

**SLOVENSKI  
STANDARD**

**SIST HD 368 S1:2000**

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februar 2000

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Direct acting recording electrical measuring instruments and their accessories  
(IEC 60258:1968+A1:1976)

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EUROPEAN COMMITTEE FOR ELECTROTECHNICAL STANDARDIZATION

CENELEC HARMONIZATION DOCUMENT

HD 368

IEC 258 (1968 - 1st edition)  
Direct acting recording electrical measuring instruments and their accessories  
Amendment No.1 (1976)

This Harmonization Document was adopted by CENELEC on 1977-12-13.

The National Electrotechnical Committees, members of CENELEC, in

- A : Austria
- B : Belgium
- CH : Switzerland
- D : Germany
- DK : Denmark
- F : France
- I : Italy
- IRL : Ireland
- N : Norway
- NL : Netherlands
- P : Portugal
- S : Sweden
- SF : Finland
- UK : United Kingdom

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Reference of the  
relevant  
National Harmonized  
Standards  
overleaf

are obliged, in accordance with the CENELEC Internal Regulations, to implement this Harmonization Document in their respective country by

- Issuing harmonized national standard(s) and/or
- Withdrawing conflicting national standard(s)

Latest date of implementation : 1979-01-01

A : NOS  
B : NOS  
CH : ASE 3167.1978  
D : SP (DIN 57 410/VDE 0410)  
DK : DS/IEC 258 (1968)  
F : NF C 42-130 (1969)  
I : NOS  
IRL : NOS  
N : NOS  
NL : NEN 10 258 (1977)  
P : NOS  
S : NOS  
SF : NOS  
UK : NR <https://standards.iteh.ai/catalog/standards/sist/7a849d67-768c-4160-9372-d4dedf5cbf2a/sist-hd-368-s1-2000>

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NOS No national standard corresponding to the Harmonization Document  
SP Standard in preparation  
NR Standard under revision

NORME  
INTERNATIONALE  
INTERNATIONAL  
STANDARD

CEI  
IEC  
258

Première édition  
First edition  
1968

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Appareils de mesure électriques  
enregistreurs à action directe  
et leurs accessoires

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International Electrotechnical Commission  
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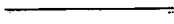
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIRECT RECORDING ELECTRICAL MEASURING INSTRUMENTS  
AND THEIR ACCESSORIES

FOREWORD

- 1) The formal decisions or agreements of the I E C on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote this international unification, the I E C expresses the wish that all National Committees having as yet no national rules, when preparing such rules, should use the I E C recommendations as the fundamental basis for these rules in so far as national conditions will permit.
- 4) The desirability is recognized of extending international agreement on these matters through an endeavour to harmonize national standardization rules with these recommendations in so far as national conditions will permit. The National Committees pledge their influence towards that end.

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PREFACE  
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This Recommendation has been prepared by Sub-Committee 13B, Indicating Instruments, of IEC Technical Committee No. 13, Measuring Instruments.

Drafts were discussed at meetings held in Stockholm in 1958, in Paris in 1960, in Portoroz in 1962 and in Budapest in 1963. The final draft was submitted to the National Committees for approval under the Six Months' Rule in July 1964. Though the Six Months' Rule document was approved by the National Committees, further modifications became necessary for conformity between this Recommendation and Amendment No. 1 to IEC Publication 51. Therefore, according to the decision of the Chairman, an amendment was submitted to the National Committees for approval under the Two Months' Procedure in March 1966. A number of comments having been received, further amendments were submitted to the National Committees for approval under the Two Months' Procedure in January 1968.

The following countries voted explicitly in favour of publication:

Australia	Korea (Republic of)
Austria *	Netherlands
Belgium	Poland
Canada	Romania
Czechoslovakia	South Africa
Denmark	Sweden
Finland	Switzerland
Germany *	Turkey
Hungary	Union of Soviet Socialist Republics
Israel	United Kingdom
Italy	Yugoslavia
Japan	

The French National committee has indicated its acceptance of the requirements given in this Publication with the exception of that for the magnetic induction symbol (F-30).

