

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Time relays and coupling relays for industrial and residential use –
Part 1: Requirements and tests**

**Relais temporisés et relais de couplage pour applications industrielles et
résidentielles –
Partie 1: Exigences et essais**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 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 Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

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 une fois par mois par email.

Service Clients - webstore.iec.ch/csc

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

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Time relays and coupling relays for industrial and residential use –
Part 1: Requirements and tests**

**Relais temporisés et relais de couplage pour applications industrielles et
résidentielles –
Partie 1: Exigences et essais**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.70

ISBN 978-2-8322-7072-1

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

CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	10
3.1 Terms and definitions related to general terms.....	10
3.2 Terms and definitions of time relay types	15
4 Classification.....	22
4.1 Switching element.....	22
4.2 Mechanical construction.....	22
4.3 Device mounting	22
4.4 Connection	22
4.5 Environment	22
5 Influence quantities	22
6 Rated values	23
6.1 General.....	23
6.2 Input voltage and frequency	23
6.3 Release voltage	24
6.4 Power consumption.....	24
6.5 Output circuit	24
6.5.1 General	24
6.5.2 Electromechanical output circuit	24
6.5.3 Solid state output circuit	25
6.5.4 Endurance and operating frequency	25
6.5.5 Conditional short-circuit current	26
6.6 Ambient temperature.....	26
6.7 Transport and storage temperature	26
6.8 Humidity	26
6.9 Pollution degree.....	26
6.10 Altitude	26
6.11 Timing circuit function	26
6.11.1 General	26
6.11.2 Setting accuracy.....	27
6.11.3 Repeatability	27
6.11.4 Recovery time and minimum control impulse	27
7 Provisions for testing	27
7.1 General.....	27
7.2 Type test.....	27
7.3 Routine test	28
7.4 Sampling test.....	29
8 Documentation and marking	29
8.1 Data.....	29
8.2 Marking.....	32
9 Heating.....	32
9.1 General.....	32
9.2 Test conditions	33
9.3 Heating of terminals.....	33

9.3.1	General	33
9.3.2	Heating of screw terminals and screwless terminals	33
9.3.3	Heating of quick-connect terminations	34
9.3.4	Heating of sockets	34
9.3.5	Heating of alternative termination types	35
9.4	Heating of accessible parts	35
9.5	Ball pressure test	35
10	Basic operating function	36
10.1	General	36
10.2	Operate	36
10.3	Release	36
10.4	Time function	36
10.4.1	General	36
10.4.2	Functional test at reference values of input quantities	36
10.4.3	Effect of influence of voltage and temperature	37
11	Dielectric strength and impulse withstand	37
11.1	General	37
11.2	Preconditioning	37
11.3	Insulation test	38
11.3.1	General	38
11.3.2	Impulse withstand test	38
11.3.3	Dielectric AC power frequency voltage test	39
12	Electrical endurance	40
12.1	General	40
12.2	Resistive loads, inductive loads, and special loads	40
12.3	Low energy loads	40
13	Conditional short-circuit current of an output circuit	41
13.1	General	41
13.2	Test procedure	41
13.3	Test circuit electromechanical output circuit	41
13.4	Test circuit solid state output circuit	42
13.5	Condition of switching element after test	42
14	Insulation coordination and protection against electric shock	43
14.1	General	43
14.2	Clearances and creepage distances	43
14.2.1	General	43
14.2.2	Clearances	44
14.2.3	Creepage distances	44
14.3	Solid insulation	45
14.4	Protection against direct contact	46
15	Mechanical strength	46
15.1	General	46
15.2	Mechanical strength of terminals and current-carrying parts	46
15.2.1	General	46
15.2.2	Mechanical strength of screw terminals and screwless terminals	46
15.2.3	Mechanical strength of flat quick-connect terminations	46
15.2.4	Mechanical strength of sockets	47
15.2.5	Mechanical strength of alternative termination types	47

