

# AUTOMATIC CAPACITANCE & TAN DELTA TEST SETS



ACTS 12K PLUS



ACTS 5K PLUS

- Aesthetically designed Single Unit consisting of Measuring Bridge, Power Supply with in-built Standard Capacitor. Ideal for field/ portable applications.
- Highly compact & Portable – Approx 66Kgs only.
- Advanced Protection Circuitry – specially suitable for 400kV s/s applications.
- Successfully passed all required EMI/EMC Tests at SAMEER Chennai IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-5; IEC 61000-4-11;
- Improved Plug-in type of “Power In” and “Gnd” connectors.
- Preo 2 Stage RF Power line Filters incorporated for 230V Power Input and Bridge Power Input for improved EMI Power line Protection.
- Improved 2 sets of LV measuring cables.
- Improved Ultra durable, double shielded PVC HV cable for rugged field use.
- Larger diameter Teflon ring on the HV Cable at specimen end – thus increasing distance between HV & Guard/Gnd points & greatly minimizing shorting possibilities.
- Improved front panel sensing type keypad – when keys are pressed, they can be sensed – thus avoiding keys being pressed twice.
- USB Printer Interface for printer connectivity.
- Conveniently located user controls – including “HV ON” indicating Lamp which is visible from a distance.
- Front Panel based Test Set. Laptop/ PC not needed for routine operation.
- Alphanumeric characters & Temperature entry from front panel keypad.

Etel Automatic Capacitance & Tan Delta test sets Model ACTS-12K Plus / ACTS-5K Plus are instruments designed to conduct Power Factor tests on electrical insulation. The test sets are capable of automatically measuring the insulation Power Factor of multi-terminal equipment at voltages ranging from less than 1 kV upto 12 kV (upto 5kV on ACTS - 5K Plus). Being equipped with two measuring leads, the test sets can measure all the quantities associated with multi-terminal electrical power equipment. In addition to measuring the Capacitance and Power Factor of insulation, the test sets can measure the excitation current of transformers and other equipments.

## PRINCIPLE

The Etel Automatic Capacitance and Tan Delta Test Sets operate on the transformer ratio arm bridge principle. The current from the device under test is compared to the current of an internal reference capacitor. The residual of this comparison is measured and resolved into in-phase (watt loss) and quadrature current components. The test voltage and total specimen current are also measured. From these measured quantities, Power Factor and Capacitance are calculated and displayed along with the test voltage, current and power loss.

## APPLICATION

Model ACTS-12K Plus / ACTS-5K Plus Automatic Capacitance and Tan Delta Test Sets can be used for shop or field testing of electrical insulation at voltages upto 12 kV, (5 kV on ACTS - 5K Plus) where the need for portability and simple operation is required. Examples of equipment that can be tested include : Power, Generator, Distribution, & Instrument Transformers, Bushings, Bus & Line CVTs, EHV Class Transformer windings, shunt reactor windings, grading Capacitors of CBs, motor coils, Generators / HT Motors, cables & Transformer Oils (with optional accessories). The Capacitance & Tan Delta measurements are carried out at line frequency. The test voltage has to be applied using the variac on the front panel.

## INTERFERENCE SUPPRESSION

The Test set has a fully Automatic Interference measurement and suppression circuitry. When activated by the operator, the circuitry automatically measures and suppresses the interference, which enables accurate measurements in HV Switchyards where interference levels are normally high. Interference Suppression in the Model ACTS-12K Plus is derived from a Phase locked Oscillator that provides separate Capacitance & Tan Delta adjustments. This Oscillator can be phase locked to the Line Frequency. The Interference is measured and displayed either in % or directly in milli Amperes.

## ADVANCED PROTECTION CIRCUITRY

The ACTS-12K Plus incorporates advanced in-built Protection for the ALTERA, DSP section & associated circuitry to safeguard the measurement circuitry in case of flash-over.

## SPECIFICATIONS

### CAPACITANCE

Range : 0 to 0.26  $\mu$ F (Bridge range).

(ACTS-12K Plus with the 12 kV/ 200 mA Power Supply maximum Capacitance of upto 0.06  $\mu$ F @ 10 kV, 50 Hz or 0.05  $\mu$ F @ 10 kV, 60 Hz can be tested).

(ACTS-5K Plus with the 5 kV/ 200 mA Power Supply maximum Capacitance of upto 0.12  $\mu$ F @ 5 kV, 50 Hz or 0.1  $\mu$ F @ 5 kV, 60 Hz can be tested).

Accuracy :  $\pm 0.1\%$  of reading  $\pm 0.3$  pF (UST).  
 $\pm 0.1\%$  of reading  $\pm 5$  pF (GST).

Read out : 5 digits.

Resolution : 0.001 pF.

### DISSIPATION FACTOR (TAN DELTA)

DF Range : 0 to  $\pm$  infinity.

Accuracy :  $\pm 1\%$  of reading  $\pm 0.05\%$ .

Readout : 5 digits.

Highest Resolution : 0.00001.

### INTERFERENCE CURRENT

Range : 0 to 100 mA.

