

Digital recorders for measurements in high-voltage impulse tests —

Part 2: Evaluation of software used for the determination of the parameters of impulse waveforms

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National foreword

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English version

**Digital recorders for measurements in high-voltage impulse tests
Part 2: Evaluation of software used for the determination
of the parameters of impulse waveforms
(IEC 1083-2:1996)**

Enregistreurs numériques pour les
mesures pendant les essais de choc
à haute tension
Partie 2: Evaluation du logiciel utilisé
pour obtenir les paramètres des formes
d'onde de choc
(CEI 1083-2:1996)

Digitalrecorder für Stoßspannungs-
und Stoßstromprüfungen
Teil 2: Bewertung der Software zur
Parameterbestimmung von
Stoßspannungen und -strömen
(IEC 1083-2:1996)

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European Committee for Electrotechnical Standardization
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Foreword

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The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 1997-09-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1997-09-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A, B and C are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 1083-2:1996 was approved by CENELEC as a European Standard without any modification.

CONTENTS

INTRODUCTION.....	4
1 Scope	5
2 Normative references	5
3 Definitions	5
3.1 Terms defined in the referenced subclauses of IEC 1083-1.....	5
4 Test data generator (TDG).....	6
5 Software validation	7
5.1 Test procedure	7
5.2 Evaluation procedure	7
5.3 Data format	8
5.4 Setting characteristics	8
5.5 Application	8
6 Classification and prescribed limits of the reference waveforms	8
6.1 Classification into waveform groups	8
6.2 Specified limits of the parameters of the reference waveforms	9
7 Record of performance	10
8 Performance check.....	11
8.1 Performance check for user-developed software	11
8.2 Performance check for compiled code and firmware	11
9 Use of processed data	11
Annex A (informative) Examples of reference waveforms	13
Annex B (informative) Test data generator (description of the IEC-TDG software)	21
Annex C (informative) Switching impulses – time to peak.....	23
Annex ZA (normative) Normative references to international publications with their corresponding European publications	25

INTRODUCTION

IEC 61083-1 specifies the test requirements for digital recorders. Digital recorders, like analog oscilloscopes, are susceptible to changes of their characteristics. However, the more stringent testing specified for digital recorders (more than is practical for analog oscilloscopes) has led to the accuracy of digital recorders being more clearly demonstrated.

The method of processing a digital record is left to the parties concerned in the test; the only condition specified is that the raw data are retained for comparison with the processed data. However, since the parameters of the test impulse (including the test value) may be read from the processed data, it is important to establish tests to ensure that the reading of parameters is adequately performed. The problem is how to ensure this, while permitting users to develop a wide range of techniques which may give greater accuracy.

This problem is further complicated by the different needs of various users, ranging from single-purpose test laboratories, for example a cable manufacturer who may only test a few objects which are capacitive, to large high-voltage test/research laboratories, which may perform tests on a very wide range of objects, which have a correspondingly wide range of impedances.

The approach taken in this part of IEC 61083 is to provide from a floppy disk waveforms (and ranges of their parameters), which a user can employ to verify that a procedure gives values within the specified ranges. To reduce the amount of testing required the waveforms are divided into groups (see table 1), and the user need only check those groups which are appropriate for the high-voltage tests to be performed in his laboratory.

The detailed studies of methods for the evaluation of parameters has revealed (or emphasized) some fundamental problems with the definitions of some parameters. The use of digital techniques provides an opportunity to improve the definition of some parameters, such as time-to-peak, and the classification of overshoot and oscillations. These matters are still under consideration.

DIGITAL RECORDERS FOR MEASUREMENTS IN HIGH-VOLTAGE IMPULSE TESTS –

Part 2: Evaluation of software used for the determination of the parameters of impulse waveforms

1 Scope

This part of IEC 61083 is applicable to the processing of records taken by digital recorders used for measurements during tests with high-voltage impulses and high current impulses as specified in IEC 60060. It specifies the test procedures to be applied to assess the accuracy of software used to process and read the records of impulses and calibration signals.

This part:

- defines the terms specifically related to digital processing;
- establishes the tests which are necessary to show that software is compatible with the requirements of IEC 60060-1 and IEC 61083-1;
- specifies limits on estimates of the values of parameters of the reference waveforms;
- gives the requirements for the record of performance.

NOTE For waveforms not specified in IEC 60060, for example waveforms accepted in tests of transformers and arresters, it is recommended to evaluate the impulse parameters from the raw data in the traditional way prescribed by the relevant technical committee.

