



## FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

***GO™ switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J, 7L***

Manufactured by

***Topworx***  
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*Louisville*  
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*USA*

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Have 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/subsystem suitable for use in safety related systems performing safety functions up to and including

**SIL 2 capable with HFT = 0 (1oo1)\***  
**SIL 3 capable with HFT = 1 (1oo2)\***

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 Decision:

James Lynskey

Initial Certification: 27/04/2009  
This certificate issued: 16/02/2024  
Renewal date: 15/06/2029

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



## Product description and scope of certification

This assessment covers the hardware safety integrity of the GO™ Switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J and 7L. The components in the 73-7L models that perform the safety function are all identical, therefore all models ranging from 73-7L proximity switches have been identified as 'Series 70' throughout this report and supporting FMEA.

The magnetic proximity switches incorporate a permanent magnet to create a magnetic field which will be interrupted by an external ferrous or magnetic object as it comes within the switch's sensing range. This interaction causes an armature in the switch to snap to its alternative position and thereby change the state of the electrical contacts (closing an open contact or opening a closed contact depending on the configuration).

As the switches are purely electro-mechanical (non-solid state); multiple switches may be used in series or in parallel for increased reliability without suffering voltage drops or leakage current.

The internal contact arrangements are available with SPDT and DPDT contacts.



**Figure 1:** Final assembly of the GO™ Switch models: 73 (example of 70 series product).

## Use in safety function(s)

The element safety functions for the GO™ Switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J and 7L:

- 1) To close a normally open contact.**
- 2) To open a normally closed contact.**

## Certified data in support of use in safety functions

The assessment has been carried out with reference to the *Conformity Assessment of Safety-related Systems* (CASS) methodology using the Route 1<sub>H</sub> approach.

Based on the documents submitted by Topworx Inc, the Failure Mode and Effect Analysis (FMEA) of the GO™ Switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J and 7L has verified the documents as evidence of conformity to IEC 61508-2:2010 in respect of 'hardware safety integrity'. Component failure rates have been sourced against the failure modes using Item software reliability package and RIAC Automated Data book. Tables 1 and 2 below summarize the FMEA assessment:

**Table 1:** FMEA results of the GO™ Switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J and 7L

<b>Safety Function:</b> 'To close a normally open contact'					
<b>Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4</b>		<u>GO™ Series Models: 70 – SPDT model</u>	<u>GO™ Series Models: 70 – DPDT model</u>	<b>Verdict</b>	
Architectural constraints & Type of product A/B		<b>HFT (1oo1) =0</b>	<b>HFT (1oo2) =1</b>	<b>Type A</b>	
Safe Failure Fraction (SFF)		<b>7.15%</b>	<b>8%</b>	<b>SIL 1</b>	<b>SIL 2</b>
Random hardware failures: [h <sup>-1</sup> ]	λ <sub>DD</sub>	0.00E+00	0.00E+00		
	λ <sub>DU</sub>	3.48E-07	3.59E-08		
Random hardware failures: [h <sup>-1</sup> ]	λ <sub>SD</sub>	0.00E+00	0.00E+00		
	λ <sub>SU</sub>	2.68E-08	2.69E-09		
Diagnostic coverage (DC)		0%	0%		
PFD @ PTI = 8760Hrs MTTR = 8 Hrs		<b>1.53E-03</b>	<b>1.55E-04</b>	<b>SIL 2</b>	<b>SIL 3</b>
Average Freq' of Dangerous failure (High Demand - PFH)		3.48E-07	3.59E-08	<b>SIL 2</b>	<b>SIL 3</b>
Hardware safety integrity compliance		Route 1 <sub>H</sub>			
Systematic safety integrity compliance		See report R70008287B			
Systematic Capability		SC3 as per clause 7.4.3 (part2) of IEC 61508			
Hardware safety integrity achieved		<b>SIL 1 achieved for SPDT Series 70 proximity switch</b> <b>SIL 2 achieved for DPDT Series 70 proximity switch</b>			

