

## A Versatile, Non-Obsolescent ESD Simulation System

The Thermo KeyTek Series 2000 ESD Simulation System provides a combination of performance features unlike any other offering. Physically, it is housed in two interconnected units: the ESD-1 Discharger (or gun), which may be either hand-held or tripod-mounted, and its associated Power Supply/Control/Unit PSC-1. The Discharger is made up of the basic handle, polarity switch, high-voltage set knob and digital display. The Power Supply/Control Unit includes selectors for repetition rate, charge rate and burst/normal modes.

Interchangeable Discharge Networks, Current Injection Adapters and Tips, all plug directly into the Discharger's barrel. The Discharge Network is also remotable via an optional cable, to provide a lighter, hand-held probe for extended testing without a tripod. In this latter mode, the Discharger may be mounted on the Power Supply/Control Unit via tripod mounting hardware, which is included.

Specific Series 2000 Model Groups have been identified, to help users select the ESD test capabilities most appropriate to their immediate needs.

Expansions and additions, selected from the next Model Group or from anywhere in the entire Series 2000, can be made at any time.

## MONITORS/CALIBRATORS

### 1. DIGITAL STORED VOLTAGE MONITOR

(supplied with all units)

Located at eye level on the Discharger. It reads the low-voltage, programming signal to which the high-voltage will be slaved, until the trigger is depressed to generate the high voltage. It then switches over automatically to directly measure actual stored high-voltage output. The reading decays quickly on discharge, clearly signifying discharge. This visual indication of discharge provides positive identification of the ESD event, even at low voltages at which there is no discernable spark.

### 2. AUDIBLE-DISCHARGE MONITOR

(supplied with all units)

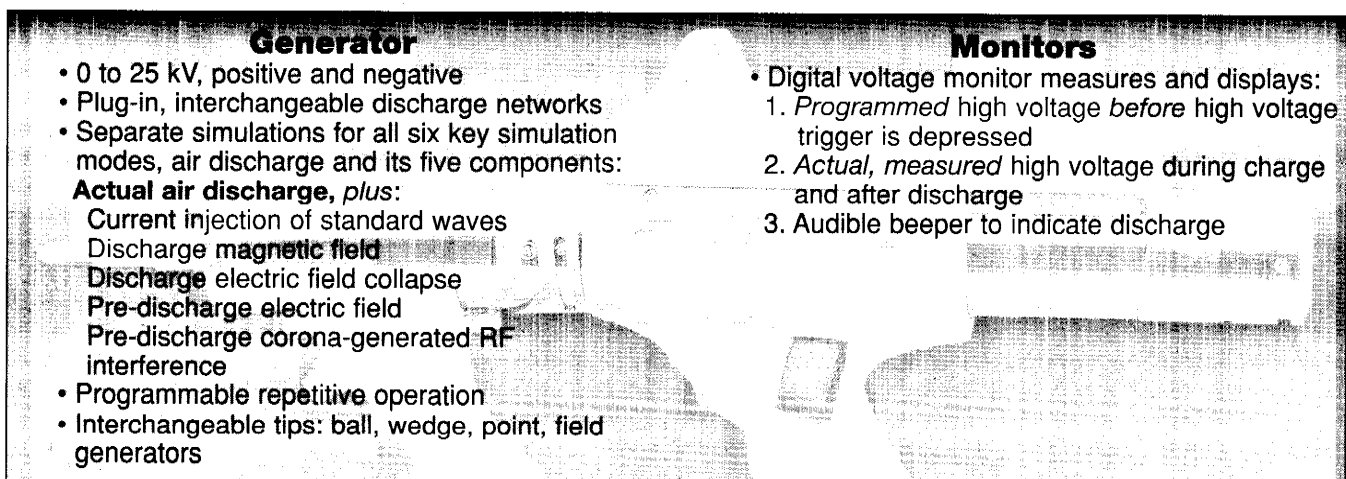
Beeper located within the Discharger handle. Informs the user when a discharge has occurred.

### 3. CTC-1 WAVEFORM VERIFICATION TARGET

Using a storage oscilloscope, this target allows daily verification that the ESD pulse has not changed over time (full calibration, of course requires much higher bandwidth targets and test set-ups).

### 4. DC OUTPUT CALIBRATION ATTENUATOR

Model DCA-1 (optional). Attenuator network to allow scope or meter monitoring of DC stored on the discharge capacitor (10,000:1 ratio).



