÜV SÜD Industrie Service GmbH  
Abteilung Elektro- und Gebäudetechnik  
Niederlassung Regensburg

**Test Items** Fail-safe function blocks  
F\_SAFE\_POS  
F\_SLP\_MONITOR  
F\_ENDZONE  
F\_BRAKE\_TEST  
F\_LOAD\_MONITOR  
F\_MIN\_MAX  
F\_SBR\_MONITOR  
F\_SCALE\_DINT  
SCALE\_DINT

Date: 2014-06-23

Our reference:  
IS-EG1-RGB/mt

Report no.:  
E-T-2039-01-14

The document consists of  
9 pages.  
Page 1 of 9

**Manufacturer** Siemens AG  
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TÜV SÜD Industrie Service GmbH

**Scope of order** Safety-related and functional test of the fail-safe  
function blocks

Test results refer exclusively to  
the units under test.

**Employee in charge** Dipl.-Ing. (FH) Thomas Maget

**Test Period** 04/2014 – 06/2014

**Evaluation Criteria** See section 2



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## 1 Purpose and Scope of the Test

By order of Siemens AG a theoretical safety-related test on the documentation of the fail-safe function blocks to control and monitor storage and retrieval machines, as described below, in conjunction with the safety-related automation systems SIMATIC S7 Distributed Safety and SIMATIC STEP 7 Safety Advanced of Siemens AG, was performed, to verify their compliance with the requirements set out in the standards mentioned in Section 2 which form the basis for the test.

The successful validation of the documentation was made on the basis of practical tests performed in a simulation system by Siemens AG and TÜV SÜD Industrie Service GmbH, IS-EG1-RGB.

Fail-safe function blocks to control and monitor storage and retrieval machines are used to facilitate the programming, functional tests and final acceptance of the application-specific user programs.

## 2 Evaluation Criteria

The test was made on the basis of the standards and technical rules set out below, each in conjunction with the relevant conditions described in the Safety Manual of each of the safety-related automation systems:

- /G1/ DIN EN 528: 2008 "Rail Dependent Storage and Retrieval Equipment – Safety Requirements"
- /G2/ DIN EN ISO 13849-1: 2008 "Safety of Machinery – Safety-Related Parts of Control Systems – Part 1: General Principles of Design"
- /G3/ DIN EN ISO 13849-2: 2013 "Safety of Machinery – Safety-Related Parts of Control Systems – Part 2: Validation"
- /G4/ DIN EN 62061: 2005 "Safety of Machinery – Functional Safety of Safety-Related Electrical, Electronic and Programmable Electronic Control Systems"

## 3 Test Documents

The following documents were used for the test:

- /U1/ FSM/Validation Plan, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version D2 dated 2014-01-10
- /U2/ Safety Requirements Specification, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version D2 dated 2014-01-30
- /U3/ Functional Design Specification, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version F2 dated 2014-05-05
- /U4/ Safety Requirements Tracking List, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version C2 dated 2014-05-14
- /U5/ Detail Design Specification, F\_SAFE\_POS, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version G2 dated 2014-05-06
- /U6/ Detail Design Specification, F\_SLP\_MONITOR, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version E2 dated 2014-05-06
- /U7/ Detail Design Specification, F\_ENDZONE, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version E2 dated 2014-05-06
- /U8/ Detail Design Specification, F\_Brake\_TEST, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version E2 dated 2014-05-06

