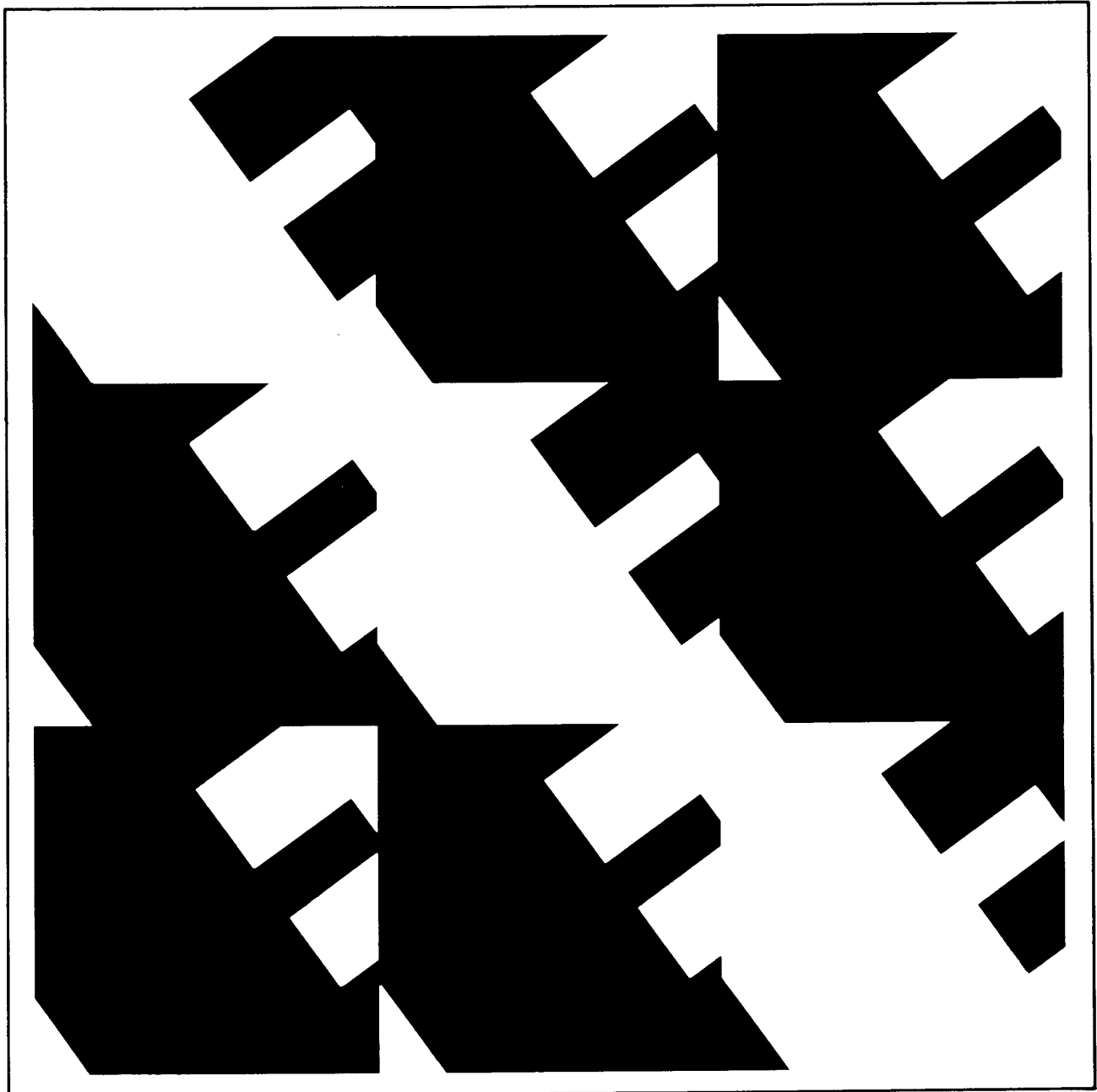


IEEE Standard for Digital Recorders for Measurements in High-Voltage Impulse Tests



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**IEEE Standard for Digital Recorders
for Measurements in High-Voltage Impulse Tests**

Sponsor
**Power Systems Instrumentation and Measurement Committee
of the
IEEE Power Engineering Society**

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Foreword

(This Foreword is not a part of ANSI/IEEE Std 1122-1987, IEEE Standard for Digital Recorders for Measurements in High-Voltage Impulse Tests.)

