Technical Report for Functional Safety

Report No.: 2511183571W-002-L

Applicant:	Suzhou DEJI Machinery & equipment Co., Ltd
Address:	No.58, Shi Jin Lu, Xukou Town, Wuzhong District, Suzhou, Jiangsu, China
Project Title:	F29 Auto Milling Nozzle Equipment
Model No.:	DJC012503013
Tested Standards:	EN ISO 13849-1:2023,EN ISO 12100:2010,IEC 60204-1:2016
Conclusion:	In this report, the safety protection functions (include over/deep under-charging voltage, under-discharging voltage, over-charging current, over-discharging current, high and low temperature protection) for F29 Auto Milling Nozzle Equipment could be used in PL d application according to EN ISO 13849-1:2023. Annex C, the safety architecture and performance level meet EN ISO13849-1:2023, detail information of safety functions item see Table 1.

This evaluation report confirms the achievement of the requirements of functional safety based on the following proofs:

- Proof of systematic safety integrity for defined phases of the life cycle
- Proof of the required safety-related parameters (failure rate, $MTTF_D$, DC, CCF, PFH)
- Proof of the techniques and measures according toEN ISO 13849-1:2023
- Proofs that processes and methods are established at the manufacturer guaranteeing that unexceptionable processes In terms of risk analysis, design, production, validation, change management and quality management comply with the safety-related standard.

Tested by (name + signature):	Franco Zhan
Reviewed by (name + signature):	Jack Meng
Date of Issue:	2025-12-4

苏州全道通检测技术有限公司/QuanDaoTong (Suzhou) Testing Technologies Co., LTD.
苏州市 工业园区 金陵东路 266号5楼南区/South Area of 5/F, No. 266, Jinling Road (East), SIP, Suzhou, Jiangsu, China
电话: 0512-68832957
邮箱: service@qdttest.com

PR **Project name: F27 Auto Milling Nozzle Equipment**

Date of issue:	2025-12-4
Total number of pages:	22 pages report
Project number:	2511183571W-002-L
Name of Testing Laboratory preparing the Report:	Quandaotong (Suzhou) Testing Technologies Co., LTD
Applicant's name:	Suzhou DEJI Machinery & equipment Co.,Ltd
Address:	No.58, Shi Jin Lu, Xukou Town, Wuzhong District, Suzhou
Manufacturer:	Same as applicant
Trade Mark:	DEJI Industrial Automation system
Model/Type reference:	DJC012503013
Ratings:	380V AC, 50Hz, 10KW
Version of software:	SISTEMA: 3.0.2 build 1
Version of standard:	ISO 13849-1:2023, ISO 13849-2:2012
Checksum:	8bf61ba424134044caf96051b99102cf
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 documentations on SF, SB, BL and EL
- ☐ Show CCF and DC measures in detail
- ☐ Show requirements on PL and Category
- ☐ Show parameter documentations on PLr, PL, Category, CCF, MTTFD and DC
- ☑ Show messages

Contained safety functions

SF Name: Emergency Stop

Required: PLr d **Reached: PL d** **PFH [1/h]: 1.06E-7**
Status: green

List of documented messages:

- No messages known -

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

- No devices known -

SF Name: Safety Light Curtain

Required: PLr e **Reached: PL e** **PFH [1/h]: 9.48E-8** **Status: green**

List of documented messages:

- No messages known -

PR **Project name: F27 Auto Milling Nozzle Equipment**

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

- No devices known -

SF Name: Safety Door Lock

Required: PLr e	Reached: PL e	PFH [1/h]: 9.48E-8	Status: green

List of documented messages:

- No messages known -

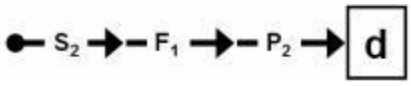
List of devices with a permissible operation time (T10D) of less than 20 years:

- No devices known -

SF Safety function: Emergency Stop

Identifier of the Safety function:	
Safety function type:	Safety-related stop function initiated by safeguard
Triggering event:	Push the E-stop button
Reaction and Behaviour on power failure:	Lead to and keep safety state
Safe state:	Power off servo drive
Operation mode:	Automatic or setting mode
Interfaces:	
Demand rate:	one times per day
Running-on time:	3 seconds for servo drive
Priority:	Highest
Documentation:	
Document:	

Required Performance Level Safety function

PLr (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:	
Documentation:	
Document:	

Performance Level Safety function

Reached PL: d	**PFH [1/h]: 1.06E-7**

Electromagnetic immunity, EMI (Annex L) Safety function

Route for fulfilment of EMI measures:	n/a
Documentation:	
Document:	

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

Device list:	

