



FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

T-Series Switchbox

Manufactured by

Topworx **Emerson Machinery Equipment (Shenzhen) Co. Ltd**
3300 Fern Valley Road 101 Building 2, COFCO Park,
Louisville Honglang North 2nd Road,
Kentucky 40213 Xin'an Street, Bao'an District,
USA Shenzhen 51801, China

Emerson AFCP Poland Sp. z o. o **Asco Valve (Shanghai) Co. Ltd**
Kurczaki 132 No.480, Xin Miao No.3 Road
Łódź 93-3331 Xiao Qiao Town, Song Jiang District
Poland Shanghai 201612, China

Ascoval Indústria e Comércio Ltda
Rua Goiatuba 81, Jardim Mutinga – Barueri
São Paulo, 06465-010y, Brazil

Has been assessed by Sira Certification Service with reference to the CASS methodologies and found to meet the requirements of

IEC 61508-2:2010 Systematic Capability (SC3)

As an element suitable for use in safety related systems performing safety functions up to and including

Use as a Controller – up to and including SIL 2*
Use as an Indicator – up to and including SIL 3*

* This certificate does not waive the need for further functional safety verification to establish the achieved Safety Integrity Level (SIL) of the safety related system.

Certification Manager:

James Lynskey

Initial Certification: 19th June 2012
This certificate re-issued: 25th March 2024
Renewal date: 18th June 2027

This certificate may only be reproduced in its entirety without any change.

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**Sira Certification Service
CSA Group UK**

Unit 6 Hawarden Industrial Park,
Hawarden, CH5 3US, United Kingdom.
Tel: +44 (0) 1244 670900
Email: ukinfo@csagroup.org
Web: www.csagroupuk.org

Report Summary

T-Series Discrete Valve Controller			
Safety Function:			
<i>"TO CLOSE OFF (RELIEVE) PNEUMATIC PRESSURE TO SPOOL VALVE"</i>			
Architectural constraints:	Type A HFT=0 SFF 87.39%	Proof Test Interval = 8760Hrs MTTR = 8 Hrs	SIL2
Random hardware failures:	$\lambda_{DD} = 0$ $\lambda_{DU} = 2.90E-08$	$\lambda_{SD} = 0$ $\lambda_{SU} = 8.40E-08$	
Probability of failure on demand:	PFD _{AVG} = 1.27E-04 (Low Demand Mode)		SIL3
Average Frequency of Dangerous failure on safety function:	PFH = 2.90E-08 (High Demand Mode)		SIL3
Hardware safety integrity compliance	Route 1 _H		
Systematic safety integrity compliance	Route 1 _S		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 2 (Low Demand) SIL 2 (High Demand)		

Selection of Proof Time Interval versus SIL % Contribution

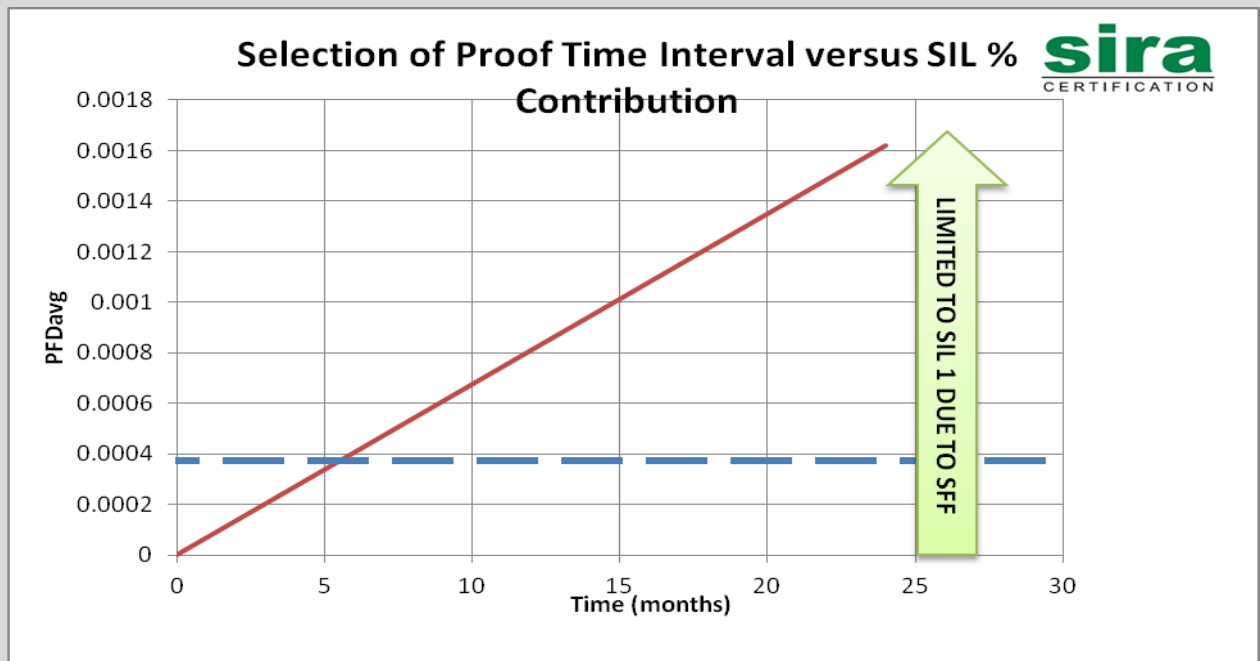
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CERTIFICATION