**Generator**

- 0 to 25 kV, positive and negative
- Plug-in, interchangeable discharge networks
- Separate simulations for all six key simulation modes, air discharge and its five components:  
**Actual air discharge, plus:**
  - Current injection of standard waves
  - Discharge magnetic field
  - Discharge electric field collapse
  - Pre-discharge electric field
  - Pre-discharge corona-generated RF interference
- Programmable repetitive operation
- Interchangeable tips: ball, wedge, point, field generators

**Monitors**

- Digital voltage monitor measures and displays:
  1. Programmed high voltage before high voltage trigger is depressed
  2. Actual, measured high voltage during charge and after discharge
  3. Audible beeper to indicate discharge

Specification and prices subject to change without notice

continued underleaf ►

## GENERATOR

### 1. VOLTAGE CONTINUOUSLY SELECTABLE FROM 1 TO 25kV, IN BOTH POLARITIES.

### 2. LIBRARY OF INTERCHANGEABLE, PLUG-IN DISCHARGE NETWORKS.

Networks meet IEC, EIA, NEMA and MIL Standards. Custom Networks can also be furnished to meet special requirements.

Discharge Networks can be operated as a remote probe using an optional additional cable between the DN and the simulator body.

### 3. DISCHARGE NETWORKS, DISCHARGE AND FIELD TIPS, PLUS AUXILIARY ADAPTERS FOR AIR DISCHARGE AND ALL FIVE OF ITS BASIC COMPONENTS:

**Air Discharge Generation:** simulates the basically unrepeatable, but highly realistic, real-world human discharge; for both direct and proximity testing.

- **Discharge Current-Wave Injection:** provides highly-repeatable, standardized waves into the test piece, via Current Injection Adapters.
- **Discharge Magnetic-Field Simulation:** a repeatable field which minimizes electric field and other air-discharge effects, to facilitate diagnostic work with the magnetic field alone. Uses a special Magnetic Field Tip, plus an appropriate Current Injection Adapter.
- **Discharge Electric-Field Collapse Simulation:** a repeatable field which minimizes the magnetic effects of the air-discharge event, again for diagnostic work. Employs the Electric Field Tip, plus an appropriate Current Injection Adapter and the Discharge Electric Field Adapter.
- **Pre-Discharge Electric Field Simulation:** permits repeatable, E-field and rate-of-approach E-field simulation, independent of operator position and approach speeds; via electronically-determined ramp speed. Uses E-Field Tip.
- **Pre-Discharge Corona Simulation:** generates a relatively repeatable, standard or enhanced corona, which in turn generates RFI to facilitate investigation of EUT sensitivity. Uses standard Ball and Point Discharge Tip, alone or in conjunction with the Self-Discharge, Proximity Field Tip.

### 4. CURRENT INJECTION ADAPTERS:

Variable to 8kV to meet IEC and other international requirements, plus fixed adapters at 10kV and 20kV. For current-injection (rather than air-discharge) operating mode, an Adapter is placed between the Discharge Network and the tip. When the tip is held in contact with metal on the DUT, a repeatable current pulse is generated.

### 5. INTERCHANGEABLE DISCHARGE TIPS:

IEC-specified ball-finger, as well as point (awl) and wedge (screwdriver).

### 6. INTERCHANGEABLE FIELD-GENERATOR TIPS AND ADAPTERS:

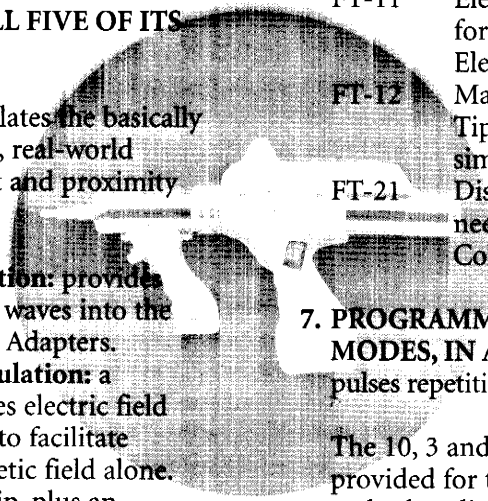
- FT-10 Self-Discharge, Proximity Field Tip
- FT-11 Electric Field (E-Field Simulation) Tip, for both Pre-Discharge and Discharge Electric Field Collapse simulations.
- FT-12 Magnetic Field (H-Field Simulation) Tip, for Discharge Magnetic Field simulation.
- FT-21 Discharge Electric Field Adapter (only needed for Discharge Electric Field Collapse simulation).

### 7. PROGRAMMABLE REPETITIVE OPERATING MODES, IN ADDITION TO SINGLE-SHOT: pulses repetitive every 10, 3, 1 and .05 seconds. \*

The 10, 3 and 1-second delays per pulse are provided for thorough ESD-testing of computers and other digital equipment capable of running in check-sum and parity modes.

