



FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

Range of Load Cells and Associated Amplifiers

manufactured by

Elite Transducers Ltd

Units 5&6 Zephyr House,
Calleva Park
Aldermaston Berkshire
RG7 8JN
United Kingdom

have been assessed by CSA Group Testing UK Ltd with reference to the CASS methodologies and found to meet the requirements of


IEC 61508-2:2010 Routes 1_H & 1_S Systematic Capability (SC2)

as an element/subsystem suitable for use in safety related systems performing safety functions up to and including

SIL 1, 2 capable with HFT=0 (1001)*

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 : 2023-08-29
This certificate re-issued : -----
Renewal date : 2028-08-28

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



Product description and scope of certification

The Range of Load Cells and Associated Amplifiers (in following "LOAD CELLS") from Elite Transducers Limited are intended for use in diverse applications, including safety Instrumented systems. The type and mechanical rating of each specific load cell is defined by the physical dimensions and characteristics of the metal element and the mounting orientation.

All the LOAD CELLS are based on a conventional strain gauge (Wheatstone resistance bridge) bonded onto a metal element which is mechanically stressed by the load being measured. Deformation (strain) in the metal element and hence the strain gauge resistors is then detected by the change in signal developed across the strain gauge bridge, which is then amplified to a level suitable for measurement and control functions (e.g., 4-20mA or voltage).

The product models listed in Annex A have been assessed to IEC 61508:2010 under reports R80174406A (Random Hardware Safety Integrity) and R80174406B (Systematic Safety Integrity).

Element Safety Functions

The element safety functions of the LOAD CELLS are defined as follows:

No.	Element safety function ^[1] suitable for use in SIL applications	Expected relationship between element safety function and EUC safe state	Safety function mode ^[3] of operation supported	Dangerous failure ^[4] mode of the element considered for each analysis
1	An increasing strain causes the measurement signal to exceed a specified level is used to activate the safety function	EUC safe state is produced if measurement signal level exceeds specified limit	High demand Low demand	Failure to provide a measurement signal that exceeds a specified level for the corresponding strain
2	A decreasing strain causes the measurement signal to drop below a specified level is used to activate the safety function	EUC safe state is produced if measurement signal drops below specified limit	High demand Low demand	Failure to provide a measurement signal that drops below a specified level for the corresponding strain
3	A range of strain with a corresponding range of measurement signal between specified high and low limits is used to activate the safety function	EUC safe state is produced or maintained when either the measurement signal falls within, or outside, a range specified by high and low limits	Continuous demand High demand Low demand	Failure to provide a measurement signal for the corresponding strain that falls within, or outside, a range specified by high and low limits

IEC 61508 definitions associated with table above:

[1] *element safety function* = refer to IEC 61508-4, clause 3.5.3

[2] *safety function* = refer to IEC 61508-4, clause 3.5.1

[3] *mode of operation* = refer to IEC 61508-4, clause 3.5.16

[4] *dangerous failure* = refer to IEC 61508-4, clause 3.6.7

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.

Based on the documentation submitted by Elite Transducers Limited the Failure Mode and Effect Analysis (FMEA) of the LOAD CELLS has verified the documents as evidence of conformity to IEC 61508-2:2010 in respect of 'hardware safety integrity'. Component failure rates have been extracted from or calculated using either: Supplier data sheets, the Siemens SN29500 database (via ALD Engineering MTBF Calculator) or Technis FARADIP.THREE v8.1. Failure modes were generally taken from IEC 62061 unless otherwise indicated by the failure database.

The results in Table 1 summarize the LOAD CELLS FMEA assessment and achieved safety integrity level. The certified figures represent the worst-case failure data which can be considered applicable to all load cells in the range.

Table 1: Summary of assessment for the LOAD CELLS

Safety Functions: Refer to section "Element Safety Function".	
Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4	LOAD CELLS
Architectural constraints & Type of product A/B	HFT = 0 TYPE A
Safe Failure Fraction (SFF)	70%
Random hardware failures: [h ⁻¹]	0 3.0E-08
Random hardware failures: [h ⁻¹]	0 7.1E-08
Diagnostic coverage (DC)	0.0%
PFD @ PTI = 8760 Hrs. MTTR = 8 Hrs.	1.3E-04
Probability of Dangerous failure (High Demand - PFH) [h ⁻¹]	1.01E-07
Hardware safety integrity compliance	Route 1 _H See report R80174406A
Systematic safety integrity compliance	Route 1 _s See report R80174406B
Systematic Capability (SC1, SC2, SC3, SC4)	SC 2
Hardware safety integrity achieved	SIL 2

Note 1: The failure data:

- 1) The PFD_{AVG} 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_{AVG} calculations from the failure data.
- 2) The verified failure rates used in the safe failure fraction and diagnostic coverage do not include (λ 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 LOAD CELLS

1	Product identification:	Range of Load Cells and Associated Amplifiers (s. Annex A)
2	Functional specification:	Refer to section "product description and scope of certification"
3-5	Random hardware failure rates:	Refer to table 1 of this certificate.
6	Environment limits:	Operating temperature: -20 to +60 °C.
7	Lifetime/replacement limits:	10 years (nominal). Refer to SM-01 SIL Safety Manual.
8	Proof Test requirements:	Refer to SM-01 SIL Safety Manual.
9	Maintenance requirements:	Refer to SM-01 SIL Safety Manual.
10	Diagnostic coverage:	0% diagnostic coverage.
11	Diagnostic test interval:	Refer to SM-01 SIL Safety Manual.
12	Repair constraints:	Refer to SM-01 SIL Safety Manual.
13	Safe Failure Fraction:	70%
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 - SM-01.
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 R80174406B.
21	Systematic capability (SC1, SC2, SC3)	SC2 - See systematic report R80174406B.
22	Systematic fault avoidance measures:	Compliance with techniques and measures from IEC 61508-2 Annex B to SIL 2 - See systematic report R80174406B.
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 R80174406A.
24	Validation records:	All documents that have been used in support of the hardware have been documented in section 5.24 of report R80174406A; this includes the FMEA document and insertion tests.

