

1 **IEEE P81™/D11**  
2 **Draft Guide for Measuring Earth**  
3 **Resistivity, Ground Impedance and**  
4 **Earth Surface Potentials of a**  
5 **Grounding System**

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1 **Abstract:** Practical test methods and techniques are presented for measuring  
2 the electrical characteristics of grounding systems. Topics addressed include  
3 safety considerations; measuring earth resistivity; measuring the power system  
4 frequency resistance or impedance of the ground system to remote earth;  
5 measuring the transient or surge impedance of the ground system to remote  
6 earth; measuring step and touch voltages; verifying the integrity of the grounding  
7 system; reviewing common methods for performing ground testing; reviewing  
8 instrumentation characteristics and limitations; and reviewing various factors that  
9 can distort test measurements.

10  
11 **Keywords:** Ground testing, soil resistivity, ground resistance, ground  
12 impedance, ground potential rise, remote earth, electrical measurements  
13

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## 1 Introduction

2 This introduction is not part of IEEE P81/D8, Draft Guide for Measuring Earth Resistivity, Ground Impedance and  
3 Earth Surface Potentials of a Grounding System .

4 IEEE Standard 81-1983 was prepared by the Power System Instrumentation and  
5 Measurement Committee of the IEEE Power and Energy Society. The guide was  
6 intended to cover the majority of field measurements that did not require special, high-  
7 precision equipment, and did not address unusual difficulties that can occur in large  
8 grounding systems, abnormally high stray ac or dc currents, etc. In 1991, Standard 81  
9 was re-affirmed and IEEE Standard 81.2-1991 was released to cover the measurement of  
10 very low impedances (less than 1 ohm) along with specialized instrumentation,  
11 measurement techniques, and safety considerations.

12  
13 After nearly two decades of inactivity, the Substation Committee of the IEEE Power and  
14 Energy Society determined that IEEE Standard 81-1983 and Standard 81.2-1991  
15 contained subject matter that is very relevant for applications in electric utility facilities  
16 but the standards needed to be updated. A working group was formed to combine both  
17 standards into a singular document that included updated instrumentation, techniques and  
18 information. This document represents the efforts of that working group.

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17 **1. Overview**

18 **1.1 Scope**

19 The test methods and techniques used to measure the electrical characteristics of the grounding system  
20 include the following topics:

- 21
- 22 a) Establishing safe testing conditions.
  - 23
  - 24 b) Measuring earth resistivity.
  - 25
  - 26 c) Measuring the power system frequency resistance or impedance of the ground system to remote
  - 27 earth.
  - 28
  - 29 d) Measuring the transient (surge) impedance of the ground system to remote earth.
  - 30
  - 31 e) Measuring step and touch voltages.