16	Heat and fire resistance.....	47
16.1	General.....	47
16.2	Glow-wire test.....	47
17	Vibration and shock.....	48
17.1	Vibration.....	48
17.2	Shock.....	48
18	Electromagnetic compatibility (EMC).....	49
18.1	General.....	49
18.2	Immunity.....	49
18.3	Radiated and conducted emission.....	49
19	Cybersecurity for industrial automation and control systems (IACS).....	50
20	Environmental information.....	50
20.1	Environmentally conscious design process.....	50
20.2	Procedure to establish material declaration.....	50
Annex A (informative) Setting accuracy, repeatability and effect of influence calculation.....		51
A.1	General.....	51
A.2	Example of calculation.....	51
Annex B (informative) Risk assessment.....		52
B.1	General.....	52
B.2	Risk assessment procedure.....	52
B.3	Achieving tolerable risk.....	53
B.4	Application of risk assessment procedures (proposal for the user).....	57
Annex C (normative) Tests for EMC.....		58
C.1	General.....	58
C.2	EMC immunity.....	58
C.2.1	General.....	58
C.2.2	Performance criteria.....	58
C.3	EMC radiated and conducted emission.....	62
C.3.1	General.....	62
C.3.2	Conducted radio-frequency emission tests.....	62
C.3.3	Radiated radio-frequency emission tests.....	62
Bibliography.....		63
Figure 1 – Definition of ports.....		13
Figure 2 – Power ON-delay relay.....		15
Figure 3 – Power OFF-delay relay.....		15
Figure 4 – OFF-delay relay with control signal.....		16
Figure 5 – ON- and OFF-delay relay with control signal.....		16
Figure 6 – Flasher relay.....		17
Figure 7 – Star-delta relay.....		18
Figure 8 – Summation time relay.....		18
Figure 9 – Pulse delayed relay.....		19
Figure 10 – Pulse delayed relay with control signal.....		19
Figure 11 – Interval relay.....		20
Figure 12 – Interval relay with control signal.....		20

Figure 13 – Retriggerable interval relay with control signal ON	21
Figure 14 – Retriggerable interval relay with control signal OFF	21
Figure 15 – Maintained time relay	22
Figure 16 – Test circuit electromechanical output, conditional short-circuit current	42
Figure 17 – Test circuit solid state output, conditional short-circuit current.....	42
Figure B.1 – Iterative process of risk assessment and risk reduction.....	53
Figure B.2 – Risk reduction.....	55
Figure B.3 – Example of the time relay circuit block diagram.....	56
Table 1 – Influence quantities and reference values.....	23
Table 2 – Preferred values of endurance	25
Table 3 – Preferred values of maximum permissible operating frequency.....	25
Table 4 – Recommended final values of the setting range.....	27
Table 5 – Type testing	28
Table 6 – Routine testing	29
Table 7 – Required time relay or coupling relay information	29
Table 8 – Thermal classification.....	32
Table 9 – Cross-sectional areas and lengths of conductors dependent on the current carried by the terminal	34
Table 10 – Maximum steady state current dependent on the connector size	34
Table 11 – Temperature rise limits of accessible parts	35
Table 12 – Changing of influencing quantities	37
Table 13 – Impulse test for basic insulation	39
Table 14 – Dielectric test voltage for basic insulation for devices suitable for use in single-phase three- or two-wire AC and DC systems.....	39
Table 15 – Dielectric test voltage for basic insulation for devices suitable for use in three-phase four or three-wire AC systems	40
Table 16 – Minimum clearances for basic insulation.....	44
Table 17 – Minimum clearances in controlled overvoltage conditions	44
Table 18 – Minimum creepage distances for basic insulation	45
Table A.1 – Calculation formulae	51
Table B.1 – Examples of the relation between failure mode, consequences and hazard.....	56
Table B.2 – Severity of harm.....	57
Table B.3 – Probability of harm.....	57
Table B.4 – Risk category	57
Table C.1 – Environmental conditions influencing EMC.....	58
Table C.2 – Immunity tests for industrial environments	60
Table C.3 – Immunity tests for residential, commercial and light-industrial environments	61
Table C.4 – Terminal disturbance voltage limits for conducted radio-frequency emission (for power port)	62
Table C.5 – Radiated emission test limits.....	62

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TIME RELAYS AND COUPLING RELAYS FOR INDUSTRIAL AND RESIDENTIAL USE –

Part 1: Requirements and tests

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.

IEC 61812-1 has been prepared by IEC technical committee 94: Electrical relays. It is an International Standard.

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) update of references;
- b) addition of requirements for risk assessment;
- c) addition of requirements for routine test;
- d) renumbering of clauses to bring them into a more logical order;
- e) clarification of the requirement for shock;
- f) addition of cybersecurity requirements for industrial automation and control systems;

- g) addition of environmentally conscious design requirement;
- h) addition of common data dictionary reference;
- i) addition of terms and definitions of relay types;
- j) addition of coupling relays in title;
- k) addition of coupling relays in scope.

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

FDIS	Report on voting
94/843/FDIS	94/889/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts of the IEC 61812 series can be found, under the general title *Time relays and coupling relays for industrial and residential use*, on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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 document 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.