SLOVENSKI STANDARD
SIST EN 60523:2000

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Potenciometri za enosmerni tok (IEC 60523:1975 + A1:1979 + corrigendum dec. 1980)

Direct-current potentiometers

Gleichspannungs-Kompensatoren

Potentiomètres à courant continu

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ENGLISH VERSION

Direct-current potentiometers
(IEC 523:1975 + A1:1979 + corrigendum 1980)

Potentiomètres à courant continu
(CEI 523:1975 + A1:1979 +
corrigendum 1980)

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(IEC 523:1975 + A1:1979 +
Corrigendum 1980)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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FOREWORD

At the request of 72 Technical Board, HD 613 S1:1992 (IEC 523:1975 + A1:1979 + corrigendum December 1980) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The text of the International Standard was approved by CENELEC as EN 60523 on 9 March 1993.

The following dates were fixed:

- latest date of publication of an identical national standard	(dop)	1994-03-01
- latest date of withdrawal of conflicting national standards	(dow)	-

ENDORSEMENT NOTICE

The text of the International Standard IEC 523:1975 and its amendment 1:1979 with corrigendum December 1980, was approved by CENELEC as a European Standard without any modification.

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Potentiomètres à courant continu

Direct-current potentiometers

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIRECT-CURRENT POTENTIOMETERS

FOREWORD

1) The formal decisions or agreements of the IEC 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.

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PREFACE

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

Drafts were discussed at the meetings held in Toronto in 1972 and in Copenhagen in 1973. The draft, Document 13B(Central Office)44, was submitted to the National Committees for approval under the Six Months' Rule in May 1974.

The following countries voted explicitly in favour of publication:

Argentina	Japan
Austria	Poland
Belgium	Portugal
Brazil	Romania
Canada	South Africa (Republic of)
Denmark	Sweden
Finland	Turkey
France	United Kingdom
Germany	United States of America
Hungary	Yugoslavia
Israel	

DIRECT-CURRENT POTENTIOMETERS

1. Scope

This standard applies to d.c. potentiometers assembled from resistors and switches and operating entirely on direct current, having accuracy classes of 0.0005 ... 0.1 (5 ppM ... 1 000 ppM (parts per million)). It applies also to auxiliary equipment which is a built-in part of the potentiometer.

This standard does not apply to potentiometers which are set automatically or semi-automatically nor to those which also employ graduations on the null detector to obtain a part of the indicated value, nor to external auxiliary equipment used with the potentiometer.

2. Terms and definitions

For the purposes of this standard, the following definitions apply.

2.1 *D.C. potentiometer (hereinafter designated "potentiometer")*

A voltage-measuring instrument in which the voltage to be measured is balanced against a known voltage obtained by passing a fixed current through an adjustable resistor or an adjustable current through a fixed resistor, or any combination thereof.

2.2 *Measuring dials*

The dials from which, taking into account the range factor, if any, the value of the measured quantity is determined.

2.3 *Effective range*

For a specified range factor, the range of dial settings for which the potentiometer can measure with the stated accuracy.

2.4 *Range-changing device*

A device whereby the effective range may be multiplied by a factor (e.g. 0.1) which is known as the range factor.

2.5 *Standardization of a potentiometer*

Adjustment(s) necessary to ensure that a potentiometer is set correctly for measurement.

2.6 *Dial setting*

The setting of the measuring dials after balancing the potentiometer, multiplied by the range factor, if applicable, when determining a measured voltage, after standardization of the potentiometer.

2.7 *Auxiliary equipment*

Additional equipment, which is or is not an integral part of the potentiometer, necessary to enable the potentiometer to operate accurately and safely as specified.

2.8 *Resolution*

The voltage corresponding to either one step or the smallest division on the measuring dial of lowest value.

2.9 *Circuit insulation voltage (nominal circuit voltage)*

The highest voltage with respect to earth which may be applied to a circuit(s) of the potentiometer so that the potentiometer is unlikely to become dangerous to touch.

