



NSAI
Standards

Irish Standard
I.S. EN 61810-2:2017

Electromechanical elementary relays - Part 2: Reliability

I.S. EN 61810-2:2017

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 61810-2:2017

Published:

2017-10-06

*This document was published
under the authority of the NSAI
and comes into effect on:*

2017-10-24

ICS number:

29.120.70

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 61810-2:2017 is the adopted Irish version of the European Document EN 61810-2:2017, Electromechanical elementary relays - Part 2: Reliability

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

EN 61810-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2017

ICS 29.120.70

Supersedes EN 61810-2:2011

English Version

Electromechanical elementary relays - Part 2: Reliability (IEC 61810-2:2017)

Relais électromécaniques élémentaires - Partie 2: Fiabilité
(IEC 61810-2:2017)

Elektromechanische Elementarrelais -
Teil 2: Funktionsfähigkeit (Zuverlässigkeit)
(IEC 61810-2:2017)

This European Standard was approved by CENELEC on 2017-07-04. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

EN 61810-2:2017**European foreword**

The text of document 94/415/FDIS, future edition 3 of IEC 61810-2, prepared by IEC/TC 94 "All-or-nothing electrical relays" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61810-2:2017.

The following dates are fixed:

- latest date by which the document has to be (dop) 2018-04-06
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-10-06
standards conflicting with the
document have to be withdrawn

This document supersedes EN 61810-2:2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61810-2:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61810-2-1	NOTE	Harmonized as EN 61810-2-1.
IEC 61810-3	NOTE	Harmonized as EN 61810-3.
IEC 62061	NOTE	Harmonized as EN 62061.
ISO 13849-1:2015	NOTE	Harmonized as EN ISO 13849-1:2015 (not modified).

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61649	2008	Weibull analysis	EN 61649	2008
IEC 61810-1	2015	Electromechanical elementary relays - Part 1: General and safety requirements	EN 61810-1	2015

This page is intentionally left blank



IEC 61810-2

Edition 3.0 2017-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electromechanical elementary relays –
Part 2: Reliability**

**Relais électromécaniques élémentaires –
Partie 2: Fiabilité**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



IEC 61810-2

Edition 3.0 2017-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electromechanical elementary relays –
Part 2: Reliability**

**Relais électromécaniques élémentaires –
Partie 2: Fiabilité**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.70

ISBN 978-2-8322-4388-6

<p>Warning! Make sure that you obtained this publication from an authorized distributor.</p> <p>Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.</p>
--

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
3.21 Terms and definitions related to tests	10
4 General considerations.....	10
5 Test conditions	11
5.1 Sample items	11
5.2 Environmental conditions	12
5.3 Operating conditions	12
5.4 Test equipment	13
6 Failure criteria	13
7 Output data	13
8 Analysis of output data	13
9 Presentation of reliability measures	13
Annex A (normative) Data analysis	15
A.1 General.....	15
A.2 Abbreviations.....	15
A.3 Symbols and definitions	15
A.4 Weibull distribution	16
A.5 Procedure	17
A.5.1 Graphical methods.....	17
A.5.2 Numerical methods.....	22
A.5.3 Confidence Intervals	23
A.5.4 WeiBayes Approach	25
Annex B (informative) Example of data analysis.....	28
B.1 Graphical methods case study (cumulative hazard plot).....	28
B.1.1 General	28
B.1.2 Procedure of cumulative hazard plot.....	28
B.1.3 Example applied to life test data	30
B.2 Numerical methods case study (Weibull probability).....	33
B.2.1 General	33
B.2.2 Distribution parameters.....	33
B.2.3 Mean cycles to failure (MCTF).....	33
B.2.4 Value of \hat{B}_{10}	34
B.2.5 Mean time to failure (MTTF)	34
B.3 Confidence intervals case study.....	34
B.3.1 General	34
B.3.2 Interval estimation of β	34
B.3.3 Interval estimation of η	35
B.3.4 Lower confidence limit for B10.....	35
B.3.5 Lower confidence limit for R	36
B.4 WeiBayes case study.....	36
Annex C (informative) Statistical tables.....	38

C.1	Table of gamma function.....	38
C.2	Fractiles of the normal distribution	38
Annex D (informative)	Success run – Test without failures	40
D.1	General.....	40
D.2	Confidence level and minimum reliability.....	40
D.3	Example.....	41
Bibliography	42
Figure A.1	– An example of Weibull probability paper	18
Figure A.2	– An example of cumulative hazard plotting paper	20
Figure A.3	– Plotting of data points and drawing of a straight line	20
Figure A.4	– Estimation of distribution parameters	21
Figure B.1	– Estimation of distribution parameters	30
Figure B.2	– Cumulative hazard plots	32
Figure B.3	– Type test versus WeiBayes analysed periodic test	37
Table A.1	– Confidence levels for WeiBayes without failures	26
Table B.1	– Worksheet for cumulative hazard analysis.....	28
Table B.2	– Example worksheet.....	31
Table B.3	– First twenty failures in this example	33
Table C.1	– Values of the gamma function.....	38
Table C.2	– Fractiles of the normal distribution	39
Table D.1	– Number of samples and life cycles.....	41