Accuracy :  $\pm 1\%$  of reading.

Best Resolution : 1 micro ampere.

### POWER

Range : 0 to  $\pm 2$  kW.

Accuracy :  $\pm 1\%$  of reading.

Readout : 4 digits.

Highest Resolution : 1 micro watt.

The watts/ mWatts are calculated and displayed automatically. The watts/ mWatts in a C&DF Test measures the total losses in the insulation. These values can be added or subtracted to cross-verify measurements on multi-terminal equipments.

### EQUIVALENT READINGS

Provides printout for equivalent values at 2.5 or 10 kV readout as selected by operator.

### POWER FACTOR

Range : 0 to 100% (Positive or Negative) pF display in absolute value & in %.  
 It will display (0 to 0.99999) with a 5 digits resolution.

Accuracy :  $\pm 1\%$  of reading  $\pm 0.05\%$ .

Highest Resolution : 0.00001.

### INDUCTANCE

Range : Infinity upto 40 H (50 Hz) & 27 H (60 Hz).

Accuracy :  $\pm 0.2\%$  of reading.

Resolution : 0.01 H.

Inductance measurement is carried out only when the Excitation Test is carried out.

### VOLTAGE

Range : 0-12000 V (ACTS-12K Plus).  
 0-5000 V (ACTS-5K Plus).

Test Voltage is continuously variable.

Accuracy :  $\pm 1\%$  of reading, RMS responding.

Resolution : 1 volt.

## CURRENT

Range : 0 to 2000 mA.  
(Upto 5A when used with the set of Compensating Reactors and Range extension Transformer).

Accuracy :  $\pm 1\%$  of reading.

Highest Resolution : 1 micro ampere.

## FREQUENCY

Operating Range : 50/ 60 Hz  $\pm 10\%$ .

Accuracy :  $\pm 0.02$  Hz.

Resolution : 0.01 Hz.

## DATA STORAGE FACILITY

Can store upto a maximum of 160 readings & the data is retained in memory even when the instrument is switched OFF.

## INDICATION

240 x 128 dot matrix LCD panel with back light.

## INTERFACE

RS232C serial interface to PC for full control. USB printer interface.

## KEYBOARD

20 keys, membrane keyboard on front panel.

Temperature correction for test results is through Windows Interface Software provided.

Option for entering specimen no. & ambient temperature before test is provided.

## STANDARD CAPACITOR

Capacitance : 200 pF Air Capacitor with guard.

Tan Delta :  $< 2 \times 10^{-4}$ .

Max Voltage rating : Upto 12 kV.

Temperature Coefficient :  $< 30$ ppm/ $^{\circ}$ C.

Capacitance ageing  
30ppm/year.

## POWER OUTPUT

### ACTS - 12K PLUS

0-12 kV Tap 0-12 kV @ 100 mA continuous.  
0-12 kV @ 200 mA intermittent.

0-2.4 kV Tap 0-2.4 kV @ 500 mA continuous.  
0-2.4 kV @ 1000 mA intermittent.

### ACTS - 5K PLUS

0-5 kV 0-5 kV @ 100 mA continuous.  
0-5 kV @ 200 mA intermittent.

## POWER INPUT

### ACTS - 12K PLUS

230V  $\pm 10\%$ , 50 Hz - 1.2 kVA (2.4 kVA intermittent) OR  
110V  $\pm 10\%$ , 60 Hz - 1.2 kVA (2.4 kVA intermittent).

### ACTS - 5K PLUS

230V  $\pm 10\%$ , 50 Hz - 500 VA (1000 VA Intermittent) OR  
110V  $\pm 10\%$ , 60 Hz - 500 VA (1000 VA Intermittent).

## SAFETY FEATURES

- Zero start control and interlock for HV output.
- Double grounded connections needed to operate set with an open ground indicating lamp.
- All operator controls are at earth potential.
- External interlock must be manually closed for HV output.
- A interlock is provided to actuate safety barrier, warning light, etc.
- No energised terminals accessible from outside of modules.
- Fuse Protective Circuit and Transformer Thermal Sensor to guard against sustained overloading of the power supply.
- Short Circuit Protection.
- Indicating lamps for power supply & for HV 'ON'.
- Reset switch provided for disabling short-circuit and over voltage indicators.

## POWER SUPPLY RATING / MAX. CAPACITANCE MEASURING RANGES GENERATORS / MOTOR TESTING

EQUIPMENT	ACCESSORY	TEST VOLTAGE	MAX CAPACITANCE (50 Hz)	MAX CAPACITANCE (60Hz)
ACTS-12K Plus	–	10 kV 2.4 kV	0.06 $\mu$ F 0.26 $\mu$ F	0.05 $\mu$ F 0.2 $\mu$ F
ACTS-12K Plus	CTS-RE	10 kV 2.4 kV	0.06 $\mu$ F 1.2 $\mu$ F	0.05 $\mu$ F 1.0 $\mu$ F
ACTS-12K Plus	CTS-RE CTS-100 (1No. of 0.1 $\mu$ F) CTS-50 (1No. of 0.2 $\mu$ F)	10 kV	0.36 $\mu$ F	0.3 $\mu$ F
ACTS-12K Plus	CTS-RE CTS-100 (1No. of 0.1 $\mu$ F) CTS-50 (5Nos. of 0.2 $\mu$ F)	10 kV	1.1 $\mu$ F	1.0 $\mu$ F

