

| | | |
|------------|--|---------------------------|
| STN | Prúdové a napäťové snímače alebo detektory používané na indikáciu poruchy. Časť 1: Všeobecné princípy a požiadavky. | STN EN 62689-1 |
| | | 35 1370 |

Current and voltage sensors or detectors, to be used for fault passage indication purposes - Part 1: General principles and requirements

Táto norma obsahuje anglickú verziu európskej normy.

This standard includes the English version of the European Standard.

Táto norma bola označená vo Vestníku ÚNMS SR č. 05/17

Obsahuje: EN 62689-1:2016, IEC 62689-1:2016

124856

Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2017

Podľa zákona č. 264/1999 Z. z. o technických požiadavkách na výrobky a o posudzovaní zhody a o zmene a doplnení niektorých zákonov v znení neskorších predpisov sa slovenská technická norma a časti slovenskej technickej normy môžu rozmnrožovať alebo rozširovať len so súhlasom slovenského národného normalizačného orgánu.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 62689-1

December 2016

ICS 17.220.20

English Version

**Current and voltage sensors or detectors, to be used for fault
passage indication purposes - Part 1: General principles and
requirements**
(IEC 62689-1:2016)

Capteurs ou détecteurs de courant et de tension, à utiliser
pour indiquer le passage d'un courant de défaut -
Partie 1: Exigences et principes généraux
(IEC 62689-1:2016)

Strom- und Spannungs-Sensoren oder Anzeigegeräte zur
Erkennung von Kurz- und Erdschlägen - Teil 1: Allgemeine
Grundsätze und Anforderungen
(IEC 62689-1:2016)

This European Standard was approved by CENELEC on 2016-06-16. 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, 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

European foreword

The text of document 38/503/FDIS, future edition 1 of IEC 62689-1, prepared by IEC/TC 38 "Instrument transformers" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62689-1:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-06-16
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-12-16

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

Endorsement notice

The text of the International Standard IEC 62689-1:2016 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 60044-7 | NOTE | Harmonized as EN 60044-7. |
| IEC 60044-8 | NOTE | Harmonized as EN 60044-8. |
| IEC 60068-2-64 | NOTE | Harmonized as EN 60068-2-64. |
| IEC 60068-2-75 | NOTE | Harmonized as EN 60068-2-75. |
| IEC 60255-1:2009 | NOTE | Harmonized as EN 60255-1:2010 (not modified). |
| IEC 60660 | NOTE | Harmonized as EN 60660 |
| IEC 60695-1-10 | NOTE | Harmonized as EN 60695-1-10. |
| IEC 60721-3-3 | NOTE | Harmonized as EN 60721-3-3. |
| IEC 60721-3-4 | NOTE | Harmonized as EN 60721-3-4. |
| IEC 61000-4-30 | NOTE | Harmonized as EN 61000-4-30. |
| IEC 61109 | NOTE | Harmonized as EN 61109. |
| IEC 61850-6 | NOTE | Harmonized as EN 61850-6. |
| IEC 61850-7-3 | NOTE | Harmonized as EN 61850-7-3. |
| IEC 61850-7-4 | NOTE | Harmonized as EN 61850-7-4. |
| IEC 61869-1 | NOTE | Harmonized as EN 61869-1. |
| IEC 61869-2 | NOTE | Harmonized as EN 61869-2. |
| IEC 61869-3 | NOTE | Harmonized as EN 61869-3. |
| IEC 61869-4 | NOTE | Harmonized as EN 61869-4. |
| IEC 61869-6 | NOTE | Harmonized as EN 61869-6. |
| IEC 62262 | NOTE | Harmonized as EN 62262. |
| IEC 62689-2 | NOTE | Harmonized as EN 62689-2. |

Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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 60028 | - | International standard of resistance for copper | - | - |
| IEC 60038 | - | IEC standard voltages | EN 60038 ¹⁾ | - |
| IEC 60060-1 | - | High-voltage test techniques - Part 1: General definitions and test requirements | EN 60060-1 | - |
| IEC 60068-2-1 | - | Environmental testing - Part 2-1: Tests - Test A: Cold | EN 60068-2-1 | - |
| IEC 60068-2-14 | - | Environmental testing - Part 2-14: Tests - Test N: Change of temperature | EN 60068-2-14 | - |
| IEC 60068-2-2 | - | Environmental testing - Part 2-2: Tests - Test B: Dry heat | EN 60068-2-2 | - |
| IEC 60068-2-6 | - | Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal) | EN 60068-2-6 | - |
| IEC 60068-2-30 | - | Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) | EN 60068-2-30 | - |
| IEC 60068-2-78 | - | Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state | EN 60068-2-78 | - |
| IEC 60071-1 | - | Insulation co-ordination - Part 1: Definitions, principles and rules | EN 60071-1 | - |
| IEC 60085 | - | Electrical insulation - Thermal evaluation and designation | EN 60085 | - |
| IEC 60121 | - | Recommendation for commercial annealed - aluminium electrical conductor wire | - | - |
| IEC 60270 | - | High-voltage test techniques - Partial discharge measurements | EN 60270 | - |
| IEC 60417-DB | - | Graphical symbols for use on equipment | - | - |

¹⁾ The title of EN 60038 is "CENELEC standard voltages".

EN 62689-1:2016

| <u>Publication</u> | <u>Year</u> | <u>Title</u> | <u>EN/HD</u> | <u>Year</u> |
|--------------------|-------------|---|----------------|-------------|
| IEC 60455 | Series | Resin based reactive compounds used for electrical insulation | EN 60455 | Series |
| IEC 60529 | - | Degrees of protection provided by enclosures (IP Code) | EN 60529 | - |
| IEC 60695-1-30 | - | Fire hazard testing - Part 1-30: Guidance for assessing the fire hazard of electrotechnical products - Preselection testing process - General guidelines | EN 60695-1-30 | - |
| IEC 60695-7-1 | - | Fire hazard testing - Part 7-1: Toxicity of fire effluent - General guidance | EN 60695-7-1 | - |
| IEC/TS 60815 | Series | Selection and dimensioning of high-voltage - insulators intended for use in polluted conditions | | - |
| IEC/TS 60815-1 | - | Selection and dimensioning of high-voltage - insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles | | - |
| IEC/TS 60815-2 | - | Selection and dimensioning of high-voltage - insulators intended for use in polluted conditions - Part 2: Ceramic and glass insulators for a.c. systems | | - |
| IEC/TS 60815-3 | - | Selection and dimensioning of high-voltage - insulators intended for use in polluted conditions - Part 3: Polymer insulators for a.c. systems | | - |
| IEC 60870-5-101 | - | Telecontrol equipment and systems - Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks | EN 60870-5-101 | - |
| IEC 60870-5-104 | - | Telecontrol equipment and systems - Part 5-104: Transmission protocols - Network access for IEC 60870-5-101 using standard transport profiles | EN 60870-5-104 | - |
| IEC 61000-4-10 | - | Electromagnetic compatibility (EMC) - Part 4-10: Testing and measurement techniques - Damped oscillatory magnetic field immunity test | EN 61000-4-10 | - |
| IEC 61000-4-11 | - | Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests | EN 61000-4-11 | - |
| IEC 61000-4-12 | - | Electromagnetic compatibility (EMC) - Part 4-12: Testing and measurement techniques - Ring wave immunity test | EN 61000-4-12 | - |

