

# CTERP-2000 comparison with ANSI C57.13.1

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**CTERP-2000**

This document compares the IEEE Guide for Field Testing of Relaying Current Transformers with the performance and features of the Relaying CT Analyzer, Model CTERP-2000.

## **1. Introduction.**

The purpose of the guide is to assure that the current transformers are connected properly, are of marked ratio and polarity, and are in condition to perform as designed.

***The CTERP-2000 has been designed to assist technicians to accomplish this task.***

## **2. Consideration of American National Standards Institute (ANSI) Accuracy Classes.**

*The CTERP-2000 recognizes the ANSI relaying accuracy classes (C10, 20, 50, 100, 200, 400, 800) and test the CT for compliance. In addition to this the instrument can perform test to IEC specifications as well as other tests.*

## **3. Safety Considerations in Field Testing Current Transformers.**

*Yes, testing of CTs should be done by experienced personnel familiar with any peculiarities of danger that may exist. However, as the CTERP-2000 applies a voltage of only 12 Vdc for testing the performance of the CT and 500V DC for measuring the insulation, it is considerably safer to use than other conventional test equipment used for this application.*

## **4. Current Transformer Types, Construction, Effect On Test Methods.**

### **4.1 Bushing, Window, or Bar-Type Current Transformers.**

*Yes, the CTERP-2000 is designed to test CTs built with "uniformly distributed windings" as covered by this part (4.1).*

### **4.2 Wound Current Transformers.**

*Yes, wound-type CTs with uniformly distributed secondary windings can be tested with the CTERP-2000 as described in the standard.*

### **4.3 Consideration of Remanence.**

*The CTERP-2000 measures the remanence (residual magnetism) of the test CT as well as demagnetizes the test CT, leaving a magnetic field within 3% of the saturation flux density. The demagnetization is automatic when conducting the ANSI, IEC or the FULL TEST.*

***This is the only instrument known to perform a measurement of remanence and to automatically demagnetize the test CT.***

## **5. Insulation Resistance Tests.**

*Yes, the CTERP-2000 measures the resistance of the secondary winding with respect to ground using a 500 volt, two terminal measurement (no guard).*

## **6. Ratio Tests.**

### **6.1 Voltage Method.**

*Yes, the CTERP-2000 measures the ratio of the CT using square wave excitation of 12 volts. The range of the measurement is 5 . . . 1,000 to 1 amperes.*

## 6.2 Current Method.

No, the CTERP-2000 uses the "Voltage Method" of CT excitation.

## 7. Polarity Check.

### 7.1 DC Voltage Test.

No, the CTERP-2000 uses the AC voltage test.

### 7.2 AC Voltage Test.

Yes, the CTERP-2000 uses the AC voltage test to determine the polarity of the test CT windings.

## 7.3 Current Method.

No, the CTERP-2000 uses the AC voltage test.

## 8. Winding and Lead Resistance.

Yes, the CTERP-2000 measures resistance in the range of  $0 \dots >100$  ohms using a four-terminal connection. Depending on the connection, it will measure the test CT secondary winding resistance, or the total secondary circuit resistance.

## 9. Excitation Test.

The excitation test that the CTERP-2000 conducts is different from the conventional method of applying power frequency (50, 60 Hz) voltage to the test CT winding and then measuring the resulting current. For the excitation test, the CTERP-2000 conducts a measurement that is identical to the basic magnetic measurement conducted on magnetic materials using an Epstein Frame. The CTERP-2000 applies a dc voltage, measures the applied voltage and the resulting current, both with respect to time. A series of such measurements allows the instrument to calculate the excitation characteristics for the CT for any frequency (50, 60 Hz).

For the magnetic flux density (B) the instrument measures "volt-seconds". Once converted to a voltage at the power frequency, this reading is identical to the "average responding voltmeter" specified in the standards. This voltage is plotted on the vertical axis.

For the magnetic force (H) the instrument measures instantaneous current. As the current is measured with respect to time, its "rms" value can be calculated and plotted on the horizontal axis.

In summary, the plotted excitation characteristics, as well as the numerical values quoted in the results, are the same as would be obtained during a "conventional" excitation test.

## 10. Burden Measurements.

The CTERP-2000 will measure the resistance of the burden connected to the test CT. The preferred method of measuring the burden resistance is to subtract the winding resistance from the total resistance.

## 11. Special Situations.

All of the discussions in this section apply equally to the CTERP-2000 as they do to more conventional test methods.

### ADDITIONAL INFORMATION.

The CTERP-2000 conducts more tests than are specified by C57.13.1-1981, most of these are useful in searching for problems in test CTs.

The important measurement performed by the CTERP-2000 and not specified or even mentioned in the standard is the measurement of core loss and core loss power factor. This is done during the excitation test and is a valuable tool in spotting shorted turns or damaged cores. Even though the losses and their power factor will vary between manufacturers and between types of CTs, there are at least three CTs in a protection system, thus one can compare these against each other. The CT with a shorted turn will be easily identified by the higher core loss and/or power factor.

The above is infinitely more sensitive for finding CT problems than that suggested in the standard, Clause 9, which is: "deviation of the excitation curve for the test CT from curves of similar CTs should be investigated".

Some of the less important measurements include the measurement and plotting of the hysteresis curve and the plotting of the excitation characteristics on a >peak - vs - peak< graph as well as on the more traditional >average volts - vs - rms current< scales.



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