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Edition 2.0 2022-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Measuring relays and protection equipment – Part 1: Common requirements

Relais de mesure et dispositifs de protection – Partie 1: Exigences communes



IEC 60255-1:2022-12(en-fr)



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INTERNATIONAL STANDARD

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Measuring relays and protection equipment – Part 1: Common requirements

Relais de mesure et dispositifs de protection – Partie 1: Exigences communes

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 1: Common requirements

FOREWORD

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IEC 60255-1 has been prepared by IEC technical committee 95: Measuring relays and protection equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

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

a) scope of document clarified;
b) merging units and communications as an integral part of the protection added;
c) binary output clarification expanded;
d) environmental operating conditions added (Annex B);
e) test reference conditions added;
f) multiple changes to improve understanding across most clauses;
g) derating by manufacturer added;

h) safety and EMC tests removed from document and referenced only;

i) relay setting and type test guidelines modified (Annex A)

j) battery monitor port and low power instrument transformers added.

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

Draft	Report on voting
95/513/FDIS	95/521/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/publications.

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 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.

INTRODUCTION

The following explains the numbering of documents falling under the responsibility of TC 95:

The numbering of documents follows the following principle:

- common standards start with IEC 60255–XX;
- protection functional standards fall into IEC the 60255-1XX series.

The IEC 60255 series consists of the following parts:

a) Common standards:
   Part 1: Common requirements
   Part 21: Vibration, shock, bump and seismic tests
   Part 24: Common format for transient data exchange (COMTRADE) for power systems
   Part 26: Electromagnetic compatibility requirements
   Part 27: Product safety requirements
b) Protection functional standards:
   Part 1XX: Functional requirements

NOTE The last two digits of the part of the proposed functional standard new numbering correspond to function numbers as established in IEEE Std C37.2™-2008 [3][1].

[1] Numbers in square brackets refer to the Bibliography.

MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 1: Common requirements

1 Scope

This part of IEC 60255 specifies common rules and requirements applicable to measuring relays and protection equipment, including any combination of equipment to form a distributed protection scheme for power system protection such as control, monitoring and process interface equipment, to obtain uniformity of requirements and tests. This document covers the main technologies in use today; other emerging technologies present specific EMC and safety issues but the philosophy in this document will be applied.

All measuring relays and protection equipment used for protection within the power system environment are covered by this document. Other documents in this series can define their own requirements which in such cases take precedence. The typical locations for measuring relays and protection equipment are where protection of electrical equipment is required: generally power stations, substations and industrial locations.

Measuring relays and protection equipment installed in special applications (marine, railways, aerospace, explosive atmospheres, computer centres, etc.) could be enhanced by additional requirements required by that application.

2 Normative references

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

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

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

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

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 60255-21-1, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section One: Vibration tests (sinusoidal)*

IEC 60255-21-2, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section Two: Shock and bump tests*

IEC 60255-21-3, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 3: Seismic tests*

IEC 60255-26, *Measuring relays and protection equipment – Part 26: Electromagnetic compatibility requirements*

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

IEC 60255-1XX (all parts), *Measuring relays and protection equipment – Part 1XX: Functional requirements*

IEC 60688, *Electrical measuring transducers for converting AC and DC electrical quantities to analogue or digital signals*

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

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

IEC 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

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

IEC 61869-10, *Instrument transformers – Part 10: Additional requirements for low-power passive current transformers*

IEC 61869-11, *Instrument transformers – Part 11: Additional requirements for low-power passive voltage transformers*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
absolute error
difference between a measured value and its declared value

[SOURCE: IEC 60050-447:2020 [5], 447-08-01]

3.1.2
analogue input port
port intended for current or voltage input whose values are directly proportional to physical measured quantities, i.e. transducer input (measuring temperature, light, etc.)

3.1.3
analogue output port
port that generates an analogue output signal to drive actuators, analogue panel meters, etc.

Note 1 to entry: Typically a current or voltage less than or equal to 20 mA or 10 V DC respectively.