| <u>Publication</u> | <u>Year</u> | <u>Title</u> | <u>EN/HD</u> | <u>Year</u> |
|--------------------|-------------|---|---------------|-------------|
| IEC 61000-4-16 | - | Electromagnetic compatibility (EMC) - Part 4-16: Testing and measurement techniques - Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz | EN 61000-4-16 | - |
| IEC 61000-4-18 | - | Electromagnetic compatibility (EMC) - Part 4-18: Testing and measurement techniques - Damped oscillatory wave immunity test | EN 61000-4-18 | - |
| IEC 61000-4-2 | - | Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test | EN 61000-4-2 | - |
| IEC 61000-4-3 | - | Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test | EN 61000-4-3 | - |
| IEC 61000-4-4 | - | Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test | EN 61000-4-4 | - |
| IEC 61000-4-5 | - | Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test | EN 61000-4-5 | - |
| IEC 61000-4-6 | - | Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields | EN 61000-4-6 | - |
| IEC 61000-4-8 | - | Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test | EN 61000-4-8 | - |
| IEC 61000-4-9 | - | Electromagnetic compatibility (EMC) - Part 4-9: Testing and measurement techniques - Pulse magnetic field immunity test | EN 61000-4-9 | - |
| IEC 61000-6-2 | 2005 | Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments | EN 61000-6-2 | 2005 |
| IEC 61850-7-2 | - | Communication networks and systems for power utility automation - Part 7-2: Basic information and communication structure - Abstract communication service interface (ACSI) | EN 61850-7-2 | - |
| IEC 60255-27 | 2013 | Measuring relays and protection equipment - Part 27: Product safety requirements | EN 60255-27 | 2014 |

EN 62689-1:2016

| <u>Publication</u> | <u>Year</u> | <u>Title</u> | <u>EN/HD</u> | <u>Year</u> |
|--------------------|-------------|---|---------------|-------------|
| IEC 61000-4-13 | - | Electromagnetic compatibility (EMC) - Part 4-13: Testing and measurement techniques - Harmonics and interharmonics including mains signaling at a.c. power port, low frequency immunity tests | EN 61000-4-13 | - |
| IEC 61000-4-29 | - | Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests | EN 61000-4-29 | - |



INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Current and voltage sensors or detectors, to be used for fault passage indication purposes –
Part 1: General principles and requirements**

**Capteurs ou détecteurs de courant et de tension, à utiliser pour indiquer le passage d'un courant de défaut –
Partie 1: Exigences et principes généraux**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2016 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 Varembé
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 15 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.

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 15 langues additionnelles. Egalelement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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.

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.

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.

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.



INTERNATIONAL STANDARD

NORME INTERNATIONALE



Current and voltage sensors or detectors, to be used for fault passage indication purposes –

Part 1: General principles and requirements

Capteurs ou détecteurs de courant et de tension, à utiliser pour indiquer le passage d'un courant de défaut –

Partie 1: Exigences et principes généraux

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

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..... | 7 |
| INTRODUCTION..... | 9 |
| 1 Scope..... | 11 |
| 2 Normative references..... | 11 |
| 3 Terms, definitions, abbreviations and symbols..... | 13 |
| 3.1 General terms and definitions | 14 |
| 3.2 Terms and definitions related to neutral point treatment | 18 |
| 3.3 Terms and definitions related to dielectrics ratings | 19 |
| 3.4 Terms and definitions related to current ratings..... | 21 |
| 3.5 Terms and definitions related to other ratings | 21 |
| 3.6 Abbreviations and symbols | 21 |
| 4 Choice of FPI requirements according to network and fault type | 22 |
| 5 Overview of applications | 22 |
| 5.1 General description | 22 |
| 5.2 Application with regard to installation type | 24 |
| 5.2.1 Overhead line applications | 24 |
| 5.2.2 Underground cable application | 24 |
| 5.3 Application with regard to fault detection capability | 24 |
| 5.3.1 Single phase application | 24 |
| 5.3.2 Three-phase application | 24 |
| 5.3.3 Residual current application | 25 |
| 5.3.4 Three-phase and residual current application..... | 25 |
| 6 Application with regard to network configuration and operation | 25 |
| 7 FPI's/DSU's main elements..... | 25 |
| 7.1 General..... | 25 |
| 7.2 Current and voltage sensors..... | 25 |
| 7.2.1 General | 25 |
| 7.2.2 Accuracy for current (and voltage) sensors | 26 |
| 7.3 Transmission of signals between sensors and CPIU..... | 26 |
| 7.4 Conditioning, processing and indicating unit (CPIU) | 26 |
| 7.5 Human–Machine Interface (HMI) | 26 |
| 7.5.1 General | 26 |
| 7.5.2 Local display..... | 27 |
| 7.5.3 Remote display | 27 |
| 8 FPI/DSU classification and usage classes (data model and profile definition, testing)..... | 27 |
| 8.1 General..... | 27 |
| 8.2 Integration of FPIs in the electrical grid..... | 28 |
| 8.2.1 FPI for local indication of fault detection | 28 |
| 8.2.2 FPIs for remote indication of fault detection | 29 |
| 8.2.3 DSUs fully integrated in network operation system (SCADA) | 29 |
| 8.3 Information from FPIs/DSUs | 29 |
| 8.3.1 General | 29 |
| 8.3.2 Information from FPIs for local indication of fault detection..... | 30 |
| 8.3.3 Information from FPIs for remote indication of fault detection | 30 |

