



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

PR Project name:SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

Projectfile name:	G:\00 Project D\02 1117B\DL\«Y, Å×Ó¼¼¼â\1117B\09Bolt MDÔô¼¼ÔĐÍ°Å»úÓÚ1117B\NR.2025.1117B\MD\13 Test report\SISTEMA EVALUATION REPORT1.ssm
Creationdate:	21/12/2021 16:42:32
Projectstatus:	Completed (GREEN)
Project number:	NR.2025.1117B.3
Projectversion:	V1.0
At thors:	NIUSAFETEC
Project managers:	Kevin Hong
Inspect ors:	George Chen
Dangerouspoint/machine:	(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)
Document at i on:	TCF
Document :	
Versionof software:	3.0.4 build 5
Versionof standard:	ISO 13849-1:2023, ISO 13849-2:2012
Checksum	d8df7f7ff332d54f15810479203152ab
Options:	☒ Use DC intermediate levels for calculation of PFH (more precise) ☐ MTTFD capping for category 4 lower from 2500 to 100 years.
Status:	✔ green
Note:	There are no warnings listed for this project (or it's subordinate basic elements).

Print options

- | | |
|--|---|
| ☒ Show device details | ☒ Show requirements on PL and Category |
| ☒ Show documentations on SF, SB, BL and EL | ☒ Show parameter documentations on PLr, PL, Category, CCF, MTTFD and DC |
| ☒ Show CCF and DC measures in detail | ☒ Show messages |

Contained safety functions

SF Name: Emergency stop for the laser [SF1]

Required: PLr d	Reached: PL d	PFH[1/h]: 1.22E-7	Status: green
-----------------	---------------	-------------------	---------------

List of documented messages:

- No message known

List of devices with a permissible operation time (T10D) of less than 20 years:

- No devices known



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

PR Project name:SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

SF Name: Emergency stop for the motors [SF1]

Required:PLr c	Reached:PL d	PFH[1/h]: 1.22E-7	Status: green
----------------	--------------	-------------------	---------------

List of documented messages:

- No message known

List of devices with a permissible operation time (T10D) of less than 20 years:

- No devices known

SF Name: Interlocking guard for the laser [SF3]

Required:PLr d	Reached:PL d	PFH[1/h]: 1.22E-7	Status: green
----------------	--------------	-------------------	---------------

List of documented messages:

- No message known

List of devices with a permissible operation time (T10D) of less than 20 years:

- No devices known

SF Name: Interlocking guard for the motors [SF3]

Required:PLr d	Reached:PL d	PFH[1/h]: 1.22E-7	Status: green
----------------	--------------	-------------------	---------------

List of documented messages:

- No message known

List of devices with a permissible operation time (T10D) of less than 20 years:

- No devices known



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Identifier of the Safetyfunction:	SF1
Safetyfunction type:	Emergency stop function
Triggering event:	Push the emergency stop button
Reaction and Behaviour on power failure:	Initiated by pushing the emergency stop button to stop the laser by cutting off power supply to laser
Safetate:	Cut off power supply to laser
Operation mode:	All mode
Interfaces:	
Demand rate:	12 times/year
Running-ortime:	--
Priority:	Highest
Document at i on:	TCF
Document :	

Required Performance Level Safety function

PL (by risk graph):	d
Severity of injury (S):	Serious (normally irreversible) injury or death
Frequency exposure times to hazard f:	Seldom to less often / exposure time is short
Possibility of avoiding (P):	Scarcely possible
Risk graph:	
Document at i on:	TCF
Document :	

Performance Level Safety function

Reached PL:	d	PF [1/h]:	1.22E-7
-------------	---	-----------	---------

Electromagnetic immunity, EMI (Annex L) Safety function

Route for fulfilment of EMI measures:	n/a
Document at i on:	
Document:	

List of devices with a permissible operation time (T10D) of less than 20 years:

Device:	
---------	--



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Status / Messages Safety function

Status: green

Subsystem 1 / 3)

SB Name: INPUT (E-stop pilot device)

Reference designator: SB1

Inventory number: SB Emergency stop

Device details Subsystem

Device Manufacturer: Schneider electric

Device Identifier: SB Emergency stop

Device group: SB Emergency stop

Part number: SB Emergency stop

Revision: SB Emergency stop

Function: ☒ Input ☐ Logic ☐ Output ☐ unknown

Use case: Input emergency stop signal

Description of the use case:

Input emergency stop signal to the logic unit

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PL determination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspects suitable upto PL: n/a

Documentation:

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Reached PL:	e	PF ₁ [1/h]:	4.29E-8
-------------	---	------------------------	---------

Document at i on:
TCF

Category Subsystem

a.:	3
-----	---

Category requirements:	fulfilled
------------------------	-----------

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-tried safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:
TCF

Source (e.g. standard) Category:	EN ISO 13849-1
----------------------------------	----------------

Re

MTTFD and Mission time Subsystem

MTTFD ₁ [a]:	100 (High)
-------------------------	------------

Mission time [a]:	20	Shortest mission time [a]:	20
-------------------	----	----------------------------	----

Diagnostic coverage Subsystem

DCavg [%]:	90 (Medium)
------------	-------------

Common cause failure Subsystem

CCF Points:	75 (fulfilled)
-------------	----------------

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Components used are well-tried | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)
- 10 Points | Other influences | Environmental (section F.3.6)

Document at i on:
TCF

Document :

Status / Messages Subsystem

Status:	green
---------	-------



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: INPUT

Referencedesignator:	BL1-1
Inventory number:	SB Emergency stop
Device details Block	
DeviceManufacturer:	Schneider electric
DeviceIdentifier:	SB Emergency stop
Devicegroup:	INPUT DEVICE
Part number:	SB Emergency stop
Revision:	SB Emergency stop
Function:	☒ Input☐ Logic☐ Output☐ unknown
Technology:	electromechanic
Category:	1
Usecase:	Input emergency stop signal
Description of the usecase: Input emergency stop signal to the logic unit	

Documentation Block

Document at i on:
TCF
Document :

MTTFD and Mission time Block

MTTFD[a]:	83333.3 (High)		
Missiontime [a]:	20	Shortest missiontime [a]:	20

Diagnostic coverage Block

DC[%]:	90 (Medium)
--------	-------------

Status / Messages Block

Status:	green
---------	-------

Elements(1 / 1)

EL Name: E-STOP contact

Referencedesignator:	EL1-1
----------------------	-------



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Inventory number:	SB Emergency stop		
Device details Element			
DeviceManufacturer:	Schneider electric		
DeviceIdentifier:	SB Emergency stop		
Devicegroup:	INPUT DEVICE		
Part number:	SB Emergency stop		
Revision:	SB Emergency stop		
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown	
Technology:	electromechanic		
Category:	1		
Usecase:	Input emergency stop signal		
Description of the usecase: Input emergency stop signal to logic unit			
Documentation Element			
Document at i on:	TCF		
Document :			
MTTFD and Mission time Element			
MTTFD[a]:	83333.3 (High)		
Missiontime[a]:	20		
B10D[cycles]:	100000	no[cycles/a]:	12
Document at i on:	EN ISO 13849-1 B10D DATA		
Document :			
Diagnostic coverage Element			
DC[%]:	90 (Medium)		
Measure:	Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally open and normally closed mechanically linked contacts (Input devices) (90 %)		
Document at i on:	TCF		
Document :			
Status / Messages Element			
Status:	green		



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Channels Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: INPUT

Referencedesignator:	BL1-2
Inventory number:	SB Emergency stop
Device details Block	
DeviceManufacturer:	Schneider electric
DeviceIdentifier:	SB Emergency stop
Devicegroup:	INPUT DEVICE
Part number:	SB Emergency stop
Revision:	SB Emergency stop
Function:	☒ Input ☐ Output ☐ Logic ☐ unknown
Technology:	electromechanic
Category:	1
Use case:	Input emergency stop signal
Description of the use case: Input emergency stop signal to the logic unit	

Documentation Block

Document at i on:
TCF
Document :

MTTFD and Mission time Block

MTTFD[a]:	83333.3 (High)		
Mission time [a]:	20	Shortest mission time [a]:	20

Diagnostic coverage Block

DC[%]:	90 (Medium)
--------	-------------

Status / Messages Block

Status:	green
---------	-------

Elements(1 / 1)

EL Name: E-STOP contact

Referencedesignator:	EL1-2
----------------------	-------



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Inventory number:	SB Emergency stop		
Device details Element			
DeviceManufacturer:	Schneider electric		
DeviceIdentifier:	SB Emergency stop		
Devicegroup:	INPUT DEVICE		
Part number:	SB Emergency stop		
Revision:	SB Emergency stop		
Function:	☒ Input	☐ Logic	
	☐ Output	☐ unknown	
Technology:	electromechanic		
Category:	1		
Usecase:	Input emergency stop signal		
Description of the usecase: Input emergency stop signal to logic unit			
Documentation Element			
Document at i on:	TCF		
Document :			
MTTFD and Mission time Element			
MTTFD[a]:	83333.3 (High)		
Missiontime[a]:	20		
B10D[cycles]:	100000	no[cycles/a]:	12
Document at i on:	EN ISO 13849-1 B10D DATA		
Document :			
Diagnostic coverage Element			
DC[%]:	90 (Medium)		
Measure:	Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally open and normally closed mechanically linked contacts (Input devices) (90 %)		
Document at i on:	TCF		
Document :			
Status / Messages Element			
Status:	green		



