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Responsible committee: PEL/85 Measuring equipment for electrical and electromagnetic quantities

Interested committees:

Title: Draft BS EN 60051-1 Direct acting indicating analogue electrical measuring instruments and their accessories

Part 1: Definitions and general requirements common to all parts

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- iii) requires additional national guidance or information

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Responsible Committee Secretary: **Committee Service Centre (BSI)**  
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## Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent standard. There is a high probability that this text could be adopted by CENELEC as a reference document for harmonization or as a European Standard. Recipients of this draft are requested to comment on the text bearing in mind this possibility.

## UK Vote

Please indicate whether you consider the UK should submit a negative (with reasons) or positive vote on this draft.

## Submission of Comments

- The guidance given below is intended to ensure that all comments receive efficient and appropriate attention by the responsible BSI committee. **Annotated drafts are not acceptable and will be rejected.**
- All comments must be submitted, preferably electronically, to the Responsible Committee Secretary at the address given on the front cover. Comments should be compatible with version 6.0 or version 97 of Microsoft Word for Windows, if possible; otherwise comments in ASCII text format are acceptable. **Any comments not submitted electronically should still adhere to these format requirements.**
- All comments submitted should be presented as given in the example below. Further information on submitting comments and how to obtain a blank electronic version of a comment form are available from the BSI website at: <http://drafts.bsigroup.com/>

## Template for comments and secretariat observations

|                  |                               |
|------------------|-------------------------------|
| Date: xx/xx/20xx | Document: <b>ISO/DIS xxxx</b> |
|------------------|-------------------------------|

| 1  | 2                                          | (3)                           | 4               | 5                                                                                                                                  | (6)                                                                      | (7)                                                |
|----|--------------------------------------------|-------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/ Figure/ Table/Note | Type of comment | Comment (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                  | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                   | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |



85/472/CD

COMMITTEE DRAFT (CD)

|                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                    |                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| IEC/TC or SC:<br>85                                                                                                                                                  |  | Project number<br>IEC 60051-1 Ed.6.0                                                                                                                                                                                                                                                               |                                                |
| Title of TC/SC:<br>Measuring Equipment for Electrical and Electromagnetic Quantities                                                                                 |  | Date of circulation<br><b>2014-02-28</b>                                                                                                                                                                                                                                                           | Closing date for comments<br><b>2014-05-30</b> |
| Also of interest to the following committees                                                                                                                         |  | Supersedes document<br>85/422/RR                                                                                                                                                                                                                                                                   |                                                |
| Proposed horizontal standard<br><input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CD to the TC/SC secretary            |  |                                                                                                                                                                                                                                                                                                    |                                                |
| Functions concerned:<br><input type="checkbox"/> Safety <input type="checkbox"/> EMC <input type="checkbox"/> Environment <input type="checkbox"/> Quality assurance |  |                                                                                                                                                                                                                                                                                                    |                                                |
| Secretary:<br>Mr. Chen Bo<br>CHINA                                                                                                                                   |  | THIS DOCUMENT IS STILL UNDER STUDY AND SUBJECT TO CHANGE. IT SHOULD NOT BE USED FOR REFERENCE PURPOSES.<br><br>RECIPIENTS OF THIS DOCUMENT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION. |                                                |

Title:

IEC 60051-1: Direct acting indicating analogue electrical measuring instruments and their accessories - Part 1: Definitions and general requirements common to all parts

Introductory note

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIRECT ACTING INDICATING ANALOGUE ELECTRICAL MEASURING  
INSTRUMENTS AND THEIR ACCESSORIES –****Part 1: Definitions and general requirements common to all parts**

## FOREWORD

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International Standard IEC 60051-1 has been prepared by IEC technical committee 85: Measuring equipment for electromagnetic quantities.

This sixth edition cancels and replaces the fifth edition published in 1997. This edition constitutes a technical revision.

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

- adding the EMC requirements and the test items;
- updating the safety symbols and requirements with IEC 61010 series;
- replacing the intrinsic error by uncertainty;
- adding service environment classification and classification by method of operation, mechanical condition or enclosure protection category, as well as the requirements of mechanical resistance to shock and impact, resistance to heat and flame, enclosure protective capability and connecting terminal;

- adding the requirements for package and storage of instruments and accessories according to IEC 60359;
- updating the Annexes to provide more information.

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

| FDIS       | Report on voting |
|------------|------------------|
| XX/XX/FDIS | XX/XX/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.