- /U9/ Detail Design Specification, F\_LOAD\_MONITOR, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version E2 dated 2014-05-06
- /U10/ Detail Design Specification, F\_MIN\_MAX, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version D2 dated 2014-05-06
- /U11/ Detail Design Specification, F\_SBR\_MONITOR, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version F2 dated 2014-05-06
- /U12/ Detail Design Specification, F\_SCALE\_DINT, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version D2 dated 2014-05-06
- /U13/ Detail Design Specification, SCALE\_DINT, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version E2 dated 2014-05-06
- /U14/ Module Test Report, F\_SAFE\_POS, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-04-02
- /U15/ Module Test Report, F\_SLP\_MONITOR, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-04-02
- /U16/ Module Test Report, F\_ENDZONE, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-04-02
- /U17/ Module Test Report, F\_BRAKE\_TEST, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version B2 dated 2014-05-12
- /U18/ Module Test Report, F\_LOAD\_MONITOR, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version B2 dated 2014-05-12
- /U19/ Module Test Report, F\_MIN\_MAX, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-04-02
- /U20/ Module Test Report, F\_SBR\_MONITOR, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-04-02
- /U21/ Module Test Report, SCALE\_DINT und F\_SCALE\_DINT, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-04-02
- /U22/ Handbuch, Fehlersichere Funktionsbausteine für Regalbediengeräte, Distributed Safety / TIA Safety Advanced, Edition 06/2014, Version v1.0
- /U23/ Factory Acceptance Test Report, Projekt: fehlersichere Funktionsbausteine für Regalbediengeräte, Version A2 dated 2014-05-28
- /U24/ Print-out of the test project for the Factory Acceptance Test, Total Signature Safety Program 8032E645, V5.4+SP5, time of generation: 2014-05-28 13:27:21
- /U25/ Records of the expected Results/Signals through the SPS Analyzer Pro 5 (AUTEM), dated 2014-05-27/28

#### 4 Description of Test Items

The software function blocks listed below

F_SAFE_POS	Function block to create a safe actual position and actual speed value
F_SLP_MONITOR	Function block for safe position monitoring
F_ENDZONE	Function block to monitor the speed at the end zone of the movement range



F_BRAKE_TEST	Function block to perform a safe brake test in combination with the drive function <i>SBT</i>
F_LOAD_MONITOR	Function block to recognise overload and slack rope, including the option to test the measuring unit
F_MIN_MAX	Function block for minimum / maximum value selection
F_SBR_MONITOR	Function block for monitoring the brake ramp
F_SCALE_DINT, SCALE_DINT	Blocks for safe scaling of 32Bit values

are intended to be used, depending on the relevant application, in a system to control and monitor storage and retrieval machines in the programming environments SIMATIC STEP 7 Professional V5.5 + SP3 (or higher) with Distributed Safety V5.4 + SP5 and/or SIMATIC STEP 7 Professional V13 (or higher) with SIMATIC STEP 7 V13 with Safety Advanced V13, in conjunction with the fail-safe automation components of the company Siemens AG.

The blocks map the protective function which is mandatorily prescribed in DIN EN 528.

In order to be able to achieve the defined protection targets, the following automation blocks are necessary as a minimum:

- Fail-safe control SIMATIC S7– Distributed Safety, usable up to SIL3/PLe, inclusive, pursuant to the Certificate Z10 09 07 67803 003 issued by TÜV SÜD Product Service GmbH and the associated Test Report SN73331C issued by TÜV SÜD Rail GmbH;
- Frequency inverter SINAMICS S120 with Control Unit CU320-2 (beginning with Firmware 4.6) with encoder(s) on sensor modules SMC20/SMC30 or via DRIVE-CLiQ, usable up to SIL2/PLd, inclusive, pursuant to the Certificate Z 10 11 04 59719 003 issued by TÜV SÜD Product Service GmbH and the associated Test Report SE83704C issued by TÜV SÜD Rail GmbH;
- PROFIsafe transmission between SINAMICS and F-CPU;
- F-DO assembly for controlling the brakes;
- F-AI assembly or comparably safe signal source for load measuring during the recognition of overload / slack rope;
- External mechanic brake and/or motor holding brake.

The block package covers several versions of encoder combinations. It is possible to select both one-encoder systems consisting of one safe motor encoder with a safe (form-fit) connection and two- or three-encoder systems consisting of several non-safe encoders, depending on the application.

User must determine the safety integrity level / performance level of the protective functions based on the different encoder versions and the resulting hardware versions which can be used for a variety of purposes. The design forming the subject matter hereof is able to achieve a maximum of SIL2 / PLd.

## 5 Test Performance

The application-related valuation of the individual function blocks which was made on the basis of the standards set out under Art. 2 was performed on the basis of the specification documents submitted (Safety Requirements Specification, Functional Design Specification und Detail Design Specification etc.).

