



## FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

***Magnetic Target Sensor (MTS)***

manufactured by

***TopWorx***  
3300 Fern Valley  
Road Louisville,  
Kentucky  
40213 USA

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

**IEC 61508-2:2010**  
**Routes 1<sub>H</sub> & 1<sub>S</sub>**  
**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)\***

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 : 28/08/2020

This certificate re-issued : 28/08/2020

Renewal date : 27/08/2025

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



Certificate No.: Sira FSP 20005

Form 7016 issue 4

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## Product description and scope of certification

The Magnetic Target Sensor (MTS) by TopWorx is a hermetically sealed reed switch placed inside a metal, threaded body tube meant to act as a proximity switch when paired with a magnetic target. First, the reed switch has wires or cabling attached to each of the three leads by soldering. It is then placed inside an insulated plastic housing and installed inside the body tube; the reed is aligned axially with the body tube. An insulating epoxy is poured inside to bond the reed switch to the body tube and complete the assembly process.

The proximity switch can then be mounted into a matching circular or slotted hole and held with two nuts, or it can mount directly into a matching threaded hole. Once the magnetic sensing target comes close to the sensing end of the switch, the ferromagnetic reed (Common contact) and contact labelled NO become polarized, attract each other, and move into contact. When the magnetic target moves away from the switch, the reed springs away from the contact labelled NO and connects with the contact labelled NC.

This is a Single Pole Double Throw (SPDT) contact form.

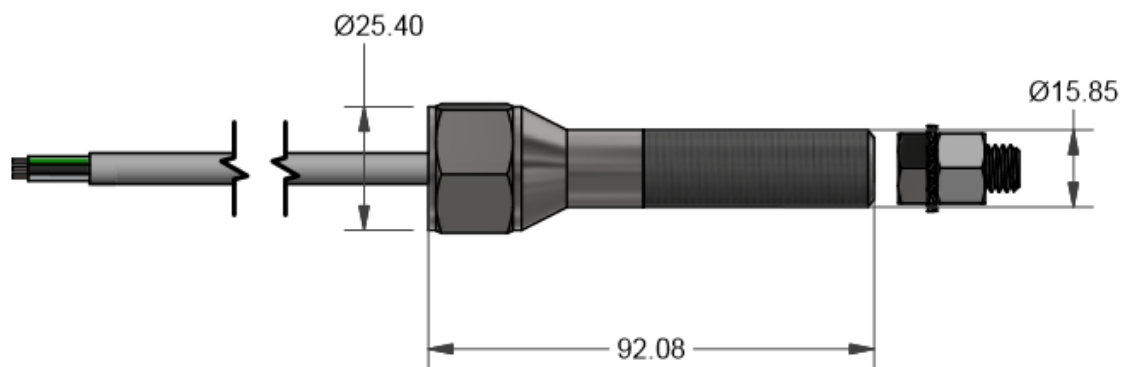


Figure 1: Typical Assembly of the Magnetic Target Sensor

## Element Safety Function

The element safety functions of the MTS are defined as follows:

**1) To close a normally open contact.**

Contact labelled NO connected to Common indicates when the magnet target is within range.

Contact labelled NC connected to Common indicates when the magnet target is not within range.

**2) To open a normally closed contact.**

Contact labelled NC not connected to Common indicates when the magnet target is within range.

Contact labelled NO not connected to Common indicates when the magnet target is not within range.



## 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 document submitted by Topworx the Failure Mode and Effect Analysis (FMEA) of the MTS Magnetic Target Sensor has verified the documents as evidence of conformity to IEC 61508-2:2010 in respect of 'hardware safety integrity'. Components failure rates have been sourced against the failure modes using Item software reliability package.

The results in Table 1 summarize the MTS Magnetic Target Sensor FMEA assessment and achieved safety integrity level.