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.

The National Committees are requested to note that for this publication the stability date is 20XX.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

## INTRODUCTION

IEC 60051 is published in separate parts according to the following structure and under the general title *Direct acting indicating analogue electrical measuring instruments and their accessories*.

Part 1: Definitions and General Requirements Common to all Parts.

Part 2: Special Requirements for Ammeters and Voltmeters.

Part 3: Special Requirements for Wattmeters and Varmeters.

Part 4: Special Requirements for Frequency Meters.

Part 5: Special Requirements for Phase Meters, Power Factor Meters and Synchrosopes.

Part 6: Special Requirements for Ohmmeters (Impedance Meters) and Conductance Meters.

Part 7: Special Requirements for Multi-function Instruments.

Part 8: Special Requirements for Accessories.

Part 9: Recommended Test Methods.

Parts 2 to 9 are not complete in themselves and shall be read in conjunction with this Part 1.

All of these parts are arranged in the same format and a standard relationship between subject and clause number is maintained throughout. This re-arrangement will assist the reader of IEC 60051 to distinguish information relating to the different types of instruments.

The following statement aims to explain the principal changes comparing with the previous edition, which will be deleted in the final publication.

1. The analogue indicating instruments with electronic transducer have been introduced, and the electronic transducer may be influenced by electromagnetic interference, resulting in the change of indication. Therefore, EMC requirements and the test items (e.g. Electrostatic discharge immunity test, Radiated, radio-frequency, electromagnetic field immunity test, Electrical fast / burst immunity test, Immunity to conducted disturbances, induced by radio frequency fields, Surge immunity test, Oscillatory waves immunity test and etc.) are added.

2. Based on the requirements of IEC 61010-1:2010, the safety symbols have been updated and the safety requirements (e.g. Constructional requirement for protection against electric shock, clearances and creepage distances, requirements for accessible parts, requirements for connections to external circuits, requirements for connections to mains supply source, the requirements for the battery (if any) mounted in an instrument or accessory) has been added.

3. Since today the measuring results are expressed in the form of uncertainty of measurement, the “intrinsic error” in original edition has been replaced by “uncertainty”.

4. The existing publication is mainly for instruments used indoor or in laboratory so the specified nominal range of use is very limited. Therefore, service environment classification and classification by method of operation, mechanical condition and enclosure protection category, as well as the requirements of mechanical resistance to shock and impact, resistance to heat and flame, enclosure protective capability and connecting terminal have been added.

5. According to the provision of clause 4.3 in IEC 60359: 2001 “the manufacturer shall specify the limiting conditions and storage and transport conditions for each specified influence quantity”, the requirements for package and storage have been added in the new edition.

# **DIRECT ACTING INDICATING ANALOGUE ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES –**

## **Part 1: Definitions and general requirements common to all parts**

### **1 Scope**

This part of IEC 60051 series standards specified the terms, definitions, classifications, technical requirements, marks and symbols, package and storage, and test rules.

This part applies to direct acting indicating analogue electrical measuring instruments, such as:

- ammeters and voltmeters;
- wattmeters and varmeters;
- frequency meters of pointer and vibrating-reed types;
- phasemeters, power-factor meters and synchrosopes;
- ohmmeters(impedance meters) and conductance meters;
- multi-function instruments of the above types.

It also applies to:

- Certain accessories used with these instruments, such as:
  - shunts;
  - series resistors and impedance elements;
  - current sensors used Hall effect;
  - voltage sensors used Hall effect;
  - electronic transducers.
- Combination of the instruments and the accessories provided that the adjustments have been made for the combination;
- Direct acting indicating electrical measuring instrument whose scale marks do not correspond directly to its electrical input quantity, provided that the relationship between them is known;
- Instruments and accessories having electronic devices in their measuring and /or auxiliary circuits.

These series standards do not apply to:

- Special purpose instruments which are covered by their own IEC standards;
- Special purpose devices which are covered by their own IEC standards when they are used as accessories.

This standard does not specify requirements concerning dimensions of instruments or accessories (for the former, see IEC60473).