3.1.4
assigned error
error limits within which the manufacturer declares that any measuring relay or protection equipment of a given type will perform under reference conditions of influence quantities

[SOURCE: IEC 60050-447:2020 [5], 447-08-13, modified – the term “declared error” has been removed.]

3.1.5
auxiliary power supply port
AC or DC auxiliary energizing input

Note 1 to entry: Some modern relays have a single auxiliary power supply port that can be energized with both AC and/or DC.

3.1.6
battery monitor port
port intended for connection to the station battery for the purpose of battery voltage monitoring

3.1.7
binary input port
port intended for inputs which have an on or off state given by direct connection to an energizing quantity without any communications protocol

3.1.8
binary output port
port intended for outputs which have an on or off state given by direct connection without any communications protocol

3.1.9
substation control room
room of a substation in which are located facilities necessary to monitor and control substation items

[SOURCE: IEC 60050-605:1983 [7], 605-02-34]

3.1.10
communication port
interface on measuring relays and protection equipment used for transfer of information in digital format pertaining to, for example, current or voltage inputs or outputs, binary inputs, binary outputs, data files

3.1.11
dynamic performance
set of characteristics defining the ability of a measuring relay or protection equipment to achieve the intended functions under fault conditions (for example, single phase to earth fault) and/or abnormal system conditions which occur at the power system frequency (for example, power swings, harmonics)

[SOURCE: IEC 60050-447:2020 [5], 447-07-15]

3.1.12
earth port
point where a cable intended for connection to earth for functional or safety purposes can be connected

3.1.13
energizing quantity
quantity itself or signal representing the information corresponding to the quantity that, applied to a measuring relay or protection equipment under specified conditions, enables it to operate

Note 1 to entry: Both input energizing quantity and auxiliary energizing quantity are energizing quantities.

[SOURCE: IEC 60050-447:2020 [5], 447-03-01]

3.1.14
equipment
single apparatus or set of devices or apparatuses, or a set of main devices of an installation, or all devices necessary to perform a specific task

Note 1 to entry: Examples of equipment are a power transformer and the equipment of a substation.

Note 2 to entry: For this document, equipment is a measuring relay or protection equipment.

[SOURCE: IEC 60050-151:2001 [4], 151-11-25, modified – Note 2 to entry has been added.]

3.1.15
equipment under test
EUT
equipment submitted to a test, including any accessories such as communication modules, plug in power supplies, unless otherwise specified

3.1.16
human machine interface
HMI
user interface or dashboard that allows a person to access and operate a system, or device

3.1.17
influence quantity
quantity not essential for the performance of an EUT but affecting its performance

Note 1 to entry: For electric devices, typical influence quantities may be temperature, humidity, pressure.

[SOURCE: IEC 60050-151:2001 [4],151-06-31, modified – the term “item” has been replaced by “EUT”.]

3.1.18
input port
port through which the EUT is energized or controlled in order to perform its function(s)

EXAMPLE Analogue current transformer (LPCT or CT) input, analogue voltage transformer (LPVT or VT) input, binary input, battery monitor input, etc.

3.1.19
intrinsic accuracy
quality that characterizes the ability of a measuring relay or protection equipment, when used under reference conditions of influence quantities, to operate both at the value of characteristic quantity and at the time close to their declared values (e.g. setting values)

[SOURCE: IEC 60050-447:2020 [5], 447-08-18]

3.1.20
low-power instrument transformer
LPIT
arrangement, consisting of one or more current or voltage transformer(s) which may be connected to transmitting systems and secondary converters, all intended to transmit a low-

power analogue or digital output signal to measuring instruments, meters and protective or control devices or similar apparatus

EXAMPLE An arrangement consisting of three current sensors, three voltage sensors connected to one merging unit delivering one digital output is considered an LPIT.

Note 1 to entry: LPITs are commonly called non-conventional instrument transformers (NCIT).

Note 2 to entry: The output power produced by these devices is typically lower or equal to 1 VA.

[SOURCE: IEC 61869-6:2016 [20], 3.1.601, modified – Note 3 to entry has been removed.]