| | | |
|--------|---|----|
| 8.3.4 | Information from DSUs fully integrated in network operation system (SCADA)..... | 31 |
| 8.4 | FPI/DSU classification through performance/capabilities classes..... | 32 |
| 8.4.1 | General | 32 |
| 8.4.2 | Fault detection capability class..... | 34 |
| 8.4.3 | Communication capability class..... | 34 |
| 8.4.4 | Power supply class | 35 |
| 8.4.5 | FPI/DSU additional optional feature classes not strictly related to pure fault detection | 35 |
| 8.4.6 | Complete FPI/DSU classification through performance/capability classes | 36 |
| 9 | Service conditions | 41 |
| 9.1 | General..... | 41 |
| 9.2 | Normal service conditions | 41 |
| 9.2.1 | Auxiliary power supply | 41 |
| 9.2.2 | Ambient air temperature | 41 |
| 9.2.3 | Altitude | 42 |
| 9.2.4 | Vibrations or earth tremors | 42 |
| 9.2.5 | Other service conditions for indoor FPI/DSU | 42 |
| 9.2.6 | Other service conditions for outdoor FPI/DSUs | 42 |
| 9.3 | Special service conditions | 43 |
| 9.3.1 | General | 43 |
| 9.3.2 | Altitude | 43 |
| 9.3.3 | Vibration or earthquakes | 43 |
| 10 | Ratings..... | 43 |
| 10.1 | General..... | 43 |
| 10.2 | Rated primary voltage | 44 |
| 10.3 | Standard values of rated voltage factor..... | 44 |
| 10.3.1 | Earthed electronic voltage transformers..... | 44 |
| 10.3.2 | Unearthed electronic voltage transformers..... | 44 |
| 10.4 | Highest insulation levels for FPI primary terminals | 44 |
| 10.4.1 | General | 44 |
| 10.4.2 | Other requirements for FPI/DSU primary terminals insulation | 46 |
| 10.4.3 | Insulation requirements for low voltage components (terminals of secondary voltage sensors)..... | 46 |
| 10.5 | Rated frequency range | 48 |
| 10.6 | Rated primary current..... | 48 |
| 10.7 | Rated short-time thermal current | 48 |
| 10.8 | Rated dynamic current | 48 |
| 10.9 | Rated supply voltage of auxiliary and control circuits | 48 |
| 10.10 | Rated supply frequency of auxiliary circuits | 49 |
| 11 | Design and construction | 49 |
| 11.1 | General..... | 49 |
| 11.2 | Requirement for insulation material in equipment..... | 49 |
| 11.3 | Requirements for temperature rise of sensor parts and components | 49 |
| 11.3.1 | General | 49 |
| 11.3.2 | Influence of altitude on temperature-rise..... | 50 |
| 11.4 | Earthing of equipment | 51 |
| 11.4.1 | General | 51 |

