

STN	Meracie relé a ochranné zariadenia. Časť 121: Funkčné požiadavky na dištančnú ochranu.	STN EN 60255-121 35 3410
------------	---	--

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 01/15

Obsahuje: EN 60255-121:2014, IEC 60255-121:2014

119904

EUROPEAN STANDARD

EN 60255-121

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2014

ICS 29.120.70

English Version

**Measuring relays and protection equipment - Part 121:
Functional requirements for distance protection
(IEC 60255-121:2014)**

Relais de mesure et dispositifs de protection - Partie 121:
Exigences fonctionnelles pour protection de distance
(CEI 60255-121:2014)

Messrelais und Schutzeinrichtungen - Teil 121:
Funktionsanforderungen für den Distanzschutz
(IEC 60255-121:2014)

This European Standard was approved by CENELEC on 2014-04-11. 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

Foreword

The text of document 95/319/FDIS, future edition 1 of IEC 60255-121, prepared by IEC/TC 95 "Measuring relays and protection equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60255-121:2014.

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) 2015-01-11
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-04-11

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 60255-121:2014 was approved by CENELEC as a European Standard without any modification.

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 60050	series	International electrotechnical vocabulary	-	-
IEC 60255-1	-	Measuring relays and protection equipment -- Part 1: Common requirements	EN 60255-1	-
IEC 61850	series	Communication networks and systems for power utility automation	EN 61850	series
IEC 61869-2	2012	Instrument transformers -- Part 2: Additional requirements for current transformers	EN 61869-2	2012
IEC 61869-5	2011	Instrument transformers -- Part 5: Additional requirements for capacitor voltage transformers	EN 61869-5	2011



INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Measuring relays and protection equipment –
Part 121: Functional requirements for distance protection**

**Relais de mesure et dispositifs de protection –
Partie 121: Exigences fonctionnelles pour protection de distance**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 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 more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 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 plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 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.



INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Measuring relays and protection equipment –
Part 121: Functional requirements for distance protection**

**Relais de mesure et dispositifs de protection –
Partie 121: Exigences fonctionnelles pour protection de distance**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XG**
CODE PRIX

ICS 29.120.70

ISBN 978-2-8322-1399-5

**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.....	9
1 Scope.....	11
2 Normative references	11
3 Terms and definitions	12
4 Specification of the function.....	13
4.1 General.....	13
4.2 Input energizing quantities/energizing quantities	13
4.3 Binary input signals.....	14
4.4 Functional logic.....	15
4.4.1 Faulted phase identification	15
4.4.2 Directional signals	15
4.4.3 Distance protection function characteristics	15
4.4.4 Distance protection zone timers	16
4.5 Binary output signals	16
4.5.1 General	16
4.5.2 Start (pickup) signals	16
4.5.3 Operate signals	17
4.5.4 Other binary output signals	17
4.6 Additional influencing functions/conditions	17
4.6.1 General	17
4.6.2 Inrush current	17
4.6.3 Switch onto fault/trip on reclose	17
4.6.4 Voltage transformer (VT) signal failure (loss of voltage).....	17
4.6.5 Power swings	18
4.6.6 Behavior during frequencies outside of the operating range	18
5 Performance specifications.....	18
5.1 General.....	18
5.2 Effective and operating ranges.....	18
5.3 Basic characteristic accuracy under steady state conditions	19
5.3.1 General	19
5.3.2 Determination of accuracy related to time delay setting	19
5.3.3 Disengaging time.....	20
5.4 Dynamic performance	20
5.4.1 General	20
5.4.2 Transient overreach (TO).....	20
5.4.3 Operate time and transient overreach (SIR diagrams).....	21
5.4.4 Operate time and transient overreach (CVT-SIR diagrams).....	21
5.4.5 Typical operate time	21
5.5 Performance with harmonics	22
5.5.1 General	22
5.5.2 Steady-state harmonics tests.....	23
5.5.3 Transient LC oscillation tests	23
5.6 Performance during frequency deviation	23
5.6.1 General	23
5.6.2 Steady state testing during frequency deviation	23
5.6.3 Transient testing during frequency deviation	23
5.7 Double infeed tests	24