Note. — Auxiliary circuit(s) (if any) may have different value(s) of circuit insulation voltage (nominal circuit voltage).

2.10 *Ripple content*

The ripple content of a d.c. supply expressed as a percentage of the d.c. component is:

$$\frac{\text{r.m.s. voltage of the fluctuating component}}{\text{d.c. voltage}} \times 100$$

2.11 *Leakage current screen (circuit)*

A conductive path which prevents leakage currents from affecting the results of measurements.

2.12 *Electrostatic screen*

An electrically conductive enclosure or coating intended to protect the enclosed space from external electrostatic influences.

2.13 *Measuring terminals*

The terminals to which the circuit of the voltage to be measured is intended to be connected.

2.14 *Measuring circuit*

The internal circuit of the potentiometer which is (or can be) conductively connected to the measuring terminals.

2.15 *Measured quantity circuit selector switch*

The switch which selects the set of measuring terminals to be connected to the measuring circuit.

2.16 *Residual e.m.f. of a potentiometer*

The open circuit voltage present at the measuring terminals due to the potentiometer itself when it is operational and its measuring dials are set to zero.

2.17 *Incremental linearity*

The overall linearity of a potentiometer is characterized by both of the following aspects:

a) constancy of the developed voltage for any two different settings of the measuring dials, each setting indicating the same value.

b) constancy of incremental voltage developed between adjacent settings of any one measuring dial.

2.18 *Influence quantity*

A quantity, other than the measured quantity, which is liable to cause unwanted variation in the dial setting.

2.19 *Common mode voltage*

A voltage which exists between one of the measuring terminals (called the reference terminal of common mode voltage) and the earth terminal, or the leakage current screen terminal, or the electrostatic screen terminal, separately or collectively (as specified).

2.20 *Variation with influence quantity*

The difference between two measured values for the same measured quantity when an influence quantity assumes successively two different specified values.

2.21 *Reference conditions*

The specified conditions under which the potentiometer meets the requirements concerning intrinsic errors.

2.22 *Reference value*

A specified single value of an influence quantity at which, within the stated tolerance, the potentiometer meets the requirements concerning intrinsic errors.

2.23 *Reference range*

A specified range of values of an influence quantity within which the potentiometer meets the requirements concerning intrinsic errors.

2.24 *Nominal range of use*

A specified range of values which each influence quantity can assume without causing a variation exceeding the specified limits.

2.25 *Limiting values of an influence quantity*

Extreme values which an influence quantity may assume without the potentiometer being damaged or permanently altered in such a way that it no longer satisfies the requirements of its accuracy class.

2.26 *Fiducial value*

A single value for each effective range to which reference is made in order to specify the accuracy of a potentiometer.

Unless otherwise stated by the manufacturer, the fiducial value of a given effective range is the highest integral power of 10 within that range.

Example: A potentiometer having a maximum dial setting of 1.8 V and range factors of 1, 0.1 and 0.01 will have fiducial values of 1.0 V, 0.1 V and 0.01 V respectively.

2.27 *Error*

Value obtained by subtracting the true value of the measured quantity from the dial setting.

Since the true value cannot be determined by measurement, a value obtained under specified test conditions and at a specified time is used instead. This value is traceable to national measurement standards or to measurement standards agreed upon by manufacturer and user.

Note. — The error due to any auxiliary equipment which is not built-in to the potentiometer is not included in the error of the potentiometer.

2.28 *Intrinsic error*

An error determined under reference conditions.

2.29 *Accuracy*

The accuracy of a potentiometer is defined by the limits of intrinsic error and the limits of variations due to influence quantities.

2.30 *Accuracy class*

A class of potentiometers the accuracy of all of which can be designated by the same number if they comply with all the requirements of this standard.

2.31 *Class index*

The number which designates the accuracy class.

3. Classification

Potentiometers specified in this standard are classified according to their accuracy classes as defined in Sub-clause 2.30 as follows:

a) 0.0005, 0.001, 0.002, 0.005, 0.01, 0.02, 0.05, 0.1

b) 5 ppM, 10 ppM, 20 ppM, 50 ppM, 100 ppM, 200 ppM, 500 ppM, 1 000 ppM.

