

## FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

### ***D-Series Switchbox***

Manufactured by

***Topworx***  
*3300 Fern Valley Road*  
*Louisville*  
*Kentucky 40213*  
*USA*

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\***

When used in accordance with the scope and conditions of this certificate

\* 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:



Wayne Thomas  
Certification Manager

Initial Certification: 19<sup>th</sup> June 2012  
This certificate re-issued: 04<sup>th</sup> September 2018  
Renewal date: 18<sup>th</sup> June 2022

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](mailto:ukinfo@csagroup.org)  
Web: [www.csagroupuk.org](http://www.csagroupuk.org)

## Report Summary

<b>D-Series Discrete Valve Controller</b>			
<b>Safety Function:</b> "TO CLOSE OFF (RELIEVE) PNEUMATIC PRESSURE TO THE SPOOL VALVE"			
Architectural constraints:	Type A HFT=0 SFF 74%	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 <sub>AVG</sub> = 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 <sub>H</sub>		
Systematic safety integrity compliance	Route 1 <sub>S</sub>		
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**

The graph illustrates the selection of a proof time interval based on the required SIL contribution. The y-axis represents the average probability of failure on demand (PFD<sub>avg</sub>), and the x-axis represents the proof time interval in months. A red line shows the contribution of the safety function (SFF) to the total PFD<sub>avg</sub>. A horizontal dashed blue line indicates the target PFD<sub>avg</sub> for SIL 2. A green arrow points to the intersection of the red line and the blue line, which occurs at approximately 26 months, indicating that the proof time interval is limited to SIL 2 due to the SFF contribution.



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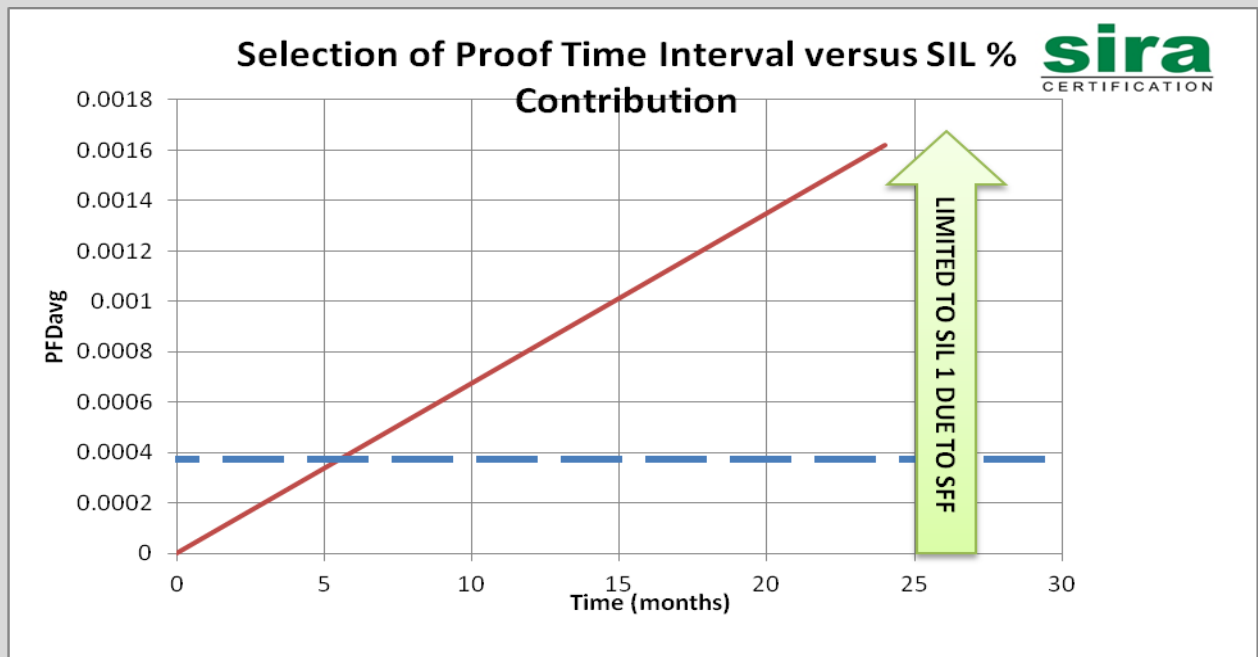
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Tel: +44 (0) 1244 670900  
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## D-Series Discrete Valve Controller