5.7.1	General	24
5.7.2	Single line, double infeed system.....	24
5.7.3	Double line, double infeed system	24
5.8	Instrument transformer (CT, VT and CVT) requirements	25
5.8.1	General	25
5.8.2	CT requirements	25
6	Functional tests	29
6.1	General.....	29
6.2	Rated frequency characteristic accuracy tests	29
6.2.1	General	29
6.2.2	Basic characteristic accuracy under steady state conditions	30
6.2.3	Basic directional accuracy under steady state conditions	43
6.2.4	Determination of accuracy related to time delay setting	48
6.2.5	Determination and reporting of the disengaging time	48
6.3	Dynamic performance	50
6.3.1	General	50
6.3.2	Dynamic performance: operate time and transient overreach (SIR diagrams)	51
6.3.3	Dynamic performance: operate time and transient overreach (CVT-SIR diagrams)	61
6.3.4	Dynamic performance: transient overreach tests.....	65
6.3.5	Dynamic performance: typical operate time	69
6.4	Performance with harmonics	74
6.4.1	Steady state harmonics tests	74
6.4.2	Transient oscillation tests (network simulation L-C)	75
6.5	Performance during off-nominal frequency	82
6.5.1	Steady state frequency deviation tests.....	82
6.5.2	Transient frequency deviation tests	85
6.6	Double infeed tests	90
6.6.1	Double infeed tests for single line	90
6.6.2	Double infeed tests for parallel lines (without mutual inductance).....	96
6.6.3	Reporting of double infeed test results.....	100
7	Documentation requirements	101
7.1	Type test report	101
7.2	Documentation.....	101
Annex A (informative)	Impedance characteristics	102
A.1	Overview.....	102
A.1.1	General	102
A.1.2	Non-directional circular characteristic	102
A.1.3	MHO characteristic	102
A.1.4	Quadrilateral/polygonal.....	104
A.2	Example characteristics	106
A.2.1	General	106
A.2.2	Non-directional circular characteristic (ohm)	106
A.2.3	Reactive reach line characteristic	106
A.2.4	MHO characteristic	107
A.2.5	Resistive and reactive intersecting lines characteristic.....	107
A.2.6	Offset MHO characteristic.....	108

Annex B (informative) Informative guide for the behaviour of timers in distance protection zones for evolving faults	110
Annex C (normative) Setting example	112
Annex D (normative) Calculation of mean, median and mode.....	115
D.1 Mean	115
D.2 Median.....	115
D.3 Mode	115
D.4 Example.....	115
Annex E (informative) CT saturation and influence on the performance of distance relays	116
Annex F (informative) Informative guide for testing distance relays based on CT requirements specification	119
F.1 General.....	119
F.2 Test data	120
F.3 CT data and CT model	121
Annex G (informative) Informative guide for dimensioning of CTs for distance protection	125
G.1 General.....	125
G.2 Example 1.....	126
G.3 Example 2.....	128
Annex H (normative) Calculation of relay settings based on generic point P expressed in terms of voltage and current.....	131
H.1 Settings for quadrilateral/polygonal characteristic	131
H.2 Settings for MHO characteristic.....	133
Annex I (normative) Ramping methods for testing the basic characteristic accuracy	134
I.1 Relationship between simulated fault impedance and analog quantities	134
I.2 Pre-fault condition.....	134
I.3 Phase to earth faults	134
I.4 Phase to phase faults.	136
I.5 Ramps in the impedance plane	139
I.5.1 Pseudo-continuous ramp	139
I.5.2 Ramp of shots	140
Annex J (normative) Definition of fault inception angle.....	143
Annex K (normative) Capacitive voltage instrument transformer model	145
K.1 General.....	145
K.2 Capacitor voltage transformer (CVT).....	145
Figure 1 – Simplified distance protection function block diagram.....	14
Figure 2 – Basic accuracy specification of an operating characteristic	19
Figure 3 – Basic angular accuracy specifications of directional lines	20
Figure 4 – SIR diagram – Short line average operate time	22
Figure 5 – Fault positions to be considered for specifying the CT requirements	26
Figure 6 – Test procedure for basic characteristic accuracy.....	31
Figure 7 – Calculated test points A, B and C based on the effective range of U and I	32
Figure 8 – Modified points B' and C' based on the limited setting range	32
Figure 9 – Position of test points A, B, C, D and E in the effective range of U and I	33
Figure 10 – Position of test points A, B', C', D and E in the effective range of U and I	33