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Subsystem(2 / 3)

SB Name: Logic

Reference designator:	SB2
Inventory number:	Logic unit
Device details Subsystem	
DeviceManufacturer:	schmersal
DeviceIdentifier:	Logic unit
Devicegroup:	Logic unit
Part number:	Logic unit
Revision:	Logic unit
Function:	☐ Input ☒ Logic ☐ Output ☐ unknown
Usecase:	Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the usecase:
Receive the emergency stop input signal and generate safety output control signal to cut off the laser

Documentation Subsystem

Document at i on:	TCF
Document :	

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL:	e
Documentation:	TCF
Document:	

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures:	The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.
PL requirements:	fulfilled

ThePLshall be determinedbythe estimation of the following aspects(section 6.1.1):
- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL:	e	PF[L/h]:	5.38E-8
-------------	---	----------	---------



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Document at i on:

Manufacturer's data

Category Subsystem

a.: 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-tried safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:

Manufacturer's data

Source (e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD[a]: 50 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20

Diagnostic coverage Subsystem

DCavg[%]: 99 (High)

Common cause failure Subsystem

CCFPoints: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on:

TCF

Document :

Status / Messages Subsystem

Status: green

Channels Test channels(1 / 2)

CH Name: Channel 1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

MTTFD [a]: 50

Block(1 / 1)

BL Name: Logic

Referencedesignator: BL1

Inventory number: MCU1

Device details Block

DeviceManufacturer:

DeviceIdentifier:

Devicegroup:

Part number:

Revision:

Function: ☐ Input ☐ Logic ☐ Output ☒ unknown

Technology: electronic

Category: -

Usecase: Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the usecase: Receive the emergency stop input signal and generate safety output control signal to cut off the laser

Documentation Block

Document at i on: TCF

Document :

MTTFD and Mission time Block

MTTFD[a]: 50 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20

Diagnostic coverage Block

DC[%]: 99 (High)

Status / Messages Block

Status: green

Element(1 / 1)

EL Name: MCU1

Referencedesignator: EL1

Inventory number: EL1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Device details Element

DeviceManufacturer:			
DeviceIdentifier:			
Devicegroup:			
Part number:			
Revision:			
Function:	☐ Input	☐ Logic	☒ unknown
		☐ Output	
Technology:	electronic		
Category:	-		
Use case:	Receive the emergency stop input signal and generate safety output control signal to the actuator		
Description of the use case: Receive the emergency stop input signal and generate safety output control signal to cut off the laser			

Documentation Element

Document at i on:
TCF
Document :

MTTFD and Mission time Element

MTTF[a]:	50 (High)		
Mission time [a]:	20		
MTBF[a]:	50	RDF[%]:	100
Document at i on:			
Document :			

Diagnostic coverage Element

DQ[%]:	99 (High)
Measure: Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays (Logic) (99 %)	
Document at i on: TCF	
Document :	

Status / Messages Element

Status:	green
---------	-------



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergency stop for the laser

Channels Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 50

Blocks(1 / 1)

BL Name: Logic

Reference designator:	BL2		
Inventory number:	MCU2		
Device details Block			
Device Manufacturer:			
Device Identifier:			
Device group:			
Part number:			
Revision:			
Function:	☐ Input	☐ Logic	
	☐ Output	☒ unknown	
Technology:	electronic		
Category:	-		
Use case:	Receive the emergency stop input signal and generate safety output control signal to the actuator		

Description of the use case:
Receive the emergency stop input signal and generate safety output control signal to cut off the laser

Documentation Block

Document ation:	
TCF	
Document :	

MTTFD and Mission time Block

MTTFD [a]:	50 (High)		
Mission time [a]:	20	Shortest mission time [a]:	20

Diagnostic coverage Block

DC [%]:	99 (High)
---------	-----------

Status / Messages Block

Status:	green
---------	-------

Elements(1 / 1)

EL Name: MCU1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Reference designator:	EL1		
Inventory number:	EL1		
Device details Element			
DeviceManufacturer:			
DeviceIdentifier:			
Devicegroup:			
Part number:			
Revision:			
Function:	☐ Input ☐ Output	☐ Logic ☒ unknown	
Technology:	electronic		
Category:	-		
Use case:	Receive the emergency stop input signal and generate safety output control signal to the actuator		
Description of the use case:	Receive the emergency stop input signal and generate safety output control signal to cut off the laser		

Documentation Element			
Document at i on:	TCF		
Document :			

MTTFD and Mission time Element			
MTTF[a]:	50 (High)		
Mission time [a]:	20		
MTBF[a]:	50	RDF[%]:	100
Document at i on:			
Document :			

Diagnostic coverage Element			
DC[%]:	99 (High)		
Measure:	Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays (Logic) (99 %)		
Document at i on:	TCF		
Document :			

Status / Messages Element			
---------------------------	--	--	--



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Satus:	green		
--------	-------	--	--

Subsystem3 / 3)

SB

Name: Output (AC contactor)

Referencedesignator:	SB3		
Inventory number:	output ac contactor		
Device details Subsystem			
DeviceManufacturer:	schneider electric		
DeviceIdentifier:	output ac contactor		
Devicegroup:	Output		
Part number:	output ac contactor		
Revision:	output ac contactor		
Function:	☐ Input	☐ Logic	
	☒ Output	☐ unknown	
Usecase:	Receive safety control signal from upstream and cut off the power supply to laser		
Description of the usecase: Receive safety control signal from upstream and cut off the power supply to laser			
Documentation Subsystem			
Document at i on:	TCF		
Document :			
Performance Level Subsystem			
PLdetermination:	Determine PL/PFH from Category, MTTFD and DCavg		
Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem			
Qualitative aspectssuitable upto PL:	d		
Documentation:			
Document:			
Electromagnetic immunity, EMI (Annex L) Subsystem			
Route for fulfilment of EMI measures:	The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.		
PL requirements:	fulfilled		
ThePLshall be determinedbythe estimation of the following aspects(section 6.1.1): - Behaviour of the safety function under fault conditions [fulfilled] - Safety-related software according to clause 7 and Annex J or no software included [fulfilled] - Systematic failure (see clause 6.1.7 and Annex G) [fulfilled] - Ability to perform a safety function under expected environmental conditions [fulfilled]			
Reached PL:	d	PFIL/h]:	2.47E-8



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Document at i on:

Manufacturer's data

Category Subsystem

a.: 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-ried safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:

Manufacturer's data

Source (e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD [a]: 100 (High)

Missiortime [a]: 20 **Shortest missiortime [a]:** 20

Diagnostic coverage Subsystem

DCavg [%]: 99 (High)

Common cause failure Subsystem

CCFPoints: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Components used are well-ried | Design/application/experience (section F.3.3)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on:

TCF

Document :

Status / Messages Subsystem

Status: green

Message (Status of Message):

- Because of qualitative aspects (e.g. software), the subsystem is only suitable up to performance level "d". [green]



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: AC contactor

Referencedesignator:	BL3-1
Inventory number:	output ac contactor
Device details Block	
DeviceManufacturer:	output ac contactor
DeviceIdentifier:	KM
Devicegroup:	Output
Part number:	output ac contactor
Revision:	output ac contactor
Function:	☐ Input ☒ Logic ☒ Output ☐ unknown
Technology:	electromechanic
Category:	1
Usecase:	Receive safety control signal from upstream and cut off the power supply to laser

Description of the usecase:
Receive safety control signal from upstream and cut off the power supply to laser

Documentation Block

Document ation:	TCF
Document :	

MTTFD and Mission time Block

MTTFD[a]:	509.6 (High)		
Missiontime [a]:	20	Shortest missiontime [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Elements(1 / 1)

EL Name: AC contactor



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7f332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Reference designator:	EL3-1		
Inventory number:	output ac contactor		
<i>Device details Element</i>			
DeviceManufacturer:	Schneider electric		
DeviceIdentifier:	KM		
Devicegroup:	Output		
Part number:	output ac contactor		
Revision:	output ac contactor		
Function:	☐ Input ☒ Output	☐ Logic ☐ unknown	
Technology:	electromechanic		
Category:	1		
Use case:	Receive safety control signal from upstream and cut off the power supply to laser		
Description of the use case: Receive safety control signal from upstream and cut off the power supply to laser			

Documentation Element

Document at i on:	TCF
Document :	

MTTFD and Mission time Element

MTTFD[a]:	509.6 (High)		
Mission time [a]:	20		
B10Dcycles]:	1369863	no cycles/a]:	26880
No parameter:	Days: 280	Hours: 16	Seconds: 600
Document at i on:	TCF		
Document :			

Diagnostic coverage Element

DQ[%]:	99 (High)
Measure:	Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Output device) (99 %)
Document at i on:	
Document :	