T-Series Discrete Valve Controller

Safety Function:

"TO OPEN (ADMIT) PNEUMATIC PRESSURE TO THE SPOOL VALVE"

Architectural constraints:	Type A HFT=0 SFF 31.36%	Proof Test Interval =8760Hrs MTTR = 8 Hrs	SIL1
Random hardware failures:	$\lambda_{DD} = 0$ $\lambda_{DU} = 1.85E-07$	$\lambda_{SD} = 0$ $\lambda_{SU} = 7.04E-08$	
Probability of failure on demand:	PFD _{AVG} =8.10E-04 (Low Demand Mode)		SIL3
Average Frequency of Dangerous failure on safety function:	PFH = 1.85E-07 (High Demand Mode)		SIL2
Hardware safety integrity compliance	Route 1 _H		
Systematic safety integrity compliance	Route 1 _S		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 1 (Low Demand)		
	SIL 1 (High Demand)		

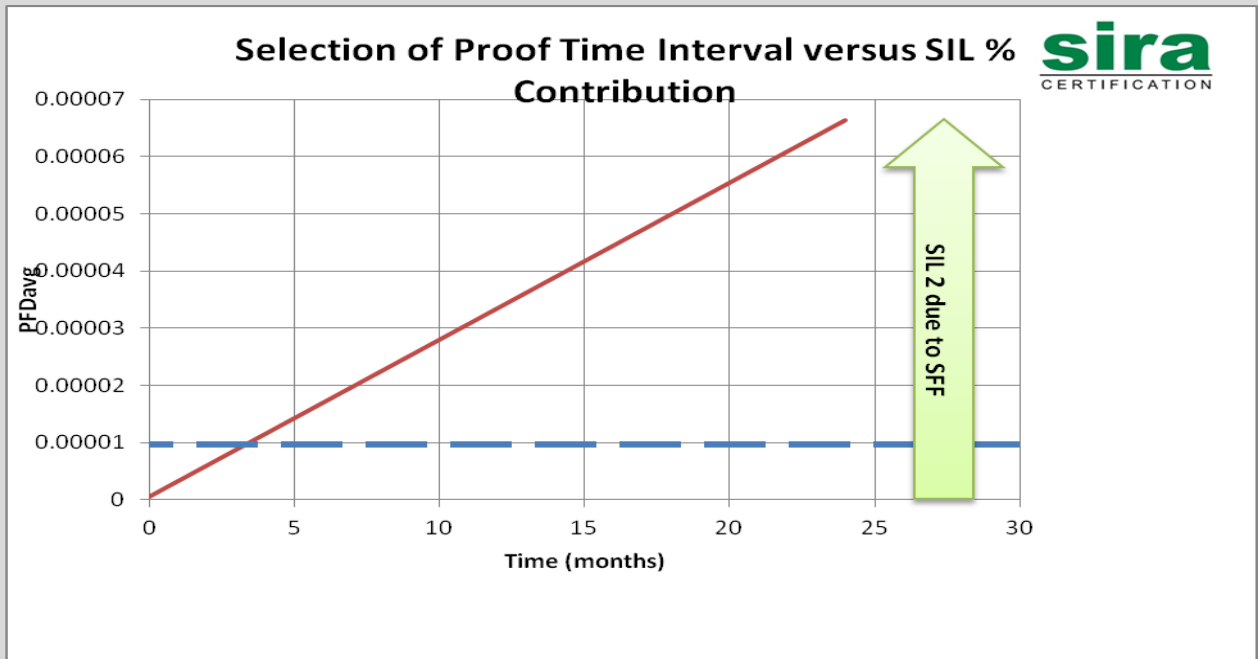


T-Series Switchboxes used as Indicators

Safety Function:

"TO PROVIDE AN INDICATION OF THE MONITORED VALVE POSITION"

Architectural constraints:	Type A HFT=0 SFF=89%	Proof Test Interval =8760Hrs MTTR = 8 Hrs	SIL2
Random hardware failures:	$\lambda_{DD} = 6.74E-08$ $\lambda_{DU} = 7.50E-09$	$\lambda_{SD} = 0.00E-00$ $\lambda_{SU} = 0.00E-00$	
Probability of failure on demand:	PFD _{AVG} =3.34E-05 (Low Demand Mode)		SIL4
Average Frequency of Dangerous failure on safety function:	PFH = 7.50E-09 (High Demand Mode)		SIL4
Hardware safety integrity compliance	Route 1 _H		
Systematic safety integrity compliance	Route 1 _S		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 2 (Low Demand) SIL 2 (High Demand)		

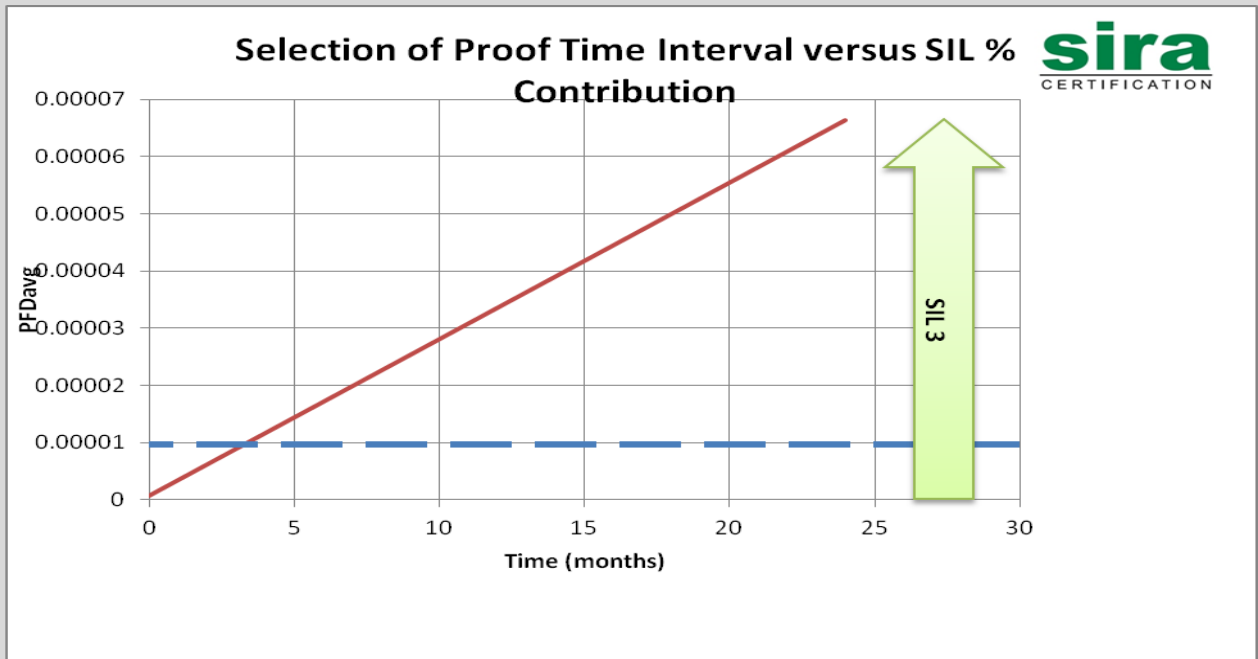


T-Series Indicator using GO switches (L series and 35 series)

Safety Function:

"TO PROVIDE AN INDICATION OF THE MONITORED VALVE POSITION"

Architectural constraints:	Type A HFT=0 SFF=91%	Proof Test Interval =8760Hrs MTTR = 8 Hrs	SIL3
Random hardware failures:	$\lambda_{DD} = 7.07E-08$ $\lambda_{DU} = 7.50E-09$	$\lambda_{SD} = 0.00E-00$ $\lambda_{SU} = 0.00E-00$	
Probability of failure on demand:	PFD _{AVG} =3.35E-05 (Low Demand Mode)		SIL4
Average Frequency of Dangerous failure on safety function:	PFH = 7.50E-09 (High Demand Mode)		SIL4
Hardware safety integrity compliance	Route 1 _H		
Systematic safety integrity compliance	Route 1 _S		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 3 (Low Demand) SIL 3 (High Demand)		