### Safety Function:

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

Architectural constraints:	Type A HFT=0 SFF 29%	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 <sub>AVG</sub> =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 <sub>H</sub>		
Systematic safety integrity compliance	Route 1 <sub>s</sub>		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 1 (Low Demand) SIL 1 (High Demand)		



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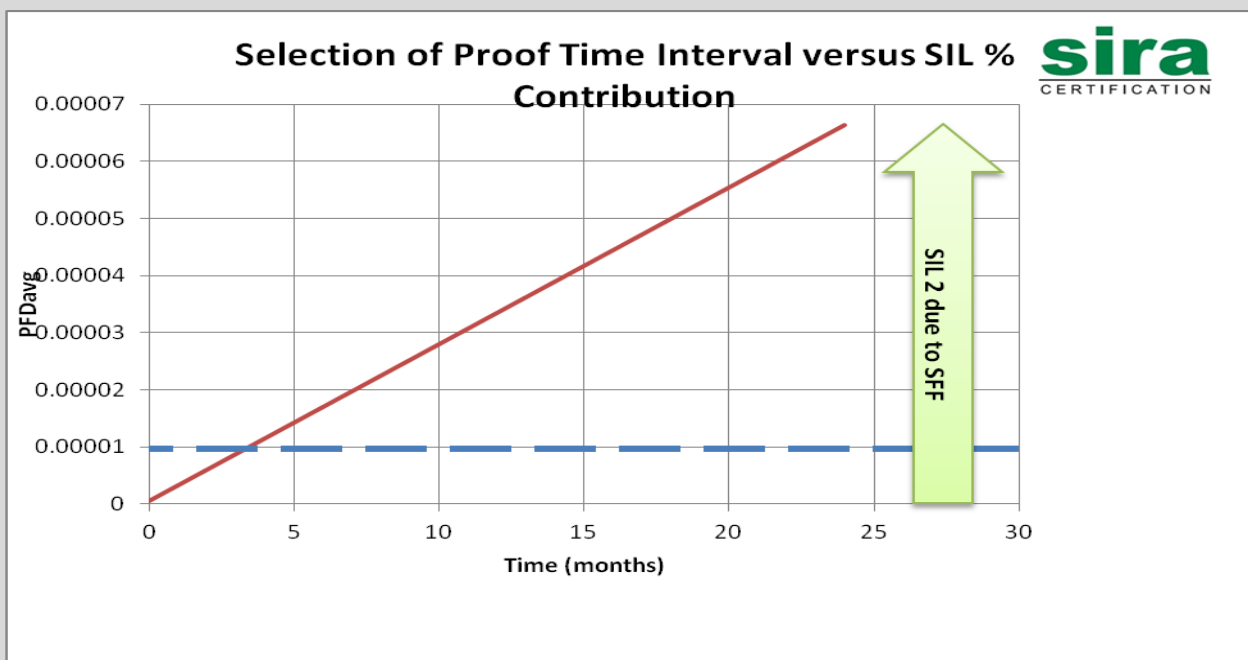
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## D-Series Switchboxes used as Indicators

### 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 <sub>AVG</sub> =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 <sub>H</sub>		
Systematic safety integrity compliance	Route 1 <sub>s</sub>		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 2 (Low Demand) SIL 2 (High Demand)		