### **2 Normative references**

The following normative documents contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

- 82 The following referenced documents are indispensable for the application of this document. For dated  
83 references, only the edition cited applies. For undated references, the latest edition of the referenced  
84 document (including any amendments) applies.
- 85 IEC 60050-151:2001, *International Electrotechnical Vocabulary - Part 151: Electrical and magnetic*  
86 *devices*
- 87 IEC 60050-300:2001, *International Electrotechnical Vocabulary – Electrical and Electronic*  
88 *Measurements and Measuring Instruments – Part 311: General terms relating to measurements – Part*  
89 *312: General terms relating to electrical measurements – Part 313: Types of electrical measuring*  
90 *instruments*
- 91 IEC 60051-9:201X, *Direct acting indicating analogue electrical measuring instruments and their*  
92 *accessories Part 9: Recommended Test Methods*
- 93 IEC 60068-2-11:1981, *Environmental testing – Part 2: Tests – Test Ka: Salt mist*
- 94 IEC 60359:2001, *Electrical and electronic measurement equipment – Expression of performance*
- 95 IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*
- 96 IEC 60721-3-3:2002, *Classification of environmental conditions – Part 3-3: Classification of groups of*  
97 *environmental parameters and their severities – Stationary use at weather protected locations*
- 98 IEC 60721-3-7:2002, *Classification of Environmental condition – Part 3-7: Classification of groups of*  
99 *environmental parameters and their severities- Portable and non-stationary use*
- 100 IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement*  
101 *techniques- Electrostatic discharge immunity test*
- 102 IEC 61000-4-3:2010, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement*  
103 *techniques- Radiated, radio-frequency, electromagnetic field immunity test*
- 104 IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement*  
105 *techniques- Electrical fast / burst immunity test*
- 106 IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement*  
107 *techniques- Surge immunity test*
- 108 IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement*  
109 *techniques- Immunity to conducted disturbances, induced by radio frequency fields*
- 110 IEC 61000-4-12:2006, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement*  
111 *techniques- Oscillatory waves immunity test*
- 112 IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and*  
113 *laboratory use – Part 1: General requirements*
- 114 ISO 780:1997, *Packaging – Pictorial marking for handling of goods*
- 115 **3 Terms and definitions**
- 116 **3.1 General terms**
- 117 **3.1.1**
- 118 **electrical measuring instrument**
- 119 measuring instrument intended to measure an electrical or non-electrical quantity using electrical or  
120 electronic means

121 [SOURCE: IEC 60359:2001, definition 3.2.4]

122 **3.1.2**

123 **analogue display instrument**

124 measuring instrument intended to present or display the output information as a continuous function of  
125 the measured quantity

126 Note□1 to entry: An instrument in which a change of the indication occurs by small discrete steps, but which does not have a  
127 digital display, is considered to be an analogue instrument.

128 **3.1.3**

129 **indicating (measuring) instrument**

130 measuring instrument which displays an indication

131 Note□1 to entry: The display can be analogue (continuous or discontinuous), digital or coded [IEV].

132 Note□2 to entry: Values of more than one quantity can be displayed simultaneously [IEV].

133 Note□3 to entry: A displaying measuring instrument can also provide a record [IEV].

134 Note□4 to entry: The display can consist of an output signal not directly readable by a human observer, but able to be  
135 interpreted by suitable devices [IEV].

136 Note□5 to entry: An indicating instrument may consist of a chain of transducers with the possible addition of other process  
137 devices, or it may consist of one transducer.

138 Note□6 to entry: The interaction between the indicating instrument, the measured system and the environment generates a  
139 signal in the first stage of the instrument(called sensor).This signal is elaborated inside the instrument into an output signal  
140 which carries the information on the measurand. The description of the output signal in a suitable output format is the indication  
141 supplied by the instrument.

142 Note□7 to entry: A chain of instruments is treated as a single indicating instrument when a single calibration diagram is  
143 available that connects the measurand to the output of the last element of the chain. In this case the influence quantities must  
144 be defined for the whole chain.

145 [SOURCE: IEC 60359:2001, definition 3.2.2]

146 **3.1.4**

147 **direct acting indicating instrument**

148 instrument in which the indicating device is mechanically connected to and actuated by the moving  
149 element

150 **3.1.5**

151 **electronic measuring instrument**

152 measuring instrument intended to measure an electrical or non-electrical quantity using electronic  
153 means

154 **3.1.6**

155 **single function instrument**

156 an instrument intended for the measurement of one kind of quantity only

157

158 **3.1.7**

159 **multi-function instrument**

160 instrument having a single means of indication intended for the measurement of more than one kind of  
161 quantity (e.g. an instrument measuring current, voltage and resistance)