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Status / Messages Element

Status: green

Channels Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: AC contactor

Reference designator: BL3-2

Inventory number: output ac contactor

Device details Block

DeviceManufacturer: output ac contactor

DeviceIdentifier: KM

Devicegroup: Output

Part number: output ac contactor

Revision: output ac contactor

Function: ☐ Input ☒ Logic ☒ Output ☐ unknown

Technology: electromechanic

Category: 1

Use case: Receive safety control signal from upstream and cut off the power supply to laser

Description of the use case: Receive safety control signal from upstream and cut off the power supply to laser

Documentation Block

Documentation: TCF

Document :

MTTFD and Mission time Block

MTTFD[a]: 509.6 (High)

Mission time [a]: 20 Shortest mission time [a]: 20

Diagnostic coverage Block

DC[%]: 99 (High)

Status / Messages Block

Status: green



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Element\$1 / 1)

EL Name: AC contactor

Reference designator:	EL3-2		
Inventory number:	output ac contactor		
Device details Element			
DeviceManufacturer:	Schneider electric		
DeviceIdentifier:	KM		
Devicegroup:	Output		
Part number:	output ac contactor		
Revision:	output ac contactor		
Function:	☐ Input	☐ Logic	☐ unknown
	☒ Output		
Technology:	electromechanic		
Category:	1		
Use case:	Receive safety control signal from upstream and cut off the power supply to laser		

Description of the use case:
Receive safety control signal from upstream and cut off the power supply to laser

Documentation Element

Document at i on:
TCF
Document :

MTTFD and Mission time Element

MTTFD[a]:	509.6 (High)		
Mission time [a]:	20		
B10D[cycles]:	1369863	no[cycles/a]:	26880
Non parameter:	Days: 280	Hours: 16	Seconds: 600
Document at i on:			
TCF			
Document :			

Diagnostic coverage Element

DQ[%]:	99 (High)
Measure:	Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Output device) (99 %)



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Emergencystop for the laser

Document at i on:

Document :

Status / Messages Element

Status: green

SF Safetyfunction: Emergencystop for the motors

Identifier oftheSafetyfunction:	SF1
Safetyfunctiontype:	Emergency stop function
Triggeringevent:	Push the emergency stop button
Reaction and Behaviouron powerfailure:	Initiated by pushing the emergency stop button to stop the motors by cutting off power supply to motors
Safestate:	Cut off power supply to motors
Operation mode:	All mode
Interfaces:	
Demandate:	12 times/year
Running-ortime:	--
Priority:	Highest

Document at i on:
TCF

Document :

Required Performance Level Safety function

PL(by risk graph):	c
Severityofinjury (S):	Serious (normally irreversible) injury or death
Frequency exposure times to hazard f:	Seldom to less often / exposure time is short
Possibility ofavoiding(P):	Possible under specific conditions
Riskgraph:	

Document at i on:
TCF

Document :

Performance Level Safety function

Reached PL:	d	PF[L/h]:	1.22E-7
-------------	---	----------	---------

Electromagnetic immunity, EMI (Annex L) Safety function



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Route for fulfilment of EMI measures: n/a

Document at i on:

Document:

List of devices with a permissible operation time (T10D) of less than 20 years:

Devidist:

Status / Messages Safety function

Status: green

Subsystem(1 / 3)

SB Name: INPUT (E-stop pilot device)

Referencedesignator: SB1

Inventory number: SB Emergency stop

Device details Subsystem

DeviceManufacturer: Schneider electric

DeviceIdentifier: SB Emergency stop

Devicegroup: SB Emergency stop

Part number: SB Emergency stop

Revision: SB Emergency stop

Function: ☒ Input ☐ Logic ☐ Output ☐ unknown

Use case: Input emergency stop signal

Description of the use case:

Input emergency stop signal to the logic unit

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PL determination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspects suitable upto PL: n/a

Documentation:

Document:



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: e PF [1/h]: 4.29E-8

Document at i on: TCF

Category Subsystem

Category: 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-trying safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on: TCF

Source (e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD [a]: 100 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20

Diagnostic coverage Subsystem

DCavg [%]: 90 (Medium)

Common cause failure Subsystem

CCF Points: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Components used are well-trying | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)
- 10 Points | Other influences | Environmental (section F.3.6)

Document at i on:
TCF

Document :

Status / Messages Subsystem

Status: green

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Block(1 / 1)

BL Name: INPUT

Reference designator: BL1-1

Inventory number: SB Emergency stop

Device details Block

DeviceManufacturer: Schneider electric

DeviceIdentifier: SB Emergency stop

Devicegroup: INPUT DEVICE

Part number: SB Emergency stop

Revision: SB Emergency stop

Function: ☒ Input ☐ Logic
☐ Output ☐ unknown

Technology: electromechanic

Category: 1

Use case: Input emergency stop signal

Description of the use case:
Input emergency stop signal to the logic unit

Documentation Block

Document at i on:
TCF

Document :

MTTFD and Mission time Block

MTTF[a]: 83333.3 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Diagnostic coverage Block

DC[%]: 90 (Medium)

Status / Messages Block

Status: green

Elements (1 / 1)

EL Name: E-STOP contact

Reference designator: EL1-1

Inventory number: SB Emergency stop

Device details Element

DeviceManufacturer: Schneider electric

DeviceIdentifier: SB Emergency stop

Devicegroup: INPUT DEVICE

Part number: SB Emergency stop
Revision: SB Emergency stop

Function: ☒ Input ☐ Logic ☐ Output ☐ unknown

Technology: electromechanic

Category: 1

Use case: Input emergency stop signal

Description of the use case:
Input emergency stop signal to logic unit

Documentation Element

Document at i on:
TCF

Document :

MTTFD and Mission time Element

MTTFD[a]: 83333.3 (High)

Mission time [a]: 20

B10D[cycles]: 100000 no[cycles/a]: 12

Document at i on:
EN ISO 13849-1 B10D DATA

Document :

Diagnostic coverage Element

DC[%]: 90 (Medium)

Measure:
Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

open and normally closed mechanically linked contacts
(Input devices)
(90 %)

Document at i on:
TCF

Document :

Status / Messages Element

Status: green

Channels Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: INPUT

Reference designator: BL1-2
Inventory number: SB Emergency stop

Device details Block

DeviceManufacturer: Schneider electric
DeviceIdentifier: SB Emergency stop
Devicegroup: INPUT DEVICE

Part number: SB Emergency stop
Revision: SB Emergency stop

Function: ☒ Input ☐ Logic
☐ Output ☐ unknown

Technology: electromechanic

Category: 1

Use case: Input emergency stop signal

Description of the use case:
Input emergency stop signal to the logic unit

Documentation Block

Document at i on:
TCF

Document :

MTTFD and Mission time Block

MTTFD[a]: 83333.3 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Diagnostic coverage Block

DC[%]: 90 (Medium)

Status / Messages Block

Status: green

Elements(1 / 1)

EL Name: E-STOP contact

Reference designator: EL1-2

Inventory number: SB Emergency stop

Device details Element

DeviceManufacturer: Schneider electric

DeviceIdentifier: SB Emergency stop

Devicegroup: INPUT DEVICE

Part number: SB Emergency stop
Revision: SB Emergency stop

Function: ☒ Input ☐ Logic ☐ Output ☐ unknown

Technology: electromechanic

Category: 1

Use case: Input emergency stop signal

Description of the use case:
Input emergency stop signal to logic unit

Documentation Element

Document at i on:
TCF

Document :

MTTFD and Mission time Element

MTTFD[a]: 83333.3 (High)

Mission time [a]: 20

B10D[cycles]: 100000 no[cycles/a]: 12

Document at i on:
EN ISO 13849-1 B10D DATA

Document :

Diagnostic coverage Element

DC[%]: 90 (Medium)

Measure:
Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SB Safety function: Emergency stop for the motors

open and normally closed mechanically linked contacts
(Input devices)
(90 %)

Document at i on:
TCF

Document :

Status / Messages Element

Status: green

Subsystem(2 / 3)

SB Name: Logic

Referencedesignator: SB2

Inventory number: Logic unit

Device details Subsystem

DeviceManufacturer: schmersal

DeviceIdentifier: Logic unit

Devicegroup: Logic unit

Part number: Logic unit

Revision: Logic unit

Function: ☐ Input ☒ Logic ☐ Output ☐ unknown

Usecase: Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the usecase:
Receive the emergency stop input signal and generate safety output control signal to cut off the motors

Documentation Subsystem

Document at i on:
TCF

Document :

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL: e

Documentation:
TCF

Document:



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: e **PF₁ [1/h]:** 5.38E-8

Document at i on:
Manufacturer's data

Category Subsystem

Cat.: 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-trying safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:
Manufacturer's data

Source (e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD [a]: 50 (High)

Mission time [a]: 20 **Shortest mission time [a]:** 20

Diagnostic coverage Subsystem

DCavg [%]: 99 (High)

Common cause failure Subsystem

CCF Points: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
- 5 Points | Training | Training (section F.3.5)



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on: TCF

Document :

Status / Messages Subsystem

Status: green

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 50

Block(1 / 1)

BL Name: Logic

Reference designator: BL1

Inventory number: MCU1

Device details Block

DeviceManufacturer:

DeviceIdentifier:

Devicegroup:

Part number:

Revision:

Function: ☐ Input ☐ Logic ☐ Output ☒ unknown

Technology: electronic

Category: -

Use case: Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the use case: Receive the emergency stop input signal and generate safety output control signal to cut off the motors

Documentation Block

Document at i on: TCF

Document :

MTTFD and Mission time Block

MTTFD [a]: 50 (High)

Mission time [a]: 20 Shortest mission time [a]: 20



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Diagnostic coverage Block

DC[%]: 99 (High)

Status / Messages Block

Status: green

Elements (1 / 1)

EL Name: MCU1

Reference designator: EL1

Inventory number: EL1

Device details Element

DeviceManufacturer:

DeviceIdentifier:

Devicegroup:

Part number:

Revision:

Function: ☐ Input ☐ Logic ☐ Output ☒ unknown

Technology: electronic

Category: -

Use case: Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the use case: Receive the emergency stop input signal and generate safety output control signal to cut off the motors

Documentation Element

Document at i on: TCF

Document :

MTTFD and Mission time Element

MTTFD[a]: 50 (High)

Mission time [a]: 20

MTBF[a]: 50 RDF[%]: 100

Document at i on:

Document :

Diagnostic coverage Element

DC[%]: 99 (High)



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Measure:
Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays
(Logic)
(99 %)

Document at i on:
TCF

Document :

Status / Messages Element

Status: green

Channels\$ Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 50

Blocks(1 / 1)

BL Name: Logic

Reference designator: BL2
Inventory number: MCU2

Device details Block

DeviceManufacturer:

DeviceIdentifier:

Devicegroup:

Part number:

Revision:

Function: ☐ Input ☐ Logic
☐ Output ☒ unknown

Technology: electronic

Category: -

Use case: Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the use case:
Receive the emergency stop input signal and generate safety output control signal to cut off the motors

Documentation Block

Document at i on:
TCF

Document :

MTTFD and Mission time Block

MTTFD[a]: 50 (High)



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Missiortime [a]:	20	Shortest missiortime [a]:	20
------------------	----	---------------------------	----

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Elements (1 / 1)

EL Name: MCU1

Reference designator:	EL1
Inventory number:	EL1

Device details Element

DeviceManufacturer:	
DeviceIdentifier:	
Devicegroup:	
Part number:	
Revision:	
Function:	☐ Input ☐ Output ☐ Logic ☒ unknown
Technology:	electronic
Category:	-
Usecase:	Receive the emergency stop input signal and generate safety output control signal to the actuator

Description of the usecase:

Receive the emergency stop input signal and generate safety output control signal to cut off the motors

Documentation Element

Document at i on:	TCF
Document :	

MTTFD and Mission time Element

MTTFD[a]:	50 (High)		
Missiortime [a]:	20		
MTBF[a]:	50	RDF[%]:	100
Document at i on:			
Document :			



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Diagnostic coverage Element

DC[%]: 99 (High)

Measure:

Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays
(Logic)
(99 %)

Document at i on:

TCF

Document :

Status / Messages Element

Status: green

Subsystems / 3)

SB Name: Output (AC contactor)

Reference designator: SB3

Inventory number: output ac contactor

Device details Subsystem

DeviceManufacturer: schneider electric

DeviceIdentifier: output ac contactor

Devicegroup: Output

Part number: output ac contactor

Revision: output ac contactor

Function:

☐ Input

☐ Logic

☒ Output

☐ unknown

Use case: Receive safety control signal from upstream and cut off the power supply to laser

Description of the use case:

Receive safety control signal from upstream and cut off the power supply to laser

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PL determination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspects suitable upto PL: d

Documentation:



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergencystop for the motors

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: d PF [1/h]: 2.47E-8

Document at i on: Mnaufacturer's data

Category Subsystem

Q. : 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-tried safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on: Manufacturer's data

Source (e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTF [a]: 100 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20

Diagnostic coverage Subsystem

DCavg [%]: 99 (High)

Common cause failure Subsystem

CCF Points: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergencystop for the motors

- 5 Points | Components used are well-tried | Design/application/experience (section F.3.3)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on:
TCF

Document :

Status / Messages Subsystem

Status: green

Message[Status of Message]:
- Because of qualitative aspects (e.g. software), the subsystem is only suitable up to performance level "d". [green]

Channel\$ Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Block\$ (1 / 1)

BL Name: AC contactor

Reference designator:	BL3-1
Inventory number:	output ac contactor
Device details Block	
DeviceManufacturer:	output ac contactor
DeviceIdentifier:	KM
Devicegroup:	Output
Part number:	output ac contactor
Revision:	output ac contactor
Function:	☐ Input ☒ Logic ☒ Output ☐ unknown
Technology:	electromechanic
Category:	1
Usecase:	Receive safety control signal from upstream and cut off the power supply to motors

Description of the usecase:
Receive safety control signal from upstream and cut off the power supply to motors

Documentation Block

Document at i on:
TCF

Document :



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

MTTFD and Mission time Block

MTTF[a]:	509.6 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Elements (1 / 1)

EL Name: AC contactor

Reference designator:	EL3-1
Inventory number:	output ac contactor
Device details Element	
DeviceManufacturer:	Schneider electric
DeviceIdentifier:	KM
Devicegroup:	Output
Part number:	output ac contactor
Revision:	output ac contactor
Function:	☐ Input ☐ Logic ☒ Output ☐ unknown
Technology:	electromechanic
Category:	1
Use case:	Receive safety control signal from upstream and cut off the power supply to motors

Description of the use case:
Receive safety control signal from upstream and cut off the power supply to motors

Documentation Element

Document at i on:	TCF
Document :	

MTTFD and Mission time Element

MTTF[a]:	509.6 (High)		
Missiortime [a]:	20		
B10 cycles]:	1369863	no cycles/a]:	26880
Nop parameter:	Days: 280	Hours: 16	Seconds: 600



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Document at i on:
TCF

Document :

Diagnostic coverage Element

DC[%]: 99 (High)

Measure:
Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements)
(Output device)
(99 %)

Document at i on:

Document :

Status / Messages Element

Status: green

Channels Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: AC contactor

Reference designator: BL3-2

Inventory number: output ac contactor

Device details Block

DeviceManufacturer: output ac contactor

DeviceIdentifier: KM

Devicegroup: Output

Part number: output ac contactor

Revision: output ac contactor

Function: ☐ Input ☒ Logic ☒ Output ☐ unknown

Technology: electromechanic

Category: 1

Use case: Receive safety control signal from upstream and cut off the power supply to motors

Description of the use case:
Receive safety control signal from upstream and cut off the power supply to motors

Documentation Block



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

Document at i on:
TCF

Document :

MTTFD and Mission time Block

MTTFD[a]:	509.6 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DQ[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Element\$1 / 1)

EL Name: AC contactor

Reference designator:	EL3-2
-----------------------	-------

Inventory number:	output ac contactor
-------------------	---------------------

Device details Element

DeviceManufacturer:	Schneider electric
---------------------	--------------------

DeviceIdentifier:	KM
-------------------	----

Devicegroup:	Output
--------------	--------

Part number:	output ac contactor
Revision:	output ac contactor

Function:	☐ Input ☐ Logic ☒ Output ☐ unknown
-----------	---

Technology:	electromechanic
-------------	-----------------

Category:	1
-----------	---

Usecase:	Receive safety control signal from upstream and cut off the power supply to motors
----------	--

Description of the usecase:
Receive safety control signal from upstream and cut off the power supply to motors

Documentation Element

Document at i on:
TCF

Document :

MTTFD and Mission time Element

MTTFD[a]:	509.6 (High)
Missiortime [a]:	20



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safety function: Emergency stop for the motors

B100[cycles]: 1369863 **no[cycles/a]:** 26880

Nop parameter: Days: 280 Hours: 16 Seconds: 600

Document at i on:
TCF

Document :

Diagnostic coverage Element

DQ[%]: 99 (High)

Measure:

Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements)
(Output device)
(99 %)

Document at i on:

Document :

Status / Messages Element

Status: green

SF Safetyfunction: Interlocking guardfor the laser

Identifier oftheSafetyfunction: SF3

Safetyfunctiontype: Safety-related stop function initiated by safeguard

Triggeringevent: Open the interlocking door

Reaction and Behaviour on power failure: Initiated by open the interlocking door to stop the laser by cutting off power supply to laser

Safetate: Cut off power supply to laser

Operation mode: All mode

Interfaces:

Demandate: 8 times/day

Running-ortime: --

Priority: High

Document at i on:
TCF

Document :

Required Performance Level Safety function

PL(by risk graph): d



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Severityofinjury (S):	Serious (normally irreversible) injury or death
Frequency/ exposure times to hazard f:	Seldom to less often / exposure time is short
Possibility ofavoiding(P):	Scarcely possible
Riskgraph:	

Document at i on:	TCF
Document :	

Performance Level Safety function

Reached PL:	d	PF[L/h]:	1.22E-7
-------------	---	----------	---------

Electromagnetic immunity, EMI (Annex L) Safety function

Route for fulfilment of EMI measures:	n/a
Document at i on:	
Document:	