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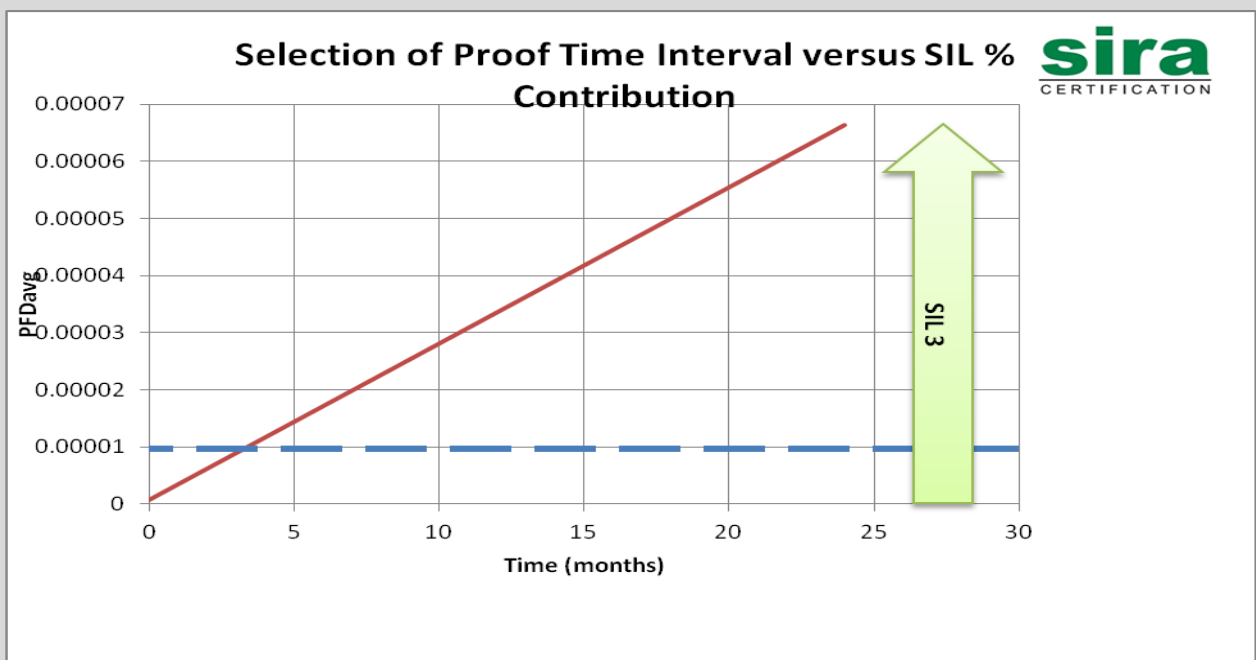
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## D-Series Indicator using GO switches (Z series, L series and 35 series)

### 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 <sub>AVG</sub> =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 <sub>H</sub>		
Systematic safety integrity compliance	Route 1 <sub>s</sub>		
Systematic Capability	SC 3 (See report R56A24114B)		
Overall SIL-capability achieved	SIL 3 (Low Demand) SIL 3 (High Demand)		



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## Product description and scope of certification



### On/Off Valve controllers and Indicators (D-Series)

D-Series discrete valve controllers are certified for use in every world area. 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 D-Series consists of three models. DXP, DXS, and DXR variants are all capable of incorporating a pilot valve and position sensors with the enclosure differing per model type depending on the application requirements

### Modules in the D-Series Valve Controller

The D-Series Valve Controller 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)

### D-Series Safety Functions

The safety functions of the D-Series Valve Controller are defined as:

#### D-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.

#### D-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.	Re v	Date	Document description
ES-01141-1	7	3/15/2012	D series final assembly drawing
ES-01857-1	13	-	D Series master installation, operation and maintenance manual
ES-02292-1	1	-	D series (DXP) configuration document
ES-02293-1	1	-	D series (DXS) configuration document
ES-04900-1	6	10/30/2017	HART Module Assembly

The assessment has produced the supporting information given in Table 2 below.



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**Table 2: Base Information**

1	Product identification:	D-Series as described in manufacturer's product catalogue
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:-20 to +100°C for the D-Series GO switch option:-60 to +100°C for the D-Series
7	Lifetime/replacement limits:	Refer to IOM manual D-Series – ES-01857-1 R13
8	Proof Test requirements:	
9	Maintenance requirements:	
10	Diagnostic coverage:	NA
11	Diagnostic test interval:	
12	Repair constraints:	
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 D-Series – ES-01857-1 R13
17	Evidence of similar conditions in previous use:	Compliance Route 2 <sub>H</sub> (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 Process Management**

8000 Székesfehérvár  
Holland fasor 6  
Hungary

**Emerson Machinery Equipment**

Bao Heng Industry Park, Liu Xian 1st Road,  
District 68 Bao'an District, Shenzhen, P.R.  
China.  
Post code: 518101



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## 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.
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.