162 **3.1.8**

163 **fixed instrument**

164 measuring instrument designed to be permanently mounted and which is intended to be connected by  
165 means of permanently installed conductors

166 [SOURCE: IEC 60050-300:2001, 312-02-17]

167 **3.1.9**  
168 **portable instrument**  
169 instrument specifically designed to be carried out by hand

170 Note□1 to entry: The instrument is intended to be connected and disconnected by the user.

171 **3.1.10**  
172 **hand-held instrument**  
173 instrument intended to be held to measure by one hand in normal use

174 **3.1.11**  
175 **panel mounted instrument**  
176 fixed installed instrument intended to be mounted in a cut out of a panel or a chassis

177 [SOURCE: IEC 62586-1:2013, definition 3.1.6]

178 **3.1.12**  
179 **modular instrument fixed on DIN rail**  
180 fixed installed instrument intended to be used in switchgear or control gear, fixed on a DIN rail

181 [SOURCE: IEC 62586-1:2013, definition 3.1.7]

182 **3.1.13**  
183 **housing instrument fixed on DIN rail**  
184 fixed installed instrument, intended to be fixed on a DIN rail within a control panel

185 [SOURCE: IEC 62586-1:2013, definition 3.1.8]

186 **3.1.14**  
187 **polyphase instrument**  
188 instrument for measurement in a polyphase system and arranged for connection to more than one  
189 phase of the system

190 **3.1.15**  
191 **balanced load polyphase instrument**  
192 polyphase instrument for use in a balanced polyphase system. This does not include a single-phase  
193 wattmeter scaled in terms of polyphase power

194 **3.1.16**  
195 **instrument with magnetic screen**  
196 instrument shielded by ferro-magnetic material from the influence of a magnetic field of external origin

197 **3.1.17**  
198 **astatic instrument**  
199 instrument in which the measuring element is so constructed as to be unaffected by a uniform magnetic  
200 field of external origin

201 **3.1.18**  
202 **instrument with electric screen**  
203 instrument shielded by conductive material from the influence of an electric field of external origin

204 **3.1.19**  
205 **accessory**  
206 element group of elements or device associated with the measuring circuit of a measuring instrument in  
207 order to confer specified characteristics to the measuring instrument

208 **3.1.20**  
209 **interchangeable accessory**  
210 accessory having its own properties and accuracy, these being independent of those of the instrument  
211 with which it may be associated

212 Note□1 to entry: An accessory is considered to be interchangeable when its rated characteristics are known and marked and  
213 are sufficient to enable its errors and variations to be determined without using the associated instrument. A shunt whose  
214 adjustment takes into account an instrument current which is not negligible and which is known, is considered to be  
215 interchangeable.

### 216 3.1.21

#### 217 **accessory of limited interchangeability**

218 accessory having its own properties and accuracy, which can only be associated with measuring  
219 instruments for which certain characteristics are within specified limits

### 220 3.1.22

#### 221 **non-interchangeable accessory**

222 accessory adjusted to take into account the electrical characteristics of a specific measuring instrument

### 223 3.1.23

#### 224 **shunt**

225 resistor connected in parallel with a measuring circuit of a measuring instrument

226 Note□1 to entry: A shunt is generally intended to provide a voltage proportional to a current to be measured.

### 227 3.1.24

#### 228 **series resistor (impedance)**

229 resistor (impedance) connected in series with a measuring circuit of a measuring instrument

230 Note□1 to entry: A series resistor (impedance) is generally intended to extend the voltage measuring range of an instrument.

### 231 3.1.25

#### 232 **electronic transducer**

233 technical device which performs a given elaboration on an input signal, and then converts it into an  
234 output signal using electronic means

235 Note□1 to entry: All indicating instruments contain transducers and they may consist of a single transducer. When the signals  
236 are elaborated by a chain of transducers, the input and output signals of each transducer are not always directly and univocally  
237 accessible.

### 238 3.1.26

#### 239 **electric current sensor used Hall effect**

240 electronic device used Hall effect intended to transmit a signal corresponding to the current flowing  
241 through the primary circuit of this device

242 Note□1 to entry: The output signal of the sensor is an analogue electrical signal in this standard.

### 243 3.1.27

#### 244 **electric voltage sensor used Hall effect**

245 electronic device used Hall effect intended to transmit a signal corresponding to the voltage across the  
246 primary terminals of this device

247 Note□1 to entry: The output signal of the sensor is an analogue electrical signal in this standard.

### 248 3.1.28

#### 249 **instrument lead**

250 lead comprising one or more conductors, specially designed for interconnecting measuring instruments  
251 to external circuits or to accessories

### 252 3.1.29

#### 253 **calibrated instrument lead**

254 instrument lead whose resistance has a specified value

255 Note□1 to entry: A calibrated instrument lead is considered as being an interchangeable accessory of a measuring instrument.