| | | |
|---------|--|----|
| 11.4.2 | Electrical continuity | 51 |
| 11.5 | Maximum mass for clip on installation | 51 |
| 11.6 | Marking and additional information | 52 |
| 11.6.1 | Rating plate markings | 52 |
| 11.6.2 | Terminal markings | 52 |
| 11.7 | Degree of protection by enclosures | 53 |
| 11.7.1 | General | 53 |
| 11.7.2 | Protection of persons against access to hazardous parts and protection of the equipment against ingress of solid foreign objects | 53 |
| 11.7.3 | Protection against ingress of water | 53 |
| 11.7.4 | Recommended IP degrees: indoor installation | 54 |
| 11.7.5 | Recommended IP degrees: outdoor installation | 54 |
| 11.7.6 | Protection of equipment against mechanical impact under normal service conditions | 54 |
| 11.8 | Creepage distances | 54 |
| 11.8.1 | Pollution | 54 |
| 11.8.2 | Corrections | 55 |
| 11.9 | Flammability | 55 |
| 11.10 | Environmental compatibility | 55 |
| 11.10.1 | General | 55 |
| 11.10.2 | Requirements for electromagnetic compatibility (EMC) | 56 |
| 11.10.3 | Requirements for climatic immunity | 58 |
| 11.10.4 | Mechanical requirements | 59 |
| 11.11 | Mechanical stresses on terminals (optional) | 59 |
| 12 | Tests | 59 |
| 12.1 | General | 59 |
| 12.1.1 | Classification of tests | 59 |
| 12.1.2 | List of tests | 60 |
| 12.2 | Type tests | 60 |
| 12.2.1 | General provisions for type tests | 60 |
| 12.2.2 | Information for identification of specimen | 61 |
| 12.2.3 | Information to be included in type test reports | 61 |
| 12.2.4 | Short time current test | 62 |
| 12.2.5 | Power-frequency voltage withstand tests on primary terminals | 62 |
| 12.2.6 | Temperature-rise test | 63 |
| 12.2.7 | Lightning impulse voltage test on primary terminals | 63 |
| 12.2.8 | Wet test for outdoor type transformers | 64 |
| 12.2.9 | Low-voltage component voltage withstand test | 64 |
| 12.2.10 | Electromagnetic Compatibility (EMC) tests | 64 |
| 12.2.11 | Partial discharge test on primary terminals | 65 |
| 12.2.12 | Verification of markings | 66 |
| 12.2.13 | Verification of the degree of protection by enclosures | 66 |
| 12.2.14 | Functional tests | 66 |
| 12.2.15 | Climatic tests | 66 |
| 12.2.16 | Mechanical tests | 67 |
| 12.3 | Routine tests | 67 |
| 12.3.1 | General | 67 |
| 12.3.2 | Power-frequency voltage withstand test for primary terminals | 67 |
| 12.3.3 | Power-frequency voltage withstand test for low-voltage components | 67 |

