

**INSTRUCTION
MANUAL**

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**ELECTROSTATIC DISCHARGE SIMULATOR
MODEL EDS-250/300**

WTD 71-620-425

Zur Kalibrierung

ELECTRO-METRICS

A PENRIL COMPANY

INSTRUCTION MANUAL
FOR
ELECTROSTATIC DISCHARGE SIMULATOR
MODEL EDS-250/300

ELECTRO-METRICS

A PENRIL COMPANY

100 Church Street * Amsterdam, New York 12010 * (518) 843-2600

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 READ THIS FIRST

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*****CAUTION*****

WHEN USING THE PD-SERIES OF DISCHARGE UNITS,
ALWAYS START WITH THE HV CONTROL SET FULLY
COUNTERCLOCKWISE (CCW). WHEN SETTING UP THE
VOLTAGE OF THE DISCHARGE UNIT, ALWAYS INCREASE
THE HV CONTROL SLOWLY AND IN SET INCREMENTS
E.G., IF A TOP VOLTAGE OF 20 kV IS REQUIRED,
INCREASE IN STEPS OF APPROXIMATELY 5 kV UNTIL
THE OPERATING LEVEL OF 20 kV IS REACHED. ALLOW
THE DISCHARGE UNIT TO STABILIZE 1 MINUTE AT
THE OPERATING VOLTAGE BEFORE PERFORMING THE
TESTING REQUIRED.

*****>>> WARNING <<<*****

HIGH VOLTAGES of up to 25 kV are present during the operation of this instrument. Always exercise extreme caution and care when operating the unit. SERIOUS INJURY OR DEATH could result from improper setup and operation. Always operate the equipment in accordance with the instructions contained within this manual.

*****>>> WARNING <<<*****

MAY BE HAZARDOUS TO PACEMAKER WEARERS

===== NOTE =====

This instrument must be serviced only by competent, qualified personnel. Electro-Metrics recommends returning the unit to the factory for repair, servicing, or calibration. Warranty void if control unit or probes are opened and/or serviced by other than qualified personnel. The PD and DD probes are sealed non-servicable units and should be returned to Electro-Metrics for calibration, repair, or service.

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SECTION I INTRODUCTION AND SPECIFICATIONS

1.1 INTRODUCTION EDS-250/300 ELECTROSTATIC DISCHARGE SIMULATOR

The EDS-250/300 Electrostatic Discharge Simulator is designed to simulate in a known and repeatable manner the effects produced by static electricity discharging into electronic equipment from human beings and inanimate objects. An example of this phenomenon is the sparking which occurs after a person walks across a woolen or nylon carpet in winter and then touches a metal doorknob or table. This resultant spark is the discharge of up to 30 000 volts of static electricity built up on the person's body from the friction of their shoes on the carpet.

Accurate and repeatable simulation of these "static electricity" events is extremely important in the design, development, and manufacture of electronic equipment. If a computer is susceptible to "operator induced" ESD, its response may be anything from an error in computation or data storage to a complete failure caused by component burnout. If an assembler in a factory causes an ESD event, the sensitive components (e.g. transistors, integrated circuits, etc) being handled may be damaged, and the resultant damage may not be discovered until later in the manufacturing process. Only by having an accurate and repeatable simulation of these and other types of ESD events can a manufacturer be assured that its products, whether they are semiconductor devices, computers, or home entertainment equipment, will withstand their everyday operating environment.

1.2 INSTRUMENT SPECIFICATIONS

The electrical and general specifications for the EDS-250/300 Electrostatic Discharge Simulator are given in TABLE 1.1.

TABLE 1.1
EDS-250/300 SPECIFICATIONS

FUNCTION/CHARACTERISTICS	DESCRIPTION/PERFORMANCE
EQUIPMENT	ELECTROSTATIC DISCHARGE SIMULATOR
EDS-250:	Consists of the following: <ul style="list-style-type: none"> a. Control Module¹. b. One or more DD (DC) or PD (Pulse) series Discharge Units.
EDS-300:	Consists of the following: <ul style="list-style-type: none"> a. Control Module¹. b. Collapsible Vane Assembly (CV-300). c. One or more Pulse Discharge Units used with the vanes. d. Vane Platform: used to mount the other components. <p>NOTE: 1. The Control Module is identical for each simulator.</p>
CONTROL MODULE	<ul style="list-style-type: none"> a. Variable High Voltage Output. b. High Voltage Output Monitor: 3 digit LED. c. Pulse Counter: 4 digit LED. d. Two (2) modes of operation: <ul style="list-style-type: none"> 1. STOP ON COUNT: select from 1 to 9999 pulses. 2. FREE RUNNING: until manually stopped. e. Adjustable PULSE RATE: 1 Hz to 10 Hz, plus three fixed rates of 1 Hz, 10 Hz, 60 Hz. f. RESET/START and STOP controls. g. For use with PULSED Discharge Units only: <ul style="list-style-type: none"> 1. SINGLE PULSE Switch. 2. TRIGGER SELECTOR Switch: External or Internal. 3. TTL Level Trigger Input.
DISCHARGE UNITS	<p>There are three basic types of Discharge Units:</p> <ul style="list-style-type: none"> a. Pulse Discharge Unit, PD series, used with the EDS-250/300. b. Pulse Discharge Unit, consisting of separate power and discharge modules, used only with the EDS-300. c. DC Discharge Unit, DD series, used with the EDS-250/300.

TABLE 1.1 CONT'D
EDS-250/300 SPECIFICATIONS

FUNCTION/CHARACTERISTICS	DESCRIPTION/PERFORMANCE
<u>PULSED DISCHARGE UNITS</u>	
GENERAL FEATURES:	<p>NOTE: The following general information applies to the PD Series used with the EDS-250 and the pulse units used with the EDS-300.</p> <ul style="list-style-type: none"> a. Operates with tip in short circuit with equipment under test. b. Eliminates spark discharge. c. Repeatable fast rise time (1 ns/kV). d. Waveform not affected by: <ul style="list-style-type: none"> 1. Corona. 2. Spark formation. 3. Multi-channelling. 4. Humidity.
EDS-250 PULSED UNITS:	<p>PD SERIES SPECIFICATIONS:</p> <ul style="list-style-type: none"> a. Output Resistance: 150 ohms, standard (Other resistance values available on request). b. Capacitance: 150 pF (Other capacitance values available on request). c. Output Voltage Polarity: Switchable between plus and minus. d. Connection to Control Module: Multi-conductor cable, 7-pin HV connector. e. Case: Tubular metal shell, electrically grounded, with plastic handle.
MODEL PD-5-250:	<p>Voltage Range: 0.5-5.0 kV Type: Pulse</p>
MODEL PD-8-250:	<p>Voltage Range: 1.5-8.0 kV Type: Pulse</p>
MODEL PD-25-250:	<p>Voltage Range: 7-25 kV Type: Pulse</p>
EDS-300 PULSED UNITS:	<p>Used only with CV-300 Vane Assembly.</p> <p>SPECIFICATIONS:</p> <ul style="list-style-type: none"> a. Output Resistance: 15 ohms and 1800 ohms. b. Capacitance: Distributed capacitance established by the vane assembly at 150 pF.

TABLE 1.1 CONT'D
EDS-250/300 SPECIFICATIONS

FUNCTION/CHARACTERISTICS	DESCRIPTION/PERFORMANCE
EDS-300 PULSED UNITS (CONT'D):	c. Case: Square, bracket for mounting onto vane assembly. Metal case is electrically "hot" when connected to the EDS-250/300 Control Module (unit turned on).
MODEL MP-3:	
PULSER MODULE:	Voltage Range: 0 to 2.5 kV. Type: Pulse. Trigger Cable Connector: TWINAX.
POWER SUPPLY MODULE:	Voltage range: 0 to 2.5 kV. Case: Identical to the Pulser Module. Connection to Control Module: Multi-conductor cable, 7-pin HV connector.
MODEL P-7I:	
PULSER MODULE:	Voltage Range: 0.5 to 7 kV. Type: Pulse. Trigger Cable Connector: BNC
POWER SUPPLY MODULE:	Voltage Range: 0.5 to 7 kV. Case: Identical to the Pulser Module. Connection to Control Module: Multi-conductor cable, 7-pin HV connector.
MODEL P-15I	PD SERIES CONFIGURATION, CAN BE USED WITH EITHER AN EDS-250 OR EDS-300. NORMALLY SUPPLIED AS PART OF A COMPLETE EDS-300 DISCHARGE SIMULATOR SYSTEM. Voltage Range: 0.8 to 15 kV. Type: Pulse. Output Resistance: 15 ohms Capacitance: 150 pF Case: Identical to DD and PD series used with EDS-250. (Used independently of the vane assembly). Connection to Control Module: Multi-conductor cable, 7-pin HV connector.

TABLE 1.1 CONT'D
EDS-250/300 SPECIFICATIONS

FUNCTION/CHARACTERISTICS	DESCRIPTION/PERFORMANCE
DC DISCHARGE UNITS	
GENERAL FEATURES:	a. Ability to have high voltage level set on the Control Module without high voltage present on discharge unit tip. b. Trigger switch to turn on the high voltage at the discharge unit tip. c. High voltage potential will remain on tip until discharge occurs. d. Discharge controlled by electric field between tip and ground. e. Fast risetime (1 ns/kV).
DC DISCHARGE UNITS: (EDS-250 ONLY)	DD SERIES SPECIFICATIONS: a. Output Resistance: Operator selectable, 150-ohm tip standard (other resistor tips available on request). b. Capacitance: Operator selectable, 150 pF module standard (other capacitance module available on request). c. Output Voltage Polarity: Switchable between plus and minus. d. Connection to Control Module: Multi-conductor cable, 7-pin HV connector. e. Case: Tubular metal shell, electrically grounded, with plastic handle.
MODEL DD-25-250:	Voltage Range: 1-25 kV Type: DC
NOTE: HIGHER VOLTAGE MODEL DISCHARGE UNITS FOR SPECIAL APPLICATIONS ARE AVAILABLE ON REQUEST FOR BOTH PULSED AND DC UNITS.	
NOTE: ALL DISCHARGE UNITS AND ACCESSORIES USED WITH THE EDS-250 CAN BE USED WITH THE EDS-300 SINCE THE IDENTICAL CONTROL MODULE IS USED BY BOTH SIMULATORS.	
PHYSICAL CHARACTERISTICS	
CONTROL MODULE:	MAJOR COMPONENT EDS-250 Height: 203 mm (8") with cover 127 mm (5") without cover Depth: 406 mm (16") Width: 229 mm (9") Weight: Approx. 9 kg (20 lbs)

TABLE 1.1 CONT'D
EDS-250/300 SPECIFICATIONS

FUNCTION/CHARACTERISTICS	DESCRIPTION/PERFORMANCE
PHYSICAL CHARACTERISTICS	
EDS-300:	VANE ASSEMBLY PLUS CONTROL MODULE
	Height: 600 mm (23.6") with vane assembly.
	152 mm (6.0") without vane assembly.
	Depth: 641 mm (25.25") with control module.
	368 mm (14.5") without control module.
	Width: 349 mm (13.75").
	Weight: Approx. 20 kg (45 lbs).

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION II SAFETY AND OPERATIONAL PRECAUTIONS

***** CAUTION *****
*
* READ ALL INFORMATION IN THIS SECTION BEFORE *
* ATTEMPTING OPERATION. IMPROPER OR UNSAFE OPERATION *
* CAN DAMAGE THE INSTRUMENT PLUS CAUSE SERIOUS INJURY *
* OR DEATH OF THE OPERATOR. *
*

***** READ THIS FIRST *****

2.1 OPERATIONAL PRECAUTIONS

2.1.1 AC POWER SOURCE

The EDS-250/300 operates from a "STANDARD" AC power source of 120 VAC $\pm 10\%$ 50/60 Hz.

For "OPTIONAL" 220 VAC $\pm 10\%$ 50/60 Hz operation, the EDS-250/300 must be either ordered with 220 VAC from the factory or be returned for modification to this option. The EDS-250/300 DOES NOT CONTAIN A POWER SOURCE SWITCH for switching between two or more AC power sources.

Operation from an AC power source other than the one specified could cause extensive damage to the circuitry.

2.1.2 EDS-250 HIGH VOLTAGE PRECAUTIONS

Always observe the following high voltage precautions when working around EDS-250:

- a. When the EDS-250 is turned "ON", keep hands and other extremities away from the TIPS of the Discharge Units.
- b. NEVER turn "ON" the Control Module without a Discharge Unit connected.
- c. Turn "OFF" the Control Module when not in use.

2.1.3 EDS-300 HIGH VOLTAGE PRECAUTIONS

Always observe the following high voltage precautions when working around EDS-300:

- a. When the EDS-300 is turned "ON", keep hands and other extremities away from the following:
 1. Cases of the MP-3 and P-7I Probes, which are electrically "HOT".
 2. Vane assembly with probe connected.
 3. Tips of the Discharge Units.
- b. NEVER turn "ON" the Control Module without a Discharge Unit connected.

- c. Never connect more than one Discharge Unit to the vane assembly at one time.
- d. Turn "OFF" the Control Module when not in use.

2.2 SAFETY PROCEDURES

*****>>>> WARNING <<<<*****

- a. THE ESD TEST DISCHARGE MAY BE HAZARDOUS TO PACE-MAKER WEARERS.
- b. PERSONNEL WITH PACE-MAKERS, HEART PROBLEMS, NERVOUS DISORDERS, AND SIMILAR PROBLEMS SHOULD NOT BE ALLOWED TO OPERATE THE EDS-250/300 OR OTHER ESD SIMULATORS OR BE PRESENT WHEN ESD TESTING IS OCCURRING.

The EDS-250/300 Electrostatic Discharge Simulator is a high voltage instrument producing voltage levels up to 25 kV. The energy level of this voltage is below that which is considered a lethal level for a normal healthy person but even this lower energy level* can, at the minimum, give a very unpleasant shock to the user. Operating and working around any high voltage instrument or device requires a high degree of responsibility, care, and common sense. Extreme caution and care should always be exercised when working with these (or any other) high voltage and energy levels since under some circumstances--environmental conditions, health of operator, etc--even these levels can be fatal. Moreover, even a healthy person can be startled by a static discharge and accidentally injure him/herself.

2.2.1 SAFETY PRECAUTIONS TO OBSERVE

The following safety precautions should always be observed when using the EDS-250/300 to perform Electrostatic Discharge testing.

2.2.1.1 TEST AREA/EQUIPMENT UNDER TEST PRECAUTIONS

- a. The ESD test area and equipment under test should be kept isolated and separate from other test, operating, and administrative areas.
- b. The ESD test area should be clearly marked with the appropriate WARNING and CAUTION signs denoting that high voltage testing is being conducted.
- c. The number of personnel in the High Voltage test area should be limited to that which is required to perform the testing. The greater the number of people in the test area, the greater the probability of the occurrence of accidents and other undesired incidents.

* Usually much less than 0.15 joule.

- d. The equipment under test should be properly grounded, unless the procedure being followed states otherwise, to protect the test personnel and the EDS-250/300. In addition, the equipment under test should be clearly marked as such.

2.2.1.2 EDS-250/300 PRECAUTIONS AND USAGE

- a. Always verify that the EDS-250/300 is returned to ground, unless the procedure being followed states otherwise, to protect the operator, EDS-250/300, and other equipment in the area.
- b. Never perform ESD testing near other equipment or machinery. ESD discharges can effect electronically controlled and/or computer controlled equipment, medical equipment such as pacemakers, and many other electronic devices. These discharges may possibly cause malfunctions, breakdowns, and (in the extreme) life-threatening problems.
- c. NEVER connect a Discharge Unit to the Control Module with module turned "ON". To do so could damage or destroy the Control Module circuitry.
- d. Turn "OFF" the Control Module when not in use or when removing/connecting Discharge Units.
- e. Do not operate the discharge units above the voltage ratings indicated for each unit as this could damage the discharge unit. Below the voltage rating indicated, the discharge unit will not operate reliably.
- f. The HV Control should always be set FULLY COUNTERCLOCKWISE (CCW) before the Control Module is turned on to prevent SHOCK and POSSIBLE INJURY.
- g. Before performing any work or checks on the equipment under test or the EDS-250/300, always push the STOP Switch to stop operation of the EDS-250/300 (regardless of the EDS-250/300 operating mode) plus turn off and remove the high voltage from the Discharge Unit.