The 20/second rep rate is far too fast for medium or high-voltage ESD testing because of the high average power it can apply to sensitive devices. It is used primarily for low-voltage, investigative work below a few kV. The 20/second rep rate is also useful for air-discharge proximity testing, in which the discharge current flows only in the simulator's return and not in the Equipment Under Test.

\* .05 seconds for human body simulation capacitor to 150pf; proportionately slower for higher capacitor values in other Discharge Networks.



# SPECIFICATIONS

## Series 2000 ESD Simulators

### Voltage Range:

- 1 to 25 kV with Ball Tip (and without Extender Cable EC-1).
- 1 to 20 kV with Point and Wedge Tips (DT-2, DT-3).
- 1 to 20 kV with Extender Cable EC-1 and any tip.

**Polarity:** Operator-Selectable (plus or minus)

**Operating Modes:** Single-shot and repetitive

**Repetition Rates:** One shot per approximately 1, 3, or 10 seconds. Fast, repetition rate of nominally 20/second, for discharge distances well within breakdown voltage settings, is also available, in momentary (not lock-on) mode.

### Built-In Digital Voltmeter:

**High Voltage Trigger On:** Measures and displays actual high voltage at the ESD Simulator's tip ( $\pm 5\%$  of reading  $\pm .2$  kV).

### High Voltage Trigger Off:

**Before** tip voltage has decayed to below 300-500 V, continues to measure and display tip high voltage ( $\pm 5\%$  of reading  $\pm .2$  kV);

**After** tip voltage has decayed to below 300-500 V, displays "Program Voltage" – the voltage that *will* appear at the tip when the high-voltage trigger is depressed.

### Display Indicators:

**Actual V:** Indicates that the DVM is displaying actual tip High Voltage (independent of trigger position – stays on till tip voltage has decayed below 300-500 V).

**Program V:** Indicates that the DVM is displaying Programmed Voltage. Can be illuminated only when tip voltage is less than 300-500 V.

**Program Voltage Adjust:** Multi-turn, long-life potentiometer, mounted in thumb-accessible position on ESD gun handle.

**Discharge Ground Strap:** Equivalent inductance to IEC-specified strap, but with insulation adequate for 25 kV. Length ~ 2000 mm, or 6.5 feet.

### Trigger Position:

- Up: Lock-On \*
- Center: OFF
- Down: Momentary On

\* Note: Lock-On position is operational only when the ESD gun is tripod-mounted (special tripod bushing required), or is mounted to the PSC-1 power supply unit (supplied as part of all Series 2000 systems).

This built-in personnel safety feature, the inability to operate in Lock-On mode when the ESD gun is hand-held, insures that a charge cannot continue to exist on the gun after it is put down.

Finally, 20/sec repetition rate is unavailable in Lock-On mode, to insure against use on actual equipment (which might receive too much energy in this mode), and to maximize ESD gun life.

### Normal/Slow Ramp Selector:

**Slow Ramp Position:** In Slow Ramp mode, for repetition rates of one shot per 3 seconds and one shot per 10 seconds, the high-voltage ramps up slowly enough to permit the digital voltmeter to display the voltage at which the simulated ESD breakdown occurs. (Useful for applications in which the ESD gun location is fixed.)

**Normal Ramp Position:** Preferred for most other work. The high voltage ramps up rapidly, thereby minimizing stress on internal high-voltage components, with consequently prolonged instrument life and reliability.

**Normal (Single-shot)/Burst Selector:** In Burst position, allows realistic simulation of multiple discharges even when the ESD tester is on a tripod or is otherwise in a fixed location. Also required is an appropriate Discharge Network like the DN-3 or DN-4. (Multiple ESD discharges usually occur from a rapidly-advancing human finger, or from an appropriate hand or finger simulator.)

## DISCHARGE NETWORK

### Characteristics and Performance

#### I. DISCHARGE NETWORK DN-1

Energy Storage Capacitor: 150pf  $\pm 10\%$

Discharge Resistor: 150  $\Omega$   $\pm 5\%$

All performance specifications based on use of 100 MHz bandwidth instrumentation, and *shortest possible ground strap* (~ 30 cm), as per IEC specifications.

Discharge current is measured into an IEC-specified, coaxial 2  $\Omega$  load.