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMECHANICAL ELEMENTARY RELAYS –

Part 2: Reliability

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61810-2 has been prepared by IEC technical committee 94: All-or-nothing electrical relays.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) not only graphical but also numerical methods are added;
- b) reduction of number of samples in specified cases;
- c) new subclauses of confidence intervals are added;
- d) the WeiBayes approach is added to facilitate compliance tests (routine test) with lower effort;

- e) annexes have been restructured into an Annex A for data analysis (normative) and Annex B (informative) where various examples of the data analysis are given;
- f) the former Annex C has been incorporated into the modified Annex B;
- g) a new Annex C replaces the old Annex D.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
94/415/FDIS	94/418/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This International Standard is to be used in conjunction with IEC 61649:2008.

A list of all parts in the IEC 61810 series, published under the general title *Electromechanical elementary relays*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Within the IEC 61810 series of basic standards covering elementary electromechanical relays, IEC 61810-2 is intended to give requirements and tests permitting the assessment of relay reliability. All information concerning endurance tests for type testing have been included in IEC 61810-1.

NOTE According to IEC 61810-1, a specified value for the electrical endurance under specific conditions (e.g. contact load) is verified by testing 1 or 3 relays. None is allowed to fail. Within this document, a prediction of the reliability of a relay is performed using statistical evaluation of the measured cycles to failure of a larger number of relays (generally 10 or more relays).

This document is the base for IEC 61810-2-1 to determine reliability values for relays where enhanced requirements for the verification of reliability (B_{10} and B_{10D}) apply.

The technical committee responsible for dependability has developed IEC 61649 dealing with Weibull-distributed test data. It contains both numerical and graphical methods for the evaluation of Weibull-distributed data as well as WeiBayes estimation.

On the basis of this basic reliability standard, this document was developed. It comprises test conditions and an evaluation method to obtain characteristic reliability values for electromechanical elementary relays. The life of relays as non-repairable items is primarily determined by the number of operations. For this reason, the reliability is expressed in terms of mean cycles to failure (MCTF).

Commonly, equipment reliability is calculated from mean time to failure (MTTF) figures. With the knowledge of the frequency of operation (cycling rate) of the relay within a piece of equipment, it is possible to calculate an effective MTTF value for the relay in that application.

Such calculated MTTF values for relays can be used to calculate respective reliability, probability of failure, and availability (e.g. MTBF (mean time between failures)) values for equipment into which these relays are incorporated.

Generally, it is not appropriate to state that a specific MCTF value is “high” or “low”. The MCTF figures are used to make comparative evaluations between relays with different styles of design or construction, and as an indication of product reliability under specific conditions.

ELECTROMECHANICAL ELEMENTARY RELAYS –

Part 2: Reliability

1 Scope

This part of IEC 61810 covers test conditions and provisions for the evaluation of endurance tests using appropriate statistical methods to obtain reliability characteristics for relays.

This document applies to electromechanical elementary relays considered as non-repaired items (i.e. items which are not repaired after failure).

The lifetime of a relay is usually expressed in number of cycles (CTF). Therefore, whenever the terms “time” or “duration” are used in IEC 61649, they carry the meaning “cycles”. However, with a given frequency of operation, the number of cycles can be transformed into respective times (e.g. times to failure (TTF)).

The failure criteria and the resulting characteristics of elementary relays describing their reliability in normal use are specified in this document. A relay failure occurs when the specified failure criteria are met.

As the failure rate for elementary relays cannot be considered as constant, particularly due to wear-out mechanisms, the cycles to failure of tested items typically show a Weibull distribution. This document provides numerical and graphical methods to calculate approximate values for the two-parameter Weibull distribution, as well as lower confidence limits and a method for confirmation of reliability values with the WeiBayes method.

This document does not cover procedures for electromechanical elementary relays where enhanced requirements for the verification of reliability apply.

NOTE 1 Such reliability test procedures are specified in IEC 61810-2-1. In particular, when electromechanical elementary relays are intended to be incorporated in safety-related control systems of machinery in accordance with IEC 62061 and ISO 13849-1, IEC 61810-2-1 defines procedures for the manufacturer to provide B_{10D} values.

NOTE 2 Electromechanical elementary relays with forcibly guided (mechanically linked) contacts according to IEC 61810-3 offer the possibility of a high diagnostic coverage according to 4.5.3 of ISO 13849-1:2015.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61649:2008, *Weibull analysis*

IEC 61810-1:2015, *Electromechanical elementary relays – Part 1: General and safety requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-