| | | |
|---|--|----|
| 12.3.4 | Partial discharge test on primary terminals | 67 |
| 12.3.5 | Functional tests | 67 |
| 12.3.6 | Verification of markings..... | 67 |
| 12.4 | Special tests | 67 |
| 12.4.1 | General | 67 |
| 12.4.2 | Chopped impulse voltage withstand test on primary terminals | 67 |
| 12.4.3 | Fire hazard test..... | 68 |
| 12.4.4 | Ageing test | 68 |
| 12.4.5 | Mechanical stresses on terminals test | 68 |
| Annex A (informative) | Example of guide for the selection of equipment according to use – information to be provided with inquiries, tenders, and orders..... | 69 |
| Annex B (informative) | Examples of possible FPI/DSU architectures | 70 |
| Annex C (informative) | Examples of FPI/DSU regarding communication capabilities | 75 |
| Bibliography | | 83 |
| Figure 1 – General architecture of an FPI | | 10 |
| Figure 2 – Possible architecture of a typical FPI | | 22 |
| Figure 3 – Possible detailed architecture of a DSU in a wide extended configuration | | 23 |
| Figure 4 – Example of possible coexistence of different performance level FPIs/DSUs on the same MV feeder..... | | 28 |
| Figure 5 – Example of possible ports to consider concerning insulation requirements for LV components..... | | 47 |
| Figure 6 – Altitude correction factor for the temperature rise | | 51 |
| Figure B.1 – Example of a F5NC(or C) – T2 – P3 – 3 class FPI for underground cable application..... | | 70 |
| Figure B.2 – Example of a F3NC(or C) – T1 – P2 – max 2 class FPI for underground cable application..... | | 71 |
| Figure B.3 – Example of an F6NC –T4 – P3 – 4 class DSU for underground cable application..... | | 72 |
| Figure B.4 – Example of an F6NC –T4 – P3 – 4 class DSU for underground cable application..... | | 73 |
| Figure B.5 – Example of a F5C(or NC) – T2 – P4 – 3 class FPI for underground cable application..... | | 74 |
| Figure C.1 – Example of an F1 (F2/F3) C (NC) – T2 – P2 – 1 (2) class FPI for outdoor installation on overhead conductors | | 75 |
| Figure C.2 – Examples of an F4 (F5/F6) C (NC) – T2 – P3 (P4) – 3 (4) class DSU for underground cable application | | 77 |
| Figure C.3 – Examples of an F4 (F5/F6) C (NC) – T2 – P3 (P4) – 4 class DSU for underground cable application | | 79 |
| Figure C.4 – Examples of a F4 (F5/F6) C (NC) – T3 (T4) – P3 (P4) – 3(4) class DSU for underground cable application | | 82 |
| Table 1 – FPI/DSU classification principles through classes to be used for data model and profile definitions and testing | | 33 |
| Table 2 – FPI fault detection capability classes to be used for data model and profile definition and testing | | 34 |
| Table 3 – Communication capability to be used for data model and profile definition and testing | | 35 |
| Table 4 – Power supply class | | 35 |

| | |
|---|----|
| Table 5 – Additional optional feature classes (not strictly related to pure fault detection) | 35 |
| Table 6 – FPIs usage classes: fault detection capabilities and communication capabilities | 37 |
| Table 7 – FPI/DSU minimum and maximum temperatures | 41 |
| Table 8 – Standard values of rated voltage factor (k_U) | 44 |
| Table 9 – Rated insulation levels..... | 45 |
| Table 10 – Partial discharge test voltages and permissible levels..... | 46 |
| Table 11 – Rated values of auxiliary supply voltage – d.c. voltage | 48 |
| Table 12 – Rated values of auxiliary supply voltage – a.c. voltage | 49 |
| Table 13 – Limits of temperature rise for various parts, materials and dielectrics of sensors | 50 |
| Table 14 – Unified specific creepage distance (USCD) | 55 |
| Table 15 – Fire hazard of electrotechnical products | 55 |
| Table 16 – Electromagnetic immunity requirements | 56 |
| Table 17 – Climatic immunity requirements | 58 |
| Table 18 – Mechanical immunity requirements..... | 59 |
| Table 19 – List of tests..... | 60 |
| Table 20 – EMC test | 64 |
| Table 21 – Climatic tests..... | 66 |
| Table 22 – Mechanical tests..... | 67 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CURRENT AND VOLTAGE SENSORS OR DETECTORS,
TO BE USED FOR FAULT PASSAGE INDICATION PURPOSES –****Part 1: General principles and requirements****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 62689-1 has been prepared by IEC technical committee 38: Instrument transformers.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|-------------|------------------|
| 38/503/FDIS | 38/510/RVD |

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

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

A list of all the parts in the IEC 62689 series, under the general title *Current and voltage sensors or detectors, to be used for fault passage indication purposes*, can be found on the IEC website.