The specifications were verified and validated on the basis of the module tests performed by Siemens AG, on the one hand, and, by practical trials performed in a simulation system during the Factory Acceptance Tests (FAT), by Siemens AG and TÜV SÜD Industrie Service GmbH, IS-EG1-RGB, on the other hand.

## 6 Test Result

Below are the results of the theoretical and practical tests.

### 6.1 Management of the Functional Safety

Given the fact that Siemens AG operates a system for the management of the functional safety pursuant IEC 61508-1 to -7:2011, it was assumed that the function blocks forming the subject matter hereof are sufficiently free of systematic errors.

Certificates are in place to confirm that the automation components used for the tests are suitable for use in safety-related applications (see section 4).

The measures necessary to avoid errors in the development of the software are sufficiently complied with on account of the programming environments (SIAMTIC STEP 7) which have already undergone testing.

The individual blocks are mapped in software modules. The software was developed on the basis of the V model and created in a manner to ensure modularity and testability.

The achievement of the functionality, operational sequence and time-related information, limits as to time, compliance, data structure and property of data, assumptions and dependencies in the draft and the testability have sufficiently been taken into account for the individual applications and are sufficiently described in the specification documents of the individual blocks.

### 6.2 Test of Block F\_SAFE\_POS "Safe Position and Speed"

The functionality test of the block F\_SAFE\_POS performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_SAFE\_POS" (see section 3) revealed that the requirements specified therein were properly complied with for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

### 6.3 Test of Block F\_SLP\_MONITOR "Safe Position"

The functionality test of the block F\_SLP\_MONITOR performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_SLP\_MONITOR" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

### 6.4 Test of Block F\_ENDZONE "Monitor the Speed at the End Zone of the Movement Range"

The functionality test of the block F\_ENDZONE performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_ENDZONE" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

#### 6.5 Test of Block F\_BRAKE\_TEST "Brake Test"

The functionality test of the block F\_BRAKE\_TEST performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_BRAKE\_TEST" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

#### 6.6 Test of Block F\_LOAD\_MONITOR "Recognition of Overload and Slack Rope"

The functionality test of the block F\_LOAD\_MONITOR performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_LOAD\_MONITOR" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

#### 6.7 Test of Block F\_MIN\_MAX "Minimum / Maximum Value Selection"

The functionality test of the block F\_MIN\_MAX performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_MIN\_MAX" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

#### 6.8 Test of Block F\_SBR\_MONITOR "Brake Ramp Monitor"

The functionality test of the block F\_SBR\_MONITOR performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification" and "Detail Design Specification F\_SBR\_MONITOR" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

#### 6.9 Test of Block F\_SCALE\_DINT, SCALE\_DINT "Safe Scaling of 32Bit Values"

The functionality test of the block F\_SCALE\_DINT, SCALE\_DINT performed on the basis of the documents "Safety Requirements Specification", "Functional Design Specification", "Detail Design Specification F\_SCALE\_DINT" and "Detail Design Specification SCALE\_DINT" (see section 3) revealed that the requirements specified therein were properly met for the individual application.

The conditions mentioned in section 8 must mandatorily be taken into account for any use of the function block.

#### 6.10 Module Tests and Factory Acceptance Test (FAT)

The requirements determined in the specification documents for the function blocks were verified and validated on the basis of the module tests performed by Siemens AG. The validation documents presented (Module Test Specifications, Module Test Reports, see section 3) proved that the requirements specified for the individual function blocks were properly realised.

The safety-relevant functions/properties of the blocks were finally validated on the basis of practical trials performed in the context of a Factory Acceptance Tests (FAT) in a simulation system,



conducted by Siemens AG in the presence of TÜV SÜD Industrie Service GmbH, IS-EG1-RGB in the period from 27 to 28 May.

At the end of the tests, the following total signature was found for the fail-safe application program of the test design: 8032E645 with the time stamp 28 May 2014 13:27:21

### 6.11 Block Numbers and Signatures

The function blocks are summarised in the libraries "RBG\_Failsafe\_DS\_V5\_4" for SIMATIC S7 Distributed Safety Programming" or "RBG\_Failsafe\_TS\_V13" for SIMATIC STEP 7 Safety Advanced and are thus available to the application.

The blocks are only available in the libraries in blocked versions and can no longer be changed. Users have no option to cancel such blocking.