List of devices with a permissible operation time (T10D) of less than 20 years:

Devidist:	
-----------	--

Status / Messages Safety function

Status:	green
---------	-------

Subsystem 1 / 3)

SB Name: INPUT (Interlocking switch)

Referencedesignator:	SB1
Inventory number:	SB Interlocking switch
Device details Subsystem	
DeviceManufacturer:	Schmersal
DeviceIdentifier:	SB Interlocking switch
Devicegroup:	SB Interlocking switch
Part number:	SB Interlocking switch
Revision:	SB Interlocking switch
Function:	☒ Input ☐ Logic ☐ Output ☐ unknown
Usecase:	Input movable gaurd interlocking stop signal



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Description of the usecase:

Input movable gaurd interlocking stop signal to the logic unit

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL: n/a

Documentation:

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: e **PFH [1/h]:** 4.29E-8

Document at i on:

TCF

Category Subsystem

Category: 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-trying safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:

TCF

Source (e.g. standard) Category: EN ISO 13849-1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Re

MTTFD and Mission time Subsystem

MTTFD[a]:	100 (High)		
Missiortime[a]:	20	Shortest missiortime[a]:	20

Diagnostic coverage Subsystem

DCavg[%]:	90 (Medium)
-----------	-------------

Common cause failure Subsystem

CCFPoints:	75 (fulfilled)
------------	----------------

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Components used are well-tried | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)
- 10 Points | Other influences | Environmental (section F.3.6)

Document at i on:

TCF

Document :

Status / Messages Subsystem

Status:	green
---------	-------

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: INPUT

Referencedesignator:	BL1-1
Inventory number:	SB Interlocking switch

Device details Block

DeviceManufacturer:	Schmersal
DeviceIdentifier:	SB Interlocking switch
Devicegroup:	INPUT DEVICE
Part number:	SB Interlocking switch
Revision:	SB Interlocking switch

Function:	☒ Input	☐ Logic
	☐ Output	☐ unknown



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Technology:	electromechanic
Category:	1
Usecase:	Input movable gaurd interlocking stop signal
Description of the usecase: Input movable gaurd interlocking stop signal to the logic unit	

Documentation Block

Document at i on:	TCF		
Document :			

MTTFD and Mission time Block

MTTF[a]:	52083.3 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DC[%]:	90 (Medium)		
--------	-------------	--	--

Status / Messages Block

Status:	green		
---------	-------	--	--

Element\$1 / 1)

EL Name: Interlocking switch contact

Referenc&esignator:	EL1-1		
Inventory number:	SB Interlocking switch		

Device details Element

DeviceManufacturer:	Schmersal		
DeviceIdentifier:	SB Interlocking switch		
Devicegroup:	INPUT DEVICE		
Part number:	SB Interlocking switch		
Revi si on:	SB Interlocking switch		
Funct i on:	☒ Input ☐ Logic ☐ Output ☐ unknown		

Technology:	electromechanic
Category:	1
Usecase:	Input movable gaurd interlocking stop signal
Description of the usecase: Input movable gaurd interlocking stop signal to the logic unit	

Documentation Element



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Document at i on:			
TCF			
Document :			
MTTFD and Mission time Element			
MTTFD[a]:	52083.3 (High)		
Missiontime [a]:	20		
B10Dcycles]:	25000000	no[cycles/a]:	4800
Non parameter:	Days: 300	Hours: 16	Seconds: 3600
Document at i on:			
EN ISO 13849-1 B10D DATA			
Document :			
Diagnostic coverage Element			
DQ[%]:	90 (Medium)		
Measure:			
Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally open and normally closed mechanically linked contacts (Input devices) (90 %)			
Document at i on:			
TCF			
Document :			
Status / Messages Element			
Status:	green		

Channels Test channels(2 / 2)

CH Name: Channel 2	
MTTFD [a]: 100	
Blocks(1 / 1)	
BL Name: INPUT	
Referencedesignator:	BL1-2
Inventory number:	SB Interlocking switch
Device details Block	
DeviceManufacturer:	Schmersal
DeviceIdentifier:	SB Interlocking switch
Devicegroup:	INPUT DEVICE
Part number:	SB Interlocking switch
Revision:	SB Interlocking switch



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Technology:	electromechanic	
Category:	1	
Usecase:	Input movable gaurd interlocking stop signal	
Description of the usecase:	Input movable gaurd interlocking stop signal to the logic unit	

Documentation Block

Document at i on:	TCF
Document :	

MTTFD and Mission time Block

MTTFD[a]:	52083.3 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DC[%]:	90 (Medium)
--------	-------------

Status / Messages Block

Status:	green
---------	-------

Elements(1 / 1)

EL Name: Interlocking switch contact

Reference designator:	EL1-2	
Inventory number:	SB Interlocking switch	
Device details Element		
DeviceManufacturer:	Schmersal	
DeviceIdentifier:	SB Interlocking switch	
Devicegroup:	INPUT DEVICE	
Part number:	SB Interlocking switch	
Revision:	SB Interlocking switch	
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Technology:	electromechanic	
Category:	1	
Usecase:	Input movable gaurd interlocking stop signal	
Description of the usecase:	Input movable gaurd interlocking stop signal to the logic unit	



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Documentation Element

Document at i on:
TCF

Document :

MTTFD and Mission time Element

MTTFD[a]:	52083.3 (High)		
Missiontime[a]:	20		
B10D[cycles]:	25000000	no[cycles/a]:	4800
Non parameter:	Days: 300	Hours: 16	Seconds: 3600

Document at i on:
EN ISO 13849-1 B10D DATA

Document :

Diagnostic coverage Element

DC[%]: 90 (Medium)

Measure:

Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally open and normally closed mechanically linked contacts
(Input devices)
(90 %)

Document at i on:
TCF

Document :

Status / Messages Element

Status: green

Subsystem 2 / 3)

SB Name: Logic

Reference designator:	SB2		
Inventory number:	Logic unit		
Device details Subsystem			
DeviceManufacturer:	schmersal		
DeviceIdentifier:	Logic unit		
Devicegroup:	Logic unit		
Part number:	Logic unit		
Revision:	Logic unit		
Function:	☐ Input	☒ Logic	☐ unknown
	☐ Output		
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator		



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Description of the usecase:

Receive the interlock input signal and generate safety output control signal to cut off the laser

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL: e

Documentation:

TCF

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: e **PFH [1/h]:** 5.38E-8

Document at i on:

Manufacturer's data

Category Subsystem

Category: 3

Category requirements: fulfilled

Requirements for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-trying safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:

Manufacturer's data

Source (e.g. standard) Category: EN ISO 13849-1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Re

MTTFD and Mission time Subsystem

MTTFD[a]:	50 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Subsystem

DCavg[%]:	99 (High)
-----------	-----------

Common cause failure Subsystem

CCFPoints:	75 (fulfilled)
------------	----------------

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on:

TCF

Document :

Status / Messages Subsystem

Status:	green
---------	-------

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 50

Blocks(1 / 1)

BL Name: Logic

Referencedesignator:	BL1
Inventory number:	MCU1

Device details Block

DeviceManufacturer:	
DeviceIdentifier:	
Devicegroup:	
Part number:	
Revision:	

Function:	☐ Input	☐ Logic
	☐ Output	☒ unknown



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Technology:	electronic
Category:	-
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator
Description of the usecase:	Receive the interlock input signal and generate safety output control signal to cut off the laser

Documentation Block

Document at i on:	TCF
Document :	

MTTFD and Mission time Block

MTTFD[a]:	50 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Elements(1 / 1)

EL Name: MCU1			
Reference designator:	EL1		
Inventory number:	EL1		
Device details Element			
DeviceManufacturer:			
DeviceIdentifier:			
Devicegroup:			
Part number:			
Revision:			
Function:	☐ Input	☐ Logic	☒ unknown
Technology:	electronic		
Category:	-		
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator		
Description of the usecase:	Receive the interlock input signal and generate safety output control signal to cut off the laser		



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Documentation Element

Document at i on:
TCF

Document :

MTTFD and Mission time Element

MTTFD[a]:	50 (High)		
Missiontime[a]:	20		
MTBF[a]:	50	RDF[%]:	100

Document at i on:

Document :

Diagnostic coverage Element

DQ[%]: 99 (High)

Measure:
Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays
(Logic)
(99 %)

Document at i on:
TCF

Document :

Status / Messages Element

Status: green

Channels\$ Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 50

Blocks(1 / 1)

BL Name: Logic

Referencedesignator:	BL2
Inventory number:	MCU2

Device details Block

DeviceManufacturer:

DeviceIdentifier:

Devicegroup:

Part number:

Revision:



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Function:	☐ Input	☐ Logic
	☐ Output	☒ unknown
Technology:	electronic	
Category:	-	
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator	

Description of the usecase:
Receive the interlock input signal and generate safety output control signal to cut off the laser

Documentation Block

Document at i on:
TCF
Document :

MTTFD and Mission time Block

MTTF[a]:	50 (High)		
Mission time [a]:	20	Shortest mission time [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Element(1 / 1)

EL Name: MCU1	
Reference designator:	EL1
Inventory number:	EL1

Device details Element

DeviceManufacturer:
DeviceIdentifier:
Devicegroup:
Part number:
Revision:

Function:	☐ Input	☐ Logic
	☐ Output	☒ unknown
Technology:	electronic	
Category:	-	
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator	



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Description of the usecase:
Receive the interlock input signal and generate safety output control signal to cut off the laser

Documentation Element

Document at i on:
TCF

Document :

MTTFD and Mission time Element

MTTFD[a]: 50 (High)
Missiortime[a]: 20
MTB[a]: 50 RDF[%]: 100
Document at i on:

Document :

Diagnostic coverage Element

DC[%]: 99 (High)
Measure:
Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays
(Logic)
(99 %)

Document at i on:
TCF

Document :

Status / Messages Element

Status: green

Subsystems / 3)

SB Name: Output (AC contactor)

Referencedesignator: SB4
Inventory number: output ac contactor

Device details Subsystem

DeviceManufacturer: schneider electric
DeviceIdentifier: output ac contactor
Devicegroup: Output
Part number: output ac contactor
Revision: output ac contactor

Function: ☐ Input ☐ Logic ☒ Output ☐ unknown



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Usecase: Receive safety control signal from upstream and cut off the power supply to laser

Description of the usecase:

Receive safety control signal from upstream and cut off the power supply to laser

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL: d

Documentation:

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: d **PF₁[1/h]:** 2.47E-8

Document at i on:

Manufacturer's data

Category Subsystem

Category: 3

Category requirements: fulfilled

Requirement for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-tries safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:

Manufacturer's data



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Source(e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTF[a]: 100 (High)

Missiortime[a]: 20 Shortest missiortime[a]: 20

Diagnostic coverage Subsystem

DCavg[%]: 99 (High)

Common cause failure Subsystem

CCPoints: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Components used are well-tried | Design/application/experience (section F.3.3)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on:

TCF

Document :

Status / Messages Subsystem

Status: green

MessageStatus of Message]:

- Because of qualitative aspects (e.g. software), the subsystem is only suitable up to performance level "d". [green]

Channels Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Block(1 / 1)

BL Name: AC contactor

Referencdesignator: BL3-1

Inventory number: output ac contactor

Device details Block

DeviceManufacturer: output ac contactor

DeviceIdentifier: KM

Devicegroup: Output

Part number: output ac contactor



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Revi si on:	output ac contactor		
Fnct i on:	☐ Input	☒ Logic	☐ unknown
	☒ Output		
Technol ogy:	electromechanic		
Category:	1		
Usecase:	Receive safety control signal from upstream and cut off the power supply to laser		

Description of the usecase:
Receive safety control signal from upstream and cut off the power supply to laser

Documentation Block

Document at i on:	TCF		
Document :			

MTTFD and Mission time Block

MTTFD[a]:	509.6 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)		
--------	-----------	--	--

Status / Messages Block

Status:	green		
---------	-------	--	--

Element\$1 / 1)

EL Name: AC contactor

Referencedesignator:	EL3-1		
Inventory number:	output ac contactor		

Device details Element

DeviceManufacturer:	Schneider electric		
DeviceIdentifier:	KM		
Devicegroup:	Output		
Part number:	output ac contactor		
Revi si on:	output ac contactor		
Fnct i on:	☐ Input	☐ Logic	☐ unknown
	☒ Output		
Technol ogy:	electromechanic		
Category:	1		
Usecase:	Receive safety control signal from upstream and cut off the power supply to laser		



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Description of the usecase:
Receive safety control signal from upstream and cut off the power supply to laser

Documentation Element

Document at i on:
TCF
Document :

MTTFD and Mission time Element

MTTFD[a]: 509.6 (High)
Missiontime[a]: 20
B10[cycles]: 1369863 no[cycles/a]: 26880
Nop parameter: Days: 280 Hours: 16 Seconds: 600
Document at i on:
TCF
Document :

Diagnostic coverage Element

DC[%]: 99 (High)
Measure:
Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements)
(Output device)
(99 %)
Document at i on:
Document :

Status / Messages Element

Status: green

Channels\$ Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 100

Blocks(1 / 1)

BL Name: AC contactor

Referencedesignator: BL3-2
Inventory number: output ac contactor

Device details Block

DeviceManufacturer: output ac contactor
DeviceIdentifier: KM



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Devicegroup:	Output
Part number:	output ac contactor
Revision:	output ac contactor
Function:	☐ Input ☒ Logic ☒ Output ☐ unknown
Technology:	electromechanic
Category:	1
Usecase:	Receive safety control signal from upstream and cut off the power supply to laser
Description of the usecase:	Receive safety control signal from upstream and cut off the power supply to laser

Documentation Block

Documentation:	TCF
Document :	

MTTFD and Mission time Block

MTTFD[a]:	509.6 (High)		
Missiontime [a]:	20	Shortest missiontime [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Element\$1 / 1)

EL Name: AC contactor	
Reference designator:	EL3-2
Inventory number:	output ac contactor
Device details Element	
DeviceManufacturer:	Schneider electric
DeviceIdentifier:	KM
Devicegroup:	Output
Part number:	output ac contactor
Revision:	output ac contactor
Function:	☐ Input ☒ Logic ☒ Output ☐ unknown
Technology:	electromechanic



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the laser

Category:	1
Use case:	Receive safety control signal from upstream and cut off the power supply to laser

Description of the use case:

Receive safety control signal from upstream and cut off the power supply to laser

Documentation Element

Document at i on:

TCF

Document :

MTTFD and Mission time Element

MTTF[a]:		509.6 (High)	
Mission time [a]:		20	
B10D[cycles]:		1369863	no[cycles/a]: 26880
Not parameter:		Days: 280	Hours: 16 Seconds: 600

Document at i on:

TCF

Document :

Diagnostic coverage Element

DC[%]:	99 (High)
Measure:	Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Output device) (99 %)

Document at i on:

Document :

Status / Messages Element

Status:	green
---------	-------

SF Safetyfunction: Interlocking guardfor the motors

Identifier of the Safetyfunction:	SF3
Safetyfunction type:	Safety-related stop function initiated by safeguard
Triggering event:	Open the interlocking door
Reaction and Behaviour on power failure:	Initiated by open the interlocking door to stop the laser by cutting off power supply to motors
Safestate:	Cut off power supply to motors



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Operation mode: All mode

Interfaces:

Demandrate: 8 times/day

Running-ortime: --

Priority: High

Document at i on:

TCF

Document :

Required Performance Level Safety function

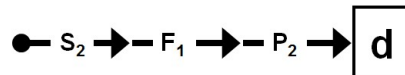
PL(by risk graph): d

Severityofinjury (S): Serious (normally irreversible) injury or death

Frequency exposure times to hazard f: Seldom to less often / exposure time is short

Possibility ofavoiding(P): Scarcely possible

Riskgraph:



Document at i on:

TCF

Document :

Performance Level Safety function

Reached PL: d

PF[L/h]: 1.22E-7

Electromagnetic immunity, EMI (Annex L) Safety function

Route for fulfilment of EMI measures: n/a

Document at i on:

Document:

List of devices with a permissible operation time (T10D) of less than 20 years:

Devidist:

Status / Messages Safety function

Status: green

Subsystem 1 / 3)

SB Name: INPUT (Interlocking switch)

Referencedesignator: SB1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Inventory number: SB Interlocking switch

Device details Subsystem

DeviceManufacturer: Schmersal

DeviceIdentifier: SB Interlocking switch

Devicegroup: SB Interlocking switch

Part number: SB Interlocking switch

Revision: SB Interlocking switch

Function: ☒ Input ☐ Logic
☐ Output ☐ unknown

Usecase: Input movable gaurd interlocking stop signal

Description of the usecase:

Input movable gaurd interlocking stop signal to the logic unit

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL: n/a

Documentation:

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: e **PFH [1/h]:** 4.29E-8

Document at i on:

TCF

Category Subsystem

Category: 3



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Category requirements: fulfilled

- Requirementfor the category:
- Accordance with relevant standards to withstand the expected influences. [fulfilled]
 - Basic safety principles are being used. [fulfilled]
 - Well-ried safety principles are being used. [fulfilled]
 - A single fault tolerance and reasonable fault detection are given. [fulfilled]
 - MTTFD is at least Low. [fulfilled]
 - Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
 - The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on: TCF

Source(e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD[a]: 100 (High)

Missiortime [a]: 20 Shortest missiortime [a]: 20

Diagnostic coverage Subsystem

DCavg[%]: 90 (Medium)

Common cause failure Subsystem

CCFPoints: 75 (fulfilled)

- CCF Measures:
- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
 - 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
 - 5 Points | Components used are well-ried | Design/application/experience (section F.3.3)
 - 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
 - 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)
 - 10 Points | Other influences | Environmental (section F.3.6)

Document at i on: TCF

Document :

Status / Messages Subsystem

Status: green

Channel\$ Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Block\$ (1 / 1)