\* The Austrian and German National Committees did not approve the exclusion of a sub-clause concerning the effect on the mechanical zero of energizing the voltage circuits of wattmeters and varimeters,



## DIRECT RECORDING ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES

### 1. Scope

1.1 This Recommendation applies to direct recording electrical measuring instruments, which are used for recording the instantaneous, effective or mean values of one or more measured quantities as a function of time. It refers to strip, drum and disc recording instruments, namely:

- ammeters;
- voltmeters;
- single-phase wattmeters, varimeters and phasemeters;
- polyphase wattmeters, varimeters and phasemeters;
- frequency meters;
- ohmmeters.

It applies to those instruments which incorporate rectifiers or diodes and to thermocouple instruments, also to certain accessories used with such apparatus, namely:

- shunts;
- series resistors, inductors and capacitors.

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In the case of other accessories associated with instruments inasmuch as the calibration has been made of the instrument together with the accessory, the Recommendation is applicable to the combination of instrument and accessory.

1.2 The Recommendation also applies to electrically measuring equipments provided that the recording electrically measuring instrument (receiver) only is considered, and that the relationship between the non-electrical quantity and the electrical one is known.

(Furthermore, it applies to recording instruments incorporating electronic devices in their auxiliary circuits.)

1.3 The Recommendation is not applicable:

- to recording instruments having a square wave response greater than 90% on a square wave with an amplitude equal to the effective range and a frequency of 5 Hz;
- to recording instruments incorporating, in their measuring circuits, amplifying or electronic devices (other than rectifiers or diodes);
- to integrating recording instruments;
- to indirect recording instruments.

## 2. Definitions

### 2.1 General terms

#### 2.1.1 Recording instrument

An instrument which inscribes or records generally the instantaneous, effective or average values which are successively assumed by the quantity being measured (IEV 20-05-015).

#### 2.1.2 Electrically measuring equipment

An equipment using electrical means for the measurement of a non-electrical quantity.

##### 2.1.2.1 Recording electrically measuring instrument (receiver)

An electrical measuring instrument used as the recording means of an electrically measuring equipment.

#### 2.1.3 Measuring circuit (of a direct recording instrument)

An electrical circuit which, when energized by a voltage (voltage circuit) or a current (current circuit), produces either alone, or in conjunction with another circuit, the deflection of the moving element of the instrument.

#### 2.1.4 Auxiliary circuit (of a direct recording instrument)

Circuit, other than the measuring circuit(s), required for the operation of the instrument.

#### 2.1.5 Response time (of a continuous line direct recording instrument)

The time taken by the marking device to reach 90% of the final steady deflection after the sudden application of the measured quantity.

#### 2.1.6 Frequency response (of a continuous line direct recording instrument)

The frequency range(s) of a sinusoidally varying quantity to which the instrument will respond within specified limits (amplitude and/or phase) and give a clear marking of the measured quantity.

#### 2.1.7 Square-wave response (of a continuous line direct recording instrument)

The frequency range of a square-wave quantity for which the instrument gives a record, the maximum values of which lie within specified limits.

#### 2.1.8 Square wave

Waveform of a quantity successively assuming two different values which are kept constant during equal time intervals, the duration of the change being negligible against these intervals. The two values may or may not have the same polarity or one of them may be zero.

#### 2.1.9 Damping time

The time taken by the marking device to reach and remain within a specified band about its final position after the sudden application of the measured quantity.

### 2.1.10 *Accessory*

Circuit element (resistor, inductor, capacitor, etc.) which is associated with the measuring instrument either in a permanent or in a non-permanent manner.

*An interchangeable accessory* has its own properties and accuracy, these being independent of those of the instrument with which it may be associated.

When this interchangeability applies only to such instruments whose resistance or impedance has a pre-determined value (e.g. a shunt having been adjusted to take into account a given instrument current), the accessory is taken as being a *limitedly interchangeable* accessory.

*A non-interchangeable accessory* is adjusted to take into account the electrical characteristics of a specific instrument or design of instrument. In this case, the Recommendation is applicable to the combination of instrument and accessory.

## 2.2 *Description of recording instruments*

### 2.2.1 *According to the recording mechanism*

#### 2.2.1.1 *Direct recording instrument*

A recording instrument in which the marking device is mechanically connected to the moving element of the measuring element and actuated thereby.

#### 2.2.1.2 *Indirect recording instrument*

A recording instrument in which the marking device is driven by a motor or other device electromechanically or electronically controlled by the measured quantity.

#### 2.2.1.3 *Integrating recording instrument*

An instrument which records the integral of a quantity over a definite period of time.

### 2.2.2 *According to the ordinates of the chart*

#### 2.2.2.1 *Instrument with rectilinear ordinates*

A recording instrument in which the marking device records a practically straight line, when the chart-driving mechanism is inoperative and the measured quantity is changed.

#### 2.2.2.2 *Instrument with curvilinear ordinates*

A recording instrument in which the marking device records a curve, when the chart driving mechanism is inoperative and the measured quantity is changed.

### 2.2.3 *According to the type of chart*

#### 2.2.3.1 *Strip chart recording instrument*

A recording instrument in which the chart is a strip driven as a function of time by the chart-driving mechanism, the chart being automatically stored, e.g. on a spool or emerging from the instrument case through a slot.

### 2.2.3.2 *Drum recording instrument*

A recording instrument in which the chart is wrapped as a single turn around a cylindrical drum, driven as a function of time by the chart-driving mechanism.

### 2.2.3.3 *Disc recording instrument*

A recording instrument in which the chart is a disc driven as a function of time by the chart-driving mechanism.

## 2.2.4 *According to the method of marking*

### 2.2.4.1 *Recording instrument with marking device in direct contact with the chart*

A recording instrument in which the record is effected by a device in direct contact with the chart, e.g.:

#### a) *Pen recording instrument*

A recording instrument in which the record on the chart is effected by a pen supplied with liquid ink.

#### b) *Stylus recording instrument*

A recording instrument in which the record is effected by a stylus requiring no ink.

### 2.2.4.2 *Recording instrument with marking device not in direct contact with the chart*

A recording instrument in which the record is effected by a device not in contact with the chart, e.g. a light ray.

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## 2.2.5 *According to the kind of marking*

### 2.2.5.1 *Continuous line recording instrument*

A recording instrument in which the record is a continuous line.

### 2.2.5.2 *Dotted line recording instrument*

A recording instrument in which the record comprises a series of successive point impressions.

## 2.3 *Characteristic features*

### 2.3.1 *Mechanism*

#### 2.3.1.1 *Measuring element*

The active part(s) of a measuring instrument the interaction between which actuates the moving element (IEV 20-35-050 modified).

#### 2.3.1.2 *Marking device*

That part of a recording instrument which records on the chart the value of the measured quantity.

It may be, according to the method and kind of marking:

- a pen associated with an ink-well (if any);
- a stylus associated with a power supply (if any);
- a printing device associated with an inking ribbon(s) or thread(s);
- or any other device performing this function.

### 2.3.1.3 *Chart-driving mechanism*

A mechanism for driving the chart as a function of time. This mechanism may be operated by one of the following:

- spring-driven hand-wound clockwork;
- spring-driven electrically wound clockwork;
- synchronous self-starting motor without running reserve;
- synchronous self-starting motor with running reserve;
- impulse-driven motor.

### 2.3.2 *Chart and record*

#### 2.3.2.1 *Chart*

A strip or disc provided with printed lines with or without figures, from which are obtained the values of the measured quantity as a function of time, possibly by means of a reading rule.

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#### 2.3.2.2 *Record*

The curve traced on the chart by the marking device of the instrument.

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#### 2.3.2.3 *Chart lines*

A series of printed lines on the chart which enables the record to be interpreted.

There may be two series of chart lines:

a) *Chart scale lines*

The lines by means of which the value of each measured quantity is read.

b) *Chart time lines*

The lines by means of which the time for each value is read.

#### 2.3.2.4 *Chart division*

The interval between two consecutive chart lines.

#### 2.3.2.5 *Chart numbering*

The series of numbers designating the chart lines.

#### 2.3.2.6 *Chart scale length (for the measured quantity)*

The length of the path (curved or straight) traversed by the marking device between the extreme chart scale lines, when the chart-driving mechanism is stationary.

### 2.3.3 *Effective range and fiducial value*

#### 2.3.3.1 *Effective range*

That part of the chart scale length in terms of the measured quantity within which measurements can be made with the stated accuracy (IEV 20-40-035 modified).