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## Certificate History

Issue	Date	Document no.	Comment
05	15/06/2015	SIRA FSP 11018	Certificate updated to include additional manufacturing faculties as a result of successful audit – report R70005298.
06	23/01/2017	SIRA FSP 11018	Certificate updated to correct incorrect SFF value in results tables 1 and 2.
07	27/06/2017	R70118946A	Certificate reissued as a result of successful recertification.
08	04/01/2018	70168119	Certificate updated to include documentation for HART v7 module. Note. HART transmitter in Annex A refers to the new HART v7 module.
09	04/09/2018	-	Minor changes to reflect systematic capability.



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## Annex A

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

*00 - No switches*  
*0A - No switches w/ 0-1K potentiometer*  
*0B - No switches w/ 0-10K potentiometer*  
*0H - HART transmitter*  
*0X - 4-20mA transmitter*  
*31 - (1) P+F NJ5-30GK-S1N*  
*32 - (2) P+F NJ5-30GK-S1N*  
*42 - (2) P+F NBB2-V3-E2*  
*44 - (2) P+F NBB2-V3-E2*  
*52 - (2) P+F NBB3-V3-Z4*  
*54 - (4) P+F NBB3-V3-Z4*  
*62 - 2-wire N/O 0-253V 200mA*  
*72 - 3-wire PNP 0-60VDC 200mA*  
*82 - (2) ITW mechanical DPDT*  
*83 - (3) ITW mechanical DPDT*  
*84 - (4) ITW mechanical DPDT*  
*B2 - (2) P+F NJ2-12GK-SN*  
*B3 - (3) P+F NJ2-12GK-SN*  
*E1 - (1) P+F NJ2-V3-N inductive NAMUR*  
*E2 - (2) P+F NJ2-V3-N inductive NAMUR*  
*E3 - (3) P+F NJ2-V3-N inductive NAMUR*  
*E4 - (4) P+F NJ2-V3-N inductive NAMUR*  
*E6 - (6) P+F NJ2-V3-N inductive NAMUR*  
*EH - HART transmitter w/ P+F NJ2-V3-N inductive NAMUR*  
*ES - ESD/PST module w/ GO™ Switch*  
*EX - 4-20mA transmitter w/ P+F NJ2-V3-N inductive NAMUR*  
*F2 - (2) P+F NJ2-12GK-N*  
*J1 - (1) P+F NJ2-11-SN-G*  
*J2 - (2) P+F NJ2-11-SN-G*  
*K2 - (2) Mechanical SPDT gold contacts*  
*K4 - (4) Mechanical SPDT gold contacts*  
*K6 - (6) Mechanical SPDT gold contacts*  
*KH - HART transmitter w/ mechanical SPDT gold contacts*  
*KX - 4-20mA transmitter w/ mechanical SPDT gold contacts*  
*L1 - (1) GO™ Switch SPDT hermetic seal*  
*L2 - (2) GO™ Switches SPDT hermetic seal*  
*L3 - (3) GO™ Switches SPDT hermetic seal*  
*L4 - (4) GO™ Switches SPDT hermetic seal*



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LH - HART transmitter w/ GO™ Switch SPDT  
LX - 4-20mA transmitter w/ GO™ Switch SPDT  
M2 - (2) Mechanical SPDT  
M4 - (4) Mechanical SPDT  
M6 - (6) Mechanical SPDT  
MA - (2) Mechanical SPDT switches w/ 0-1K potentiometer  
MH - HART transmitter w/ mechanical SPDT  
MX - 4-20mA transmitter w/ mechanical SPDT  
N2 - Namur switches  
PN - (2) SPDT module w/o LEDs, 1A max  
PS - (2) SPDT module w/ LEDs, 250mA max  
T2 - (2) Mechanical DPDT  
TX - 4-20mA transmitter w/ mechanical DPDT  
V1 - (1) P+F NJ3-18GK-S1N  
V2 - (2) P+F NJ3-18GK-S1N  
V3 - (3) P+F NJ3-18GK-S1N  
Z1 - (1) GO™ Switch DPDT hermetic seal  
Z2 - (2) GO™ Switches DPDT hermetic seal  
Z3 - (3) GO™ Switches DPDT hermetic seal  
Z4 - (4) GO™ Switches DPDT hermetic seal  
ZH - HART transmitter w/ GO™ Switch DPDT  
ZX - 4-20mA transmitter w/ GO™ Switch DPDT



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