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

0.1 General

The IEC 62689 series is a product family standard for current and voltage sensors or detectors, to be used for fault passage indication purposes by suitable devices or functions, indicated as fault passage indicator (FPI) or distribution substation unit (DSU), depending on their performances.

Different names are used to indicate FPIs depending on the region of the world and on their functionalities concerning capability to detect different kinds of faults, for instance:

- fault detector;
- smart sensor;
- faulted circuit indicator (FCI);
- short circuit indicator (SCI);
- earth fault indicator (EFI);
- test point mounted FCI.
- combination of the above.

Simpler versions, using only local information/signals and/or local communication, are called FPI, while very evolved versions are called DSU. The latter are explicitly designed for smart grids and based on IEC 60870-5 and IEC 61850 communication protocols. Compared to instrument transformers, digital communication technology is subject to on-going changes which are expected to continue in the future.

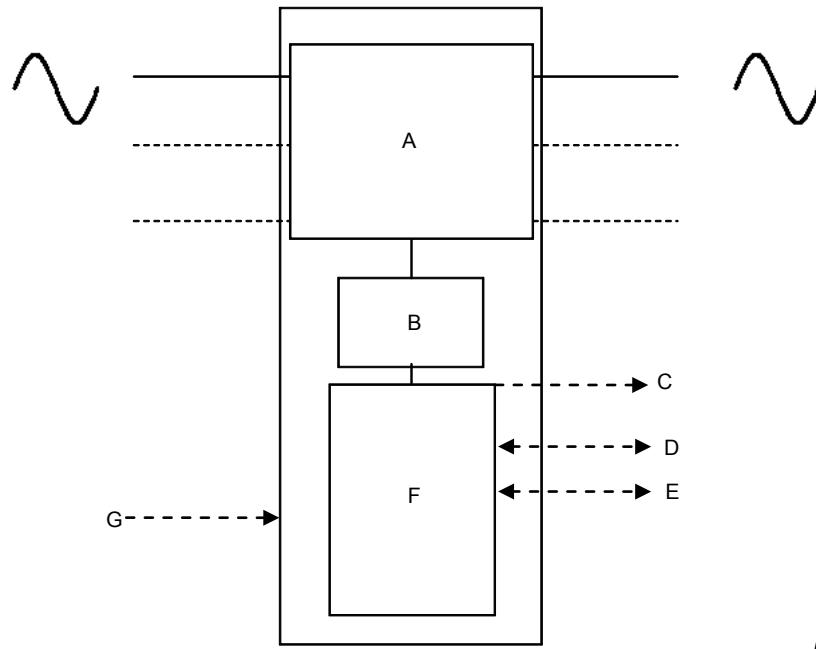
Profound experience with deep integration between electronics and instrument transformers has yet to be gathered on a broader basis, as this type of equipment is not yet widespread in the industry.

DSUs, besides FPI basic functions, may also optionally integrate additional auxiliary functions such as:

- voltage presence/absence detection for medium voltage (MV) network automation, with and without distributed energy resources presence (not for fault confirmation, which can be a basic FPI function depending on the adopted fault detection method, neither for safety-related aspects, which are covered by IEC 61243-5);
- measuring of voltage, current, and active and reactive power, etc., for various applications, such as MV network automation, monitoring of power flows, etc.;
- smart grid management (such as voltage control and unwanted island operation) by means of a proper interface with local distributed generators (DER);
- local output of collected information by means of suitable interfaces;
- remote transmission of collected information;
- others.

A general FPI scheme is outlined in Figure 1.

A DSU may have a much more complex scheme.

**Key**

- A: Current (and, if necessary, voltage) sensors. 1 or 3 phases may be monitored.
- B: Transmission of signals between sensors and electronics.
- C: Local indications (lamps, LEDs, flags, etc.).
- D: Analogue, digital and/or communication inputs/outputs for remote communication/commands (hard wired and/or wireless).
- E: Connections to field apparatus.
- F: Signal conditioning, processing and indicating unit (CPIU).
- G: Power supply.