Status / Messages Safety function

Status:	green

Subsystems (1 / 3)

SB Name: E-stop

SF Safety function: Emergency Stop

Reference designator: SI0_0_1	**Inventory number:**	
Device details Subsystem		
Device Manufacturer:	Schneider	
Device Identifier:		
Device group:		
Part number: XB2BS542C	**Revision:**	
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Use case:		
Description of the use case:		
Documentation Subsystem		
Documentation:		
Document:		
Performance Level Subsystem		
PL determination:	Determine PL/PFH from Category, MTTFD and DC avg	
Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem		
Qualitative aspects suitable up to 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]: 4.28E-8**	
Documentation:		
Category Subsystem		
Cat.:	3	
Category requirements:	fulfilled	
Requirements for the category	- Accordance with relevant standards to withstand the expected influences. [fulfilled]	

SF Safety function: Emergency Stop

Requirements for the category	- 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]
Documentation:	
Source (e.g. standard) Category:	
File:	

MTTFD and Mission time Subsystem

MTTFD [a]:	100 (High)
Mission time [a]: 20	**Shortest mission time [a]: 20**

Diagnostic coverage Subsystem

DCavg [%]:	90 (Medium)

Common cause failure Subsystem

CCF Points:	70 (fulfilled)
CCF Measures:	- 15 Points | Separation/segregation - 15 Points | Protection against over-voltage, over-pressure, over-current, over-temperature - 5 Points | Components used are well-tried - 25 Points | Prevention of EMI or impurity of fluidic medium - 10 Points | Other influences
Documentation:	
Document:	

Status / Messages Subsystem

Status:	green

Channels / Test channels (1 / 2)

CH Name: Channel 1

MTTFD [a]: 100

Blocks (1 / 1)

BL Name: SI0_0_1

Reference designator: XB2BS542C **Inventory number:**

Device details Block

Device Manufacturer:

Device Identifier:

Device group:

SF Safety function: Emergency Stop

Part number:	**Revision:**	
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Technology:	electromechanic	
Category:	-	
Use case:		
Description of the use case:		
Documentation Block		
Documentation:		
Document:		
MTTFD and Mission time Block		
MTTFD [a]: 100 (High)		
Mission time [a]: 20	**Shortest mission time [a]: 20**	
Rate of dangerous failure [FIT]:		
1141.5 Documentation:		
Document:		
Diagnostic coverage Block		
DC [%]: 90 (Medium)		
Measure:	Cross monitoring of input signals with dynamic test if short circuits are not detectable (for multiple I/O)	
Documentation:		
Document:		
Status / Messages Block		
Status:	green	

Channels / Test channels (2 / 2)

CH Name: Channel 2

MTTFD [a]: 100

Blocks (1 / 1)

BL Name: SI0_1_1

Reference designator: XB2BS542C	**Inventory number:**
Device details Block	
Device Manufacturer:	
Device Identifier:	
Device group:	

SF Safety function: Emergency Stop

Part number:	**Revision:**	
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Technology:	electromechanic	
Category:	-	
Use case:		
Description of the use case:		

Documentation Block

Documentation:	
Document:	

MTTFD and Mission time Block

MTTFD [a]: 100 (High)	
Mission time [a]: 20	**Shortest mission time [a]: 20**
Rate of dangerous failure [FIT]: 1141.5	
Documentation:	
Document:	

Diagnostic coverage Block

DC [%]: 90 (Medium)	
Measure:	Cross monitoring of input signals with dynamic test if short circuits are not detectable (for multiple I/O)
Documentation:	
Document:	

Status / Messages Block

Status:	green

Subsystems (2 / 3)

SB Name: Safety PLC

Reference designator: GC-1000	**Inventory number:**	

Device details Subsystem

Device Manufacturer:	KEYENCE CORPORATION	
Device Identifier:		
Device group:		
Part number: GC-1000		**Revision:**
Function:	☐ Input ☐ Output	☑ Logic ☐ unknown

SF Safety function: Emergency Stop

Use case:	
Description of the use case:	

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL determination:	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)

PL: e

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

Qualitative aspects suitable up to PL: n/a	
Documentation:	
Document:	

Electromagnetic immunity, EMI (Annex L) Subsystem

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

Reached PL: e	**PFH [1/h]: 3.16E-8**
Documentation:	
Mission time [a]: 20	**Shortest mission time [a]: 20**

Category Subsystem

Cat.:	4
Category requirements:	fulfilled
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.
Documentation:	
Source (e.g. standard) Category:	
File:	

Status / Messages Subsystem

Status:	green

Subsystems (3 / 3)