3.1.21
low-power current transformer
LPCT
low-power instrument transformer for current measurement

[SOURCE: IEC 61869-6:2016 [20], 3.1.602, modified – Note 1 to entry has been removed.]

3.1.22
low-power voltage transformer
LPVT
low-power instrument transformer for voltage measurement

[SOURCE: IEC 61869-6:2016 [20], 3.1.603, modified – Note 1 to entry has been removed.]

3.1.23
merging unit
physically independent unit collecting multi-channel digital signals, analogue outputs from current and voltage transformers synchronously, and which transmits these signals digitally

3.1.24
multifunction protection equipment
single apparatus taking a range of input measurements and performing a multitude of protection functions on these measurements

3.1.25
non-weatherprotected
location in which the equipment is exposed to all environmental conditions and is not protected from direct sunlight

3.1.26
operating accuracy
quality that characterizes the ability of a measuring relay or protection equipment to minimize the absolute error, when influence quantity(ies) is(are) different from its reference value(s)

Note 1 to entry: The operating accuracy of measuring relays and protection equipment depends on intrinsic accuracy and uncertainty associated with the variation of the performance of components due to influence quantities.

[SOURCE: IEC 60050-447:2020 [5], 447-08-17, modified – Note 1 to entry has been added.]

3.1.27
output port
port through which the EUT produces predetermined changes

3.1.28
overall system accuracy
accuracy of a protection system, considering intrinsic accuracy and operating accuracy of the equipment, to which are added uncertainties and variations due to external sensors accuracy and to external wires

3.1.29
partially weather protected
location in which the equipment is protected from precipitation and direct sunlight but is exposed to the outside air through ventilation or louvres

3.1.30
port
interface on measuring relays and protection equipment

SEE: Figure 1.

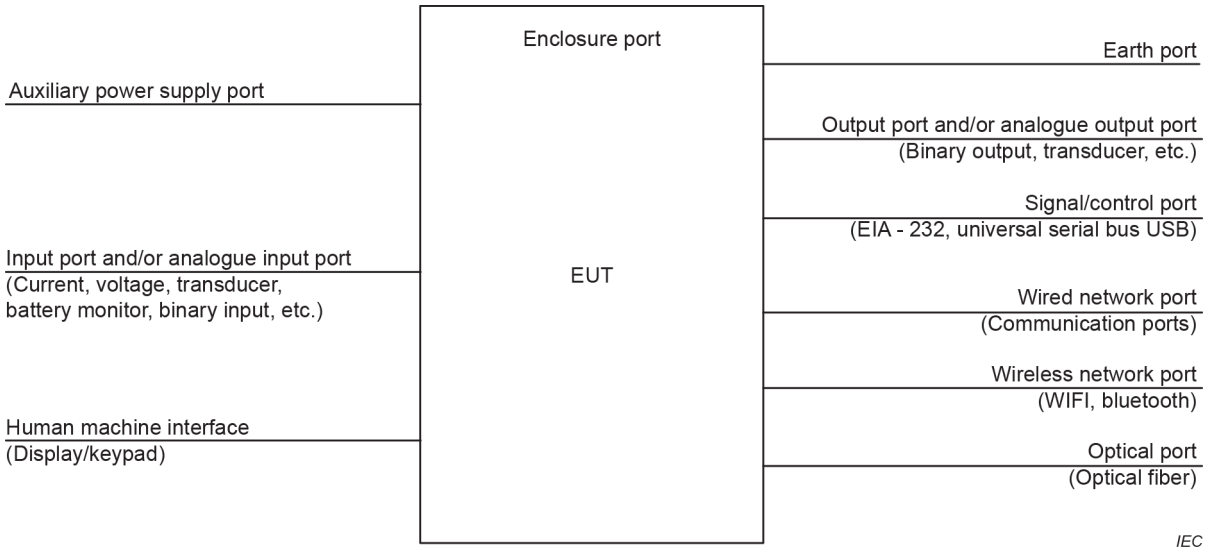


Figure 1 – Ports for measuring relays and protection equipment

3.1.31
primary relay
electric relay directly energized by the current or voltage in a main circuit, without any intermediate instrument transformer, shunt or transducer

Note 1 to entry: The main circuit includes all the conductive parts, and is intended for transmitting electrical energy.