Figure 11 – Quadrilateral characteristic showing ten test points	34
Figure 12 – Quadrilateral characteristic showing test ramps.....	35
Figure 13 – Quadrilateral characteristic showing accuracy limits	36
Figure 14 – Quadrilateral/polygonal characteristic showing accuracy limits	37
Figure 15 – MHO characteristic showing nine test points	37
Figure 16 – MHO characteristic showing test ramps.....	38
Figure 17 – Accuracy limits for MHO characteristic	39
Figure 18 – Basic directional element accuracy tests	44
Figure 19 – Directional element accuracy tests in the second quadrant.....	45
Figure 20 – Directional element accuracy tests in the second quadrant.....	46
Figure 21 – Directional element accuracy tests in the fourth quadrant.....	46
Figure 22 – Directional test accuracy lines in the fourth quadrant	47
Figure 23 – Position of the three-phase fault for testing the disengaging time	49
Figure 24 – Sequence of events for testing the disengaging time	50
Figure 25 – Power system network with zero load transfer.....	51
Figure 26 – Dynamic performance: operate time and dynamic overreach (SIR diagram)	55
Figure 27 – SIR diagram for short line: minimum operate time	56
Figure 28 – SIR diagram for short line: average operate time.....	57
Figure 29 – SIR diagram for short line: maximum operate time	57
Figure 30 – Dynamic performance tests (SIR diagrams).....	59
Figure 31 – SIR diagram for long line: minimum operate time	61
Figure 32 – SIR diagram for long line: average operate time	62
Figure 33 – SIR diagram for long line: maximum operate time	62
Figure 34 – Dynamic performance: operate time and dynamic overreach (CVT-SIR diagram)	64
Figure 35 – CVT-SIR diagram for short line: minimum operate time	66
Figure 36 – CVT-SIR diagram for short line: average operate time.....	66
Figure 37 – CVT-SIR diagram for a short line: maximum operate time	67
Figure 38 – Fault statistics for typical operate time	70
Figure 39 – Frequency distribution of operate time	73
Figure 40 – Ramping test for harmonics.....	75
Figure 41 – Steady-state harmonics test	77
Figure 42 – Simulated power system network	78
Figure 43 – Flowchart of transient oscillation tests	79
Figure 44 – Simulated voltages (U_{L1} , U_{L2} , U_{L3}) and currents (I_{L1} , I_{L2} , I_{L3})	81
Figure 45 – Transient oscillation tests – Operate time.....	82
Figure 46 – Test points for quadrilateral characteristics	83
Figure 47 – Test points for MHO characteristic	83
Figure 48 – Test ramp direction for quadrilateral characteristic	83
Figure 49 – Test ramp direction for MHO characteristic.....	84
Figure 50 – Steady-state frequency deviation tests	86
Figure 51 – Short line model for frequency deviation test.....	87
Figure 52 – Flowchart of transient frequency deviation tests	89

Figure 53 – SIR diagrams for frequency deviation tests – average operate time.....	90
Figure 54 – Network model for single line tests	91
Figure 55 – Line to earth fault	92
Figure 56 – Line to line fault	92
Figure 57 – Line to line to earth fault	92
Figure 58 – Three-phase fault.....	93
Figure 59 – Network model for parallel lines tests	98
Figure 60 – Network model for current reversal test.....	99
Figure A.1 – Non-directional circular characteristic with directional supervision	102
Figure A.2 – MHO characteristic	103
Figure A.3 – Quadrilateral/polygonal characteristics	104
Figure A.4 – Non-directional circular characteristic (ohm)	106
Figure A.5 – Reactive reach line characteristic	107
Figure A.6 – MHO characteristics	107
Figure A.7 – Resistive and reactive intersecting lines characteristics	108
Figure A.8 – Offset MHO.....	108
Figure B.1 – The same fault type evolving from time delayed zone 3 (position 1) into time delayed zone 2 (position 2) after 200 ms.....	110
Figure B.2 – Phase to earth fault in time delayed zone 3 (position 1) evolving into three-phase fault in the same zone (position 2) after 200 ms	111
Figure C.1 – Setting example for a radial feeder	112
Figure C.2 – Phase to earth fault (LN)	113
Figure C.3 – Phase to phase fault (LL).....	114
Figure E.1 – Fault positions to be considered for specifying the CT requirements	117
Figure F.1 – Fault positions to be considered.....	119
Figure F.2 – Double source network	120
Figure F.3 – Magnetization curve for the basic CT	122
Figure F.4 – Secondary current at the limit of saturation caused by AC component with no remanent flux in the CT.....	123
Figure F.5 – Secondary current in case of maximum DC offset	123
Figure G.1 – Distance relay example 1	126
Figure G.2 – Distance relay example 2	128
Figure H.1 – Quadrilateral/polygonal characteristic showing test point P on the reactive reach line.....	131
Figure H.2 – Quadrilateral distance protection function characteristic showing test point P on the resistive reach line.	132
Figure H.3 – MHO characteristic showing test point P	133
Figure I.1 – Three-line diagram showing relay connections and L1N fault	135
Figure I.2 – Voltage and current phasors for L1N fault	135
Figure I.3 – Voltages and currents for L1N fault, constant fault current	136
Figure I.4 – Voltages and currents for L1N fault, constant fault voltage	136
Figure I.5 – Three-line diagram showing relay connections and L1L2 fault.....	137
Figure I.6 – Voltage and current phasors for L1L2 fault.....	138
Figure I.7 – Voltages and currents for L1L2 fault, constant fault current.....	138
Figure I.8 – Voltages and currents for L1L2 fault, constant fault voltage	139