SB Name: Safety Relay

Reference designator: KA15

Inventory number: *Device details Subsystem*

SF Safety function: Emergency Stop

Device Manufacturer:	Shenzhen ESPE Technology Co., Ltd.	
Device Identifier:		
Device group:		
Part number: ESRP-2A1B-E	**Revision:**	
Function:	☐ Input ☑ Output	☐ Logic ☐ unknown
Use case:		
Description of the use case:		

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL determination:	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)

PL: e

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

Qualitative aspects suitable up to PL: n/a	
Documentation:	
Document:	

Electromagnetic immunity, EMI (Annex L) Subsystem

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

Reached PL: e	**PFH [1/h]: 3.16E-8**
Documentation:	
Mission time [a]: 20	**Shortest mission time [a]: 20**

Category Subsystem

Cat.:	4
Category requirements:	fulfilled
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.
Documentation:	
Source (e.g. standard) Category:	
File:	

Status / Messages Subsystem

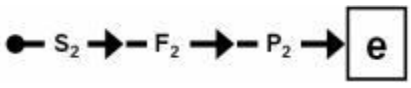
Status:	green

SF Safety function: Emergency Stop

SF Safety function: Safety Light Curtain

Identifier of the Safety function:	
Safety function type:	Safety-related stop function initiated by safeguard
Triggering event:	People or obstacles block the grating
Reaction and Behaviour on power failure:	Lead to and keep safety state
Safe state:	Power off servo drive
Operation mode:	Automatic or setting mode
Interfaces:	
Demand rate:	Three times per year
Running-on time:	3 seconds for servo drive
Priority:	Highest
Documentation:	
Document:	

Required Performance Level Safety function

PLr (by risk graph):	e
Severity of injury (S):	Serious (normally irreversible) injury or death
Frequency / exposure times to hazard (F):	Frequent to continuous / exposure time is long
Possibility of avoiding (P):	Scarcely possible
Risk graph:	
Documentation:	
Document:	

Performance Level Safety function

Reached PL: e	**PFH [1/h]: 9.48E-8**

Electromagnetic immunity, EMI (Annex L) Safety function

Route for fulfilment of EMI measures:	n/a
Documentation:	
Document:	

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

Device list:	

Status / Messages Safety function

Status:	green

Subsystems (1 / 3)

SB Name: Safety Light Curtain

SF Safety function: Safety Light Curtain

Reference designator: SO0_2	**Inventory number:**	
Device details Subsystem		
Device Manufacturer:	Shenzhen ESPE Technology Co., Ltd.	
Device Identifier:		
Device group:		
Part number: EFP3210P	**Revision:**	
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Use case:		
Description of the use case:		
Documentation Subsystem		
Documentation:		
Document:		
Performance Level Subsystem		
PL determination:	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)	
PL: e		
Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem		
Qualitative aspects suitable up to 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.	
Reached PL: e	**PFH [1/h]: 3.16E-8**	
Documentation:		
Mission time [a]: 20	**Shortest mission time [a]: 20**	
Category Subsystem		
Cat.:	4	
Category requirements:	fulfilled	
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.	
Documentation:		
Source (e.g. standard) Category:		

File:

SF Safety function: Safety Light Curtain

Status / Messages Subsystem

Status:	green

Subsystems (2 / 3)

SB Name: Safety PLC

Reference designator: GC-1000	**Inventory number:**

Device details Subsystem

Device Manufacturer:	KEYENCE CORPORATION
Device Identifier:	
Device group:	
Part number: GC-1000	**Revision:**
Function:	☐ Input ☑ Logic ☐ Output ☐ unknown
Use case:	
Description of the use case:	

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL determination:	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)

PL: e

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

Qualitative aspects suitable up to 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.

Reached PL: e	**PFH [1/h]: 3.16E-8**
Documentation:	
Mission time [a]: 20	**Shortest mission time [a]: 20**

Category Subsystem

Cat.:	4

SF **Safety function: Safety Light Curtain**

Category requirements:	fulfilled
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.
Documentation:	
Source (e.g. standard) Category:	
File:	

Status / Messages Subsystem

Status:	green

Subsystems (3 / 3)

SB Name: Safety Relay

Reference designator: KA15	**Inventory number:**

Device details Subsystem

Device Manufacturer:	Shenzhen ESPE Technology Co., Ltd.
Device Identifier:	
Device group:	
Part number: ESRP-2A1B-E	**Revision:**
Function:	☐ Input ☑ Output ☐ Logic ☐ unknown
Use case:	
Description of the use case:	

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)

PL: e

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

Qualitative aspects suitable up to 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.

SF Safety function: Safety Light Curtain

Reached PL: e	**PFH [1/h]: 3.16E-8**
Documentation:	
Mission time [a]: 20	**Shortest mission time [a]: 20**

Category Subsystem

Cat.:	4
Category requirements:	fulfilled
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.
Documentation:	
Source (e.g. standard) Category:	
File:	

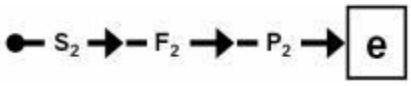
Status / Messages Subsystem

Status:	green

SF Safety function: Safety Door Lock

Identifier of the Safety function:	
Safety function type:	Safety-related stop function initiated by safeguard
Triggering event:	open the guard door
Reaction and Behaviour on power failure:	Lead to and keep safety state
Safe state:	Power off servo drive
Operation mode:	Automatic or setting mode
Interfaces:	
Demand rate:	Three times per year
Running-on time:	3 seconds for servo drive
Priority:	Highest
Documentation:	
Document:	

Required Performance Level Safety function

PLr (by risk graph):	e
Severity of injury (S):	Serious (normally irreversible) injury or death
Frequency / exposure times to hazard (F):	Frequent to continuous / exposure time is long
Possibility of avoiding (P):	Scarcely possible
Risk graph:	
Documentation:	
Document:	

Performance Level Safety function

Reached PL: e **PFH [1/h]: 9.48E-8**

Electromagnetic immunity, EMI (Annex L) Safety function

Route for fulfilment of EMI measures:	n/a
Documentation:	
Document:	

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

Device list:

Status / Messages Safety function

Status: green

Subsystems (1 / 3)

SB Name: Safety Switch

SF Safety function: Safety Door Lock

Reference designator: SI0_10	**Inventory number:**	
Device details Subsystem		
Device Manufacturer:	Shenzhen ESPE Technology Co., Ltd.	
Device Identifier:		
Device group:		
Part number: SLR11-110P-3	**Revision:**	
Function:	☒ Input ☐ Output	☐ Logic ☐ unknown
Use case:		
Description of the use case:		
Documentation Subsystem		
Documentation:		
Document:		
Performance Level Subsystem		
PL determination:	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)	
PL: e		
Qualitative aspects (e.g. software, see sections 7, 10.3) Subsystem		
Qualitative aspects suitable up to 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.	
Reached PL: e	**PFH [1/h]: 3.16E-8**	
Documentation:		
Mission time [a]: 20	**Shortest mission time [a]: 20**	
Category Subsystem		
Cat.:	4	
Category requirements:	fulfilled	
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.	
Documentation:		
Source (e.g. standard) Category:		
File:		

SF Safety function: Safety Door Lock

Status / Messages Subsystem

Status:	green

Subsystems (2 / 3)

SB Name: Safety PLC

Reference designator: GC-1000	**Inventory number:**

Device details Subsystem

Device Manufacturer:	KEYENCE CORPORATION
Device Identifier:	
Device group:	
Part number: GC-1000	**Revision:**
Function:	☐ Input ☑ Logic ☐ Output ☐ unknown
Use case:	
Description of the use case:	

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL determination:	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)

PL: e

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

Qualitative aspects suitable up to 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.

Reached PL: e	**PFH [1/h]: 3.16E-8**
Documentation:	
Mission time [a]: 20	**Shortest mission time [a]: 20**

Category Subsystem

Cat.: 4

SF Safety function: Safety Door Lock

Category requirements:	fulfilled
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.
Documentation:	
Source (e.g. standard) Category:	
File:	

Status / Messages Subsystem

Status:	green

Subsystems (3 / 3)

SB Name: Safety Relay

Reference designator: KA15	**Inventory number:**

Device details Subsystem

Device Manufacturer:	Shenzhen ESPE Technology Co., Ltd.
Device Identifier:	
Device group:	
Part number: ESRP-2A1B-E	**Revision:**
Function:	☐ Input ☑ Output ☐ Logic ☐ unknown
Use case:	
Description of the use case:	

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL	Enter PL/PFH directly (manufacturer ensures compliance with the requirements of the Category and of the PL)

PL: e

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

Qualitative aspects suitable up to 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.

SF Safety function: Safety Door Lock

Reached PL: e	**PFH [1/h]: 3.16E-8**
Documentation:	
Mission time [a]: 20	**Shortest mission time [a]: 20**

Category Subsystem

Cat.:	4
Category requirements:	fulfilled
Requirements for the category	Since the category is given by the manufacturer he is responsible to satisfy the requirements.
Documentation:	
Source (e.g. standard) Category:	
File:	

Status / Messages Subsystem

Status:	green

ATTACHMENT 1: Photos

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

******END OF REPORT******