[SOURCE: IEC 60050-447:2020 [5], 447-01-20]

3.1.32
product family
range of products based on a common hardware and/or software platform

3.1.33
programmable logic device
integrated circuit that consists of logic elements with an interconnection pattern, parts of which are user programmable

[SOURCE: IEC 60050-521:2002 [6], 521-11-01]

3.1.34
rated value
value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment, or system

[SOURCE: IEC 60050-151:2001 [4], 151-16-08]

3.1.35
routine test
conformity test made on each individual equipment during or after manufacture

Note 1 to entry: Individual equipment includes complete products and spare parts.

[SOURCE: IEC 60050-151:2001 [4], 151-16-17, modified – the word "item" has been replaced by the word "equipment" and Note 1 to entry has been added.]

3.1.36
secondary relay
electric relay energized by the quantity (e.g. electric current or voltage) derived from an instrument transformer or transducer

[SOURCE: IEC 60050-447:2020 [5], 447-01-21]

3.1.37
service port
interface on measuring relays and protection equipment used for temporary connection for the transfer of information

3.1.38
signal or control port
port intended for the interconnection of components of an EUT, or between an EUT and local auxiliary equipment, and used in accordance with relevant functional specifications (for example, for the maximum length of cable connected to it)

Note 1 to entry: Examples include EIA-232, universal serial bus (USB), high-definition multimedia interface (HDMI), IEEE Standard 1394 ("Fire Wire"), IRIG-B interface.

3.1.39
technical data
product specification made available to a user which could be product specification sheets, user manuals, etc.

3.1.40
totally weatherprotected
location in which the equipment is isolated from the outdoor environment and is maintained under stable conditions

3.1.41
transducer
equipment that converts variations in a physical quantity such as temperature, into an electrical signal

3.1.42
transient response
reaction of a measuring relay or protection equipment under transient system conditions that occur at off-rated power system frequency (for example, magnetizing inrush, capacitive voltage transformer transients)

[SOURCE: IEC 60050-447:2020 [5], 447-07-16]

3.1.43
type test
test of one or more devices made to a given design, to check if these devices comply with the requirements of the standard concerned

[SOURCE: IEC 60050-851:2008 [21], 851-12-05]

3.1.44
wired network port
port for the connection of voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network

Note 1 to entry: Examples of these include CATV, PSTN, ISDN, xDSL, LAN and similar networks.

Note 2 to entry: These ports may support screened or unscreened cables and may also carry AC or DC power (e.g. PoE) where this is an integral part of the telecommunication specification.

Note 3 to entry: A port generally intended for interconnection of components of a system under test (e.g. EIA-232, IEEE Standard 1284 (parallel printer), universal serial bus (USB), IEEE Standard 1394 ("Fire Wire"), etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a wired network port.

3.1.45
wireless network port
port for the connection of voice, data and signalling transfers intended to interconnect widely dispersed systems by radio frequency connection to a single-user or multi-user communication network

3.2 Abbreviated terms

AE	Auxiliary equipment
BI	Binary input
CATV	Communal (broadcasting) antenna/cable TV network
CT	Current transformer
EMC	Electromagnetic compatibility
EUT	Equipment under test
HMI	Human machine interface
HRV	Highest rated voltage
ISDN	Integrated services digital network
LAN	Local area network
LCD	Liquid crystal display
LPCT	Low-power current transformer
LPIT	Low-power instrument transformer
LPVT	Low-power voltage transformer
LRV	Lowest rated voltage
MCB	Miniature circuit breaker
NCIT	Non-conventional instrument transformer
PoE	Power over Ethernet
PSTN	Public switched telephone network
SEF	sensitive earth fault
USB	Universal serial bus
VT	Voltage transformer
xDSL	Generic term for all types of DSL (digital subscriber line) technology

4 Environmental conditions

4.1 General

Clause 4 specifies the environmental conditions for stationary use, maintenance and repair. Additional information on the operating environments can be found in Annex B.