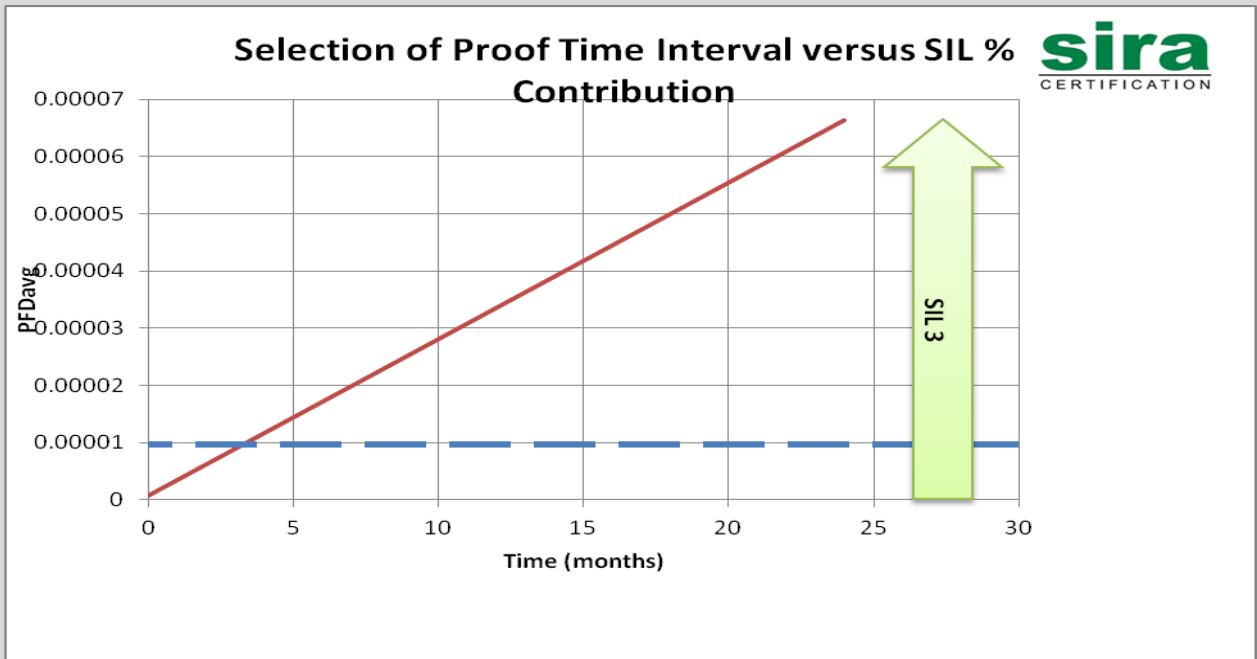


T-Series Indicator using the SD36 MiniGO switch

Safety Function:

"TO PROVIDE AN INDICATION OF THE MONITORED VALVE POSITION"

Architectural constraints:	Type A HFT=0 SFF=91%	Proof Test Interval =8760Hrs MTTR = 8 Hrs	SIL3
Random hardware failures:	$\lambda_{DD} = 7.07E-08$ $\lambda_{DU} = 7.50E-09$	$\lambda_{SD} = 0.00E-00$ $\lambda_{SU} = 0.00E-00$	
Probability of failure on demand:	PFD _{AVG} =3.35E-05 (Low Demand Mode)		SIL4
Average Frequency of Dangerous failure on safety function:	PFH = 7.50E-09 (High Demand Mode)		SIL4
Hardware safety integrity compliance	Route 1 _H		
Systematic safety integrity compliance	Route 1 _S		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 3 (Low Demand) SIL 3 (High Demand)		



Product description and scope of certification



On/Off Valve Controllers and Indicators (T-Series)

T-Series switchboxes deliver outstanding value by providing full functionality in compact, direct-mount enclosures. They carry IECEx, ATEX, and UL certifications in a single model making it easier for global customers to standardize across plants in multiple world areas.

The T-Series consists of two models. TXP & TXS variants all capable of incorporating a pilot valve and positioning sensor into a single platform with the enclosure differing per model type depending on the application requirements.