2.2.1.3 PERSONNEL PRECAUTIONS

- a. When the EDS-250/300 is turned "ON", keep hands and other extremities away from the IIPS of the PD and DD Series Discharge Units and the vane assembly plus Discharge Units for the EDS-300.
- b. THE ESD TEST DISCHARGE MAY BE HAZARDOUS TO PACE-MAKER WEARERS.
- c. Personnel with pace-makers, heart problems, nervous disorders, and similar problems should not be allowed to operate the EDS-250/300 or other ESD simulators or be present when ESD testing is occurring.
- d. Personnel should remain clear of the equipment under test when ESD testing is occurring. Only one person should operate the EDS-250/300, or any other simulator, at one time.
- e. A flashing red light and/or other similar warning device should be installed and activated to warn other personnel that high voltage testing is occurring.

- f. For the safety of all personnel and equipment, ESD and high voltage testing should be done in an area that is isolated (separate room, warning signs and signals) and, if possible, shielded from other sections of your company.
- g. If any deviation from standard operating conditions occurs (in sound, equipment indications, etc) STOP TESTING and INVESTIGATE before continuing the testing. This is good common sense and practice when doing any high voltage work.

2.2.2 SUMMARY

Always exercise extreme caution and care when working around and on ESD simulators and other high voltage equipment.

>>>>REMEMBER<<<<

CAREFUL, CAUTIOUS, AND CORRECT is better than DARING, DASHING, AND DEAD. "HIGH VOLTAGE" CAN KILL, RESPECT IT AND LIVE.

SECTION III EDS-250 OPERATION AND TEST METHODS

3.1 GENERAL

Refer to this section for information and instructions on operation of and test methods used with the Model EDS-250 Electrostatic Discharge Simulator and its associated PD and DD series of Discharge Units.

***** CAUTION *****

1. READ ALL INFORMATION IN THIS SECTION BEFORE ATTEMPTING OPERATION. IMPROPER OPERATION MAY CAUSE COSTLY DAMAGE TO THE INSTRUMENT OR SERIOUS INJURY TO THE OPERATOR.
2. REFER TO SECTION II FOR PRECAUTIONS AND SAFETY PROCEDURES TO FOLLOW WHEN OPERATING AND USING THE EDS-250.

3.2 POWER REQUIREMENTS

The EDS-250/300 Control Module operates from an AC power source of 105-130 VAC, 50/60 Hz.

3.2.1 FUSE SPECIFICATION

1.5 A SLO-BLO.

3.3 OPERATING PROCEDURE

REFER TO APPENDIX A FOR A DESCRIPTION OF THE CONTROL MODDULE FRONT PANEL CONTROL FUNCTIONS AND CONNECTORS AND APPENDIX C FOR A COMPLETE DESCRIPTION OF THE PD AND DD SERIES OF DISCHARGE UNITS.

3.3.1 INITIAL SETUP

- a. Unlatch the cover and remove the power cord.
- b. Connect the Discharge Unit chosen to the EDS-250/300 Control Module by connecting the Control Cable of the Discharge Unit to the OUTPUT Connector on the Control Module.

3.3.2 PRE-OPERATIONAL CHECKOUT

***** CAUTION *****

(1) DO NOT OPERATE THE DISCHARGE UNITS ABOVE THE VOLTAGE RATINGS INDICATED FOR EACH UNIT AS THIS COULD DAMAGE THE DISCHARGE UNIT. BELOW THE MINIMUM VOLTAGE RATING INDICATED, THE DISCHARGE UNIT WILL NOT OPERATE RELIABLY.

(2) DO NOT OPERATE THE DISCHARGE UNITS ABOVE A RECHARGE RATE OF APPROXIMATELY 10 Hz. ABOVE THE 10 Hz RECHARGE RATE, THE DISCHARGE UNIT WILL EITHER NOT FUNCTION OR OPERATE ERRATICALLY.

(3) NEVER CONNECT OR DISCONNECT A DISCHARGE UNIT WITH THE CONTROL MODULE TURNED "ON". THIS WILL DAMAGE THE CONTROL UNIT CIRCUITRY. ALWAYS TURN THE CONTROL MODULE "OFF" BEFORE PERFORMING THIS OPERATION.

3.3.2.1 CHECKOUT USING PULSED DISCHARGE UNIT.

- a. Set the Control Module controls as follows:
AC POWER Switch.....OFF
MODE Switch.....STOP ON COUNT
HV CONTROL.....FULL CCW
RECHARGE RATE Switch.....VARIABLE
RECHARGE RATE CONTROL.....MIN (FULL CCW)
- b. Set the TRIGGER Switch of the Discharge Unit to the MIDDLE (OFF) position.

***** CAUTION *****

1. THE HV CONTROL SHOULD ALWAYS BE SET FULLY COUNTERCLOCKWISE (CCW) BEFORE THE CONTROL MODULE IS TURNED ON TO PREVENT SHOCK AND POSSIBLE INJURY.
2. THE TRIGGER SWITCH ON THE DISCHARGE UNIT SHOULD ALWAYS BE SET TO THE MIDDLE (OFF) POSITION BEFORE THE CONTROL MODULE IS TURNED ON TO PREVENT SHOCK AND POSSIBLE INJURY.
3. WHEN USING THE PD-SERIES OF DISCHARGE UNITS, ALWAYS START WITH THE HV CONTROL SET FULLY COUNTERCLOCKWISE (CCW). WHEN SETTING UP THE VOLTAGE OF THE DISCHARGE UNIT, ALWAYS INCREASE THE HV CONTROL SLOWLY AND IN SET INCREMENTS E.G., IF A TOP VOLTAGE OF 20 kV IS REQUIRED, INCREASE IN STEPS OF APPROXIMATELY 5 kV UNTIL THE OPERATING LEVEL OF 20 kV IS REACHED. ALLOW THE DISCHARGE UNIT TO STABILIZE 1 MINUTE AT THE OPERATING VOLTAGE BEFORE PERFORMING THE TESTING REQUIRED.

- c. Connect the PD Discharge Unit chosen to the Control Module.
- d. Connect the AC power cord to a 115 VAC power source.
- e. Attach the ground strap of the Discharge Unit to the test object. Place the tip of the Pulsed Discharge Unit in direct contact with the test object.
- f. Set the AC POWER Switch to ON, the LED displays should light.
- g. Set the PULSE COUNT SELECTOR to a number between 0001 and 9999, e.g., 85.
- h. Push the RESET/START Switch once, the PULSE COUNTER should reset to 0000 and activate the HV circuitry.
- i. Using the HV CONTROL, set the DISCHARGE VOLTAGE MONITOR at 25% of the rated voltage level of the Discharge Unit selected. Increase the HV CONTROL slowly and in incremental steps until the rated voltage is reached. Allow 1 minute for the voltage to stabilize.

- j. Set the Discharge Unit (DU) TRIGGER Switch to the TOP (PERMANENTLY ON) position and push the RESET/START Switch a second time, the Discharge Unit should discharge for the number of pulses selected in Step e, with the unit stopping when the PULSE COUNTER reaches the number indicated.
- k. Set the MODE Switch to FREE RUNNING and push the RESET/START Switch twice with the DU TRIGGER Switch set to the TOP, as explain in Steps i thru j.* The Discharge Unit should pulse continuously with the PULSE COUNTER incrementing one count for each pulse. Rotate the RECHARGE RATE Control CW, the pulse rate should increase.

NOTE: DO NOT OPERATE THE DISCHARGE UNITS ABOVE A RECHARGE RATE OF APPROXIMATELY 10 Hz. ABOVE THE 10 Hz RECHARGE RATE, THE DISCHARGE UNIT WILL EITHER NOT FUNCTION OR OPERATE ERRATICALLY.

- l. Repeat Step j with the RECHARGE RATE Switch set to 1 Hz and 10 Hz respectively.
- m. To stop the Discharge Unit pulsing, do either 1 or 2:
 1. Set the Discharge Unit TRIGGER Switch to the MIDDLE (OFF) position, the Discharge Unit should stop pulsing. To resume pulsing, set the Discharge Unit TRIGGER Switch to the TOP (PERMANENTLY ON) position or for single pulse operation BOTTOM (MOMENTARY ON) position.
 2. Push the STOP Switch, the Discharge Unit should stop pulsing. To resume pulsing, the RESET/START Switch must be pushed twice (Refer to Steps i thru j).

3.3.2.2 CHECKOUT USING DC DISCHARGE UNIT

- a. Set the Control Module controls as follows:

AC POWER SWITCH.....	OFF
MODE SWITCH.....	STOP ON COUNT
HV CONTROL.....	FULL CCW
RECHARGE RATE Switch.....	VARIABLE
RECHARGE RATE CONTROL.....	MIN (FULL CCW)
- b. Set the TRIGGER Switch of the Discharge Unit to the MIDDLE (OFF) position.

***** CAUTION *****

1. THE HV CONTROL SHOULD ALWAYS BE SET FULLY COUNTERCLOCKWISE (CCW) BEFORE THE CONTROL MODULE IS TURNED ON TO PREVENT SHOCK AND POSSIBLE INJURY.
2. DO NOT OPERATE THE DISCHARGE UNITS ABOVE A RECHARGE RATE OF APPROXIMATELY 10 Hz. ABOVE THE 10 Hz RECHARGE RATE, THE DISCHARGE UNIT WILL EITHER NOT FUNCTION OR OPERATE ERRATICALLY.
3. THE TRIGGER SWITCH ON THE DISCHARGE UNIT SHOULD ALWAYS BE SET TO THE MIDDLE (OFF) POSITION BEFORE THE CONTROL MODULE IS TURNED ON TO PREVENT SHOCK AND POSSIBLE INJURY.

- c. Connect the AC power cord to a 115 VAC power source.
- d. Attach the ground strap on the Discharge Unit to the test object.
- e. Set the AC POWER Switch to ON, the LED displays should light.
- f. Set the PULSE COUNT SELECTOR to a number between 0001 and 9999, e.g. 25.
- g. Rotate the HV CONTROL clockwise (CW), a voltage indication between 0.2 and 5 kV may appear on the DISCHARGE VOLTAGE MONITOR. This due to leakage around the high voltage transformer. If a voltage indication greater than 5 kV is present during this step, consult Electro-Metrics for further assistance. Return the HV CONTROL to a fully CCW position.
- h. Push the RESET/START Switch, the PULSE COUNTER should reset to 0000. Using the HV CONTROL, set the DISCHARGE VOLTAGE MONITOR at 25% of the rated voltage level of the Discharge Unit selected.
- i. Set the Discharge Unit (DU) TRIGGER Switch to the TOP (PERMANENTLY ON) position, the Discharge Unit should now discharge each time the dielectric strength of the air gap between the probe tip and the test object is broken down, for the number of pulses selected in Step f. The unit should stop when the PULSE COUNTER reaches the number indicated.
- j. Set the MODE Switch to FREE RUNNING and push the RESET/START Switch. The Discharge Unit should discharge each time the tip is held near the test object. Each time the unit discharges, the PULSE COUNTER should increment one count per discharge. Rotate the RECHARGE RATE Control CW, the discharge rate should increase.

NOTE: DO NOT OPERATE THE DISCHARGE UNITS ABOVE A RECHARGE RATE OF APPROXIMATELY 10 Hz. ABOVE THE 10 Hz RECHARGE RATE, THE DISCHARGE UNIT WILL EITHER NOT FUNCTION OR OPERATE ERRATICALLY.

- k. Repeat Step j with the RECHARGE RATE Switch set to 1 Hz and 10 Hz respectively.
- l. To stop the Discharge Unit pulsing, either 1 or 2:
 - 1. Set the Discharge Unit TRIGGER Switch to the MIDDLE (OFF) position, the Discharge Unit should stop pulsing.
 - 2. Push the STOP Switch, the Discharge Unit should stop pulsing.

***** CAUTION *****

ALWAYS GROUND THE TIP OF THE DC DISCHARGE UNIT BEFORE REMOVING, TOUCHING, OR WORKING ON THE UNIT TO DISCHARGE THE RESIDUAL VOLTAGE AND PREVENT SHOCK AND POSSIBLE INJURY.

3.4 USING THE EDS-250

3.4.1 INTRODUCTION

As described previously, the EDS-250 comprises a Control Module with one or more PD or DD Series Discharge Units. The Control Module sets the operating parameters for the EDS-250 while the Discharge Units set the high voltage operating range. There are two types of Discharge Units, DC and PULSED, with each series offering ranges up to 25 kV.

The "DC" (DD-SERIES) Discharge Unit will charge up to the voltage selected by the Control Module and hold the voltage at the tip until a discharge occurs. The discharge occurs when the dielectric, in most cases air, cannot hold-off the electric field between the Discharge Unit tip and the object under test. The DC Discharge Unit comes with a round tip to minimize corona current losses.

The "PULSED" (PD-SERIES) Discharge Unit uses a series of internal high voltage switches to produce a consistent waveform. The tip remains at ground potential until it is triggered by the Control Module or the TRIGGER Switch on the Discharge Unit in accordance with the settings established by the operator. The proper method of testing is to place the tip of the Discharge Unit in direct contact with the object under test, i.e. short circuited. The PULSED Discharge Unit comes with a pointed tip to facilitate direct contact with the unit under test.

For both types of Discharge Units, the Control Module monitors and indicates the voltage directly at the Discharge Unit tip output capacitors. This eliminates any extrapolation errors.

While the "DC" Discharge Unit offers exact replication of an ESD event, it also has the same statistical variation and degradation of the waveform as allowed by spark type discharge. These deviations are the result of corona (charge leakage due to electric fields created by the Discharge Unit and the unit under test prior to discharge), unpredictable resistive phase time delay of the spark channel plus other factors such as multi-channeling of the spark.

The "PULSED" Discharge Unit does not suffer from these waveform modifiers since all of the above mentioned deviations are a result of the spark formation. The "PULSED" unit reliably replicates the waveform every time it is triggered since it switches the high voltage internally and is operated in a short circuit mode.

NOTE: Dielectric (voltage hold-off) strength is a function of geometry and the time that the voltage has been present. This is the reason why the "PULSED" unit may appear to have a shorter spark than the "DC" unit when allowed to operate with a gap (not recommended). For this reason, when performing tests on insulated equipment and testing for hold-off voltage, the "DC" unit is preferred (as explained later in this section).

3.4.2 EDS-250 OPERATION-MODES/STATES

After determining the type of ESD testing to be performed, select the Discharge Unit required and connect it to the Control Module.

3.4.2.1 CONTROL MODULE OPERATION

The EDS-250 Control Module controls and sets the state and mode of EDS operation. At any instant the Control Module is in either of two states: stopped or operate. The operator can switch states by either pushing the RESET/START Switch to put the Control Module in the operate state or by pushing the STOP Switch to put the Control Module in the stopped state.

The operator can select one of two modes of Control Module operation using the MODE Switch: FREE RUNNING or STOP ON COUNT.

- a. **FREE RUNNING:** In this mode the Control Module will operate indefinitely as controlled by the operator. When the PULSE COUNTER display exceeds 9999, it rolls to 0000 and continues.
- b. **STOP ON COUNT:** In this mode the Control Module will go to the stopped state when the PULSE COUNTER display indicates the same number as set by the operator using the PULSE COUNT SELECTOR thumb wheel switches. For the DC Discharge Unit, this means that the high voltage is turned off while for the PULSED Discharge Unit, the triggering is stopped. It is equivalent to pushing the STOP Switch manually.

3.4.2.2 OPERATION WITH DC DISCHARGE UNIT

Connect the DC Discharge Unit to the Control Module and set the DISCHARGE UNIT TRIGGER Switch to the MIDDLE (OFF) position.

Turn on the Control Module and push the RESET/START Switch to activate the high voltage. This safety feature plus the TRIGGER Switch on the Discharge Unit, prevents accidental high voltage being present at the tip of the Discharge Unit when turning on the Control Module.

Operation of the EDS-250 using a DC Discharge Unit:

- a. With Discharge Unit TRIGGER Switch set to the MIDDLE (OFF) position, push the RESET/START Switch and dial the desired voltage.
 1. There is no voltage on the tip of the Discharge Unit unless the TRIGGER Switch is pushed to either ON position (TOP or BOTTOM).
 2. The voltage displayed on the Control Module HIGH VOLTAGE MONITOR, with the Discharge Unit TRIGGER Switch set to OFF (MIDDLE), is an approximate voltage to preset the Control Module.
 3. When the Discharge Unit TRIGGER Switch is set to either ON position (TOP or BOTTOM), the actual voltage on the Discharge Unit tip is now being monitored and may be readjusted using the HIGH VOLTAGE CONTROL on the Control Module.

- b. Push the Discharge Unit TRIGGER Switch to the TOP (PERMANENTLY ON) position and begin testing by approaching the unit under test with the round tip pointing towards the desired discharge spot.
- c. Whenever a discharge occurs, the High Voltage is automatically shut off and will cycle back to the preset level at a rate controlled by the RECHARGE RATE Control on the Control Module [adjustable between 1 Hz (MIN-FULL CCW) and 60 Hz (MAX-FULL CW)].