Below is a compilation of the block numbers and signatures for verification:

<i>Number of block</i>	<i>Name of block</i>	<b>SIMATIC S7 Distributed Safety Programming</b>		<b>SIMATIC STEP 7 Safety Advanced</b>	
		<b>Signature of block</b>	<b>Initial value signature</b>	<b>Signature of block</b>	<b>Initial value signature</b>
FB 200	F_SAFE_POS	980B	B06D	51BB	B06D
FB 201	F_SLP_MONITOR	8DE4	5896	E66B	5896
FB 203	F_BRAKE_TEST	610B	64F3	610B	64F3
FB 204	F_LOAD_MONITOR	2644	129F	2644	129F
FB 207	F_SBR_MONITOR	2935	A68E	2935	A68E
FB 208	F_SCALE_DINT	0797	8DF7	0797	8DF7
FB 210	F_ENDZONE_DB16000	5796	222F	0884	222F
FB 211	F_ENDZONE_DB15999	7CE3	222F	23F1	222F
FB 212	F_ENDZONE_DB15998	FB9B	222F	A489	222F
FB 213	F_ENDZONE_DB511	7AA8	222F	25BA	222F
FB 214	F_ENDZONE_DB510	FDD0	222F	A2C2	222F
FB 215	F_ENDZONE_DB509	7459	222F	2B4B	222F



FC 206	F_MIN_MAX	6A25	none, as FC	6A25	none, as FC
FC 208	SCALE_DINT	none, as standard block	none, as standard block	none, as standard block	none, as standard block

## 7 Assessment, Summary

The safety-related and functional test of the fail-safe function blocks

F\_SAFE\_POS  
 F\_SLP\_MONITOR  
 F\_ENDZONE  
 F\_BRAKE\_TEST  
 F\_LOAD\_MONITOR  
 F\_MIN\_MAX  
 F\_SBR\_MONITOR  
 F\_SCALE\_DINT  
 SCALE\_DINT

revealed that these can be used to control and monitor storage and retrieval machines.

The functional requirements set out in the standards and technical rules below, can be met if the function blocks are parameterised and if the inputs and outputs are linked according to the application-specific requirements and by taking into account the software requirement specifications for the function blocks and by complying with the measures mentioned in section 8:

- DIN EN 528: 2008 "Rail Dependent Storage and Retrieval Equipment – Safety Requirements"
- DIN EN ISO 13849-1: 2008 "Safety of Machinery – Safety-Related Parts of Control Systems – Part 1: General Principles of Design"
- DIN EN ISO 13849-2: 2013 "Safety of Machinery – Safety-Related Parts of Control Systems – Part 2: Validation"
- DIN EN 62061: 2005 "Safety of Machinery – Functional Safety of Safety-Related Electrical, Electronic and Programmable Electronic Control Systems"



## 8 Measures

The following shall be observed in the use of the function blocks:

- 8.1 The standards and notes set out in the specifications and the Safety Manual (see section 3) must mandatorily be observed for the function blocks forming the subject matter hereof.
- 8.2 The proper wiring of the blocks themselves and the wiring of the individual blocks among each other shall be validated on site by taking into consideration the relevant applications and plant conditions. The user shall be responsible for the correct wiring of the block(s).
- 8.3 The type of stop reaction (SS2, SS1, STO) to be performed and the time until the standstill shall be determined and validated on site, on the basis of the risk assessment of the machine and by considering the relevant applications and plant conditions. The user shall be responsible for the correct wiring of the stop signals provided in his switch-off logic.
- 8.4 The user must determine the safety integrity levels / performance levels of the safety functions realised by all function blocks forming the subject matter hereof. They must always observe the entire safety function, including the periphery (sensory devices, actuators). The safety functions must meet the relevant requirements of DIN EN 528 Table C2.
- 8.5 It must be validated whether the check sums of the blocks used on site correspond to the check sums of the blocks set out in the Report.

A handwritten signature in blue ink, appearing to be 'Graf'.

Graf  
Niederlassung Regensburg  
Abteilung Elektro- und Gebäudetechnik

A handwritten signature in blue ink, appearing to be 'Maget'.

Maget  
Employee in charge