

Guide to

Oscilloscopes and peak voltmeters for impulse tests

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- Association of Short Circuit Testing Authorities
- British Industrial Ceramic Manufacturers' Association
- Electric Cable Makers Confederation
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Electricity Supply Industry in England and Wales
- Transmission and Distribution Association (BEAMA Ltd.)

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National foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Committee. It is identical with IEC 790:1984 “*Oscilloscopes and peak voltmeters for impulse tests*” published by the International Electrotechnical Commission (IEC).

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker in Figure 1. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever page numbers are quoted they are IEC page numbers.

Cross-references

International Standard	Corresponding British Standard
IEC 60	BS 923 <i>Guide on high-voltage testing techniques</i>
IEC 60-2:1973	Part 2:1980 <i>Test procedures</i> (Identical)
IEC 60-3:1976	Part 3:1980 <i>Measuring devices</i> (Identical)
IEC 60-4:1977	Part 4:1980 <i>Application guide for measuring devices</i> (Identical)
IEC 351-1:1976	BS 4739 <i>Method for expression of the properties of cathode-ray oscilloscopes</i> Part 1:1979 <i>General</i> (Identical)
IEC 359:1971	BS 4889:1973 <i>Method for specifying the performance of electronic measuring equipment</i> (Technically equivalent)

The Technical Committee has reviewed the provisions of IEC 51-1:1984 and IEC 51-2:1984, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. A related British Standard to IEC 51-1 and IEC 51-2 is BS 89:1977 “*Specification for direct acting indicating electrical measuring instruments and their accessories*”.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This standard is applicable to analogue oscilloscopes and to peak voltmeters used for measurements during tests with high impulse voltages and high impulse currents. It covers the specific characteristics and calibrations required to meet the measuring accuracies specified in IEC Publication 60-3: High-voltage Test Techniques, Part 3: Measuring Devices. It does not cover general instrument requirements because they are dealt with in IEC Publication 351-1: Expression of the Properties of Cathode-ray Oscilloscopes, and in IEC Publication 359: Expression of the Functional Performance of Electronic Measuring Equipment.

2 Object

The object of this standard is:

- to define the terms specifically related to the oscilloscopes and peak voltmeters used for impulse test;
- to specify the necessary requirements for such instruments to ensure their compliance with the requirements for impulse tests;
- to indicate the tests and procedures which are necessary in order to fulfil these requirements.

3 Conditions of use

3.1 Range of operating conditions

The ranges of operating conditions given in Table I are those under which the instrument should operate satisfactorily and should meet the accuracy requirements when it has been calibrated.

Any exceptions to the values given in Table I shall be explicitly and clearly stated with an indication that they are exceptions.

If the instrument is operated under conditions different from those specified in Table I, special precautions may be necessary.

The mains supply may have transient overvoltages superimposed on it; suitable precautions should be taken to prevent these from affecting the operation of the instrument.

If the instrument is supplied by batteries:

- it shall be capable of operating under the above environmental conditions;
- the manufacturer shall indicate the expected operating time at the reference temperature and also for the two extreme ambient temperature extremes;
- the manufacturer shall indicate the range of battery voltages over which the instrument will operate satisfactorily. It is useful to have a device which indicates when the battery voltage is too low.

Table I — Normal operating conditions for instruments with a.c. power supplies

Operating conditions	Range
<i>Environmental conditions</i>	
Ambient temperature	+ 5 °C to + 40 °C
Ambient relative humidity	10 % to 90 %
<i>Supply conditions</i>	
Mains supply voltage	Rated voltage ± 10 % (r.m.s.) ± 12 % (a.c. peak)
Mains supply frequency	Rated frequency ± 5 %

3.2 Reference conditions

The reference conditions are those for which the basic accuracy of the instrument shall be specified and under which investigation of the basic accuracy shall be made. These conditions are selected from IEC Publication 351-1, Table I and are given in Table II below.

Table II — Reference conditions

Conditions	Reference values	Tolerance on reference values
Ambient temperature	20 °C, 25 °C	± 2 °C
Ambient relative humidity	45 % to 75 %	
Supply voltage	Rated voltage	± 1 % (r.m.s.) ± 2 % (peak)
Supply frequency	Rated frequency	± 1 %
NOTE The specific temperature used as reference condition should be indicated. It is advisable to use the same temperature when checking the basic characteristics of the instrument.		

4 General definitions

4.1

transfer characteristic

the transfer characteristic is the relationship between the input and the output quantities of the instrument expressed either as a function of frequency (frequency response) or time (step response). The transfer characteristic is usually presented in a normalized form by assigning the value of unity to the constant portion of the step or frequency response. The requirements on transfer characteristics include the effect of any built-in attenuator

4.2

scale factor

the scale factor of the instrument is the factor by which the output indication is multiplied to determine the measured value of the input signal to the instrument. The scale factor includes the ratio of any built-in attenuator and is either indicated by the manufacturer or determined by appropriate calibration

4.3

deflection coefficients

the deflection coefficient of the instrument is the ratio of the voltage (or time) interval to the corresponding deflection of the instrument. This coefficient refers mainly to oscilloscopes

4.4

nominal values of the deflection coefficients

the nominal values of the deflection coefficients are those corresponding to a specific setting of the instrument and are either indicated by the manufacturer or determined by proper calibration if the instrument is linear the nominal values of the deflection coefficients are equal and constant over the entire scale or screen of the instrument

if the nominal deflection coefficient is only constant over a limited part of the scale or screen, the instrument may still be considered linear provided the measurement is made within this linear portion

4.5

non-linearity

non-linearity is any deviation of the actual deflection coefficient at any part on the scale or screen, from the nominal value for that part. It is usually expressed in the form of relative error defined as the ratio of the deviation to the nominal deflection coefficient. It does not include the effects of either ripple or limitation in the transfer characteristic of the instrument

4.6

instability

instability is any variation of the characteristics of the instrument with time. It is usually expressed in the form of relative error, defined as the ratio of the variation to the nominal value of the relevant quantity. It does not include the effect of change in the reference conditions

4.7

measuring area or scale

the measuring area or scale is the portion of the screen or of the scale within which measurements can be made with defined accuracy. It is indicated by the manufacturer or determined by calibration

NOTE The use of the word scale in this context applies to analogue and also digital type voltmeters.

4.8

rated deflection or rated scale

the rated deflection or rated scale is the maximum value within the limits of the measuring area or scale

4.9

effective screen areas or effective scale

the effective screen areas are those parts of the measuring area within which measurements can be made with the accuracies specified in Sub-clause 8.1. An example of these effective screen areas for both vertical and horizontal deflections is shown in Figure 1, page 14