Figure I.9 – Pseudo-continuous ramp distance relay characteristic on an impedance plane	140
Figure I.10 – Pseudo-continuous ramp showing impedance step change and the time step	140
Figure I.11 – Ramp of shots distance relay characteristic on an impedance plane	141
Figure I.12 – Ramp of shots showing impedance step change and the time step	142
Figure I.13 – Ramp of shots with binary search algorithm	142
Figure J.1 – Graphical definition of fault inception angle	143
Figure K.1 – CVT equivalent electrical circuit	145
Figure K.2 – Transient response of the 50 Hz version of the CVT model	147
Table 1 – Example of effective and operating ranges of distance protection	18
Table 2 – Recommended levels of remanence in the optional cases when remanence is considered	27
Table 3 – Basic characteristic accuracy for various points (quadrilateral/polygonal)	42
Table 4 – Overall basic characteristic accuracy (quadrilateral/polygonal)	42
Table 5 – Basic characteristics accuracy for various points (MHO)	42
Table 6 – Overall basic characteristic accuracy (MHO)	42
Table 7 – Basic directional accuracy for various fault types	47
Table 8 – Basic directional accuracy $e_{\alpha}\chi$	47
Table 9 – Results of disengaging time for all the tests	50
Table 10 – Short line SIR and source impedance for selected rated current and frequency	53
Table 11 – Short line SIR and source impedances for other rated current and frequency	54
Table 12 – Long line SIR and source impedances for selected rated current and frequency	59
Table 13 – Long line SIR and source impedances for other rated current and frequency	60
Table 14 – Short line CVT-SIR source impedance	63
Table 15 – Transient overreach table for short line	68
Table 16 – Transient overreach table for long line	68
Table 17 – Transient overreach table for short line with CVTs	69
Table 18 – Typical operate time	71
Table 19 – Typical operate time	71
Table 20 – Typical operate time	72
Table 21 – Typical operate time (mode, median, mean)	73
Table 22 – Steady state harmonics test	75
Table 23 – Capacitance values	78
Table 24 – Quadrilateral/polygonal basic characteristic accuracy at f_{\min} and f_{\max}	85
Table 25 – MHO basic characteristic accuracy at f_{\min} and f_{\max}	85
Table 26 – Tests without pre-fault load	94
Table 27 – Tests with pre-fault load	95
Table 28 – Current reversal test	98
Table 29 – Evolving faults (only one line affected)	99
Table 30 – Evolving faults (both lines affected)	100
Table 31 – Double infeed test results	101

Table F.1 – Magnetization curve data	122
Table G.1 – Fault currents	127
Table G.2 – Fault currents	128
Table J.1 – Fault type and reference voltage	144
Table K.1 – Parameter values for the 50 Hz version of the CVT model	146
Table K.2 – Parameter values for the 60 Hz version of the CVT model	146

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASURING RELAYS AND PROTECTION EQUIPMENT –**Part 121: Functional requirements for distance protection**

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 60255-121 has been prepared by IEC technical committee 95: Measuring relays and protection equipment.

This standard cancels and replaces IEC 60255-16.

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

FDIS	Report on voting
95/319/FDIS	95/321/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 parts in the IEC 60255 series, published under the general title *Measuring relays and protection equipment*, 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.

MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 121: Functional requirements for distance protection

1 Scope

This part of IEC 60255 specifies minimum requirements for functional and performance evaluation of distance protection function typically used in, but not limited to, line applications for effectively earthed, three-phase power systems. This standard also defines how to document and publish performance tests.

This standard covers distance protection function whose operating characteristic can be defined on an impedance plane and includes specification of the protection function, measurement characteristics, phase selection, directionality, starting and time delay characteristics.

The test methodologies for verifying performance characteristics and accuracy are included in this standard. The standard defines the influencing factors that affect the accuracy under steady state conditions and performance characteristics during dynamic conditions. It also includes the instrument transformer requirements for the protection function.

The distance protection functions covered by this standard are as follows:

	IEEE/ANSI C37.2 Function numbers	IEC 61850-7-4 Logical nodes
Phase distance protection	21	PDIS
Earth (ground) distance protection	21G	PDIS

This standard does not specify the functional description of additional features often associated with digital distance relays such as power swing blocking (PSB), out of step tripping (OST), voltage transformer (VT) supervision, switch onto fault (SOTF), trip on reclose (TOR), the logic for cross country faults in not effectively earthed networks, and trip conversion logic. Only their influence on the distance protection function is covered in this standard. The protection of series-compensated lines is beyond the scope of this standard.

The general requirements for measuring relays and protection equipment are defined in IEC 60255-1.

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 60050 (all parts), *International Electrotechnical Vocabulary* (available at <<http://www.electropedia.org>>)

IEC 60255-1, *Measuring relays and protection equipment – Part 1: Common requirements*

IEC 61850 (all parts), *Communication networks and systems for power utility automation*

IEC 61869-2:2012, *Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 61869-5:2011, *Instrument transformers – Part 5: Additional requirements for capacitor voltage transformers*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN