

# FIRING TEST SYSTEM

## Model 931

Generates discharge pulses to evaluate the electrostatic susceptibility of powders, liquids and devices. Used to determine the energy threshold required for ignition by electrostatic discharge of varying intensities up to  $\pm 26\text{kV}$ . Available with internal RC networks from 100pf to 0.5 $\mu\text{f}$  and 0-5k $\Omega$  to meet the requirements of MIL STD 1512, 1576 (Method 2205), 1751A, (Methods 1031, 1032 & 1033), 331B plus other standards. ESD pulses are applied to the test sample via direct connection to the device or through a needle electrode placed a fixed distance from a powder sample. An optional Test Chamber is available.

### Features:

- Range:  $\pm 100$  to 26kV
- Capacitors: 100pf – 0.5 $\mu\text{f}$
- Resistors: 0, 500, 1500, 5000  $\Omega$
- Custom R/C networks available
- Use for voltage & energy susceptibility testing
- Std. HV, SPDT Charge/Discharge Relay
- Custom discharge electrodes available
- Optional test chamber



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## Description:

The Model 931 Firing Test System is designed specifically to determine the ESD susceptibility of pyrotechnic devices, powders and liquids. The 2-piece Electrostatic Discharge Simulator consists of a Control Unit housing all low voltage electronics and controls plus a 4½-digit LED voltage level display and a Discharge Unit containing the HVPS, polarity reversing module, plus capacitor and resistor selector modules.

The Model 931 produces discharge pulses from ±100 Volts to ±26kV. Energy is stored in capacitor banks during the charging cycle. A discharge pulse is produced when a high voltage gas filled relay disconnects the charged capacitor from its charging source and connects it to the output of the FTS Discharge Unit. The energy storage capacitor bank is installed inside the Discharge Unit. Discharge resistors are installed within the Discharge Unit or contained in individual plug-in modules depending on system configuration. R/C values must be specified at time of order. Additional capacitor and resistor modules can be plugged into the SPARE capacitor and resistor input connectors on the front panel of the Discharge Unit. Standard capacitor values range from 100pf to 0.5µf and resistor values range from 0 to 5,000 Ohms. Non-standard capacitors, resistors and voltages up to 30kV can be special ordered. A 25 MegOhm resistor permanently connects the output to ground to bleed off residual voltage after a discharge plus an interlock cable connected to a user supplied switch removes power to the HVPS when the switch is open. Spring-loaded ARM and DISCHARGE switches control the charge/discharge cycle. The AUTO Mode allows for up to 9 discharges while holding down the ARM and DISCHARGE switches.

## Test Standards:

Many applications require the determination of the energy threshold for ignition by electrostatic discharge of varying intensities. Energy is determined by the equation  $E = \frac{1}{2}CV^2$ . Resulting data can then be used to characterize the probability of ignition due to an ESD event.

MIL-STD-1751A, (Group 1030 Test Methods) along with MIL-STDs 1512, 1576 (Method 2205) and MIL-STD-331C cover the most common test standards for electrostatic discharge sensitivity testing.

### **MIL-STD-1751A** (Powder testing):

#### **Method 1031**

Maximum test voltage: 5kV

Resistor: 0 Ω

Capacitors: 100, 250, 500, 1000, 2000, 5000pf  
0.01, 0.02, 0.05, 0.1, 0.25, 0.50µf

#### **Method 1032**

Maximum test voltage: 25kV

Resistor: 0 Ω

Capacitors: 250pf – 0.02µf

#### **Method 1033**

Maximum test voltage: 5kV

Resistor: 0 Ω

Capacitor: 0.02µf (other values are implied)