Modules in the T-Series

The T-Series consists of the following modules:

- Pilot Valve
- Spool Valve
- Shaft (only plays part in indicator safety function)
- Sensor Module (see Annex A for a full list of sensor module options covered by this certificate)
- Indicator Beacon (only plays part in indicator safety function)

T-Series Safety Functions

The safety functions of the T-Series are defined as:

T-Series as a controller:

- To relieve pneumatic pressure to the spool valve by de-energising the solenoid valve allowing the actuator to perform its safety function.
- To admit pneumatic pressure to the spool valve by energising the solenoid valve allowing the actuator to perform its safety function.

T-Series as an Indicator:

- To provide an accurate indication of the monitored valve position.

Product identification and configuration

The product is defined in the manufacturer's drawings listed in Table 1 below.

Table 1: Certified product drawings

Document no.	Rev	Date	Document description
ES-014981-1	6	2/14/2011	TD series final assembly drawing
ES-01856-1	10	-	T Series master installation, operation and maintenance manual
ES-02296-1	1	-	T series (TXP) configuration document
ES-02297-1	1	-	T series (TXS) configuration document
ES-03890-1	6	25/06/2013	36 Series TVL/TVH/TVF

The assessment has produced the supporting information given in Table 3 below.

Table 2: Base Information

1	Product identification:	T-Series as described in manufacturer's product catalogue and labeled as being manufactured in the USA
2	Functional specification:	Refer to paragraph above 'Use in safety functions' and full specification in manufacturer's product catalogue.
3-5	Random hardware failure rates:	Refer to table in report summary
6	Environment limits:	Temperature range: Solenoid option:-40 to +105°C for the T-Series GO switch option:-60 to +100°C for the T-Series
7	Lifetime/replacement limits:	Refer to IOM manual T-Series – ES-01856-1 R10
8	Proof Test requirements:	
9	Maintenance requirements:	
10	Diagnostic coverage:	When operating as an indicator the T series can claim a form of detection due to the use of diverse hardware (comparison of mechanical and electrical outputs).
11	Diagnostic test interval:	
12	Repair constraints:	Refer to IOM manual T-Series – ES-01856-1 R10
13	Safe Failure Fraction:	Refer to table in report summary
14	Hardware fault tolerance (HFT):	
15	Highest SIL (architecture/type A/B):	
16	Systematic failure constraints:	The requirements of this clause are contained in the relevant IOM Manual T-Series – ES-01856-1 R10
17	Evidence of similar conditions in previous use:	Compliance Route 2 _H (proven-in-use) not used
18	Evidence supporting the application under different conditions of use:	
19	Evidence of period of operational use:	
20	Statement of restrictions on functionality:	
21	Systematic capability:	
22	Systematic fault avoidance measures:	This assessment is based on an element which is to be used in a SRS and is not a full SRS design related assessment.
23	Systematic fault tolerance measures:	
24	Validation records:	

Additional Manufacturing Facilities

The following locations have been assessed by CSA Group UK and were found to be in conformance to IEC61508:2010 and follow the same level of rigor and process quality and control as TopWorx Inc (USA).

Emerson Machinery Equipment (Shenzhen) Co. Ltd

101 Building 2, COFCO Park,
Honglang North 2nd Road,
Xin'an Street, Bao'an District,
Shenzhen 51801, China



**Sira Certification Service
CSA Group UK**

Unit 6 Hawarden Industrial Park,
Hawarden, CH5 3US, United Kingdom.
Tel: +44 (0) 1244 670900
Email: ukinfo@csagroup.org
Web: www.csagroupuk.org

Emerson AFCP Poland Sp. z o. o
Kurczaki 132
Łódź 93-3331
Poland

Asco Valve (Shanghai) Co. Ltd
No.480, Xin Miao No.3 Road
Xiao Qiao Town, Song Jiang District
Shanghai 201612, China

Ascoval Indústria e Comércio Ltda
Rua Goiatuba 81, Jardim Mutinga – Barueri
São Paulo, 06465-010y, Brazil

Conditions of Certification

The validity of the certified data is conditional on the Manufacturer complying with the following conditions:

1. The manufacturer shall analyse failure data from returned products on an on-going basis. Sira Certification Service shall be informed in the event of any indication that the actual failure rates are worse than the certified failure rates. (A process to rate the validity of field data should be used. To this end, the manufacturer should co-operate with users to operate a formal field-experience feedback programme).
2. Sira shall be notified in advance (with an impact analysis report) before any modifications to the certified equipment or the functional safety information in the user documentation is carried out. Sira may need to perform a re-assessment if modifications are judged to affect the product's functional safety certified herein.
3. On-going lifecycle activities associated with this product (e.g., modifications, corrective actions, field failure analysis) shall be subject to surveillance by Sira in accordance with 'Regulations Applicable to the Holders of Sira Certificates'.