NOTE: The 60 Hz recharge rate is only usable with the Discharge Units used with the EDS-300. The DD and PD Series Discharge Units operate reliably up to approximately a 30 Hz recharge rate.

- d. To turn off the high voltage, push the STOP Switch at any time or set the Discharge Unit TRIGGER Switch to the MIDDLE (OFF) position.
- e. Everytime a discharge is made, the PULSE COUNTER display will increment one count. The display can be reset to 0000 at any time by pushing the RESET/START Switch.

3.4.2.3 OPERATION WITH PULSED DISCHARGE UNIT

Connect the PULSED unit to the Control Module and set the DISCHARGE UNIT TRIGGER Switch to the MIDDLE (OFF) position.
Operation of the EDS-250 using a PULSED Discharge Unit:

- a. With the Discharge Unit TRIGGER Switch set to the MIDDLE (OFF) position; turn on the Control Module, select the desired voltage level, and place the tip of the Discharge Unit directly against the unit under test.

NOTE: WHEN SETTING UP THE VOLTAGE OF THE DISCHARGE UNIT, ALWAYS INCREASE THE HV CONTROL SLOWLY AND IN SET INCREMENTS E.G., IF A TOP VOLTAGE OF 20 kV IS REQUIRED, INCREASE IN STEPS OF APPROXIMATELY 5 kV UNTIL THE OPERATING LEVEL OF 20 kV IS REACHED. ALLOW THE DISCHARGE UNIT TO STABILIZE 1 MINUTE AT THE OPERATING VOLTAGE BEFORE PERFORMING THE TESTING REQUIRED.

- b. Push the RESET/START Switch and push the Discharge Unit TRIGGER Switch to the TOP (PERMANENTLY ON) position, the Control Module will now provide a repetitive trigger signal to the Discharge Unit. The trigger rate may varied from 1 to 60 Hz using the RECHARGE RATE CONTROL.

NOTE: The 60 Hz recharge rate is only usable with the Discharge Units used with the EDS-300. The DD and PD Series Discharge Units operate reliably up to approximately a 30 Hz recharge rate.

- c. Another mode of controlling the trigger signal is using the SINGLE PULSE Switch or the BOTTOM (MOMENTARY ON) position of the Discharge Unit TRIGGER Switch.

- d. To stop the triggering of the Discharge Unit, for any mode of operation, simply push the STOP Switch or set the Discharge Unit TRIGGER Switch to the MIDDLE (OFF) position.
- e. Everytime a trigger pulse is sent to the Discharge Unit, the PULSE COUNTER display will increment one count. This will occur regardless of whether the Discharge Unit is connected to the unit under test or not. The display can be reset to 0000 at any time by pushing the RESET/START Switch.
- f. If the operator desires to have the Control Module in the stopped mode and the PULSE COUNTER display set to 0000, this can be accomplished by pushing the RESET/START Switch and then the STOP Switch.

3.5 ESD TESTING METHODS

Both types of Discharge Units produce a fast risetime ESD waveform when triggered. There are basically four methods of performing ESD testing: Direct Discharge Mode, EMI Exposure, Electrostatic, and Dielectric Hold-Off. Each will be explained using the EDS-250.

3.5.1 DIRECT DISCHARGE

PURPOSE: To produce a direct discharge to the equipment under test (EUT).

DISCHARGE UNIT REQUIRED: PULSED or DC. For more accurate and reliable data, the PULSE unit is preferred. The PULSED unit uses current injection and thus is not dependent on spark formation or other air discharge phenomenon such as corona and multi-channeling.

The discharge areas/spots/contact points chosen are usually the ones most susceptible to ESD such as corners, slits, knobs, switches, controls, cable entry areas, etc. The result is that the radiation emitted internally to the EUT can cause:

- a. A hard failure, equipment ceases to function.
- b. An operator-correctable soft failure, equipment has an apparent malfunction (example: computer-controlled machine miss a sequence) which is corrected by operator re-issuing commands to unit under test.
- c. Self-correctable or transparent soft failure. Equipment has a minor malfunction (example: computer-controlled machine misses a command but when the sequence is repeated functions correctly) but causes no lasting effect on equipment operation.

The PULSED unit resistor tip is placed in direct contact with the EUT, while the DC unit is allowed to discharge into the EUT. The distance from the DC unit resistor tip to the EUT will vary depending upon the specifications being used and the voltage level required by the test. The placement of the ground strap is a controversial topic, but in general, minimizing the length and

placing it near the discharge spot/point will cause the discharge to have a faster rise time increasing the high frequency spectral content. For small systems such as personal computers it is recommended that the ground strap be placed at the power cord entry ground point.

The DISCHARGE VOLTAGE MONITOR indicates the level of the voltage charge on the Discharge Unit tip at the instant of triggering.

3.5.2 EMI EXPOSURE

PURPOSE: To create an intense EM field that emanates through the EUT and produces failures of the type mentioned in 3.5.1 above.

DISCHARGE UNIT REQUIRED: PULSED unit only.

This test is limited to use with the PULSED Discharge Unit only. An antenna, comprising either a square plate or loop, is used as the load of the Discharge Unit. The tests consist of two types:

- a. "E" FIELD TESTING which uses the 305 mm (12-inch) and 203 mm (8-inch) square plates to expose the EUT to an electric field. The plate is fastened onto the Discharge Unit using the tip to secure it in place. The ground return is from one corner of the plate to the ground return on the Discharge Unit. Refer to Figure 3.1 for an illustration of this setup.
- b. "H" FIELD TESTING which uses the 102 mm (4-inch) and 171.5 mm (6.75-inch) loops to expose the EUT to a magnetic field. One end of the loop is fastened onto the Discharge Unit using the tip to secure it in place, while the other end of the loop is secured to the ground return of the Discharge Unit. Refer to Figure 3.2 for an illustration of this setup.

The smaller of the two loops and plates is used to limit the exposure to a small area of the EUT, while the larger of the two loops and plates is used for exposure of a larger area or the entire EUT.

3.5.3 ELECTROSTATIC

PURPOSE: To test the equipment under test for the effects of the high voltage electric field lines.

DISCHARGE UNIT REQUIRED: DC unit only.

This test is typically applied to small equipment, such as calculators and portable plastic cased instrumentation, to check its ability to withstand the effects of high voltage electric fields. The electric field stress across internal modules, pc boards, and circuitry of the device under test (DUT) will be divided in inverse proportion to the capacitance amongst these internal parts. This electric field stress may alter the logic

state of high input impedance circuits. The method of testing is to touch the ball tip of the DC Discharge to the case of the EUT at specific points of interest and noting the results. The ground return is usually connected to the power input ground return connector. The DC Discharge Unit is used here since a high voltage field is desired rather than the results of a discharge.

If the case of the EUT is entirely non-conducting, the E-Field Radiating Plate may be used (with its ground strap disconnected) as one plate of a capacitor. A metal surface under or behind the EUT and connected to the DC Discharge Unit ground return functions as the other plate.

3.5.4 DIELECTRIC HOLD-OFF

PURPOSE: To test the ability of insulating materials to hold off high voltage.

DISCHARGE UNIT REQUIRED: DC unit only.

This test is used to test the ability of insulating material (such as plastics) used for enclosures, display panels, and touch film panels to hold off high voltage. The method of testing is to touch the insulating material with the ball tip and move it around. The ground return is normally connected to one end of or behind the material under test. The DC Discharge Unit is used here since a high voltage potential is required rather than a continuous discharge into the material. The E-Field Radiating Plate may be used as a backing electrode for this test.




FIGURE 3.1
"E" FIELD TEST SETUP

(3-11)



FIGURE 3.2
"H" FIELD TEST SETUP

SECTION IV EDS-300 OPERATION AND TEST METHODS

4.1 GENERAL

Refer to this section for information and instructions on operation of and test methods used with the Model EDS-300 Electrostatic Discharge Simulator and its Vane Assembly plus associated Discharge Units.

***** CAUTION *****

1. READ ALL INFORMATION IN THIS SECTION BEFORE ATTEMPTING OPERATION. IMPROPER OPERATION MAY CAUSE COSTLY DAMAGE TO THE INSTRUMENT OR SERIOUS INJURY TO THE OPERATOR.
2. REFER TO SECTION II FOR PRECAUTIONS AND SAFETY PROCEDURES TO FOLLOW WHEN OPERATING AND USING THE EDS-300.

4.2 POWER REQUIREMENTS

The EDS-250/300 Control Module operates from an AC power source of 105-130 VAC, 50/60 Hz.

4.2.1 FUSE SPECIFICATION

1.5 A SLO-BLO.

4.3 OPERATING PROCEDURE

REFER TO APPENDIX A FOR A DESCRIPTION OF THE CONTROL MODDULE FRONT PANEL CONTROL FUNCTIONS AND CONNECTORS AND APPENDIX B FOR A COMPLETE DESCRIPTION ON HOW TO SETUP THE EDS-300.

4.3.1 PRE-OPERATIONAL CHECKOUT

- a. Set the Control Module controls as follows:
- | | |
|----------------------------|----------------|
| AC POWER SWITCH..... | OFF |
| MODE SWITCH..... | STOP ON COUNT |
| HV CONTROL..... | FULL CCW |
| RECHARGE RATE Switch..... | VARIABLE |
| RECHARGE RATE CONTROL..... | FULL CCW (MIN) |

***** CAUTION *****

The HV CONTROL should always be set fully counterclockwise (CCW) before the Control Module is turned on to prevent shock and possible injury.

- b. Connect the AC power cord to a 115 VAC power source.
- c. Attach the long ground strap, located on the right side of the Vane Platform, to the test object. Place the tip of the Discharge Unit Pulser Module in direct contact with the test object.
- d. Set the AC POWER Switch to ON, the LED displays should light.
- e. Set the PULSE COUNT SELECTOR to a number between 0001 and 9999, e.g., 85.
- f. Push the RESET/START Switch once, the PULSE COUNTER should reset to 0000 and activate the HV circuitry.
- g. Using the HV CONTROL, set the DISCHARGE VOLTAGE MONITOR at 25% of the rated voltage level of the Discharge Unit selected.
- h. Push the RESET/START Switch a second time, the Discharge Unit should discharge for the number of pulses selected in Step e, with the unit stopping when the PULSE COUNTER reaches the number indicated.
- i. Set the MODE Switch to FREE RUNNING and push the RESET/START Switch twice, as explain in Steps f thru h. The Discharge Unit should pulse continuously with the PULSE COUNTER incrementing one count for each pulse. Rotate the RECHARGE RATE Control CW, the pulse rate should increase.
- j. Repeat Step i with the RECHARGE RATE Switch set to the 1 Hz, 10 Hz, and 60 Hz respectively.
- k. Push the STOP Switch, the Discharge Unit should stop pulsing.

4.4 INFORMATION MP-3 & P-7I DISCHARGE UNITS

*****>>> WARNING <<<*****

EXTREME CAUTION must be exercised when using these two Discharge Units with the EDS-300 Simulator, since the metal cases of the units are electrically "HOT" when they are connected to the Control Module and vane sections with the vanes charged.

The MP-3 and P-7I units are designed to be used in conjunction with the metal vane assembly of the EDS-300. The vanes represent the capacitance of the charged object being simulated and therefore must have a good electrical contact with the probe units. To accomplish this, the Pulser Module of the Discharge Unit selected is attached to the bare metal strip on the vane sections at the rear of the vane platform. The Power Supply Module of the Discharge Unit selected is attached to the bare metal strip on the vane sections at the front of the vane platform. Refer to Appendix B for complete information on how to assemble the EDS-300 Simulator and its associated Discharge Unit Pulser and Power Supply Modules.

***** CAUTION *****

NEVER CONNECT MORE THAN ONE Discharge Unit (Pulser and Power Supply Modules) at one time to the vane assembly. To do so, will endanger personnel working with the EDS-300 and could damage the circuitry of the Unit not connected to the Control Module. In addition, never mix the Pulser and Power Supply Modules belonging to different Discharge Unit, e.g. a P-7I Power Supply Module with a MP-3 Pulser Module.

The Power Supply Module receives its high voltage input from the Control Module HV Connector, which is then triggered inside the Pulser Module to discharge the vanes. Each unit has a plug-in output resistor tip with a standard resistance of 15 ohms. Other values of resistances are available on request.

The output of the Discharge Unit produces a fast risetime ESD waveform when triggered.

4.5 TEST METHODS

There are two principle methods of performing ESD testing: Current Injection Mode (Direct) and E-Field Test Mode (Indirect).

4.5.1 CURRENT INJECTION MODE (DIRECT)

The object under test must be placed so that it is in direct contact with the resistor tip. A ground strap, which is attached to the right hand side of the Vane Platform, is connected to the object under test. Refer to Figure B.3 for an illustration of this test method.

The DISCHARGE VOLTAGE MONITOR indicates the voltage level of the charge on the vane assembly before triggering occurs.

4.5.2 E-FIELD TEST MODE (INDIRECT)

The resistor tip of the Pulser Module is placed in direct contact with the grounding bracket on the rear of the Vane Platform. Refer to Figure B.4 for an illustration of this method. The entire vane assembly now acts as an antenna exposing the object under test to an electric field.

4.6 P-15I DISCHARGE UNIT

The configuration and use of the P-15I Discharge Unit is identical to the PD-Series (PULSE) of Discharge Units used with the EDS-250 Simulator. The P-15I has a resistance of 15 ohms (compared to the standard 150 ohms resistance of the PD-Series) and is normally supplied as part of an EDS-300 Simulator System.

Refer to Section III (EDS-250 OPERATION AND TEST METHODS) for test methods using the PD-Series of Discharge Units and Appendix C (PD/DD-SERIES DISCHARGE UNITS DESCRIPTION) Paragraph C-2.0 for

information on the PD-Series and Paragraph C-2.1.3 for information on the P-15I.

4.7 EDS-300 CONTROL MODULE REMOVAL

The Control Module is removed from the main frame assembly by sliding the unit off the two hinges which secures the module to the Vane Platform.

APPENDIX A
EDS-250/300 CONTROL MODULE
DESCRIPTION FRONT PANEL CONTROLS AND CONNECTORS

A-1.0 CONTROL FUNCTIONS

All controls for operating the EDS-250/300 Control Module are located on the front panel of the Control Unit. The location of each individual control and indicator is shown in Figure A.1 and described in the following paragraphs.

A-2.0 HIGH VOLTAGE CONTROL

The HV Control is used to adjust the output level of the discharge voltage. The discharge voltage range is determined by the Discharge Unit connected to the Control Unit.

A-2.1 DISCHARGE VOLTAGE MONITOR

A three digit LED Meter which indicates the peak discharge voltage level.

A-3.0 POWER SWITCH

Two position switch which controls the AC power to the Control Unit.

A-4.0 MODE CONTROL SWITCH

Two position switch which selects one of two modes of Discharge Unit operation: FREE RUNNING or STOP ON COUNT.

A-4.1 FREE RUNNING

In this position, the Discharge Unit will operate continuously after the RESET/START Switch is pushed twice. To halt the operation of the unit, the STOP Switch must be pushed.

A-4.2 STOP ON COUNT

In this position, the number of discharges is determined by the setting of the PULSE COUNT SELECTOR Switch. The Discharge Unit will be turned off when the PULSE COUNTER Display reaches the number of pulses set by the PULSE COUNT SELECTOR Switch.

A-5.0 PULSE COUNT SELECTOR SWITCH

A four-section thumb wheel switch which determines the number of discharges in the STOP ON COUNT position of the MODE Switch. The pulse count can be varied from 1 to 9999 discharges, with the Discharge Unit being turned off when the selected count is reached.

A-5.1 PULSE COUNTER DISPLAY

A four digit LED readout which records the number of trigger pulses sent to the PULSED Discharge Unit. The display is reset to zero (0000) when the RESET/START Switch is pushed and counts until the Discharge Unit stops pulsing. The count is cumulative from each RESET point up to a total of 9999 before starting over again from zero (0000).

A-6.0 RECHARGE (PULSE) RATE SWITCH

A four position switch which selects between a variable rate setting (1-10 Hz) plus one of three fixed trigger pulse rates (1 Hz, 10 Hz, 60 Hz) thus controlling the application of the high voltage to the Discharge Unit.

A-6.1 RECHARGE (PULSE) RATE CONTROL

In the VARIABLE position of the Recharge Rate Switch, the Recharge Rate Control is used to vary the pulse rate from 1 Hz (MIN) to 10 Hz (MAX).

NOTE: The 60 Hz fixed recharge rate position of the RECHARGE RATE Switch is only usable with EDS-300 Discharge Units (MP-3, P-7I). The PD/DD Series of Discharge Units used with the EDS-250 Simulator function reliably up to a recharge rate of approximately 10 Hz. Above this recharge rate, the PD/DD Discharge Units either will not function or function erratically.

A-7.0 TRIGGER SWITCH

Two position switch which selects between two modes of trigger operation: INTERNAL or EXTERNAL.

A-7.1 INTERNAL

In this position of the TRIGGER Switch, the Discharge Unit is pulsed from an internal trigger circuit with the pulse rate determined by the RECHARGE RATE Control setting.

A-7.2 EXTERNAL

In this position of the TRIGGER Switch, the Discharge Unit is pulsed from an external trigger source, with ground closure causing the pulse to occur. Since the internal trigger circuitry is disabled, the Discharge Unit will not operate without the external trigger.

NOTE: The external trigger source must be buffered to drive a 20 mA TTL level signal, not to exceed 5 V. The minimum time between trigger signals is 50 msec.

A-8.0 RESET/START SWITCH

A pushbutton switch which resets the PULSE COUNTER DISPLAY to zero (0000) and starts operation of the Discharge Unit in all modes. The sequence of operation using the RESET/START Switch is:

- a. Push the switch once; and the High Voltage is turned on.
- b. Push the switch a second time; and the Trigger circuit is activated.

A-9.0 SINGLE PULSE SWITCH

A pushbutton switch which provides the Discharge Unit with a single pulse mode capability.

A-10.0 STOP SWITCH

A pushbutton switch which turns off the high voltage to the Discharge Unit in all modes of operation.

A-11.0 FRONT PANEL CONNECTORS

A-11.1 POWER INPUT CONNECTOR

A combined power connector and AC line filter which connects the Control Module to the AC power source.

A-11.2 TRIGGER CONNECTORS

Two output connectors which supply the trigger pulse to the following Discharge Units:

- a. TWINAX CONNECTOR: Used for the trigger output to the MP-3 Discharge Unit.
- b. BNC CONNECTOR: Used for the trigger output to the P-7I Discharge Unit.

A-11.3 OUTPUT CONNECTOR

7-pin insulated connector which supplies the following:

- a. High Voltage output to all Discharge Units,
- b. Monitor line which supplies the low voltage reference to drive the DISCHARGE VOLTAGE MONITOR,
- c. Pulsed/DC select,
- d. Trigger enable to PD/DD series of Pulse Discharge Units,
- e. Trigger output to PD series of Pulse Discharge Units,
- f. Ground return to Discharge Units.

A-11.4 EXTERNAL TRIGGER CONNECTOR (BNC)

A BNC connector for the external trigger input when operating in the external trigger mode.

A-11.5 GROUND PLUG

Banana jack connector for the grounding strap from the CV-300 Vane Platform. This allows for a common ground return between the Vane Platform and the Control Module.

A-12.0 FIGURE A.1 CALLOUT NUMBER CODES

- (1) POWER INPUT CONNECTOR
- (2) HIGH VOLTAGE CONTROL
- (3) DISCHARGE VOLTAGE MONITOR
- (4) MODE CONTROL SWITCH
- (5) TRIGGER SWITCH
- (6) PULSE COUNT SELECTOR SWITCH
- (7) PULSE COUNTER DISPLAY
- (8) EXTERNAL TRIGGER INPUT
- (9) GROUND PLUG
- (10) RESET/START SWITCH
- (11) SINGLE PULSE SWITCH
- (12) STOP SWITCH
- (13) RECHARGE RATE SWITCH
- (14) RECHARGE RATE CONTROL
- (15) POWER SWITCH
- (16) FUSE
- (17) OUTPUT CONNECTOR
- (18) TRIGGER CONNECTORS
- (18-1) TWINAX
- (18-2) BNC

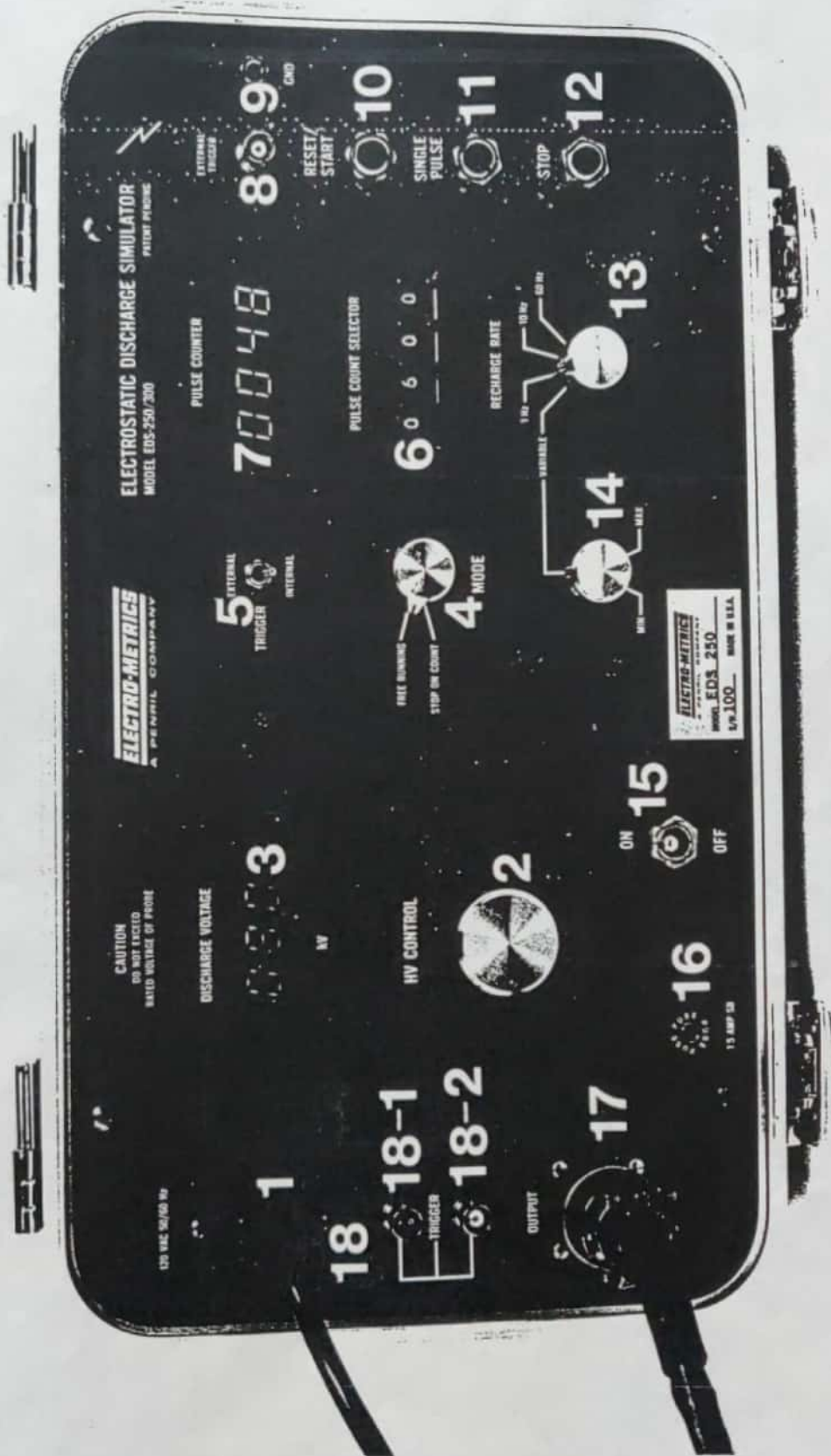


FIGURE A.1
FRONT PANEL EDS-250/300 CONTROL MODULE

(A-5)

APPENDIX B

EDS-300 SETUP/INSTALLATION

- NOTE: 1. Figures B.1 thru B.5 illustrate the basic arrangement, components, and setup of the EDS-300.
2. The only tool required to assemble or disassemble the EDS-300 is a standard screwdriver [203 mm (8") long with a 6.4 mm (1/4") wide tip].

B-1.0 EDS-300 SETUP AND ASSEMBLY INSTRUCTIONS

Figure B.1 shows the components which comprise the EDS-300 Electrostatic Discharge Simulator: Control Module, Vane Platform, Vane Assembly sections, Discharge Unit, and power cord.

Each vane section is a V-shaped piece of formed sheet metal with one edge, denoted by a rectangular extension, bent at an angle away from the V. The right hand section, as observed from the front of the simulator, contains five captive screws while the left hand section contains five captive retainers. Each vane section has areas of bare metal to provide electrical conductivity where each section must mount against each other or to the main frame brackets. In addition, bare metal strips are provided along the edges of each section for mounting the Pulser and Power Supply modules of the selected Discharge Unit.

Figure B.2 shows the EDS-300 assembled, setup, and ready for use by the operator.

B-2.0 CV-300 VANE ASSEMBLY

The vane assembly is assembled as follows:

- a. Each section is positioned on the brackets, oriented as follows:
 1. The rectangular extension at the rear of the vane platform, positioned to slide into a groove located on a rear panel insulator strip.
 2. The two V-shaped vane sections should form an X on the vane platform brackets. The captive screws in the right hand vane section should be opposite the captive retainers in the left hand vane section.
 3. The bare metal areas on the bottom of the vane sections against similar areas on the mounting brackets.
- b. Secure the two captive screws in each bracket into the captive retainers on the vane sections.
- c. Secure the five captive screws on the right hand vane section into the captive retainers on left hand vane section.

B-3.0 DISCHARGE UNIT SETUP

Mount the Pulser and Power Supply Modules of the Discharge Unit selected, MP-3 or P-7I, as shown in Figure B.2. The Pulser

module is always mounted to either the left or right hand rear sections of the vane assembly and can be positioned anywhere on the bare metal strip depending on the type of testing to be performed. The mounting bracket on the Pulser Module can be fastened to any one of three sides of the module case in either a left or right handed position. The Power Supply module is normally mounted, as shown in Figure B.2, to the left hand front section of the vane assembly. The mounting bracket on the Power Supply Module is limited to one side of the module case though it can be positioned either left or right handed. It is usually positioned high enough up the bare metal strip to be out of the way of the operator. However, since the probe case is electrically "hot" when the Simulator is on, do not touch or allow the probe to touch any part of the test setup except the equipment under test. Ground the setup according to the test being performed.

Remove the cover from the Control Module by unlocking the clasps, lifting up the cover and sliding it off the hinge pins. The Control Module is connected to the main frame assembly by sliding the unit onto the two hinges which secure the module to the Vane Platform.

Connect the cables from the Discharge Unit modules to the Control Unit as follows:

NOTE: All cables are marked for easy identification.

- a. Connect the Trigger Cable from the Pulser Module to the Trigger Output of the Control Module.

NOTE: There are two trigger output connectors:

1. **TWINAX:** Used for the trigger output to the MP-3 Discharge Unit.
2. **BNC:** Used for the trigger output to the P-7I Discharge Unit.

- b. Connect the Multi-conductor Cable of the Power Supply Module to the OUTPUT Connector on the Control Module.

Remove the short ground strap from the holding clip on the top-right-front of the Vane Platform and insert it into the ground plug on the right side of the Control Module. Connect the power cord to the Control Unit, the Simulator is ready for operation. Refer to Section IV for complete operating instructions.

Figures B.3 and B.4 show the two methods of mounting the Pulser Module to the rear of the vane assembly depending on the test method selected. Figure B.3 shows the the Pulser Module mounted to the vane section when the Current Injection Mode of Testing is selected. Figure B.4 shows the Pulser Module mounted with its resistor tip against the movable grounding bracket on the rear of the vane platform. This configuration is used when the E-Field Test Mode of Operation is selected. Refer to Section 4.5 for a complete explanation of these respective test modes.

Figure B.5 shows the arrangement of the MP-3 and P-7I Discharge Unit Pulser and Power Supply Modules.

***** NOTE *****

THE FOLLOWING FIGURES, B.1 THRU B.5, SHOWN AN
EARLIER SYTLE OF EDS-300 CONTROL MODULE AND
DISCHARGE UNITS. THE POWER SUPPLY MODULE HAS A
SINGLE MULTI-CONNECTOR CABLE, NOT TWO AS SHOWN.
EXCEPT FOR THIS DISCREPANCY, THE FIGURES
ACCURATELY REFLECT THE ARRANGEMENT OF THE
EDS-300.

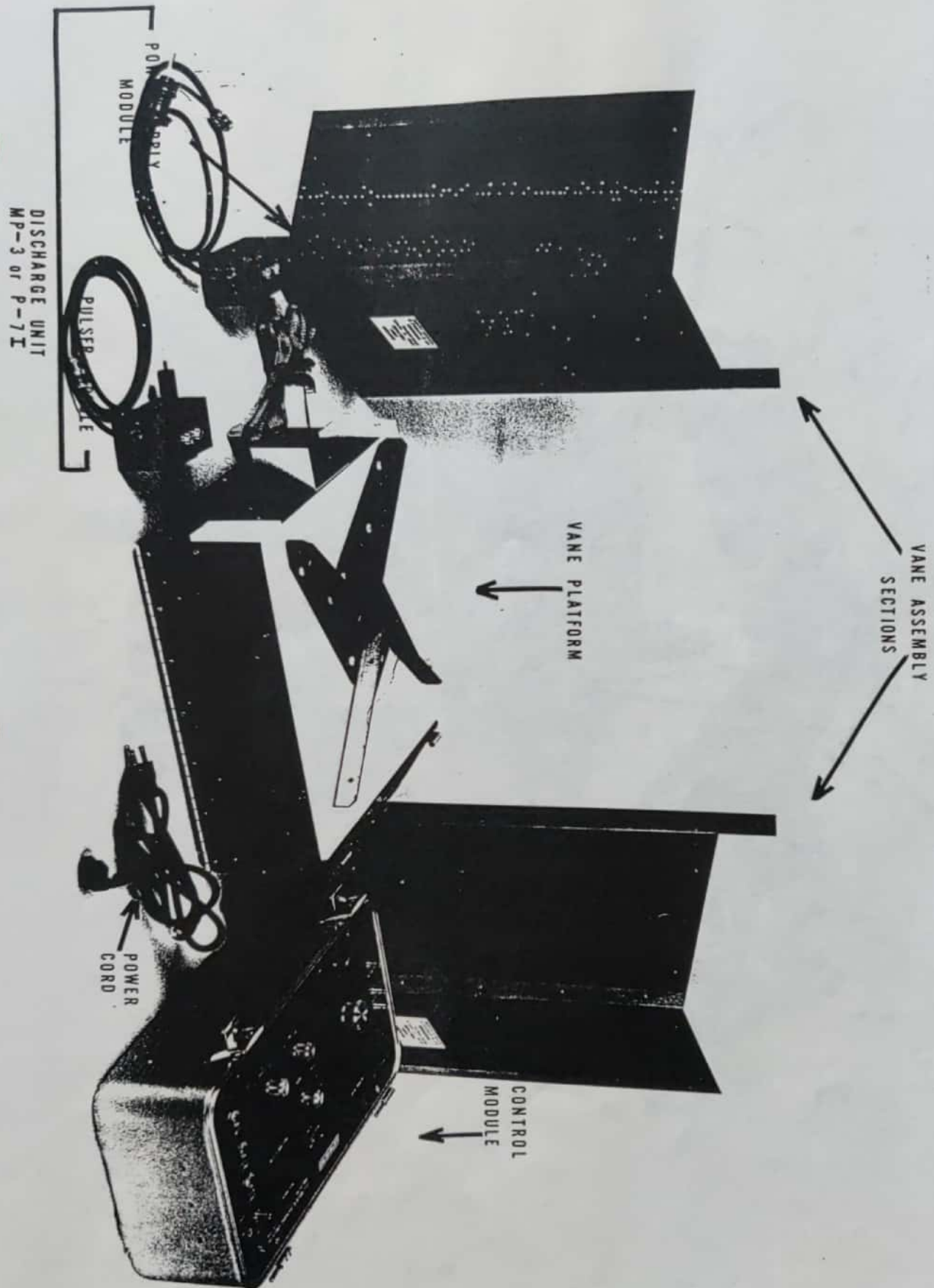


FIGURE B.1
EDS-300 MAJOR COMPONENTS

(B-3)

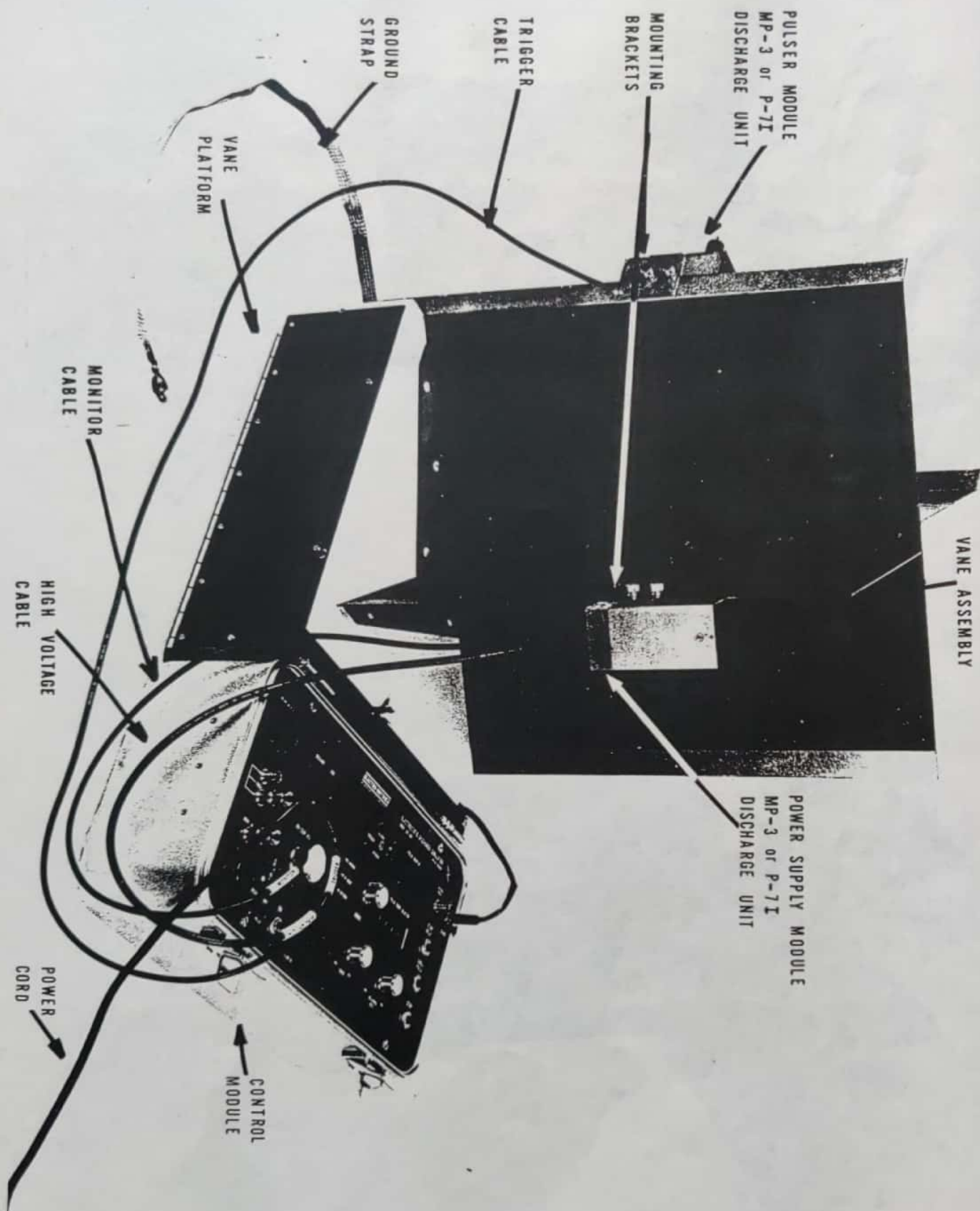


FIGURE B.2
EDS-300 ASSEMBLED FOR OPERATION

(B-4)

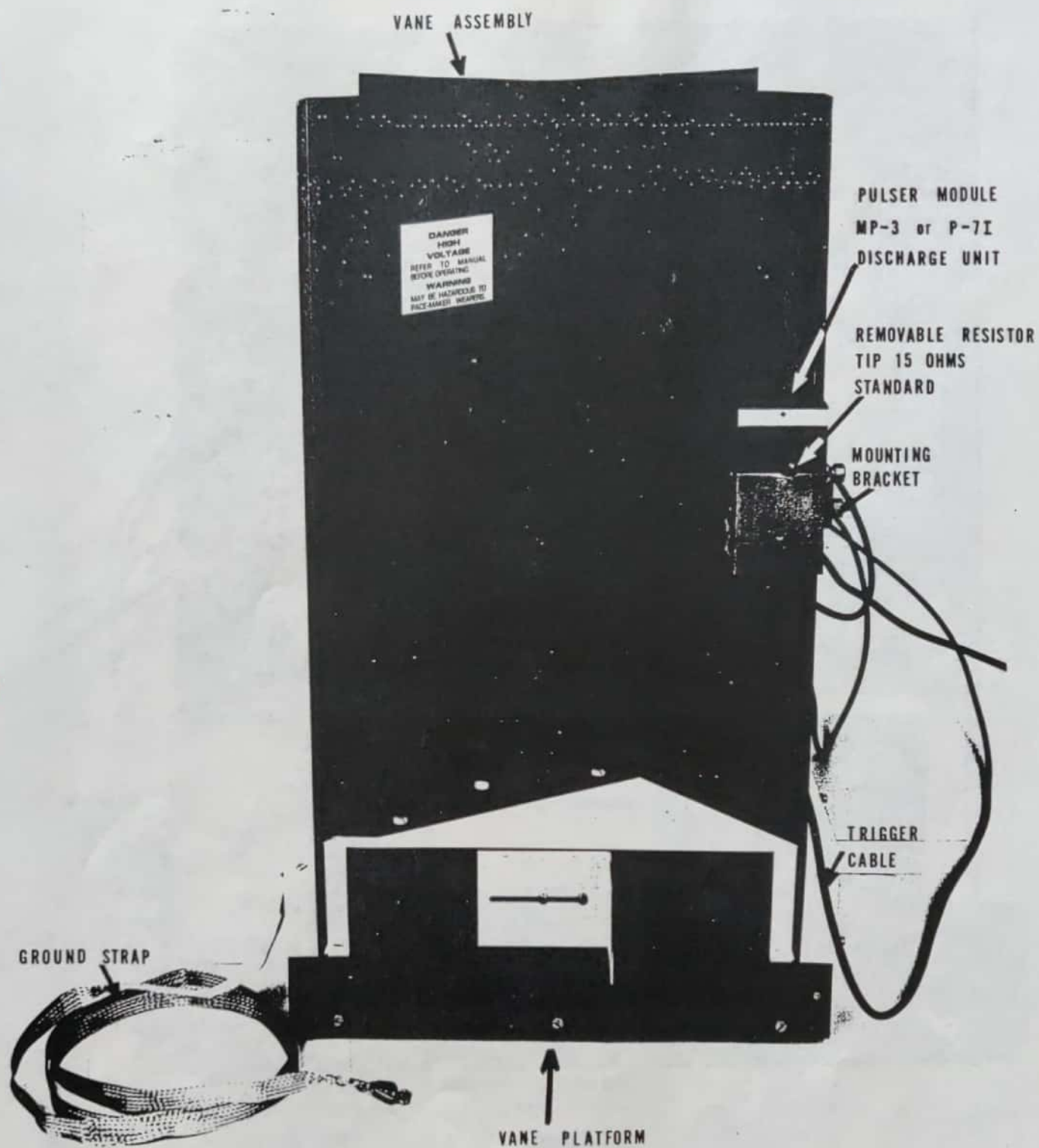


FIGURE B.3
EDS-300 REAR VIEW: CURRENT INJECTION MODE OF OPERATION

(B-5)

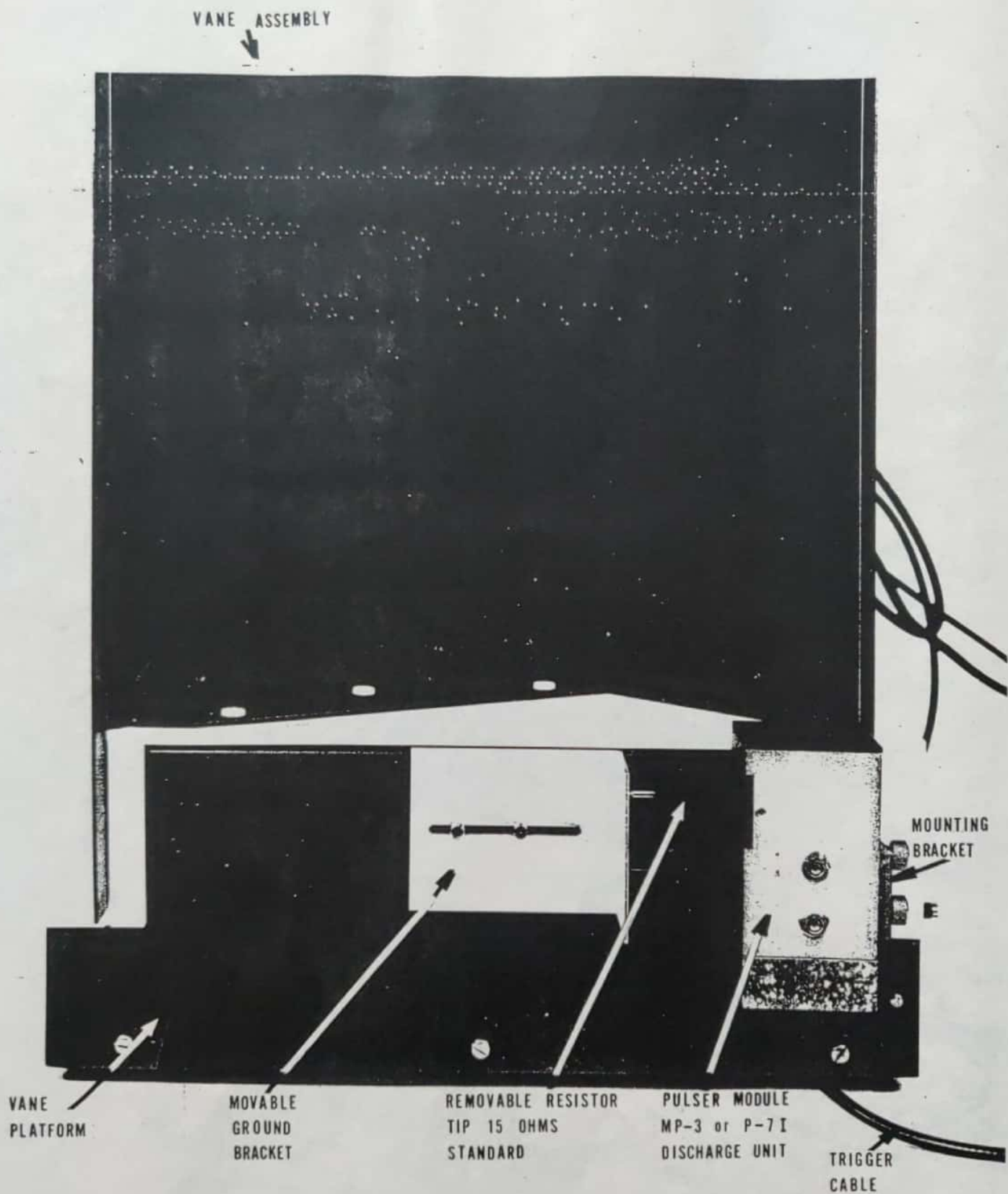


FIGURE B.4
EDS-300 REAR VIEW: E-FIELD TEST MODE OF OPERATION

(B-6)

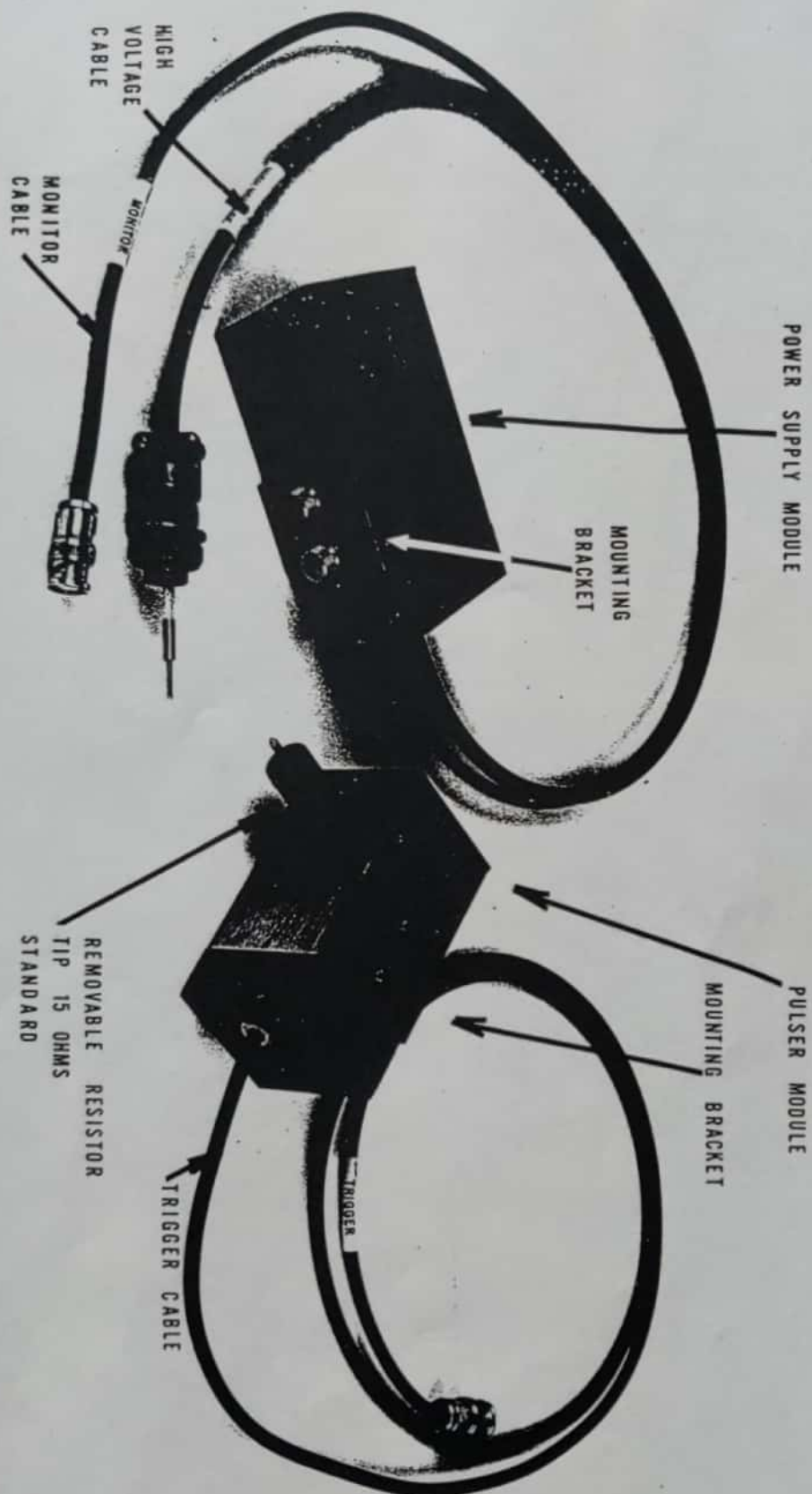


FIGURE B.5
MP-3 OR P-7I DISCHARGE UNIT CONFIGURATION

(B-7)

APPENDIX C PD/DD-SERIES DISCHARGE UNIT DESCRIPTION

C-1.0 INTRODUCTION

The following section describes the PD and DD Series of Discharge Units used with the EDS-250/300 ELECTROSTATIC DISCHARGE SIMULATORS.

C-2.0 PD SERIES PULSE DISCHARGE UNITS

(Refer to Figures C.1 thru C.3)

The PD Series of Pulse Discharge Units comprises the Model PD-5-250, Model PD-8-250, and Model PD-25-250. A Model P-15I Discharge Unit is also available which is identical in configuration to the PD series but has a lower resistance and is normally supplied as part of an EDS-300 simulator system.

In addition, higher voltage model discharge units for special applications are available on request.

C-2.1 SPECIFICATIONS

C-2.1.1 GENERAL

- a. Output Resistance: Operator selectable, 150 ohms standard (Other resistance values available on request).
- b. Capacitance: 150 pF (Other capacitance values available on request).
- c. Output Voltage Polarity: Switchable between plus and minus.
- d. Connection to Control Module: Multi-conductor cable, 7-pin HV connector.
- e. Case: Tubular metal shell, electrically grounded, with plastic handle containing the trigger switch.

C-2.1.2 SPECIFIC

- a. MODEL PD-5-250: Voltage Range: 0.5-5.0 kV
Type: Pulse
- b. MODEL PD-8-250: Voltage Range: 1.5-8.0 kV
Type: Pulse
- c. MODEL PD-25-250: Voltage Range: 7-25 kV
Type: Pulse

C-2.1.3 SPECIAL

MODEL P-15I: PD SERIES CONFIGURATION, CAN BE USED WITH EITHER AN EDS-250 OR EDS-300. NORMALLY SUPPLIED AS PART OF A COMPLETE EDS-300 DISCHARGE SIMULATOR SYSTEM.

- a. Voltage Range: 0.8 to 15 kV.
- b. Type: Pulse.

- c. Output Resistance: Operator selectable, 15 ohms standard (Other resistance values available on request).
- d. Capacitance: 150 pF
- e. Case: Identical to DD and PD series used with EDS-250.
- f. Connection to Control Module: Multi-conductor cable, 7-pin HV connector.

C-2.2 PD CONFIGURATION

The PD Pulse Discharge Unit configuration is a tubular metal shell, electrically grounded, with plastic handle containing the trigger switch. The case is composed of two sections:

- a. Main section containing the voltage multiplier circuitry and the handle,
- b. Removable front section for switching the polarity of the output voltage.

In addition, a removable resistor tip, 150 ohms standard, plugs into the front section of the Discharge Unit.

C-2.3 CHANGING POLARITY PD-5-250, PD-8-250, PD-25-250

The polarity of the output voltage at the tip of the Discharge Unit (DU) can be switched between plus and minus with reference to ground.

***** CAUTION *****

ALWAYS TURN OFF THE CONTROL MODULE BEFORE CHANGING THE POLARITY.

To change the polarity:

- a. With the tip of the DU pointing away, rotate the outer sleeve of the front section clockwise.
- b. Pull the front section out of the main section and rotate one half turn.
- c. Push the front section back into the main section.

NOTE: A slight rocking motion may be required to align the connectors.

- d. Rotate the outer sleeve of the front section counter-clockwise to engage lock.
- e. The new polarity is now shown on the top of the front section.

THE ABOVE PROCEDURE ALSO APPLIES TO CHANGING THE POLARITY ON THE P-15I DISCHARGE UNIT.

C-2.4 PD DISCHARGE UNIT TRIGGER SWITCH OPERATION

- a. The TRIGGER Switch on the handle of the PD Discharge Unit

is a three position rocker switch which functions in the following manner:

1. TOP position: Pushed "IN", PERMANENTLY ON. In this position, the voltage on the tip is controlled by the Control Module settings.
2. MIDDLE position: "CENTERED", OFF.
3. BOTTOM position: "MOMENTARY ON". In this position, the switch functions in the same manner as the SINGLE PULSE Switch on the Control Module.

C-2.5 PD DISCHARGE UNIT OPERATION

- a. Connect the Discharge Unit selected to the Control Module.
- b. Set the Control Module controls as required for the test being performed.

***** CAUTION *****

(1) NEVER CONNECT OR DISCONNECT A DISCHARGE UNIT WITH THE CONTROL MODULE TURNED "ON". THIS WILL DAMAGE THE CONTROL UNIT CIRCUITRY. ALWAYS TURN THE CONTROL MODULE "OFF" BEFORE PERFORMING THIS OPERATION.

(2) DO NOT OPERATE THE DISCHARGE UNITS ABOVE THE VOLTAGE RATINGS INDICATED FOR EACH UNIT AS THIS COULD DAMAGE THE DISCHARGE UNIT. BELOW THE MINIMUM VOLTAGE RATING INDICATED, THE DISCHARGE UNIT WILL NOT OPERATE RELIABLY.

- c. Setup the Control Module front panel controls for the test required.
- d. Set the Discharge Unit TRIGGER Switch to the mode of operation required by the test being performed.

NOTE: The "MOMENTARY ON" position is useful for hand-held operation and testing, while the "PERMANENTLY ON" position is suitable for tests where the Discharge Unit must remain stationary, e.g. mounted on a tripod, etc.

- e. Refer to Section III for EDS-250 operation and test methods.

C-3.0 DD SERIES DC DISCHARGE UNITS

(Refer to Figures C.4 thru C.6)

The DD Series of DC Discharge Units comprises the Model DD-25-250. In addition, higher voltage model discharge units for special applications are available on request.

C-3.1 SPECIFICATIONS

C-3.1.1 GENERAL

- a. Output Resistance: Operator selectable, 150 ohms standard (Other resistance values available on request).
- b. Capacitance: Operator selectable, 150 pF module standard (Other capacitance values available on request).
- c. Output Voltage Polarity: Switchable between plus and minus.
- d. Connection to Control Module: Multi-conductor cable, 7-pin HV connector.
- e. Case: Tubular metal shell, electrically grounded, with plastic handle containing the trigger switch.

C-3.1.2 SPECIFIC

- a. MODEL DD-25-250: Voltage Range: 1-25 kV
Type: DC

C-3.2 DD CONFIGURATION

The DD (DC) Discharge Unit configuration is a tubular metal shell, electrically grounded, with plastic handle containing the trigger switch. The case is composed of three sections:

- a. Front section is the removable capacitance module,
- b. Middle section containing the voltage monitoring circuitry and the handle,
- c. Removable rear section containing the voltage multiplier circuitry and for switching the polarity of the output voltage.

In addition, a removable resistor tip, 150 ohms standard, plugs into the front section of the Discharge Unit.

C-3.3 CHANGING POLARITY DD-25-250

The polarity of the output voltage at the tip of the Discharge Unit (DU) can be switched between plus and minus with reference to ground.

***** CAUTION *****

ALWAYS TURN OFF THE CONTROL MODULE AND GROUND THE TIP OF THE DD DISCHARGE UNIT BEFORE CHANGING THE POLARITY.

To change the polarity:

- a. With the tip of the DU pointing away, rotate the outer sleeve of the rear section counterclockwise.
- b. Pull the rear section out of the middle section and rotate one half turn.

- c. Push the rear section back into the middle section.

NOTE: A slight rocking motion may be required to align the connectors.

- d. Rotate the outer sleeve of the rear section clockwise to engage lock.
- e. The polarity is shown on the rear plate with the marking at the top of plate designating the polarity in effect.

C-3.4 CHANGING CAPACITANCE MODULE DD-25-250

The front capacitance module of the Discharge Unit (DU) can be replaced by one with a different value of capacitance.

To change the capacitance module:

- a. With the tip of the DU pointing away, rotate the outer sleeve of the front capacitance module clockwise.
- b. Pull the capacitance module out and away from the middle section.
- c. Insert the new capacitance module into the middle section.

NOTE: 1. The capacitance module can only be inserted into the middle section one way. DO NOT ROTATE THE MODULE, IT WILL NOT FIT.

2. A slight rocking motion may be required to align the connectors.

- d. Rotate the outer sleeve of the capacitance module counterclockwise to engage lock.

C-3.5 DD DISCHARGE UNIT TRIGGER SWITCH OPERATION

- a. The TRIGGER Switch on the handle of the DD Discharge Unit is a three position rocker switch which functions in the following manner:

- 1. TOP position: Pushed "IN", PERMANENTLY ON. In this position, the voltage on the tip is controlled by the Control Module settings.
- 2. MIDDLE position: "CENTERED", OFF.
- 3. BOTTOM position: "MOMENTARY ON". In this position, the switch functions in the same manner as the SINGLE PULSE Switch on the Control Module.

C-3.6 DD DISCHARGE UNIT OPERATION

- a. Connect the Discharge Unit selected to the Control Module.
- b. Set the Control Module controls as required for the test being performed.

***** CAUTION *****

(1) NEVER CONNECT OR DISCONNECT A DISCHARGE UNIT

(C-5)

WITH THE CONTROL MODULE TURNED "ON". THIS WILL DAMAGE THE CONTROL UNIT CIRCUITRY. ALWAYS TURN THE CONTROL MODULE "OFF" BEFORE PERFORMING THIS OPERATION.

(2) DO NOT OPERATE THE DISCHARGE UNITS ABOVE THE VOLTAGE RATINGS INDICATED FOR EACH UNIT AS THIS COULD DAMAGE THE DISCHARGE UNIT. BELOW THE MINIMUM VOLTAGE RATING INDICATED, THE DISCHARGE UNIT WILL NOT OPERATE RELIABLY.

- c. Setup the Control Module front panel controls for the test required.
- d. Set the Discharge Unit TRIGGER Switch to the mode of operation required by the test being performed.

NOTE: The "MOMENTARY ON" position is useful for hand-held operation and testing, while the "PERMANENTLY ON" position is suitable for tests where the Discharge Unit must remain stationary, e.g. mounted on a tripod, etc.

- e. Refer to Section III for EDS-250 operation and test methods.

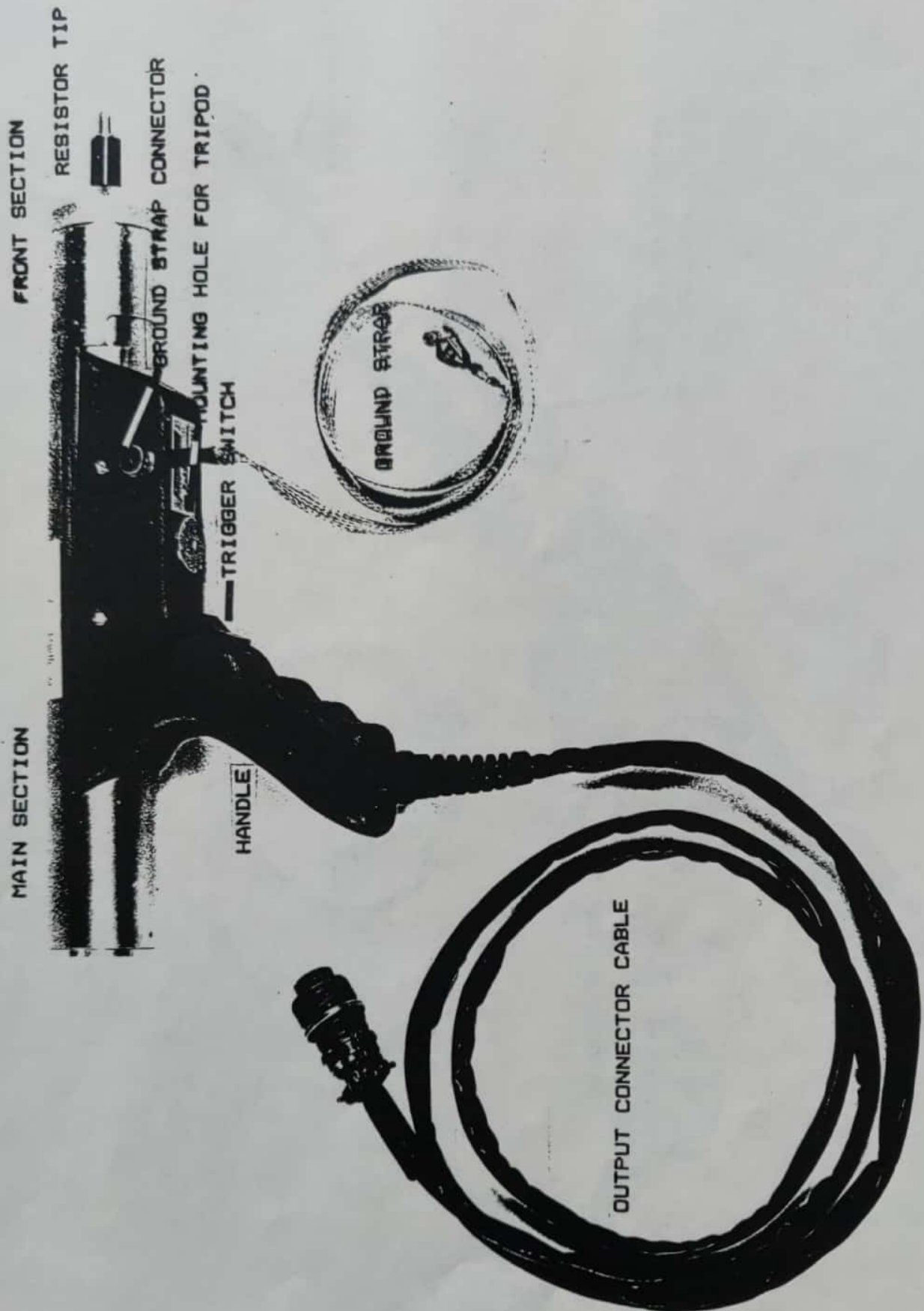


FIGURE C.1
PD-SERIES DISCHARGE UNIT

(C-7)



FIGURE C.2
PD-SERIES DISCHARGE UNIT SUB-COMPONENT BREAKDOWN

(C-8)



FIGURE C.3
PD-SERIES DISCHARGE UNIT CLOSEUP FRONT SECTION

(C-9)

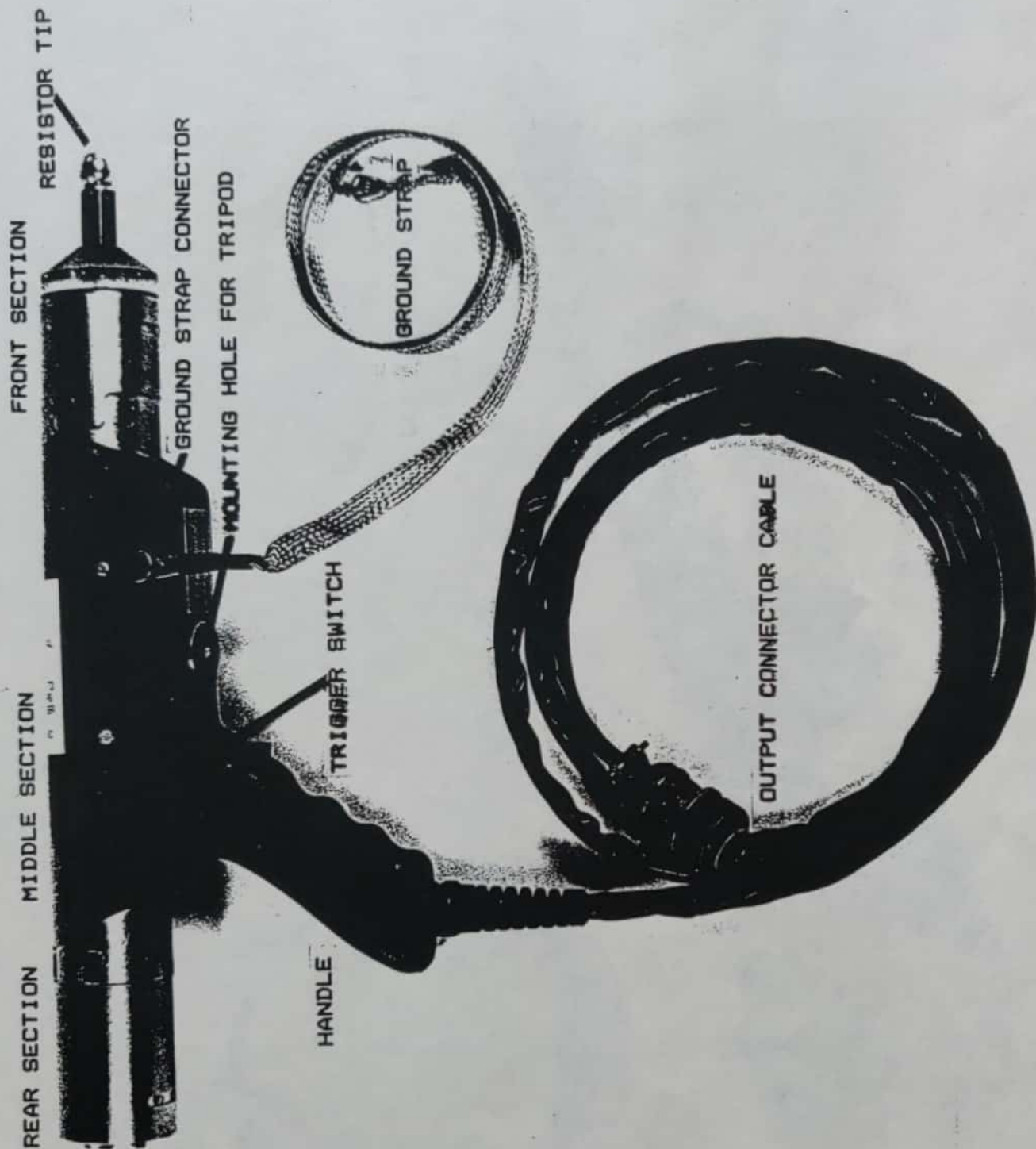


FIGURE C.4
DD-SERIES DISCHARGE UNIT

(C-10)

