

FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

IQT3 Actuator
manufactured by

Rotork Controls Ltd

(A Division of Rotork PLC)
Brassmill Lane
Bath, BA1 3JQ
UK

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

IEC 61508:2010
Routes 1_H & 1_S
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 Manager:



Wayne Thomas

Initial Certification : 19/10/2016
This certificate issued : 19/10/2016
Renewal date : 18/10/2021

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Product description and scope of certification

The IQT3 SIL range is a family of electric valve actuators categorized by output torque and speed, powered by three-phase, single phase or 24VDC supply. The scope of the certificate is based on the assessment of the IQT3 SIL range, comprising IQT, IQTM and IQTF.

The IQT3 SIL range is designed to provide local and remote operation of industrial valves and dampers of all types. As well as providing normal process control of valves, remote control may include means to ensure a valve does not move spuriously, as a priority.

The IQT3 SIL design comprises a gearcase, covers and baseplate, cast in LM20/25 aluminium. Output movement is derived from an electrical motor driving spur and worm and wheel gear running in an oil bath. The motor is controlled by an electronic control module incorporating provision for internal control power and motor switching. Actuators include a hand/auto clutch engaged handwheel for manual operation in case of loss of power supply.

IQT3 SIL Actuators are designed to operate in standard form from -40°C to +70°C, with options down to -50°C. SIL variants are only supported to -40°C to +70°C. In addition, builds certified for use in hazardous areas under the ATEX directive, international Standard IECEx, North American NFPA – NEC and CSA standards.



Figure 1. IQT3 Actuators.

IQT3 Actuator Safety Function

The IQT3 Actuator has been verified for the following variants:

- Quarter Turn AC Supply - IQT and IQTM
- Quarter Turn DC Supply - IQT and IQTM
- Multi Turn AC Supply - IQTF
- Multi Turn DC supply – IQTF

The safety function of the above IQT3 variants is defined as:

'Under remote operation, to stayput (i.e. not drive the actuator output shaft) when the motor enable input is not applied'.



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_H approach.

As part of the product assessment and supporting evidence of conformity in respect of 'hardware safety integrity' against the requirements of IEC 61508-2, Rotork have submitted the IQT3 Actuator for FMEA verification to attain SIL 2 capability. The components failure rates have been sourced by Rotork using RIAC Automated Data book, IEC TR 62380, Handbook of Reliability Prediction Procedures for Engineers (RPPFME) and manufacturer's data. The failure modes allocated to components in the Rotork FMEA were appropriately implemented as required in IEC 62380. The IQT3 Actuator assessment is summarized in tables 1 and 2 below:

Table 1. The assessment finds that the IQT3 Actuator in 1oo1 configuration achieved the following results:

Safety Function:		
<i>'To stopput (i.e. not drive the actuator output shaft) when the motor enable input is not applied'.</i>		
Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4	IQT3 actuator	Verdict
Architectural constraints & Type of product A/B	HFT=0	Type A
Safe Failure Fraction (SFF)	96%	SIL 3
Random hardware failures: [h ⁻¹]	λ_{DD} λ_{DU}	0.00E+00 4.46E-07
Random hardware failures: [h ⁻¹]	λ_{SD} λ_{SU}	0.00E+00 1.01E-05
Diagnostic coverage (DC)	0%	
PFD @ PTI = 8760Hrs MTTR = 24 Hrs	1.96E-03	SIL 2
Average Freq' of Dangerous failure (High Demand - PFH)	4.46E-07	SIL 2
Hardware safety integrity compliance	Route 1 _H	
Systematic safety integrity compliance	Route 1 _s (See report R70080750B)	
Systematic Capability (SC1, SC2, SC3, SC4)	SC3 (See report R70080750B)	
Hardware safety integrity achieved	SIL 2 achieved with HFT (1oo1) due to PFH value	



Table 2. The assessment finds that the IQT3 Actuator in 1oo2 configuration achieved the following results:

Safety Function: 'To stayput (i.e. not drive the actuator output shaft) when the motor enable input is not applied'.		
Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4	IQT3 actuator	Verdict
Architectural constraints & Type of product A/B	HFT=1	Type A
Safe Failure Fraction (SFF) Common Cause Factor (β)	96% 10%	SIL 3
Diagnostic coverage (DC)	0%	
PFD @ PTI = 8760Hrs MTTR = 24 Hrs	1.03E-04	SIL 3
Average Freq' of Dangerous failure (High Demand - PFH)	2.40E-08	SIL 3
Hardware safety integrity compliance	Route 1 _H	
Systematic safety integrity compliance	Route 1 _s (See report R70080750B)	
Systematic Capability (SC1, SC2, SC3, SC4)	SC3 (See report R70080750B)	
Hardware safety integrity achieved	SIL 3 achieved with HFT (1oo2)	

Note 1: Assumptions used in the FMEA

- 1) Numerical failure data in this report based on the FMEA assume that failure rates are constant. Infant mortalities and wear-out mechanisms are not included.
- 2) Figures derived from FMEA are random hardware failures. Systematic hardware failures (such as installation or maintenance errors) are not accounted for in the FMEA but are assessed qualitatively in this report and reviewed in the safety manual.
- 3) All components that are not part of the safety function are excluded from the FMEA; components that play no part in the safety function and therefore whose failure does not affect the safety function (either dangerous failure or spurious trip) are classified as "no part" failures and do not therefore contribute to the SFF.
- 4) No partial test or partial stroked testing has been considered in the assessment of the IQT3 Actuator.

The failure data above is supported by the base information given in Table 3 below.



Table 3.

1	Product identification:	IQT3 Actuator
2	Functional specification:	'To stayput (i.e. not drive the actuator output shaft) when the motor enable input is not applied'
3-5	Random hardware failure rates:	Refer to tables 1 and 2 above
6	Environment limits:	Temperature range: -40°C to +70°C operational
7	Lifetime/replacement limits:	Refer to installation, operation and maintenance (I, O & M) instructions
8	Proof Test requirements:	Refer to Safety Manual
9	Maintenance requirements:	Refer to Safety Manual
10	Diagnostic coverage:	No diagnostic tests are available
11	Diagnostic test interval:	No diagnostic tests are available
12	Repair constraints:	None, other than compliance with the I, O & M instructions
13	Safe Failure Fraction:	Refer to previous tables above
14	Hardware fault tolerance (HFT):	HFT=0 and HFT=1 has been considered
15	Highest SIL (architecture/type A/B):	Type A, SIL 2, HFT=0 (1oo1) Type A, SIL 3, HFT=1 (1oo1), $\beta=10\%$
16	Systematic failure constraints:	Not applicable
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:	Not applicable
21	Systematic capability:	SC3, clause 7.4.3 of IEC61508-2 not used
22	Systematic fault avoidance measures:	Refer to systematic failures introduced during the realization lifecycle from - see report R70080750B
23	Systematic fault tolerance measures:	Assessment done for HFT=1, Annex A part 2 of IEC 61508 not relevant for a type A mechanical device
24	Validation records:	Functional testing assessed in CSA reports, R70080750A and R70080750B
25	Firmware records (SIL)	N/A no software present, device is type A

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 R70080750B.

Software lifecycle assessment

No software is present, the IQT3 Actuator is a Type A device, therefore the software lifecycle assessment is not applicable.



Identification of certified equipment

The certified equipment and its safe use is defined in the manufacturer's documentation listed in Table 4 below.

Table 4: Certified documents

Document no.	Rev	Document description
ED08998	2	Schematic for IQT3 Actuator.
ER884	1	IQT3 SIL System FMEDA.
ER881	1	IQT3 SIL System FMEDA Specification.
PUB002-065-00	1	IQT Range – safe use, installation, basic setup and maintenance.
PUB002-110-00	1	IQT3 Stayput safety manual.

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 safety related components (involved in completing the safety function – detailed in project FMEDA) 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. Selection of this equipment for use in safety functions applications, the installation, configuration, overall validation, maintenance and repair shall only be carried out by competent personnel, observing the manufacturer's conditions and recommendations in the user safety manual documentation.
2. 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.
3. A proof test interval is set to 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 R70080750A and R70080750B.
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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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
00	19/10/2016	R70080750A, R70080750B	Certificate issued to client.