BL Name: INPUT

Referencedesignator: BL1-1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Inventory number:	SB Interlocking switch		
Device details Block			
DeviceManufacturer:	Schmersal		
DeviceIdentifier:	SB Interlocking switch		
Devicegroup:	INPUT DEVICE		
Part number:	SB Interlocking switch		
Revision:	SB Interlocking switch		
Function:	☒ Input	☐ Logic	
	☐ Output	☐ unknown	
Technology:	electromechanic		
Category:	1		
Usecase:	Input movable gaurd interlocking stop signal		
Description of the usecase:			
Input movable gaurd interlocking stop signal to the logic unit			

Documentation Block			
Document at i on:	TCF		
Document :			

MTTFD and Mission time Block			
MTTFD[a]:	52083.3 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block	
DC[%]:	90 (Medium)

Status / Messages Block	
Status:	green

Element\$1 / 1)

EL Name: Interlocking switch contact	
Reference designator:	EL1-1
Inventory number:	SB Interlocking switch
Device details Element	
DeviceManufacturer:	Schmersal
DeviceIdentifier:	SB Interlocking switch
Devicegroup:	INPUT DEVICE
Part number:	SB Interlocking switch
Revision:	SB Interlocking switch



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Function:	☒ Input	☐ Logic
	☐ Output	☐ unknown
Technology:	electromechanic	
Category:	1	
Usecase:	Input movable gaurd interlocking stop signal	
Description of the usecase:	Input movable gaurd interlocking stop signal to the logic unit	

Documentation Element

Document at i on:	TCF
Document :	

MTTFD and Mission time Element

MTTFD[a]:	52083.3 (High)		
Missiontime[a]:	20		
B10Dcycles]:	25000000	no[cycles/a]:	4800
Non parameter:	Days: 300	Hours: 16	Seconds: 3600
Document at i on:	EN ISO 13849-1 B10D DATA		
Document :			

Diagnostic coverage Element

DC[%]:	90 (Medium)
Measure:	Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally open and normally closed mechanically linked contacts (Input devices) (90 %)
Document at i on:	TCF
Document :	

Status / Messages Element

Status:	green
---------	-------

Channels Test channels(2 / 2)

CH Name: Channel 2
MTTFD [a]: 100
Blocks(1 / 1)
BL Name: INPUT



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Reference	designator:	BL1-2	
Inventory number:	SB Interlocking switch		
Device details Block			
Device	Manufacturer:	Schmersal	
Device	Identifier:	SB Interlocking switch	
Device	group:	INPUT DEVICE	
Part number:	SB Interlocking switch		
Revision:	SB Interlocking switch		
Function:	☒ Input	☐ Logic	
	☐ Output	☐ unknown	
Technology:	electromechanic		
Category:	1		
Use case:	Input movable gaurd interlocking stop signal		
Description of the usecase:			
Input movable gaurd interlocking stop signal to the logic unit			

Documentation Block			
Document at i on:	TCF		
Document :			

MTTFD and Mission time Block			
MTTFD[a]:	52083.3 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block	
DQ[%]:	90 (Medium)

Status / Messages Block	
Status:	green

Element\$1 / 1)

EL Name: Interlocking switch contact			
Reference	designator:	EL1-2	
Inventory number:	SB Interlocking switch		
Device details Element			
Device	Manufacturer:	Schmersal	
Device	Identifier:	SB Interlocking switch	
Device	group:	INPUT DEVICE	



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Part number:	SB Interlocking switch		
Revision:	SB Interlocking switch		
Function:	☒ Input	☐ Logic	
	☐ Output	☐ unknown	
Technology:	electromechanic		
Category:	1		
Usecase:	Input movable gaurd interlocking stop signal		
Description of the usecase: Input movable gaurd interlocking stop signal to the logic unit			

Documentation Element

Document at i on:	TCF
Document :	

MTTFD and Mission time Element

MTTFD[a]:	52083.3 (High)		
Mission time [a]:	20		
B10D [cycles]:	25000000	no [cycles/a]:	4800
No parameter:	Days: 300	Hours: 16	Seconds: 3600
Document at i on:	EN ISO 13849-1 B10D DATA		
Document :			

Diagnostic coverage Element

DC [%]:	90 (Medium)		
Measure:	Cyclic test stimulus by dynamic change of the input signals 90 % plausibility check, e.g. use of normally open and normally closed mechanically linked contacts (Input devices) (90 %)		
Document at i on:	TCF		
Document :			

Status / Messages Element

Status:	green
---------	-------

Subsystem 2 / 3)

SB Name:	Logic
Reference designator:	SB2
Inventory number:	Logic unit



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Device details Subsystem

DeviceManufacturer:	schmersal		
DeviceIdentifier:	Logic unit		
Devicegroup:	Logic unit		
Part number:	Logic unit		
Revision:	Logic unit		
Function:	☐ Input	☒ Logic	☐ unknown
	☐ Output		
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator		

Description of the usecase:

Receive the interlock input signal and generate safety output control signal to cut off the motors

Documentation Subsystem

Document at i on:	TCF
Document :	

Performance Level Subsystem

PLdetermination:	Determine PL/PFH from Category, MTTFD and DCavg
------------------	---

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL:	e
Documentation:	TCF
Document:	

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures:	The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.		
PL requirements:	fulfilled		
The PL shall be determined by the estimation of the following aspects (section 6.1.1):			
- Behaviour of the safety function under fault conditions [fulfilled]			
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]			
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]			
- Ability to perform a safety function under expected environmental conditions [fulfilled]			
Reached PL:	e	PF[L/h]:	5.38E-8
Document at i on:			
Manufacturer's data			

Category Subsystem

Category:	3
Category requirements:	fulfilled



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Requirementfor the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]
- Basic safety principles are being used. [fulfilled]
- Well-ried safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on:

Manufacturer's data

Source(e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD[a]:	50 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Subsystem

DCavg[%]:	99 (High)
-----------	-----------

Common cause failure Subsystem

CCFPoints:	75 (fulfilled)
------------	----------------

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Assessment/analysis | Assessment/analysis (section F.3.4)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on:

TCF

Document :

Status / Messages Subsystem

Status:	green
---------	-------

Channels\$ Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 50

Block\$ (1 / 1)

BL Name: Logic

Referencedesignator:	BL1
----------------------	-----

Inventory number:	MCU1
-------------------	------



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Device details Block

DeviceManufacturer:			
DeviceIdentifier:			
Devicegroup:			
Part number:			
Revision:			
Function:	☐ Input	☐ Logic	
	☐ Output	☒ unknown	
Technology:	electronic		
Category:	-		
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator		
Description of the usecase:			
Receive the interlock input signal and generate safety output control signal to cut off the motors			

Documentation Block

Documentation:	TCF
Document :	

MTTFD and Mission time Block

MTTFD[a]:	50 (High)		
Mission time [a]:	20	Shortest mission time [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Element(1 / 1)

EL Name: MCU1	
Reference designator:	EL1
Inventory number:	EL1

Device details Element

DeviceManufacturer:	
DeviceIdentifier:	
Devicegroup:	
Part number:	
Revision:	



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Function:	☐ Input	☐ Logic
	☐ Output	☒ unknown
Technology:	electronic	
Category:	-	
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator	
Description of the usecase: Receive the interlock input signal and generate safety output control signal to cut off the motors		
Documentation Element		
Document at i on:	TCF	
Document :		
MTTFD and Mission time Element		
MTTFD[a]:	50 (High)	
Mission time [a]:	20	
MTBF[a]:	50	RDF[%]: 100
Document at i on:		
Document :		
Diagnostic coverage Element		
DC[%]:	99 (High)	
Measure:	Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays (Logic) (99 %)	
Document at i on:	TCF	
Document :		
Status / Messages Element		
Status:	green	

Channels Test channels(2 / 2)

CH Name: Channel 2	
MTTFD [a]: 50	
Block(1 / 1)	
BL Name: Logic	
Reference designator:	BL2



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Inventory number:	MCU2		
Device details Block			
DeviceManufacturer:			
DeviceIdentifier:			
Devicegroup:			
Part number:			
Revision:			
Function:	☐ Input ☐ Output	☐ Logic ☒ unknown	
Technology:	electronic		
Category:	-		
Usecase:	Receive the interlock input signal and generate safety output control signal to the actuator		
Description of the usecase: Receive the interlock input signal and generate safety output control signal to cut off the motors			

Documentation Block			
Document at i on:	TCF		
Document :			

MTTFD and Mission time Block			
MTTFD[a]:	50 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block	
DC[%]:	99 (High)

Status / Messages Block	
Status:	green

Element\$1 / 1)	
EL Name: MCU1	
Reference designator:	EL1
Inventory number:	EL1
Device details Element	
DeviceManufacturer:	
DeviceIdentifier:	
Devicegroup:	
Part number:	



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Revision:

Function:

☐ Input
☐ Output

☐ Logic
☒ unknown

Technology:

electronic

Category:

-

Use case:

Receive the interlock input signal and generate safety output control signal to the actuator

Description of the use case:

Receive the interlock input signal and generate safety output control signal to cut off the motors

Documentation Element

Document at i on:

TCF

Document :

MTTFD and Mission time Element

MTTFD[a]:

50 (High)

Mission time [a]:

20

MTBF[a]:

50

RDF[%]:

100

Document at i on:

Document :

Diagnostic coverage Element

DC[%]:

99 (High)

Measure:

Dynamic principle (all components of the logic are required to change the state ON-OFF-ON when the safety function is demanded), e.g. interlocking circuit implemented by relays

(Logic)

(99 %)

Document at i on:

TCF

Document :

Status / Messages Element

Status:

green

Subsystem 3 / 3

SB Name: Output (AC contactor)

Reference designator:

SB4

Inventory number:

output ac contactor

Device details Subsystem

Device Manufacturer:

schneider electric



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

DeviceIdentifier:	output ac contactor
Devicegroup:	Output
Part number:	output ac contactor
Revision:	output ac contactor
Function:	☐ Input ☐ Logic ☒ Output ☐ unknown
Usecase:	Receive safety control signal from upstream and cut off the power supply to motors

Description of the usecase:

Receive safety control signal from upstream and cut off the power supply to motors

Documentation Subsystem

Document at i on:

TCF

Document :

Performance Level Subsystem

PLdetermination: Determine PL/PFH from Category, MTTFD and DCavg

Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem

Qualitative aspectssuitable upto PL: d

Documentation:

Document:

Electromagnetic immunity, EMI (Annex L) Subsystem

Route for fulfilment of EMI measures: The fulfilment of the measures for electromagnetic immunity (EMI) was documented in the associated safety function.

PL requirements: fulfilled

The PL shall be determined by the estimation of the following aspects (section 6.1.1):

- Behaviour of the safety function under fault conditions [fulfilled]
- Safety-related software according to clause 7 and Annex J or no software included [fulfilled]
- Systematic failure (see clause 6.1.7 and Annex G) [fulfilled]
- Ability to perform a safety function under expected environmental conditions [fulfilled]

Reached PL: d PFH [1/h]: 2.47E-8

Document at i on:

Manufacturer's data

Category Subsystem

Category: 3

Category requirements: fulfilled

Requirement for the category:

- Accordance with relevant standards to withstand the expected influences. [fulfilled]



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

- Basic safety principles are being used. [fulfilled]
- Well-tried safety principles are being used. [fulfilled]
- A single fault tolerance and reasonable fault detection are given. [fulfilled]
- MTTFD is at least Low. [fulfilled]
- Requirement fulfilled because of the assumed limit value accuracy of 5 percentage points. [fulfilled]
- The achieved score of the CCF-rating is at least 65. [fulfilled]

Document at i on: Manufacturer's data

Source(e.g. standard) Category: EN ISO 13849-1

Re

MTTFD and Mission time Subsystem

MTTFD[a]: 100 (High)

Missiortime[a]: 20 Shortest missiortime[a]: 20

Diagnostic coverage Subsystem

DCavg[%]: 99 (High)

Common cause failure Subsystem

CCFPoints: 75 (fulfilled)

CCF Measures:

- 15 Points | Separation/segregation | Separation/segregation (section F.3.1)
- 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature | Design/application/experience (section F.3.3)
- 5 Points | Components used are well-tried | Design/application/experience (section F.3.3)
- 5 Points | Training | Training (section F.3.5)
- 10 Points | Other influences | Environmental (section F.3.6)
- 25 Points | Prevention of EMI or impurity of fluidic medium | Environmental (section F.3.6)

Document at i on: TCF

Document :

Status / Messages Subsystem

Status: green

MessageStatus of Message:

- Because of qualitative aspects (e.g. software), the subsystem is only suitable up to performance level "d". [green]

Channel\$ Test channels(1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Block\$ (1 / 1)

BL Name: AC contactor

Referencedesignator: BL3-1



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Inventory number:	output ac contactor		
Device details Block			
DeviceManufacturer:	output ac contactor		
DeviceIdentifier:	KM		
Devicegroup:	Output		
Part number:	output ac contactor		
Revision:	output ac contactor		
Function:	☐ Input	☒ Logic	☐ unknown
	☒ Output		
Technology:	electromechanic		
Category:	1		
Usecase:	Receive safety control signal from upstream and cut off the power supply to motors		
Description of the usecase: Receive safety control signal from upstream and cut off the power supply to motors			

Documentation Block			
Document identifier:	TCF		
Document :			

MTTFD and Mission time Block			
MTTFD[a]:	509.6 (High)		
Missiontime [a]:	20	Shortest missiontime [a]:	20

Diagnostic coverage Block	
DC[%]:	99 (High)

Status / Messages Block	
Status:	green

Element(1 / 1)	
EL Name: AC contactor	
Reference designator:	EL3-1
Inventory number:	output ac contactor
Device details Element	
DeviceManufacturer:	Schneider electric
DeviceIdentifier:	KM
Devicegroup:	Output
Part number:	output ac contactor



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Revi si on:	output ac contactor		
Funct i on:	☐ Input ☒ Output	☐ Logic ☐ unknown	
Technol ogy:	electromechanic		
Category:	1		
Use case:	Receive safety control signal from upstream and cut off the power supply to motors		
Description of the use case: Receive safety control signal from upstream and cut off the power supply to motors			
Documentation Element			
Document at i on: TCF			
Document :			
MTTFD and Mission time Element			
MTTFD[a]:	509.6 (High)		
Mission time [a]:	20		
B10 cycles:	1369863	no cycles/a:	26880
No parameter:	Days: 280	Hours: 16	Seconds: 600
Document at i on: TCF			
Document :			
Diagnostic coverage Element			
DC[%]:	99 (High)		
Measure: Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Output device) (99 %)			
Document at i on:			
Document :			
Status / Messages Element			
Status:	green		

Channels Test channels(2 / 2)

CH Name: Channel 2

MTTFD [a]: 100



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

Block(1 / 1)

BL Name: AC contactor

Reference designator:	BL3-2	
Inventory number:	output ac contactor	
Device details Block		
DeviceManufacturer:	output ac contactor	
DeviceIdentifier:	KM	
Devicegroup:	Output	
Part number:	output ac contactor	
Revision:	output ac contactor	
Function:	☐ Input ☒ Output	☒ Logic ☐ unknown
Technology:	electromechanic	
Category:	1	
Usecase:	Receive safety control signal from upstream and cut off the power supply to motors	

Description of the use case:
Receive safety control signal from upstream and cut off the power supply to motors

Documentation Block

Document at i on:	TCF
Document :	

MTTFD and Mission time Block

MTTFD[a]:	509.6 (High)		
Missiortime [a]:	20	Shortest missiortime [a]:	20

Diagnostic coverage Block

DC[%]:	99 (High)
--------	-----------

Status / Messages Block

Status:	green
---------	-------

Element(1 / 1)

EL Name: AC contactor

Reference	designator:	EL3-2
Inventory number:	output ac contactor	
Device details Element		
Device	Manufacturer:	Schneider electric



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

SF Safetyfunction: Interlocking guardfor the motors

DeviceIdentifier:	KM		
Devicegroup:	Output		
Part number:	output ac contactor		
Revision:	output ac contactor		
Function:	☐ Input	☐ Logic	☐ unknown
	☒ Output		
Technology:	electromechanic		
Category:	1		
Usecase:	Receive safety control signal from upstream and cut off the power supply to motors		
Description of the usecase: Receive safety control signal from upstream and cut off the power supply to motors			
Documentation Element			
Document at i on:	TCF		
Document :			
MTTFD and Mission time Element			
MTTFD[a]:	509.6 (High)		
Missiontime[a]:	20		
B10fcycles]:	1369863	no[cycles/a]:	26880
Nop parameter:	Days: 280	Hours: 16	Seconds: 600
Document at i on:	TCF		
Document :			
Diagnostic coverage Element			
DC[%]:	99 (High)		
Measure:	Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Output device) (99 %)		
Document at i on:			
Document :			
Status / Messages Element			
Status:	green		

SISTEMA Safety Integrity Software Tool for the Evaluation of Machine Applications



Project name: SISTEMA(Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36)

File date: 24/12/2025 10:04:54 Report date: 2025/12/24 Checksum: d8df7f7ff332d54f15810479203152ab

EXCLUSION OF LIABILITY

Care has been taken in production of the software SISTEMA, which corresponds to the state of the art. It is made available to users free of charge.

Die Haftung des Institut für Arbeitsschutz der DGUV (IFA) ist damit auf Vorsatz und grobe Fahrlässigkeit (§ 521 BGB) bzw. bei Sach- und Rechtsmangel auf arglistig verschwiegene Fehler beschränkt (§ 23, § 24 BGB).

The Institute for Occupational Safety and Health of the German Social Accident Insurance undertakes to keep its website free of viruses; nevertheless, no guarantee can be given that the software and information provided are virus-free. The user is therefore advised to take appropriate security precautions and to use a virus scanner prior to downloading software, documentation or information.

German Social Accident Insurance (DGUV)
Glinkastraße 40
D-10117 Berlin

E-mail: info@dguv.de
Internet: www.dguv.de

NOTE

This document is not a complete technical documentation according to EN ISO 13849-1:2023, clause 12.

CONTACT

Company contact details unknown

Name in block letters

Date, signature

Authors

Authors

Inspectors

Inspectors