### 256 3.1.30

#### 257 **distortion factor (total harmonic distortion factor) (of a quantity)**

258 ratio of the r.m.s. value of the harmonic content to the r.m.s. value of the non-sinusoidal quantity

- 259 **3.1.31**  
260 **ripple content of a quantity**  
261 ratio of the r.m.s. value of the fluctuating component to the value of the d.c. component
- 262 **3.1.32**  
263 **peak factor**  
264 ratio of the peak value to the r.m.s. value of a periodic quantity
- 265 **3.2 Description of instruments according to their method of operation**
- 266 **3.2.1**  
267 **permanent-magnet moving-coil instrument**  
268 instrument which operates by the interaction of the magnetic field due to a current in a movable coil with  
269 the field of a fixed permanent magnet
- 270 Note□1 to entry: The instrument can have more than one coil, measuring the sum or ratio of the currents in them.
- 271 **3.2.2**  
272 **moving-magnet instrument**  
273 instrument which operates by the interaction of the field of a movable permanent magnet with the  
274 magnetic field due to a current in a fixed coil
- 275 Note□1 to entry: The instrument can have more than one coil.
- 276 **3.2.3**  
277 **moving-iron instrument**  
278 instrument which operates by the attraction between a movable piece of "soft" magnetic material and  
279 the field due to a current in a fixed coil or by the repulsion (and attraction) between one (or more) fixed  
280 piece(s) of "soft" magnetic material and a movable piece of "soft" magnetic material, both (all)  
281 magnetized by a current in a fixed coil
- 282 **3.2.4**  
283 **polarized moving-iron instrument**  
284 instrument comprising a movable piece of "soft" magnetic material polarized by a fixed permanent  
285 magnet and magnetically excited by a current in a fixed coil
- 286 **3.2.5**  
287 **electrodynamic instrument**  
288 instrument which operates by the interaction of the magnetic field due to a current in a movable coil with  
289 the magnetic field due to a current in one or more fixed coils
- 290 **3.2.6**  
291 **ferrodynamic instrument (iron-cored electrodynamic instrument)**  
292 electrodynamic instrument in which the electrodynamic effect is modified by the presence of "soft"  
293 magnetic material in the magnetic circuit
- 294 **3.2.7**  
295 **induction instrument**  
296 instrument which operates by the interaction of the magnetic field(s) of (a) fixed a.c. electromagnet(s)  
297 with the magnetic field(s) due to currents which they induce in (a) movable conductive element(s)
- 298 **3.2.8**  
299 **thermal instrument (electrothermal instrument)**  
300 instrument which operates by the heating effect(s) of (a) current(s) in it(s) conductor(s)
- 301 **3.2.9**  
302 **bimetallic instrument**  
303 thermal instrument in which the deformation of a bimetallic element (the materials having different rates  
304 of expansion due to a change in temperature), heated directly or indirectly by a current, produces the  
305 indication

- 306 **3.2.10**  
307 **thermocouple instrument**  
308 thermal instrument making use of the e.m.f. of one or more thermocouples heated by the current to be  
309 measured
- 310 Note□1 to entry: The e.m.f. is often measured using a permanent-magnet moving-coil instrument.
- 311 **3.2.11**  
312 **rectifier instrument**  
313 instrument which is the combination of a measuring instrument sensitive to direct current and a  
314 rectifying device whereby alternating currents or voltages may be measured
- 315 **3.2.12**  
316 **instrument with transducer**  
317 instrument which is combination of a permanent-magnet moving coil instrument or other analogue  
318 indicator and an electronic transducer whereby a measurand may be measured
- 319 **3.2.13**  
320 **electrostatic instrument**  
321 instrument the operation of which depends on the effects of electrostatic forces between fixed and  
322 movable electrodes
- 323 **3.2.14**  
324 **ammeter**  
325 instrument intended to measure the value of a current
- 326 [SOURCE: IEC 60050-300:2001, 313-01-01]
- 327 **3.2.15**  
328 **voltmeter**  
329 instrument intended to measure the value of a voltage
- 330 [SOURCE: IEC 60050-300:2001, 313-01-03]
- 331 **3.2.16**  
332 **ohmmeter**  
333 **resistance meter**  
334 instrument intended to measure electrical resistance
- 335 [SOURCE: IEC 60050-300:2001, 313-01-09]
- 336 **3.2.17**  
337 **wattmeter**  
338 instrument intended to measure active power
- 339 [SOURCE: IEC 60050-300:2001, 313-01-07]
- 340 **3.2.18**  
341 **varmeter**  
342 instrument intended to measure reactive power
- 343 [SOURCE: IEC 60050-300:2001, 313-01-08]
- 344 **3.2.19**  
345 **pointer-type frequency meter**  
346 instrument which indicates the measured frequency by the relationship between an index and a scale