Since 1970, considerable work has been performed on the application of digitizers to measurement in high-voltage (HV) impulse tests, and many laboratories have begun to use digitizers to record HV tests. The existing standards on HV measurements made no explicit provision for the use of digital recorders, and there was an urgent need to provide the necessary characteristics, calibrations, and tests required to qualify a digitizer for recording HV tests.

IEC Technical Committee 42, "High Voltage Test Techniques," formally approved the formation of a working group to prepare a standard on digital recorders for measurements in HV impulse testing at its meeting in Montreal in March, 1985. The following year the IEEE authorized a project on the same topic. An initial draft, based on the measurement requirements given in the relevant HV standards (ANSI/IEEE Std 4-1978, IEEE Standard Techniques for High Voltage Testing; IEC 60, Parts 1-4; and IEC 790-1984, Oscilloscopes and Peak Voltmeters for Impulse Tests) and on the results of research done over the past decade, was circulated to both working groups. From the outset there has been close liaison between the two committees, and it has been agreed that each committee would try to provide its parent organization with standards that were technically and substantially the same. In addition, the Working Group has made use of the existing standards on Pulse Measurement (IEEE Std 194-1977, IEEE Standard Pulse Terms and Definitions; and ANSI/IEEE Std 181-1977, IEEE Standard on Pulse Measurement and Analysis by Objective Techniques). Close liaison has been maintained with TC 10 of the IEEE Instrumentation and Measurement Society, "Waveform Measurement and Analysis."

This standard states the requirements for an impulse digitizer and the tests necessary to verify that these requirements have been met. When an impulse digitizer is used and maintained in accordance with this standard it will meet the accuracy requirements presently demanded from surge oscilloscopes.

A major difference between an oscillogram and a digital record is that the latter has a non-linear character that is introduced by the acts of sampling and quantization. Imperfections in the practical implementation of sampling and quantization will lead to increased non-linearities. The approach taken in this standard is to limit these non-linearities to values that are sufficiently small that the digitizer can be treated as a quasi-linear device. In addition, resolution and sampling rates are specified to ensure that the resolution of the impulse digitizer is as good as or better than that of the best available impulse oscilloscopes. Impulse digitizers must meet accuracy requirements (2% in amplitude measurements and 4% in time measurements, as specified in ANSI/IEEE Std 4-1978, IEEE Standard Techniques for High Voltage Testing) without any signal processing of the raw data. If these requirements are met, then signal processing is permitted in order to enhance reading accuracy. However, the raw data must be retained and used to evaluate the validity of the processing. This approach is very stringent but is justified on two counts: (1) a stringent approach will assist in the acceptance of impulse digitizers, and (2) reasonably priced but high quality digitizers that meet these stringent requirements are now available from several manufacturers.

With one addition, the treatment outlined in this standard follows the conventional approach for selection and qualification of surge oscilloscopes. Initial selection is made on the basis of nominal characteristics. The low frequency or dc performance is measured accurately and then the degradation of performance for fast pulses is checked to ensure that the impulse digitizer can be used to record the fastest impulse of interest. The addition is in the introduction of the concept of impulse scale factor, which allows a systematic error of high resolution digitizers to be corrected by direct calibration. This technique is described in more detail in 8.6, where two alternative methods are given. The preferred method is pulse calibration as described in 8.6.1, but this requires a specialized pulse generator that meets the specifications given in Table 3. However, the specialized pulse generator can be used to simplify the routine tests (Section 9).

This standard was developed by the Working Group on Digital Recorders for Impulse Measurement of the Digital Techniques in Electrical Measurements Subcommittee of the Power Systems Instrumentation and Measurement Committee of the IEEE Power Engineering Society, in conjunction with IEC Technical Committee 42, Working Group 08.

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