**Table 2:** FMEA results of the GO™ Switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J and 7L

<b>Safety Function:</b> 'To open a normally closed contact'					
<b>Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4</b>		<u>GO™ Series Models: 70 – SPDT model</u>	<u>GO™ Series Models: 70 – DPDT model</u>	<b>Verdict</b>	
Architectural constraints & Type of product A/B		<b>HFT (1oo1) =0</b>	<b>HFT (1oo2) =1</b>	<b>Type A</b>	
Safe Failure Fraction (SFF)		<b>86.49%</b>	<b>87%</b>	<b>SIL 2</b>	<b>SIL 3</b>
Random hardware failures: [h <sup>-1</sup> ]	λ <sub>DD</sub>	0.00E+00	0.00E+00		
	λ <sub>DU</sub>	5.06E-08	5.08E-09		
Random hardware failures: [h <sup>-1</sup> ]	λ <sub>SD</sub>	0.00E+00	0.00E+00		
	λ <sub>SU</sub>	3.24E-07	3.33E-08		
Diagnostic coverage (DC)		0%	0%		
PFD @ PTI = 8760Hrs MTTR = 8 Hrs		<b>2.22E-04</b>	<b>2.33E-05</b>	<b>SIL 3</b>	<b>SIL 4</b>
Average Freq' of Dangerous failure (High Demand - PFH)		5.06E-08	5.08E-09	<b>SIL 3</b>	<b>SIL 4</b>
Hardware safety integrity compliance		Route 1 <sub>H</sub>			
Systematic safety integrity compliance		See report R70008287B			
Systematic Capability		SC3 as per clause 7.4.3 (part2) of IEC 61508			
Hardware safety integrity achieved		<b>SIL 2 achieved for SPDT Series 70 proximity switch</b> <b>SIL 3 achieved for DPDT Series 70 proximity switch</b>			



**Note 1:** The failure data:

- 1) Failure rates stated in Tables 1 and 2 are in units of failures per hour
- 2) The PFD<sub>AVG</sub> figure shown is for illustration only assuming a proof test interval of 8760 hours and MTTR of 8 hours. Refer to IEC 61508-6 for guidance on PFD<sub>AVG</sub> calculations from the failure data.
- 3) The calculated failure rates used in the safe failure fraction and diagnostic coverage do not include ( $\lambda$  no parts or no effect) failures in the calculation.
- 4) Where a partial stroke test facility is provided by external element then the PFD<sub>AVG</sub> can be updated to a new value using the following expression as stated in IEC 61508 part 6.

$$PFD_{avg} = (PTF \lambda_{du} (MRT + \frac{T_{pst}}{2}) + (1 - PTF) \lambda_{du} \frac{PTI}{2})$$

Where, *PTF*: (partial proof factor); *MRT* (mean repair time); *T<sub>PST</sub>* (partial proof test); *PTI* (proof test interval);  $\lambda_{du}$  (dangerous undetected, see tables above).

- 5) Maximum *PTF* can be claimed is 60%, assuming the external element such as (PLC) can deliver the measurement.
- 6) Where *PTF* event is used, the safe failure fraction (SFF) of the element remains unchanged.

**Table 3: Conditions for maintaining safety integrity capability**

1	Product identification:	GO™ Switch models: 73, 74, 75, 76, 77, 7G, 7H, 7I, 7J and 7L.
2	Functional specification:	1 - To close a normally open contact 2 - To open a normally closed contact
3-5	Random hardware failure rates:	Refer to tables 1 & 2 of this certificate.
6	Environment limits:	Refer to hardware assessment report R70008287A.
7	Lifetime/replacement limits:	Lifetime expectancy is estimated 45 years as long as regular maintenance is carried out as recommended by the manufacturer in the safety manual.
8	Proof Test requirements:	For proof test intervals, Tables 1 & 2 show a PTI of 8760 hours (1 year) as an example.
9	Maintenance requirements:	Refer to hardware assessment report R70008287A.
10	Diagnostic coverage:	0% diagnostic coverage.
11	Diagnostic test interval:	No diagnostic test interval is required as no form of diagnostics is available in the product supported by this certificate.
12	Repair constraints:	Refer to hardware assessment report R70008287A.
13	Safe Failure Fraction:	See tables 1 & 2 of this certificate.
14	Hardware fault tolerance (HFT):	HFT=0, (1oo1/SPDT) and HFT=1 (1oo2/DPDT).
15	Highest SIL (architecture/type A/B):	Type A.
16	Systematic failure constraints:	See PTI as specified in Table 1.
17	Evidence of similar conditions in previous use:	No previous use assessment performed for this product, assessment performed was proven by design type.
18	Evidence supporting the application under different conditions of use:	Not applicable, see 17 above.
19	Evidence of period of operational use:	Not applicable, see 17 above.
20	Statement of restrictions on functionality:	Not applicable, see 17 above.
21	Systematic capability (SC1, SC2, SC3)	SC3 - see report R56A32763B.
22	Systematic fault avoidance measures:	Compliance with techniques and measures from IEC 61508-2 Annex B to SIL 2
23	Systematic fault tolerance measures:	Compliance with techniques and measures from IEC 61508-2 Annex A to support the SFF achieved
24	Validation records:	All documents that have been used in support of the hardware assessment have been documented.