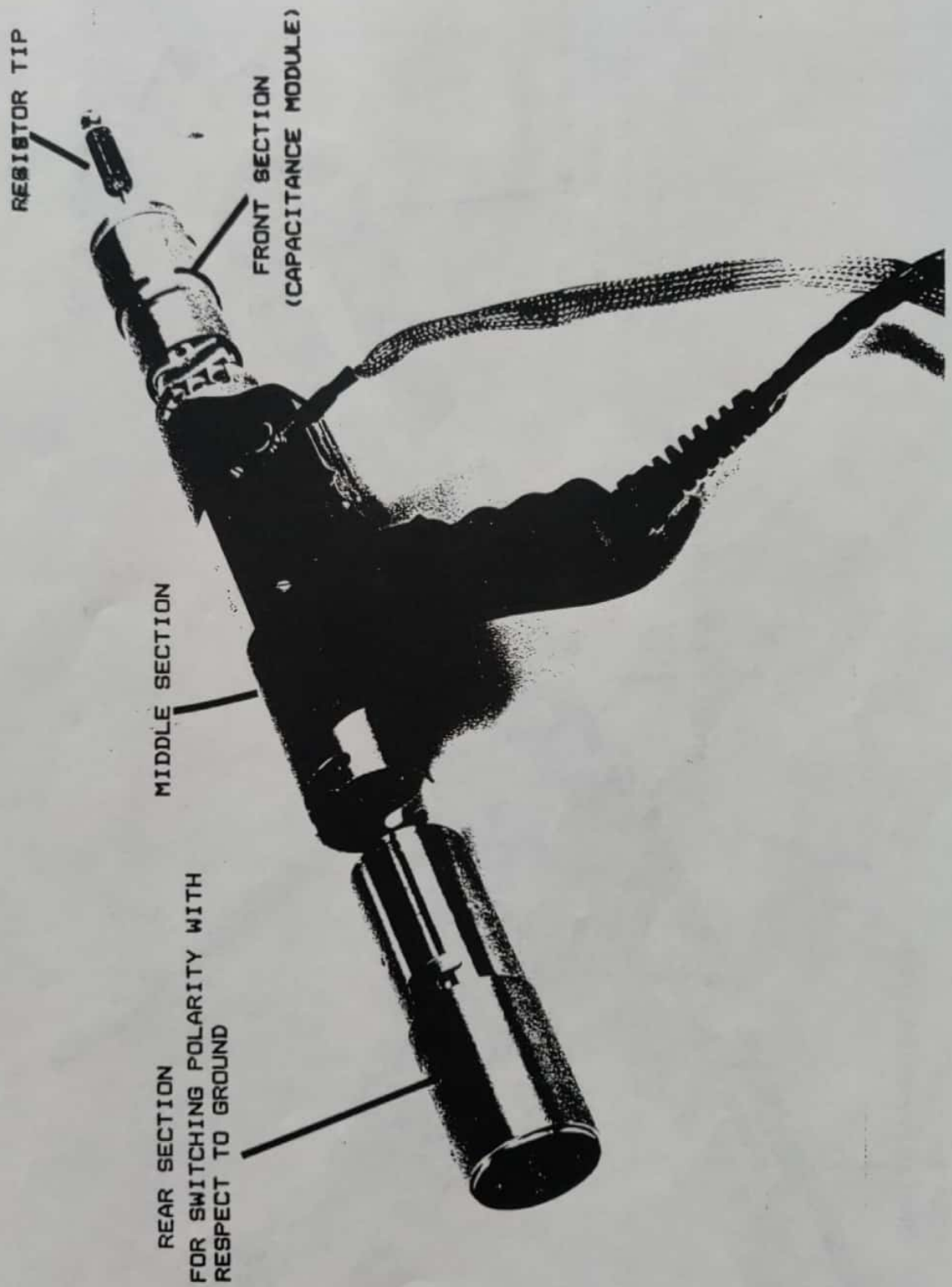


FIGURE C.5
DD-SERIES DISCHARGE UNIT SUB-COMPONENT BREAKDOWN #1

(C-11)

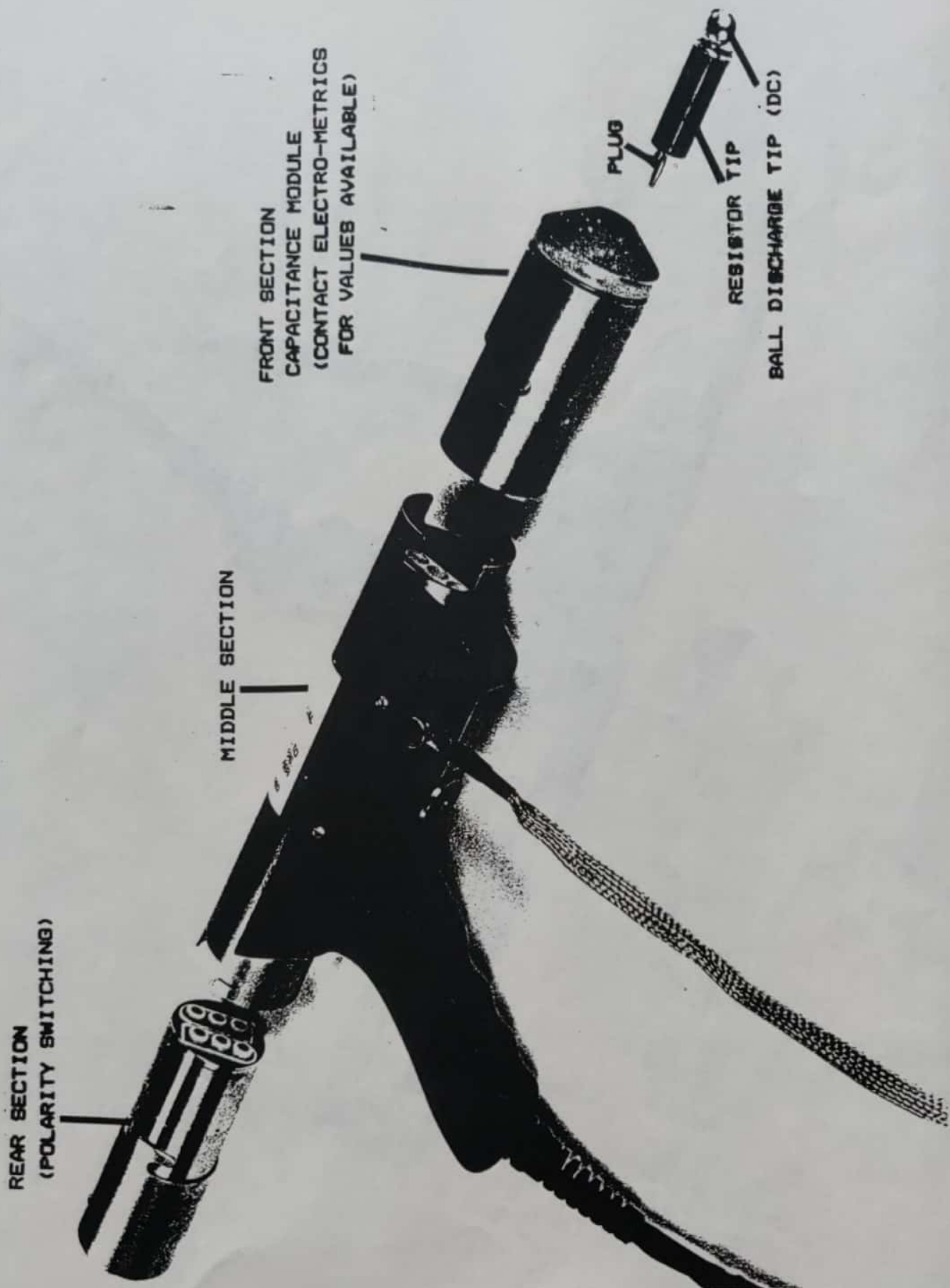


FIGURE C.6
DD-SERIES DISCHARGE UNIT SUB-COMPONENT BREAKDOWN #2

(C-12)

APPENDIX D OPERATIONAL/FUNCTIONAL DESCRIPTION OF CONTROL MODULE CIRCUITRY

D-1.0 INTRODUCTION

The following section describes the major circuitry of the EDS-250/300 ELECTROSTATIC DISCHARGE SIMULATOR CONTROL MODULE and provides a brief description of unit and circuitry function.

D-2.0 POWER SUPPLY OPERATION

(Refer to Figure F.3 and F.4)

The Power Supply Board (A1A3) provides two regulated, +5 VDC and -5 VDC, and one unregulated, +58 VDC, DC supply voltages for use by the unit.

Diode Bridge CR4, operating off one winding of input transformer A1A3T1, produces the +13.5 VDC raw voltage used by transistor Q1 to produce the regulated +5 VDC. The +5 VDC is applied to the Logic Board (A1A2) for use by the IC circuitry. The -5 VDC is produced by Zener Diode CR5 and Pass Transistor Q2 operating off the same +13.5 VDC raw voltage line. The -5 VDC is used only by the Sample and Hold Board (A1A1A1) within the Panel Meter circuitry. The unregulated +58 VDC voltage is produced by Diode Bridge CR3 operating off a second winding of input transformer A1A3T1 and is used in the trigger circuit for pulse type discharge units. In addition, a solid state relay which enables the high voltage, is also located on the power supply board.

D-3.0 HIGH VOLTAGE CIRCUITRY

(Refer to Figure F.3)

The High Voltage circuitry comprises a variable transformer, operating off the AC line voltage, driving a high voltage step-up transformer. The input to the variable transformer is enabled by a solid state relay which is located on the Power Supply Board (A1A3). This combination allows the high voltage transformer to produce an output voltage varying from 0 to 5300 VRMS. Further rectification and multiplication of this voltage is achieved in the discharge unit.

D-4.0 PANEL METER CIRCUITRY

(Refer to Figure F.3)

The Panel Meter circuitry for the EDS-250/300 comprises a 3 digit LED DC voltmeter, voltmeter drive circuit, and a sample and hold circuit.

The sample and hold circuit enables the DC voltmeter to accurately monitor the voltage of pulsed discharge units. The sample and hold circuit "samples" the voltage prior to discharge and "holds" it from this time to the time at which the voltage

recharges. The sample pulse comes from U29-11 on the Logic Board (A1A2). Two potentiometers, located on the rear of the Panel Meter module, are used for calibration of the voltmeter. A1A1A1-R5 is used for zero adjust and A1A1A1-R1 for voltage calibration.

D-5.0 LOGIC BOARD CIRCUITRY

(Refer to Figure F.1)

The Logic Board (A1A2) is divided into two sections to operate both the PULSED and DC type discharge units. The Discharge Unit connected to the Control Module automatically selects the control logic required, PULSED or DC.

The PULSED section consists of an astable multivibrator (U19), which generates the trigger pulse required for PULSED type discharge units. This trigger is gated so that one of two modes of operation may be selected; FREE RUNNING or STOP ON COUNT. The front panel MODE Switch is used to select mode of operation required. The gated trigger is then applied to a one-shot multivibrator (U23) which supplies the pulse used to drive the PULSED type discharge units and to enable the pulse counter circuit (U4-6, U25).

In the FREE RUNNING Mode; U17-5 is continually held low to allow the trigger pulse, from U19-3, to be applied to the one-shot multivibrator (U23). This mode of operation will continue until the front panel STOP Switch is pushed.

The STOP ON COUNT MODE is used when a specified number of discharges is desired. The circuitry compares the preselected setting on the pulse count selector switch registers with the number of pulses registered by the pulse counter circuit (U4-6, 25). When these two values are equal, the comparators (U8-10, 27) send a signal to an R-S flip-flop (U16), which disables the trigger circuit.

The SINGLE PULSE function allows the user to trigger a pulsed discharge unit manually. Each time the single pulse button is pressed, a negative leading edge triggers a one-shot multivibrator (U20) whose output signal is gated to U23.

The RESET/START function is gated to an R-S flip-flop (U16). The first time the RESET/START Switch is pushed; U16 enables the high voltage, resets the counter circuit to zero, and resets another flip-flop (U16). The second time the RESET/START Switch is pushed, U16 enables U19 to operate the trigger circuit for one of the two modes of unit operation.

An INTERNAL/EXTERNAL Switch is provided in case a mode other than the two listed above is desired. The EXTERNAL TRIGGER JACK will accept a pulse signal up to +15 V which will enable a trigger pulse on the positive leading edge of the external pulse signal.

The DC section of the Logic Board contains a one-shot multivibrator (U18) which is used to disable the high voltage after a discharge has taken place. The high voltage is initially enabled by pressing the RESET/START Switch. Once a discharge has taken place, U18 is activated by the signal feeding back from the monitor line. When this happens, the output of U18 changes logic levels to disable the high voltage from the discharge unit. U18

resets when the time constant, determined by C37 and P2, is achieved. The output of U18 then changes states and enables the high voltage. This operation will continue until the following occurs:

- a. FREE RUNNING MODE; STOP Switch is pushed or Discharge Unit trigger opened
- b. STOP ON COUNT; count limit is reached.

APPENDIX E ACCESSORY DATA

E-1.0 INTRODUCTION

This section contains information and data on accessory items which are available for use with the EDS-250/300 ELECTROSTATIC DISCHARGE SIMULATOR SYSTEMS.

E-2.0 ANTENNAS

- a. EF-1000 "E" FIELD DISCHARGE PLATES
203 mm (8-inch) and 305 mm (12-inch) square plates for use in radiating an electric field during EMI EXPOSURE TESTING.
- b. ML-1000 "H" FIELD DISCHARGE LOOPS
102 mm (4-inch) and 171.5 mm (6.75-inch) loops for use in radiating a magnetic field during EMI EXPOSURE TESTING.

E-3.0 IMM-30 WAVEFORM MONITOR

(IEC TYPE RESISTIVE LOAD CURRENT MONITOR)

The IMM-30 Current Monitor is designed to monitor the current waveform produced by the discharge units used with the ELECTRO-METRICS MODEL EDS-250/300 ELECTROSTATIC DISCHARGE SIMULATOR. An oscilloscope with a minimum bandwidth of 100 MHz and an input impedance of 50-ohms is required to display the waveform data obtained by the monitor, whose output connector is a BNC FEMALE.

To use the IMM-30 Current Monitor:

a. PULSED DISCHARGED UNITS

1. Connect the monitor to the oscilloscope using a coaxial cable. Refer to Page E-2 for oscilloscope specifications and settings.

***** CAUTION *****

Depending on the voltage limit of the Discharge Unit used and the Control Module voltage setting, the voltage output of the monitor may be several hundred volts. To prevent possible damage to the oscilloscope being used, it is recommended that an attenuator with a rating of 5 W be connected in series with the input of the oscilloscope.

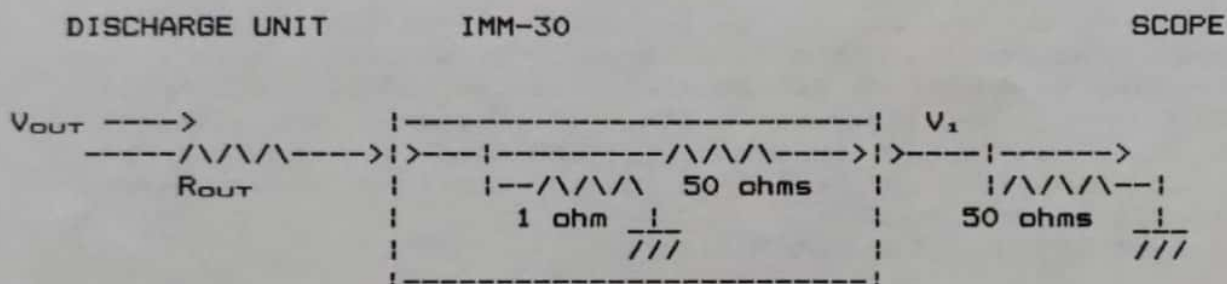
2. Connect the ground strap provided with the monitor to the case of the discharge unit.
3. Place the tip of the pulsed discharge unit selected in direct contact with the ball tip in the center of the flat circular plate on the monitor. If necessary, the ball can be unscrewed from the monitor.
4. A waveform will appear on the oscilloscope display, when the discharge unit is operating and pulsing, equivalent to the current waveform produced by the discharge unit.

NOTE: Depending on the beam intensity of the oscilloscope selected, a single shot event may or may not be easily seen. In such a case, a storage oscilloscope may be required.

b. DC DISCHARGE UNITS

1. Same as Step a-1.
2. Same as Step a-2.
3. With the DC discharge unit selected, turned on, and operating, move the tip towards the ball tip of the monitor. At some given distance from the monitor, depending on the voltage level selected and environmental conditions, a discharge will occur from the tip to the monitor.
4. A waveform will appear on the oscilloscope display equivalent to the current waveform produced by the DC discharge unit.