#### **Method 1034 (Optional)**

Maximum test voltage: 30kV

Resistor: 0 Ω

Capacitor: 0.035µf

### **MIL-STD-1576** (Device testing)

#### **Method 2205**

Maximum test voltage: 25kV

Resistors: 5000 Ω

Capacitor: 500pf

### **MIL-STD-1512** (Device testing)

Maximum test voltage: 25kV

Resistors: 0 Ω

Capacitor: 500pf

### **MIL STD 331C** (Device testing)

#### **Notice 3**

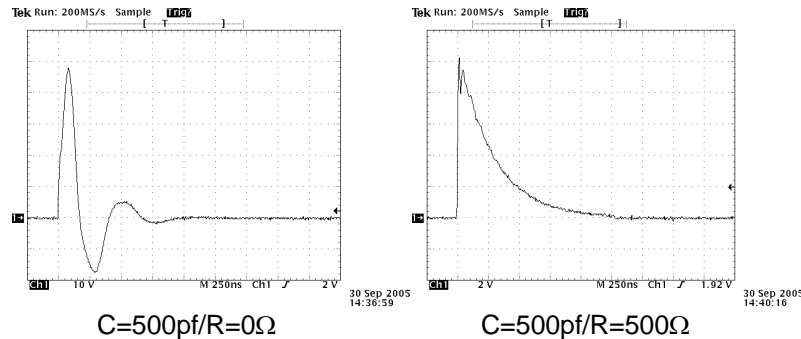
Maximum test voltage: 25kV

Resistors: 500, 5000 Ω

Capacitor: 500pf

## Discharge Waveforms:

The discharge waveform at the output is a function of the R/C network and the output impedance. When the output resistor is 0 Ohms the discharge is a damped oscillation and its peak voltage is a function of the output impedance. On the other hand, when the output resistor has a finite value such as 500 Ohms the waveform is an exponential decay where the peak voltage is primarily a function of the output resistor. Typical waveforms at 5kV are shown below using an ETS Model 949 IEC specified Test Target (transfer ratio = 1V/amp).



## Standard Configurations:

The Model 931 can be configured to meet virtually any customer requirement including custom R/C networks and pin selection of multi-pin devices. The following standard systems listed below include a 6 ft (183cm) HV Output/Gnd cable assembly with banana plugs and removable alligator clips plus a 6 ft (183cm) interlock cable for connection to a user supplied interlock switch.

### A: (Mil STD 1512, 1576, 331C)

$V_{max} = \pm 26$  kV; C = 500, 1000, 2000 & 5000 pf; R = 0, 500, 5000  $\Omega$

### B: (MIL STD 1512, 1576, 331C, 1751A-Methods 1032 & 1033)

$V_{max} = \pm 26$  kV; C = 250, 500, 1000, 2000, 5000, 10,000 & 20,000 pf; R = 0, 500, 5000  $\Omega$

### C: (Expanded B configuration)

$V_{max} = \pm 26$  kV; C = 100, 250, 500, 1000, 2000, 5000, 10,000 & 20,000 pf; R = 0, 500, 1500, 5000  $\Omega$

### D: (MIL STD 1512, 1576, 331C, 1751A-Methods 1031, 1032 & 1033)

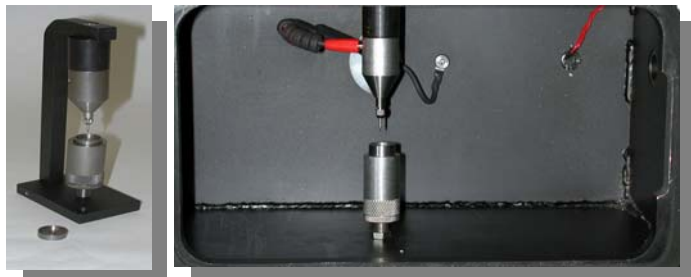
$V_{max} = \pm 26$  kV; C = 100, 250, 500, 1000, 2000, 5000, 10,000 & 20,000 pf; R = 0, 500, 5000  $\Omega$

$V_{max} = \pm 6$  kV; C = 0.05, 0.1, 0.25, 0.5  $\mu$ f (MIL STD configuration)

## Accessories (Optional):

The Model 931 Firing Test Chamber is a secure box for testing powders and small devices (<100mg of powder). It is fabricated from 3/8" (9.5mm) cold roll steel with welded seams, a 2" NPT exhaust port plus a 3/8" door with 1/2-turn latch. An interlock switch integrated with the door and plug-in device testing cables are included. An optional 0.75" (19mm) acrylic door window is available.