*Note.* — The requirements concerning the markings of the limits of the effective range are given in Sub-clause 9.2.2.

#### 2.3.3.2 *Fiducial value*

A value to which reference is made in order to specify the accuracy of an instrument.

- a) When the mechanical zero is on one extreme chart scale line or is outside the extreme chart scale lines, the fiducial value corresponds to the upper limit of the effective range.
- b) When the mechanical zero is displaced within the two extreme chart scale lines, the fiducial value is equal to the sum of the absolute electrical values corresponding to the two limits of the effective range.
- c) For frequency recorders, the fiducial value corresponds to the upper limit of their effective range.
- d) For phasemeters, the fiducial value corresponds to 90 electrical degrees.

### 2.3.4 *Mechanical zero*

The equilibrium position which the index will approach when a mechanically controlled measuring element is de-energized. This position may or may not coincide with the zero chart scale line.

*Note.* — In recording instruments without mechanical control, there is no mechanical zero and this position is indeterminate. In mechanically suppressed zero instruments, the mechanical zero does not correspond to any chart scale line.

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### 2.3.5 *Zero variation*

The part of the deflection of a recording instrument having a mechanical restoring torque which remains after the cause producing it has disappeared (IEV 20-40-135 modified).

### 2.3.6 *Device for time setting of the chart*

The device which enables the chart to be moved when necessary so that the marking device corresponds to the appropriate chart time line.

## 2.4 *Rated values*

### 2.4.1 *Rated value(s)*

Value (or one of the values) of the quantity measured or of the quantities necessary for correct operation of the instrument and which are used in specifying it.

*Note.* — The values of the voltage, current and power-factor which occur in the specification of wattmeters, varimeters and phasemeters are rated values as well as the values of the chart speed and the running-time of the chart mechanism etc.

### 2.4.2 *Rating (in terms of the quantity measured)*

The value of the quantity which corresponds to the upper limit of the effective range (IEV 20-40-050).

### 2.4.3 *Nominal circuit voltage*

The highest circuit voltage on which the instrument may be used and which determines its voltage (or insulation) test (IEV 20-40-215 modified).

### 2.4.4 *Rated values for shunts*

#### 2.4.4.1 *Rated current*

The value of current assigned by the manufacturer as that at and below which the shunt, when connected in parallel with the instrument, complies with the requirements of this Recommendation.

#### 2.4.4.2 *Rated voltage drop*

The difference in potential appearing at the potential terminals of the shunt when rated current flows through the parallel circuit of shunt and instrument (see Sub-clause 9.3.2).

2.4.4.3 In the case of *interchangeable shunts* for which the current taken by the measuring instrument is negligible compared with the rated current of the shunt, the rated current and the rated voltage drop of the shunt, as defined above, are applicable to the shunt alone.

#### 2.4.5 *Rated current of series resistors (inductors, capacitors)*

The value of current assigned by the manufacturer as that at and below which the resistor (inductor, capacitor) complies with the requirements of this Recommendation.

#### 2.4.6 *Rated power-factor ( $\cos \phi$ ) of a single-phase wattmeter*

The factor by which it is necessary to multiply the product of the rated voltage and rated current to obtain the rated power:

$$\text{Rated power-factor } (\cos \phi) = \frac{\text{rated power}}{\text{rated voltage} \times \text{rated current}}$$

In a single-phase varmeter, the rated value of  $\sin \phi$  is defined by analogy with the above expression.

#### 2.4.7 *Rated chart speed (linear or rotary)*

The value(s) of the chart speed assigned by the manufacturer.

#### 2.4.8 *Rated values of voltage and frequency of the auxiliary supply of the chart-driving mechanism*

The value(s), assigned by the manufacturer, of the voltage and frequency of the supply to the auxiliary circuits for the chart-driving mechanism.

#### 2.4.9 *Rated upper limit of the frequency response*

The upper limit of the frequency response, in hertz, at which the recorded peak value of a sinusoidally varying quantity does not differ by more than 10% from the exact peak value (see Sub-clause 8.2.6).

#### 2.4.10 *Rated running-time of the chart-driving mechanism*

The running time, assigned by the manufacturer for spring-driven clockwork and for running reserve, to which the requirements of this Recommendation are related (see Sub-clause 4.2.2).