An equivalent circuit corresponding to the discharge unit, IMM-30 Monitor, and oscilloscope is shown below:



$$V_{OUT} = 2V_1(R_{OUT}+1), \quad I_{OUT} = 2V_1$$

E-3.1 OSCILLOSCOPE SPECIFICATIONS AND SETTINGS

As noted on Page E-1, an oscilloscope with a minimum bandwidth of 100 MHz and an input impedance of 50-ohms is required to display the waveform obtained by the monitor. In general, the wider the bandwidth of an oscilloscope, the faster its response time. For this application note, we shall define an oscilloscope with a bandwidth equal to or less than 200 MHz as "slow" and with a bandwidth greater than 200 MHz as "fast".

If a "slow" oscilloscope is used as the monitor display, the waveform will be relatively "clean" but there will be a loss of amplitude level. This is due to the inability of the oscilloscope to respond to a fast rising waveform.

If a "fast" oscilloscope is used as the monitor display, the waveform will have less amplitude loss than the "slow" oscilloscope, but may have ringing and spiking due to impedance mismatching and inductive losses in the system.

E-3.2 OSCILLOSCOPE SETTINGS

E-3.2.1 TIME BASE SETTINGS

In order to observe at least 5 time constants, the time base must be set as follows:

SERIES RESISTANCE @ 150 pF	WAVEFORM DURATION (5 Time-Constants)	SUGGESTED TIME BASE SETTING
150 ohms	112 ns	20 ns/div
500 ohms	375 ns	50 ns/div
1000 ohms	750 ns	100 ns/div

E-3.2.2 AMPLITUDE SETTINGS:

In order to observe the correct amplitude indication, set the amplitude as follows:

SERIES RESISTANCE @ 150 pF	AMPLITUDE V_1 @ $V_{OUT} = 10$ kV	AMPLITUDE LEVEL PER DIVISION SETTING
150 ohms	33.3 V	5 V/div
500 ohms	20.0 V	5 V/div
1000 ohms	10.0 V	2 V/div

E-4.0 ADDITIONAL ACCESSORIES

- a. RESISTOR ADD-ON-TIPS
Contact Electro-Metrics for information on obtaining the resistor values required. Standard resistor value is 150 ohms with standard capacitance value of 150 pF for PD-SERIES Discharge Units.
- b. CAPACITANCE DISCHARGE MODULE FOR DD-SERIES DISCHARGE UNITS
Contact Electro-Metrics for information on obtaining the capacitance values required. Standard capacitance value of 150 pF for DD-SERIES Discharge Units.
- c. TRP-200 TRIPOD
To mount probe on during EMI EXPOSURE and similar testing.
- d. G-200 GROUND PROBE WITH STRAP (IEC)
186 mm (7.3") length probe with ball tip and 1.2 m (4') grounding strap which meet the test setup requirements stated in IEC Publication 801-2.
- e. TC-250/300 EQUIPMENT CARRYING CASE
Carrying case for storing the Discharge Units and other accessories for the EDS-250/300.

APPENDIX F SCHEMATICS

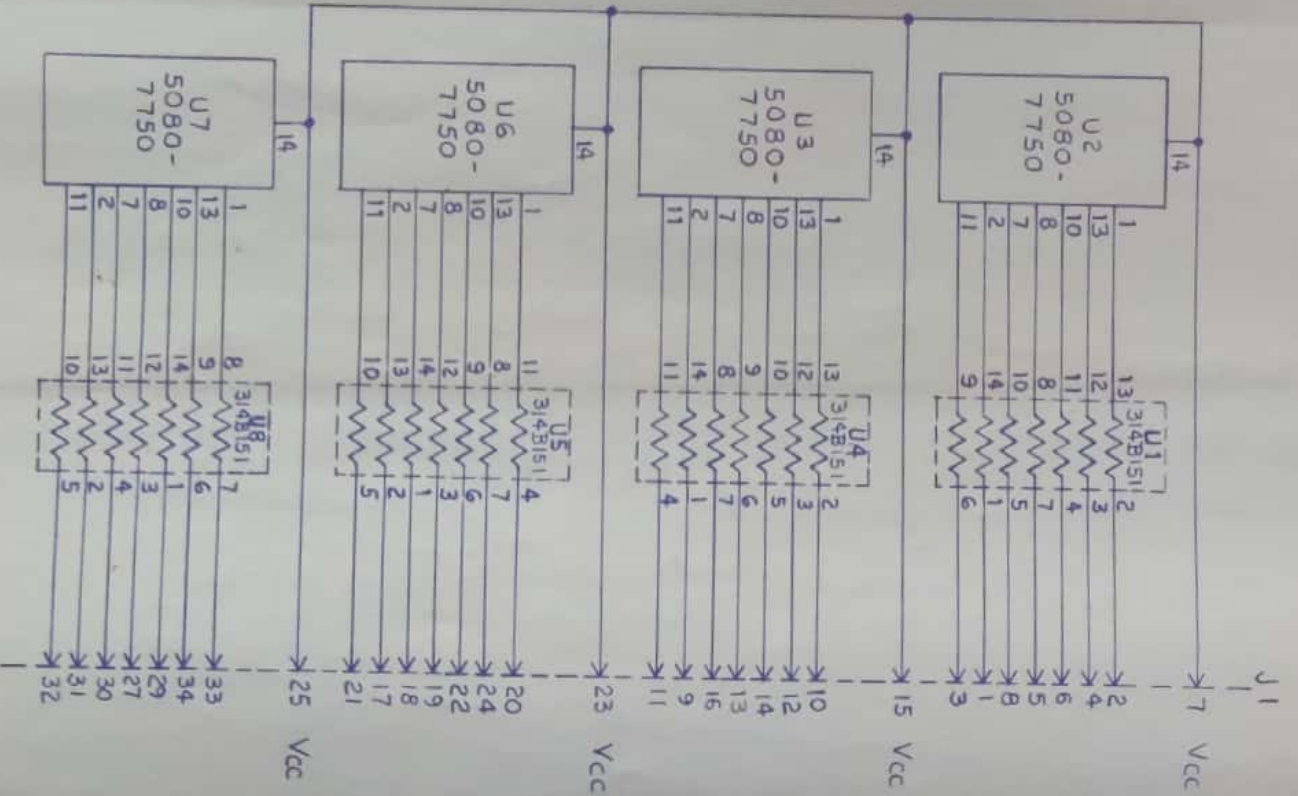
F-1.0 GENERAL

This section contains the schematics for the EDS-250/300
ELECTROSTATIC DISCHARGE SIMULATOR CONTROL MODULE.

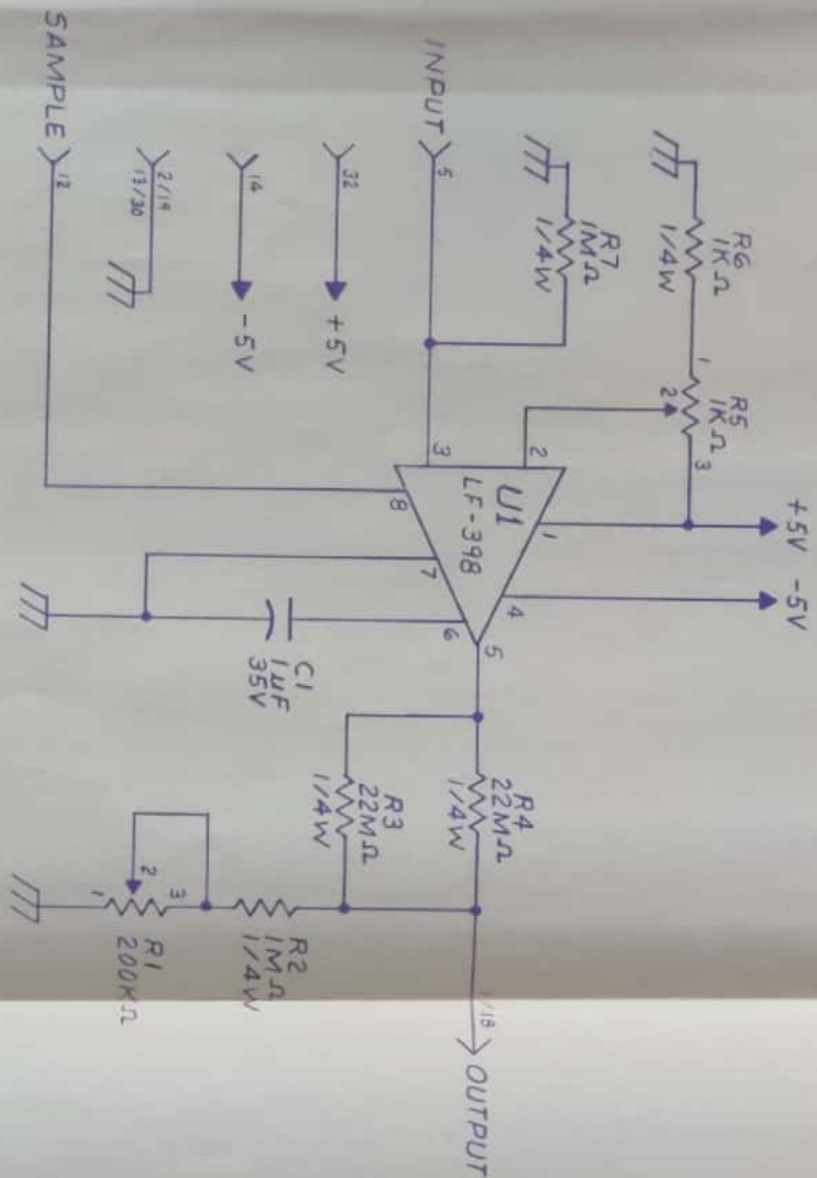
FIGURE	TITLE	SCHEMATIC NUMBER
F.1	A1A2 LOGIC BOARD SCHEMATIC	D-8330
F.2	A1A4 LED DISPLAY BOARD SCHEMATIC	B-8227-1
F.3	A1A1A1 SAMPLE AND HOLD BOARD SCHEMATIC	B-8269-1
F.4	A1A3 POWER SUPPLY BOARD SCHEMATIC	C-8333
F.5	INTERCONNECTION DIAGRAM EDS-250/300	C-8326-3



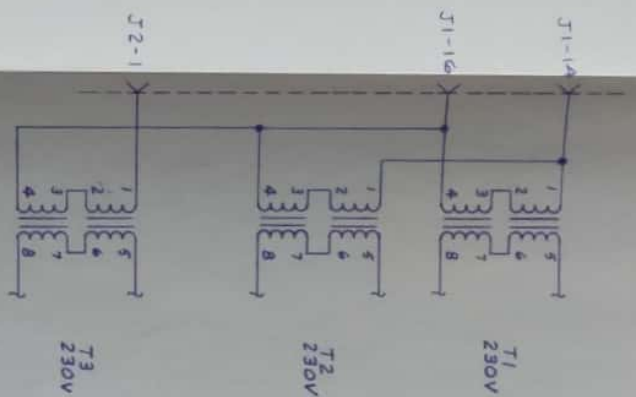
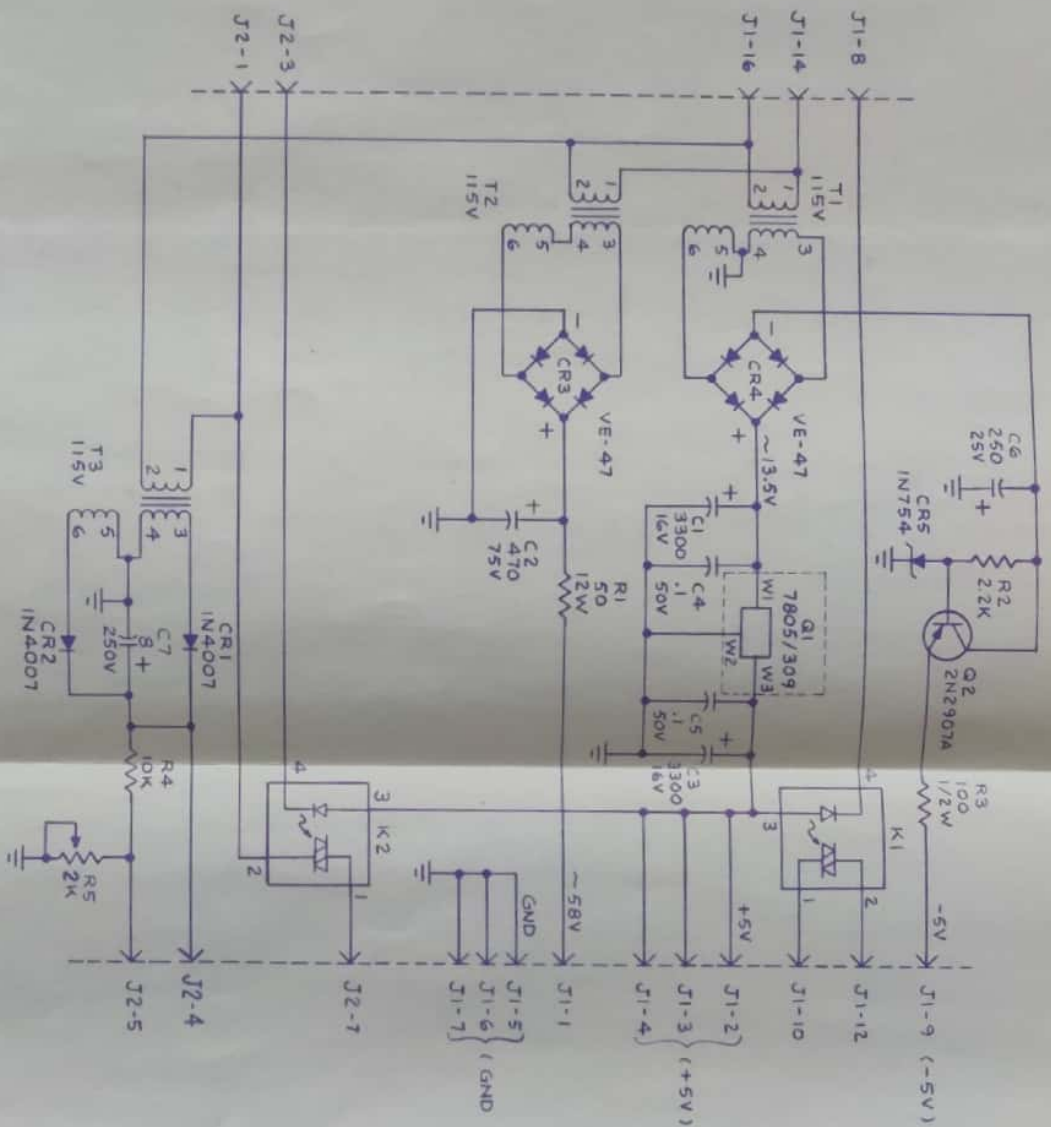
REVISIONS			
SYM	DESCRIPTION	BY	DATE
A	REVISED IADSP-350 LED TO 5080-7750	MS	10 JAN 85



ITEM NO	QTY	PART NUMBER	REF. DES.	DESCRIPTION	SOURCE
MATERIAL					
TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED FRACTIONAL: 1/64 DECIMAL: .XXX ± .008 ANGULAR: ± 0.10° SURFACE FINISH: 125				TITLE SCHEMATIC DIAGRAM LED DISPLAY EDS-300 IBM UNIT EDS-250/300	
DRAWN: DAWN CARTER CHECKED: _____ DATE: 10 MAY 84				ELECTRO-METRICS A. PENNELL COMPANY 100 Church St., Astoria, Ore. 97103	
NEXT ASSY: PL-8225-1				APPROVED: _____ DATE: _____	
PARTS LIST: _____				REWORK: _____ DATE: _____	
SCALE: 1/8"				SHEET: 1 OF 1	



ITEM NO.	QTY	PART NUMBER	REF DES	DESCRIPTION	SOURCE
MATERIAL					
2					
TITLE					
SCHEMATIC					
SAMPLE HOLD PC BD					
EDS-300, EDS-250/300					
DRAWN					
SXC					
DATE					
CHECKED					
DATE					
APPROVED					
DATE					
REWORK					
DATE					
SCALE					
B					
8269-1					
SHEET 1 OF 1					



230V TRANSFORMER APPLICATION

NOTES: UNLESS OTHERWISE SPECIFIED:
 1. ALL RESISTOR VALUES ARE IN OHMS $\pm 10\%$, $1/4$ W.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS $\pm 10\%$.

ITEM NO.	QTY	PART NUMBER	REV DES	DESCRIPTION	SOURCE
MATERIAL					
2					
FINISH					
2					
THESE PARTS AND NOTES UNLESS OTHERWISE SPECIFIED					
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