A powder electrode assembly, available either as a separate test fixture or integrated into the Test Chamber consists of a needle electrode, an adjustable height grounded base with locking ring plus 3 stainless steel 5/8" (15mm) x 1/8" (3mm) deep cups to hold the test powder.



The Model 949 Test Target is a current transducer with 50Ω impedance and frequency response to 2 GHz that is used to measure all ESD output waveforms. It has a transfer ratio of 1 Volt/amp. A 3' (91cm) RG58 cable is included. The Model 949 is designed in accordance with IEC 61000-4-2



## Specifications:

### Control Unit:

**Range:**

LO &lt;±100 – 6000V

HI: &lt;±3 – 26kV

**HV Adjust:** 10-turn potentiometer**Display:** 4½-digit LED**Resolution:** LO - 1V,  
HI - 10V**Accuracy:** Better than ±5%**Auto Mode:**

Discharges: 0-9

Interval: 0.3-10 sec

Display: 1-digit LED

Power: 90-260VAC, 50/60Hz

**Control Cable:** 6' (1.8m), 15-pin Sub D**Dimensions:** 16.5"Wx12"Dx3.5"H  
(42x31x9 cm)**Weight:** 10.5 lb (4.8kg)

### Discharge Unit:

**Polarity Select:** Reversing Module**Connectors:**

Type: Alden 2-pin, 30kV, Female (E201B12)

Selector: 12

Output: 1

**Capacitors (std available):** ± 5%@25kV: 100, 250, 500, 1000, 2000, 5000  
10,000, 20,000 pf (35,000 opt)

@ 5kV: 0.05, 0.1, 0.25, 0.50 µf

**Resistors (std available):** ±5%,

0, 500, 1500, 5000 Ω

**Output Cable:** (Not supplied with Firing Test Chamber)

Type: Alden 2-pin 30kV, Male (E200B12)

Length: 6' (1.86m), .161" Std. Banana plugs

**Interlock Cable:**

Type: 3-wire, 22 Ga, Tinned end

Length: 6' (1.86m)

Connector: 3-pin DIN

**Dimensions:** 16.5"Wx12"Dx3.5"H  
(42x31x9cm)**Weight:** 11 lb (5kg)

### Firing Test Chamber (Optional):

**Device Test Size:** 100mg MAX**Construction:**

Material: 3/8" (9.5mm) Cold rolled steel

Assembly: Welded seams

Finish: Black powder coat

Venting: 2" NPT Nipple on rear

Door: 3/8" (9.5mm) steel with pull latch  
(Optional .75" (19mm) Acrylic window)Cables: 12" (305mm) HV, banana plug with  
Replaceable clips

### Powder Electrode Assembly (Optional)

**Discharge Electrode:** Needle (replaceable)**Cup (3 ea):** .625" Dia.x.125" Deep (16x3mm)**Adjustment Range:** .75" (19mm)**Dimensions:** 2"Wx3"Dx8.5"H (51x76x217mm)**Electrical Connections:**

Input: 2-pin HV Female Alden Conn. (E201B12)

GND: Std .061" (4mm) banana jack

Interlock: SPST pushbutton, door activated

Electrodes: 12" (305mm) wire, banana plugs with,  
replaceable alligator clips**Dimensions:** 16.5"Wx12"Hx9"H  
(420x310x230mm)**Weight:** 123 lbs (55.8 kg)

### Model 949 Test Target (Optional):

**Frequency response:** 2 GHz**Transfer ratio:** 1 Volt/Amp**Output Impedance:** 50Ω**Cable:** 3' (910mm) RG58**Warranty:** One (1) Year

*Specifications subject to change without notice*