Failure to observe the above conditions will invalidate the certified data and may compromise the integrity of the safety function performed by the product.

**Management of functional safety**

The assessment has demonstrated that the certified products are supported by an appropriate functional safety management system that meets the relevant requirements of IEC 61508-1:2010 clause 6. See report R70008287B.

**Identification of certified equipment**

A full list of certified equipment documents is defined below:

<b>Document no.</b>	<b>Rev</b>	<b>Date</b>	<b>Document description</b>
S-A70-0340	05	28/06/2003	73 series SPDT w/hermetic seal (-20 to 50°C).
ES-01518-1	01	14/11/2008	74 series SPDT Go switch assembly w/leads.
S-70-7005-A	01	16/09/2008	75 series SPDT Go switch assembly w/leads.
ES-01519-1	01	14/11/2008	76 series SPDT Go switch assembly w/leads.
S-70-7010-A	01	16/09/2008	77 series SPDT Go switch assembly w/leads.
S-7G-7003-A	01	24/02/2003	7G series SPDT w/hermetic seal (-20 to 50°C).
ES-01520-1	01	14/11/2008	7H series DPDT Go Switch assembly w/leads.
S-71-7001-A	01	16/09/2008	71 series DPDT Go switch assembly w/leads.
S-A70-NEWSTD	01	08/07/2004	70 series 'E' assembly.
S-K029	19	09/11/2015	70 series Go switch IOM sheet.
CERT-ES-03777-1	05	21/10/2015	7J series SPDT Go switch assembly.
CERT-ES-05734-1	AA	28/04/2022	7L series Go switch assembly.

**Conditions of Certification**

The validity of the certified failure 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 certified functional safety.
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 failure data in any specific user application is conditional on the user complying with the following conditions:

1. The user shall comply with the conditions given in Table 3 above and the requirements given in the manufacturer's user instructions 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 of 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. Where the element is used in HFT=1 configuration, then a common cause failure analysis shall be justified.
5. A proof test interval of 1 year.

**General Conditions and Notes**

1. This certificate is based upon a functional safety assessment of the product described in Sira Test & Certification Assessment Reports R70008287A, R70008287B and R70217010B
2. If certified product 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.
5. No part of the Functional safety related aspects stated in the instruction manual shall be changed without approval of the certification body.
6. This certificate will remain valid subject to completion of two surveillance audits within the five year certification cycle, and upon receipt of acceptable response to any findings raised during this period. This certificate can be withdrawn if the manufacturer no longer satisfies scheme requirements.

**Certificate History**

Issue	Date	Report no.	Comment
04	05/05/2015	R70008287	Revision 3 of certificate issued as a result of recertification to IEC61508:2010.
05	20/08/2015	R70008287	Page 3 updated to correct safety function definition in table 2.
06	13/01/2016	R70008287	Certificate updated to include 7J – A 70 series GO switch variant.
07	03/03/2016	R70008287	Updated due to new information being added
08	09/05/2019	70217010	Temporary extension for recertification activities.
09	19/07/2019	70217010	Certificate reissued following successful recertification audit.
10	25/05/2022	80123806	7L series has been added to the certificate and reissued.
11	07 Nov 2023	80129810 - 02	Added Emerson Machinery Equipment (Shenzhen) Co. Ltd.manufacturing location
12	16/02/2024	80189295	Re-issued following successful recertification audit.