Conditions of Safe Use

The validity of the certified data is conditional on the user complying with the following conditions:

1. The user shall comply with the requirements given in the manufacturer's user documentation (referred to in Table 2 above) in regard to all relevant functional safety aspects such as application of use, installation, operation, maintenance, proof tests, maximum ratings, environmental conditions, repair, etc;
2. Selection of this equipment for use in safety functions and the installation, configuration, overall validation, maintenance and repair shall only be carried out by competent personnel, observing all the manufacturer's conditions and recommendations in the user documentation.
3. All information associated with any field failures of this product should be collected under a dependability management process (e.g., IEC 60300-3-2) and reported to the manufacturer.
4. The unit should be tested at regular intervals to identify any malfunctions; in accordance with the safety manual.

General Conditions and Notes

1. This certificate is based upon a functional safety assessment of the product described in Sira Test & Certification Assessment Report R56A24114A;

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Sira Certification Service CSA Group UK

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2. If certified product or system is found not to comply, Sira Certification Service should be notified immediately at the address shown on this certificate.
3. The use of this Certificate and the Sira Certification Mark that can be applied to the product or used in publicity material are subject to the 'Regulations Applicable to the Holders of Sira Certificates' and 'Supplementary Regulations Specific to Functional Safety Certification'.
4. This document remains the property of Sira and shall be returned when requested by the issuer.

Certificate History

Issue	Date	Document no.	Comment
05	15/06/2015	SIRA FSP 11019	Certificate updated to include additional manufacturing facilities as a result of successful on site audit – report R70005298.
06	27/06/2017	R70118946A	Certificate reissued as a result of successful recertification.
07	18/01/2018	70168119	Updated to include Q2/Q4 and G2/G4 switch variations. See Annex A.
08	04/09/2018	-	Minor changes to reflect systematic capability
09	07/07/2020	80043176	Certificate updated to include the SD36 MiniGO variant
10	24/06/2022	-	3-month certificate extension for recertification audit.
11	23/09/2022	R80132073A	Certificate renewed following successful recertification audit.
12	07/11/2023	80129810 - 3 80129810 - 2	Added Emerson AFCP Poland Sp. z o. o. and Asco Valve (Shanghai) Co. Ltd. manufacturing locations. Shenzhen location address has been updated and added to the cover and also "Additional Manufacturing Facilities" section has been updated with shanghai and Poland locations and removed Hungary location as requested by the customer. Also corrected S2/S4 and D2/D4 and Q2/Q4 ratings.
13	25/03/2024	80129810 - 1	Added Ascoval Indústria e Comércio Ltda manufacturing location to the certificate and updated "Additional Manufacturing Facilities" section.



Annex A

Below is a list of switch module configurations supported by this certificate:

0X - 4-20 mA Transmitter with no switches
42 - (2) p+f model NBB2-V3-E2
52 - (2) p+f model NBB3-V3-Z4
53 - (3) p+f model NBB3-V3-Z4
54 - (4) p+f model NBB3-V3-Z4
62 - 2-wire N/O 0-253V 200mA
72 - 3-wire PNP 0-60VDC 200mA
E1 - (1) p+f model NJ2-V3-N
E2 - (2) p+f model NJ2-V3-N
E3 - (3) p+f model NJ2-V3-N
E4 - (4) p+f model NJ2-V3-N
K2 - (2) Mech SPDT w/ gold contacts
K4 - (4) Mech SPDT w/ gold contacts
L1 - (1) SPDT GO Switch
L2 - (2) SPDT GO Switches
M2 - (2) Mech SPDT
M4 - (4) Mech SPDT
N2 – NAMUR switches
P1 - (1) SPDT reed switch (set in closed position)
P2 - (2) SPDT reed switches
P3 - (3) SPDT reed switches
P4 - (4) SPDT reed switches
R1 - (1) SPDT reed switch (set in closed position)
R2 - (2) SPDT 200mA max
R4 - (4) SPDT 200mA max
T2 - (2) Mech DPDT
Q2/Q4 – Ex ia rated, 30V250mA
Q2/Q4 - 2A/120Vac, 1A/24Vdc
G2/G4 - 4A/120Vac, 3A/24Vdc
S2/S4 - 4A/120Vac, 3A/24Vdc
D2/D4 - 2A/120Vac, 1A/24Vdc



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