## APPLICABLE STANDARDS

The ACTS-12K Plus meets the EMI/EMC Test requirements as per:

1. IEC 61000-4-2 – Electrostatic Discharge Immunity Test.
2. IEC 61000-4-3 – Radiated Susceptibility Test.
3. IEC 61000-4-4 – Electrical Fast Transient Immunity Test.
4. IEC 61000-4-5 – High Energy Surge Immunity Test.
5. IEC 61000-4-11 – Voltage Dips and Interruption Test.
6. IEC 60068-2-2 – Basic environmental testing procedures (shock).
7. IEC 60068-2-64 – Vibration broad band random.
8. Climatic Test – Cold & Damp heat test passed.

## MECHANICAL DATA

### ACTS - 12K PLUS

Weight : Approx. 66 Kgs.  
Size : 760mm x 410mm x 630mm (LxBxH).

### ACTS - 5K PLUS

Weight : Approx. 55 Kgs.  
Size : 760mm x 410mm x 630mm (LxBxH).

Cable Box : 600mm x 400mm x 340mm (LxBxH).  
Weight : Approx. 20 Kgs.  
Temperature Range :  $-10$  to 50 deg C.  
Humidity : Ambient to 90%, RH.



## STANDARD ACCESSORIES

### CABLES

- High voltage cable (12 kV / 5 kV) of 20m length double shielded and equipped with clips and hooks.
- Two low voltage leads of screened cable of 20m length equipped with clips and hooks.
- Foot switch used for safety of operator while handling high voltage; equipped with 5m length cable.
- Printer Cable for Printer - 2m length.
- Mains connecting cable of 10m length.
- Two grounding cables of 20 & 10m length equipped with clips.
- Transport Cases - Bridge, Power Supply & Cables.
- Operation Manual.
- RS232 Cable for PC Interface - 2m length.

## OPTIONAL ACCESSORIES FOR TESTING LARGE GENERATORS AND MOTORS USING MODEL ACTS-12K PLUS

Range Extension Transformer to extend the Bridge Capacitance range upto 2.6  $\mu\text{F}$ . The 10 kV Capacitance value that can be measured will depend on the number of Compensating Reactors used.

Compensating reactors to boost the power supply rating which enables measuring a Capacitance of upto 1.1  $\mu\text{F}$  at 10 kV, 50 Hz OR 1  $\mu\text{F}$  at 10 kV, 60 Hz and set of reactors for testing at 12 kV.

### OPTIONAL ACCESSORIES

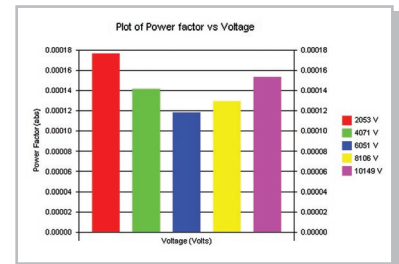
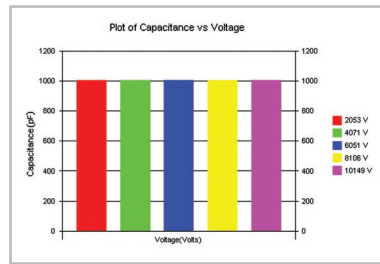
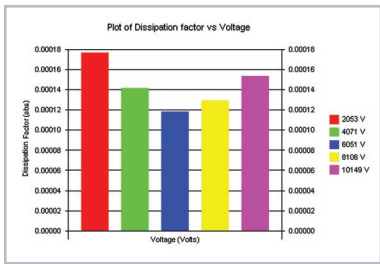
- 10kV Oil Test Cell-Measurements at ambient temperature only.
- Calibrator for Capacitance and Tan Delta - Provides One Capacitance & three Tan Delta values.
- Windows Analysis & Interface Software: This is a Windows based software and can be operated on Windows XP/Windows 7.
- External Temperature & Humidity Indicator.



## Windows Analysis & Interface Software Features and Sample Graphs

### Features

- Add New Specimen • New Test Conducting • Quick Measurements for selected SP # • Stored Data Retrieval
- Manual Data Entry • Viewing Test Settings/Details • Deleting Test Settings/ Details • Advanced Delete • Saving Data
- Copying the Selection to Clipboard (Excel/Word) • Export All Grid Data to Excel • Exporting the results to Excel after Live test
- Print Data/ Graph • Applying Temperature Correction • Plot PF/ DFVs Voltage • Compare PF/ DF with previous values
- Plot Capacitance Vs Voltage • Compare Capacitance with Previous Values • Print Settings • Record Temperature
- Add New Temperature corrections to Std List • Instrument Selection Screen



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(Specifications subject to change without notice)