**3.2.20****vibrating-reed frequency meter**

instrument intended to measure frequency, comprising a set of tuned vibrating reeds, one or a few of which resonate under the action of an alternating current of the relevant frequency flowing through one or more fixed coils

**3.2.21****phase meter**

instrument which indicates the phase angle between two electrical input quantities of the same frequency and of similar waveform

Such an instrument measures:

- the phase angle between a voltage and another voltage or between a current and another current, or
- the phase angle between a voltage and a current.

**3.2.22****power factor meter**

instrument intended to measure the ratio between the active and the apparent power in an electrical circuit

In practice, power factor meters indicate the cosine of the phase angle between a current and a related voltage.

**3.2.23****synchroscope**

instrument intended to indicate that two alternating voltages or polyphase voltage systems have the same frequency and are in phase

[SOURCE: IEC 60050-300:2001, 313-01-22]

**3.2.24****ratiometer (quotientmeter)**

instrument for measuring the ratio (quotient) of two quantities

**3.2.25****R.M.S.-responding instrument**

instrument which, over a specified frequency range, provides an indication which is designed to be proportional to the root-mean-square value of the measured quantity, even when it is not sinusoidal or containing a d.c. part

**3.2.26****mean value-responding instrument**

instrument with scale of R.M.S value but which, over a specified frequency range, provides an indication which is designed to be proportional to the mean value of the measured quantity

Note□1 to entry: These instruments do not reflect R.M.S. value of a measurand when the measurand is not sinusoidal or containing a d.c. part.

**3.2.27****ammeter with overload scale**

ammeter with the scale, a small part of which directing the overload current which is designed to be measured operating current in normal condition and over-current of short duration

Note□1 to entry: This part of the scale directing the overload current less than 1/4 of the total scale, it is not main scale.

**3.2.28****expanded scale instrument**

measuring instrument in which the greater portion of the scale length represents a small part of the measuring range

[SOURCE: IEC 60050-300:2001, 312-02-04]

**3.2.29****closed-loop sensor used Hall effect**

sensor used Hall effect with second circuit loop which adopt the principle of magnetic balance to transmit a signal corresponding to the current flowing through the primary circuit

**3.2.30****opened-loop sensor used Hall effect**

sensor used Hall effect which without second circuit loop

**3.3 Constructional features of instruments****3.3.1****measuring circuit (of an instrument)**

part of the electrical circuit internal to the instrument and its accessories, together with the interconnecting leads, if any, which is energized by a voltage or a current, one or both of these quantities being a prime factor in determining the indication of the measured quantity (one of these quantities may be the measured quantity itself)

**3.3.1.1****current circuit**

measuring circuit through which flows a current which is a prime factor in determining the indication of the measured quantity

Note□1 to entry: It may be the current directly involved in the measurement or a proportional current supplied by an external current transformer or derived from an external shunt.

**3.3.1.2****voltage circuit**

measuring circuit to which is applied a voltage which is a prime factor in determining the indication of a measured quantity

Note□1 to entry: It may be the voltage directly involved in the measurement or a proportional voltage supplied by an external voltage transformer or an external voltage divider or derived by means of an external series resistor (impedance).

**3.3.2****external measuring circuit**

part of the electrical circuit external to the instrument from which a measured value is obtained

**3.3.3****auxiliary circuit**

circuit, other than a measuring circuit, required for the operation of the instrument

**3.3.4****auxiliary supply**

auxiliary circuit which provides electrical energy

**3.3.5****measuring element**

assembly of those parts of a measuring instrument which are acted upon by a measured quantity, resulting in a movement of the moving element related to that quantity

**3.3.6****moving element**

moving part of a measuring element