The class index of a potentiometer may be expressed either in percentage using *a)* or in ppM using *b)* or both.

If a potentiometer has several measuring ranges, each range may have its own class index.

4. Limits of intrinsic error

Potentiometers shall comply with the relevant limits of intrinsic error specified for their respective accuracy classes for the duration of one year from the date of certification associated with delivery or another date to be agreed upon by the manufacturer (or responsible supplier) and the user, provided that the conditions of use, transport and storage specified by the manufacturer are complied with.

Note. — For potentiometers, stability with regard to time is an essential characteristic. Here, it is specified only for the duration of one year, but experience has shown that the rate of change due to ageing effects decreases with time.

4.1 *Permissible limits of intrinsic error*

The permissible limits of error of a potentiometer are composed of two parts:

— constant term related to the fiducial value,

— variable term proportional to the dial setting.

The two limits are given by the positive and negative values, respectively, of the binomial formula:

$$E_{\text{lim}} = \pm \frac{c}{100}\left(\frac{U_n}{10} + X\right)$$

where:

E_{lim} is the permissible limit value of the error, expressed in volts,

U_n is the fiducial value, expressed in volts,

X is the dial setting, expressed in volts,

c is the class index, expressed as a percentage.

When the class index c is expressed in ppM, the formula given below should be used:

$$E_{\text{lim}} = \pm \frac{c}{1\,000\,000}\left(\frac{U_n}{10} + X\right)$$

4.2 *Incremental linearity*

4.2.1 The difference in error corresponding to the same value of the measured quantity obtained by any two dial settings shall not exceed half of the permissible limit of intrinsic error.

4.2.2 The difference in error between any two adjacent dial settings on any one measuring dial shall not exceed half of the average of the permissible limit of intrinsic error of the same sign for these settings.

4.3 *Resolution*

The resolution shall not have a value exceeding:

$0.5 \frac{c}{100} U_n$ if the class index c is expressed in percentage.

or:

$0.5 \frac{c}{1\,000\,000} U_n$ if the class index c is expressed in ppM.

4.4 *Range-changing device*

The manufacturer shall specify if re-standardization of the potentiometer is necessary on changing the range.

4.5 *Independent circuit for standardization of a potentiometer*

If a potentiometer can be standardized on any range by means of an independent circuit without the use of the measuring dials, the additional error introduced by such standardization shall not exceed half of the permissible intrinsic error.

5. Conditions for the determination of intrinsic errors

5.1 The reference values relative to each of the influence quantities are shown in Table I.

5.2 Before any measurement, sufficient time shall elapse for the potentiometer to reach a stable state and to be in equilibrium with the reference values of the influence quantities.

5.3 The leakage current screen and the electrostatic screen, if any, shall be connected in accordance with the manufacturer's instructions.

TABLE I

Reference conditions and tolerances of the influence quantities

Influence quantity	Reference conditions unless otherwise indicated by the manufacturer	Class index		Tolerance permitted for testing purposes [1]
		%	ppM	
Ambient temperature	20 °C [2]	0.0005...0.001 0.002 ...0.01 0.02 ...0.1	5...10 20...100 200...1 000	± 0.5 °C ± 1 °C ± 2 °C
Relative humidity	40% to 60%			
Position	Any			
Ripple content [3]	Less than 0.1%			
Common mode voltage	Zero	0.0005...0.1	5...1 000	± 0.1 of the fiducial value
Period of connection to auxiliary supplies prior to measurement [4]	At least 5 min			

[1] For a reference range, no tolerance is allowed.

[2] If another temperature is indicated, it should be chosen from IEC Publication 160, that is 23 °C or 27 °C.

[3] This relates to the ripple content of each associated external d.c. supply to the ripple of the external voltage reference source (if any) and to the ripple superimposed on the measured quantity.

[4] The effects of changes in the d.c. supply(ies) are not taken into account. They are normally removed by the process of standardization.