Current sensor(s) may detect fault current passages without any need of galvanic connection to the phase(s) (for instance in case of cable type current sensors or of magnetic field sensor).

Not all the above listed parts or functions are necessarily included in the FPI, depending on its complexity and on its technology. However, at least 1 one of C or D functions shall be present.

Figure 1 – General architecture of an FPI

0.2 Position of this standard in relation to the IEC 61850 series

IEC 61850 is the series of International Standards intended to be used for communication and systems to support power utility automation.

The IEC 62689 series will also introduce a dedicated namespace to support integration of FPIs/DSUs into power utility automation.

In addition, it defines proper data models and different profiles of communication interfaces to support the different use cases of these FPIs/DSUs.

Some of these use cases rely on the concept of extended substation, which is intended as the communication among intelligent electronic devices (IED) through IEC 61850 located both along MV feeders and in the main substation, for the most sophisticated FPI versions (for smart grid applications, for instance, usually DSUs). Such a profile may not be limited to FPI/DSU devices, but may embrace features needed to support extensions of these substations along the MV feeders connected to the main substation themselves.

CURRENT AND VOLTAGE SENSORS OR DETECTORS, TO BE USED FOR FAULT PASSAGE INDICATION PURPOSES –

Part 1: General principles and requirements

1 Scope

This part of IEC 62689 defines the minimum requirements (therefore performances) and consequent classification and tests (with the exception of functional and communication ones) for fault passage indicators (FPIs) and distribution substation units (DSUs) (including their current and/or voltage sensors), which are, respectively, a device or a device/combination of devices and/or functions able to detect faults and provide indications about their localization.

By localization of the fault is meant the fault position with respect to the FPI/DSU installation point on the network (upstream or downstream from the FPI/DSU's location) or the direction of the fault current flowing through the FPI/DSU itself. The fault localization may be obtained

- directly from the FPI/DSU, or
- from a central system using information from more FPIs or DSUs,

considering the features and the operating conditions of the electric system where the FPIs/DSUs are installed.

In this part of IEC 62689, the FPI/DSU classification is specified in detail, in accordance with the first “core” classification defined in IEC 62689-2, which is explicitly focused on the description of electric phenomena and electric system response during faults, considering the most widely diffused distribution system architecture and fault typologies.

Thus, IEC 62689-2 is mainly focused on helping users in the correct choice of FPIs/DSUs, whereas IEC 62689-1, IEC 62689-3 and IEC 62689-4 are mainly focused on FPI/DSU requirements, communication and testing procedures, respectively.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60028, *International standard of resistance for copper*

IEC 60038, *IEC standard voltages*

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db:Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60121, *Recommendation for commercial annealed aluminum electrical conductor wire*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

IEC 60417, *Graphical symbols for use on equipment* (available at: <http://www.graphical-symbols.info/equipment>)

IEC 60455 (all parts), *Resin based reactive compounds used for electrical insulation*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-1-30, *Fire hazard testing – Part 1-30: Guidance for assessing the fire hazard of electrotechnical products – Preselection testing process – General guidelines*

IEC 60695-7-1, *Fire hazard testing – Part 7-1: Toxicity of fire effluent – General guidance*

IEC TS 60815 (all parts), *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions*

IEC TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC TS 60815-2, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

IEC TS 60815-3, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems*

IEC 60870-5-101, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*

IEC 60870-5-104, *Telecontrol equipment and systems – Part 5-104: Transmission protocols, Network access for IEC 60870-5-101 using standard transport profiles*

IEC 61000-4-10, *Electromagnetic compatibility (EMC) – Part 4-10: Testing and measurement techniques – Damped oscillatory magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-4-16, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-9, *Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Pulse magnetic field immunity test*

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

IEC 60255-27:2013, *Measuring relays and protection equipment – Part 27: Product safety requirements*

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

koniec náhľadu – text d'alej pokračuje v platenej verzii STN