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 R80174406B.

Identification of certified equipment

The certified equipment and it's safe use is defined in the manufacturer's documentation listed in Table 3 below and in Annex A of this certificate.

Table 3: Certified documents

Document no.	Pages	Rev	Date	Document description
SM-01	7	01	2016-04-21	SIL Safety Manual
S. Annex A	1	00	2023-08-28	List of certified products and associated drawings.

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. CSA 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. CSA 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. CSA 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 CSA in accordance with 'Regulations Applicable to the Holders of CSA Group Testing UK Ltd 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 CSA Test & Certification Assessment Report R80174406A and any further reports referenced (R80174406B).
2. If the certified product or system is found not to comply, CSA Group Testing UK Ltd should be notified immediately at the address shown on this certificate.
3. The use of this Certificate and the CSA Certification Mark that can be applied to the product or used in publicity material are subject to the 'Regulations Applicable to the Holders of CSA Group Testing UK Ltd Certificates' and 'Supplementary Regulations Specific to Functional Safety Certification'.
4. This document remains the property of CSA 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
00	29 th August 2023	R80174406A R80174406B	The release of prime certificate.



Certificate Annex A

Certificate Number: CSA FSP 26005, Issue 00.
 Product: Range of Load Cells and Associated Amplifiers
 Manufacturer: Elite Transducers Ltd

General type	Product I.D.	Filename (sheet 1)	Drawing no.	Sheets	Rev.
LOAD BEAM	SELB-RO-xxx	N-10005-GA GENERAL ASSY - 1F	10005-GA-30	1	F
LOAD BEAM	SELB-RI-xxx	N-10006-GA GENERAL ASSY - 1F	10006-GA-30	1	G
LOAD BEAM	DELB-RO-xxx	N-10010-GA GENERAL ASSY - 1F	10010-GA-30	1	F
LOAD BEAM	DELB-RI-xxx	N-10020-GA GENERAL ASSY - 1F	10020-GA-30	1	F
LOAD PIN	DELP-EGW-xxx	N-10014-GA GENERAL ASSY - 1G	10014-GA-30	1	G
LOAD PIN	DELP-IGP-xxx	N-10009-GA GENERAL ASSY - 1G	10009-GA-30	1	G
LOAD PIN	DELP-IGP-AMP-xxx	N-10024-GA GENERAL ASSY - 1G	10024-GA-30	1	G
LOAD PIN	DELP-IGP-AMP-C-xxx	N-10044-GA GENERAL ASSY - 1E	10044-GA-30	1	E
LOAD PIN	DELP-DS1950-TB-xxx	N-10196-GA GENERAL ASSEMBLY - 1K	10196-GA-30	2	K, K
LOAD PIN	DELP-DB-xxx	N-10197-GA GENERAL ASSEMBLY - 1J	10197-GA-30	2	J, J
LOAD PIN	DELP-DB-AMP-xxx	N-10254-GA GENERAL ASSY - 1F	10254-GA-30	2	F, F
COMP CELL	CLC-RO-xxx	N-10038-GA GENERAL ASSY - 1E	10038-GA-30	1	E
COMP CELL	CLC-RO-AMP-xxx	N-10036-GA GENERAL ASSY - 1E	10036-GA-30	1	E
LOAD LINK	SLL-xxx	N-10255-GA GENERAL ASSY - 1D	10255-GA-30	2	D, D
LOAD LINK	SLL-AMP-xxx	N-10257-GA GENERAL ASSY - 1D	10257-GA-30	2	D, D
LOW PROFILE MULTI WEB	LPMW-SB-xxx	N-10329-GA GENERAL ASSY - 1C	10329-GA-30	1	D
LOW PROFILE MULTI WEB	LPMW-DB-xxx	N-10330-GA GENERAL ASSY - 1C	10330-GA-30	1	D
LOW PROFILE COMP CELL	LPCC-xxx	N-10337-GA GENERAL ASSY - 1C	10337-GA-30	1	C
SILO MOUNT	SM60-RO-xxx	N-10010-GA GENERAL ASSY - 1F	10010-GA-30	1	F
LPCC	SM66-xxx	N-10337-GA GENERAL ASSY - 1C	10337-GA-30	1	C
LOW PROFILE MULTI WEB	KFP-SB-xxx	N-10329-GA GENERAL ASSY - 1C	10329-GA-30	1	D
LOW PROFILE MULTI WEB	KFP-DB-xxx	N-10330-GA GENERAL ASSY - 1C	10330-GA-30	1	D
2-WIRE AMP CIRCUIT DIAGRAM	PCB-333IS	N-10021-CD CIRCUIT DIAGRAM	10021-CD-30	1	B