Risetime of discharge current: 5 ns  $\pm 30\%$

Duration of discharge current: 30 ns  $\pm 30\%$

Peak value of discharge current,  $\pm 30\%$ :

- 9A at 2kV
- 18A at 4kV
- 37A at 8kV
- 70A at 15kV

#### II. DISCHARGE NETWORK DN-10 (IEC-specified)

Energy Storage Capacitor: 150pf  $\pm 10\%$

Discharge Resistor: 330 $\Omega$   $\pm 5\%$

#### III. ALL OTHER DISCHARGE NETWORKS

Unless otherwise specified for a particular network, characteristics are:

Discharge Capacitance Tolerance:  $\pm 15\%$

Voltage Sensitivity: Typically less than 10% capacitance decrease from 0 to 25kV.

Discharge Resistance Tolerance:  $\pm 10\%$

# Thermo KeyTek SERIES 2000 ESD Tester Model Groups

Capability	Model #	2030G	2030(STD)	2031	2032	2033	2034
<b>1. AIR-DISCHARGE SIMULATION</b> Discharge: $\pm 1$ to $\pm 25$ kV, single shot and repetitive (interval: 10s, 3s, 1s, .05s). Built-in DVM directly measures stored high voltage. IEC human-body-model Discharge Network (150 pF/150 $\Omega$ ). IEC 61000-4-2 human-body-model Discharge Network (150 pF/330 $\Omega$ ). IEC ball Discharge Tip	ESD-1	•	•	•	•	•	•
	DN-1**						
	DN-10	•	•	•	•	•	•
	DT-1	•	•	•	•	•	•
<b>2. ACCESSORIES AND POWER SUPPLY</b> Corona and Field-Enhancement Discharge Tip Proximity-Test, Self-Discharge Tip Power Supply/Control Unit Carrying Case	DT-2	•	•	•	•	•	•
	FT-10			•	•	•	•
	PSC-1	•	•	•	•	•	•
	CA-1A	•	•	•	•	•	•
<b>3. AUXILIARY DISCHARGE AND FIELD TIPS</b> Wedge, Simulating Tool E-Field (electric field) Simulator H-Field (magnetic field) Simulator Discharge E-Field Collapse Adapter	DT-3				•	•	•
	FT-11				•	•	•
	FT-12***				•	•	•
	FT-21***				•	•	•
<b>4. DIRECT CURRENT INJECTION, including</b> Fast Air-Discharge Mode, via: 10kV Fast-Approach Current Injection Adapter 20kV Fast-Approach Current Injection Adapter	FA/CIA™-10						
	FA/CIA™-20				•	•	•
<b>5. ADDITIONAL ACCESSORIES</b> Carrying Case Coax monitor for ESD current waveform. Includes Ground Plane (GP-1), scope cable with 50 $\Omega$ Termination (TC-50), and Short Ground Strap (GCS-1) (For 400 MHz applications <b>only</b> ). IEC coax monitor for ESD current waveform With 1GHz capability. Includes high-peak-power attenuator and scope cable. (Requires 1.5m x 1.5m target-plane). Target-plane Assembly, 1.5m x 1.5m as specified by IEC 61000-4-2 Probe Conversion Cable; Remotes any Discharge Network as light, hand-held probe DC Output Calibration Attenuator Field and Corona Sensor Group Common Monitor Unit, HEC-1 H-Field sensor, HFS-1 E-Field sensor, EFS-1 Pre-Discharge corona sensor, CCS-1	CA-2A				•	•	•
	CTC-1						
	CTC-3						•
	TP-3						
	EC-1			•	•	•	•
	DCA-1						•
	FCS-1						•
<b>6. ADDITIONAL DISCHARGE NETWORKS</b> NEMA Part DC33 and MIL STD 883E Discharge Network (100 pF/1500 $\Omega$ ) Upper/lower-body-model Discharge Network (700 pF/100K/150 pF/150 $\Omega$ ) Segmented-body-model Discharge Network (700 pF/100K/150 pF/150 $\Omega$ /20 pF-50 $\Omega$ ) Optimum basic human-body-model network: EIA Std, PN-1361 (Draft 6, 1985) Discharge Network (100 pF/500 $\Omega$ )	DN-2						
	DN-3						
	DN-4						
	DN-6**						
<b>7. TRUE-ESD™ AND CONTACT MODE</b> True ESD™ Hand-Tip/Discharge-Tip Combination Contact Mode, Fast-Rise Current Injection (FR/CITM), As per IEC 61000-4-2 (.7-1 ns rise time).	HT-10/DT-4**			•		•	•
	CIA-V		•	•		•	•

\*\* DN-10 may be substituted directly for DN-1; IEC Contact Mode module, CIA-V (for use with DN-10) may be directly substituted for DN-6 and HT-10/DT-4.

\*\*\* Requires an FA/CIA™, FA/CIA-20 is recommended.