2 Normative references

The following referenced documents are indispensable for the application 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 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2:1994, *High-voltage test techniques – Part 2: Measuring systems*

IEC 61083-1:1991, *Digital recorders for measurements in high-voltage impulse tests – Part 1: Requirements for digital recorders*

3 Definitions

For the purposes of this part of IEC 61083, the following definitions apply.

3.1 Terms defined in the referenced subclauses of IEC 61083-1

- | | |
|--------------------------------|--------|
| – output of a digital recorder | 1.4.2 |
| – full-scale deflection | 1.4.7 |
| – average code bin width | 1.4.9 |
| – sampling rate | 1.4.12 |
| – record length | 1.4.14 |
| – rated resolution | 1.4.6 |

- internal noise level 2.2.3

3.2

offseto

utput for zero input

3.3

raw data

original record of sampled and quantized information obtained when a digital recorder converts an analog signal into digital form.

The correction of the output for offset to give a zero-based record is permitted, as is multiplying the record by a constant scale factor: records processed in this way are still considered as raw data.

NOTE 1 This information may be made available in binary, octal, hexadecimal or decimal form.

NOTE 2 Raw data are available from most digital recorders, but not from all.

3.4

processed data

data obtained by any processing (other than correction for offset and/or multiplying by a constant scale factor) of the raw data.

NOTE Automatically processed data are not covered by IEC 61083-1 nor by this standard (see clause 9).

3.5

reference waveform

waveform supplied by the test data generator (TDG) for testing software

3.6

trigger delay

elapsed time from the occurrence of a trigger event to the time at which a specified data sample is recorded

NOTE Delayed mode: the specified data sample is the first sample in the record.

NOTE 2 Pre-trigger mode: the specified sample is selected part of the way through the record.

NOTE 3 In the TDG, the time scale origin is set equal to the instant of trigger and the pre-trigger amount is specified as a percentage of the record.

4 Test data generator (TDG)

The test data generator (TDG) is a computer program which generates reference waveforms with specified parameters. The TDG is an integral part of this standard and is provided as compiled code (for an IBMTM-PC computer ¹⁾ or for another computer compatible to it) on a floppy disk. It is a menu-driven program, which can be used without additional instructions; however, operating instructions are given in annex B.

Reference waveforms are drawn from three sources:

- analytically defined impulses without superimposed noise;
- the same analytically defined impulses with superimposed noise;
- impulses recorded under normal test conditions.

¹⁾ IBMTM-PC is the trade name of a product supplied by IBM Corporation. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

5 Software validation

Software may be validated for the evaluation of one or more sets of the following impulse parameters (definitions of these parameters are given in IEC 60060-1):

- U_p/I_p – peak value of voltage/current
- T_1 – front time
- T_2 – time to half-value
- T_c – time to chopping
- T_p – time to peak (see annex C)
- β, τ – overshoot, duration of overshoot
- A, f – amplitude and frequency of oscillations

Any parameter for which the software is validated shall be evaluated for all reference waveforms in each selected waveform group, for example, waveform group LI (reference waveforms 1 and 6). The classification of the reference waveforms is given in table 1.

The settings of the TDG shall be chosen to match the settings of the digital recorder (or recorders) which is to be used with the software (see 5.4). The resulting TDG record simulates the output of this digital recorder when recording the selected reference waveform. The 15 reference waveforms calculated for the selected settings of the TDG are shown in annex A. The prescribed limits to be met by the software being tested are given in table 2.

5.1 Test procedure

Each reference waveform from the waveform group selected by the user is generated by the TDG and is input to the software in lieu of an actual output of the digital recorder. The values of the parameters determined by the software under test are compared with the limits given in table 2. The software under test passes the test for each set if all the values of that parameter set are within the specified limits.

5.2 Evaluation procedure

Waveforms (reference and test) shall be evaluated according to the requirements given in 18.1, 18.1.3 and 19.2 of IEC 60060-1, as stated below:

18.1 Definitions of general applicability

These definitions apply to impulses without oscillations or overshoot, or to the mean curve drawn through the oscillations and overshoot.

18.1.3 Value of the test voltage

For a lightning impulse without oscillations, the value of the test voltage is its peak value.

The determination of the peak value in the case of oscillations or overshoot is considered in 19.2.

19.2 Tolerances

With some test circuits, oscillations or an overshoot may occur at the peak of the impulse (see figure 1). If the frequency of such oscillations is not less than 0,5 MHz or the duration of overshoot not more than 1 μ s, a mean curve should be drawn as in figures 10a and 10b and, for the purpose of measurement, the maximum amplitude of this curve is chosen as the peak value defining the value of the test voltage.