**Table 1: Summary of assessment for the MTS Magnetic Target Sensor**

<b><u>Safety Functions:</u></b>		1. To close a normally open contact <i>or</i> 2. To open a normally closed contact	
<b>Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4</b>		1. To close a normally open contact	2. To open a normally closed contact.
Architectural constraints & Type of product A/B		HFT = 0 Type A	HFT = 0 Type A
Safe Failure Fraction (SFF)		15.40%	84.60%
Random hardware failures: [h <sup>-1</sup> ]	$\lambda_{DD}$ $\lambda_{DU}$	0 1.22E-06	0 2.23E-07
Random hardware failures: [h <sup>-1</sup> ]	$\lambda_{SD}$ $\lambda_{SU}$	0 2.23E-7	0 1.22E-6
Diagnostic coverage (DC)		0.0%	0.0%
PFD @ PTI = 8760 Hrs. MTTR = 24 Hrs.		5.38E-03	9.81E-04
Probability of Dangerous failure (High Demand - PFH) [h <sup>-1</sup> ]		1.22E-06	2.23E-07
Hardware safety integrity compliance		Route 1 <sub>H</sub>	Route 1 <sub>H</sub>
Systematic safety integrity compliance		Route 1 <sub>S</sub> See report R80043865B	Route 1 <sub>S</sub> See report R80043865B
Systematic Capability (SC1, SC2, SC3, SC4)		SC 3	SC 3
Hardware safety integrity achieved		SIL 1	SIL 2

**Note 1:** The failure data:

- 1) 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.
- 2) The verified failure rates used in the safe failure fraction and diagnostic coverage do not include ( $\lambda$  no parts or no effect) failures in the calculation.

The failure data above is supported by the base information given in Table 2 below.



**Table 2: Base information for the MTS Magnetic Target Sensor**

1	Product identification:	MTS Magnetic Target Sensor
2	Functional specification:	See safety function definition in table 1.
3-5	Random hardware failure rates:	Refer to table 1 of this certificate.
6	Environment limits:	-40°C to +70°C (T6, T5) and -40°C to 85°C (T8)
7	Lifetime/replacement limits:	20 years
8	Proof Test requirements:	Refer to safety manual.
9	Maintenance requirements:	Refer to safety manual.
10	Diagnostic coverage:	0% diagnostic coverage.
11	Diagnostic test interval:	Refer to safety manual.
12	Repair constraints:	Refer to safety manual.
13	Safe Failure Fraction:	See Table 1 above
14	Hardware fault tolerance (HFT):	See Table 1 above
15	Highest SIL (architecture/type A/B):	Type A, SIL2.
16	Systematic failure constraints:	The hardware safety integrity assessment was based on a proof test interval of 1 year. For further information refer to safety manual.
17	Evidence of similar conditions in previous use:	Not applicable.
18	Evidence supporting the application under different conditions of use:	Not applicable.
19	Evidence of period of operational use:	Not applicable.
20	Statement of restrictions on functionality:	See systematic report R80043865B.
21	Systematic capability (SC1, SC2, SC3)	See systematic report R80043865B.
22	Systematic fault avoidance measures:	Compliance with techniques and measures from IEC 61508-2 Annex B to SIL 2 - See systematic report R80043865B.
23	Systematic fault tolerance measures:	Compliance with techniques and measures from IEC 61508-2 Annex A to support the SFF achieved – see hardware safety integrity report R80043865A.
24	Validation records:	All documents that have been used in support of the hardware have been documented in section 5.24 of report R80043865A; this includes the FMEA.

### Management of functional safety

The assessment has demonstrated that the product is supported by an appropriate functional safety management system that meets the relevant requirements of IEC 61508-1:2010 clause 6, see report R80043865B.

### Identification of certified equipment

The certified equipment and its safe use is defined in the manufacturer's documentation listed in Table 3 below.

**Table 3: Certified documents**

Document no.	Pages	Rev	Date	Document description
CERT-ES-08510-1	1	AA	1 July 2020	General Assembly Drawing titled "MAGNETIC TARGET SENSOR REED SWITCH ASSEMBLY"
COMUS group GC1917	1	2	6 May 2006	Product Data Sheet for COMUS Part No: GC1917
HSR-933W-Series-Rev-N	1	N	--	Data Sheet HSI Sensing Item Number HSR-933W Series Contact Form C Switch Configuration SPDT Rev N
HSR-933 Life Test (230VAC, 2.5A).pdf	1		12 Jan 2015	HSI Sensing Switch Life Test Report for switch type HSR-933WT tested with 230VAC @ 2.5A



ES-08524-1	2	R1	--	Installation and Operations Manual for TopWorx MTS Magnetic Target Sensor
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### Conditions of Certification

The validity of the certified base 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 base data in any specific user application 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 in regard to all relevant functional safety aspects such as application of use, installation, operation, maintenance, proof tests, maximum ratings, environmental conditions, and repair.
2. Selection of this product for use in safety function 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 safety device is to have an independent power supply, it must not share the same power supply as non-safety devices that may cause a fault to the safety device.
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 Report R80043865A and any further reports referenced (R80043865B).
2. If the 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.
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
0	28/08/2020	R80043865A R80043865B	The release of prime certificate.

