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**USER GUIDE TB-9057**  
**770004 / 770005 CHARGED PLATE ANALYZER**



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# Thank You

Thank you for buying an SCS instrument. This instrument has been designed and built to high standards to give you years of trouble-free service.

If you have any questions, please feel free to contact your SCS Representative at:

**Write:** SCS  
926 Industrial Drive  
Sanford, NC 27332

**Telephone:** (919) 718-0000

**Website:** [StaticControl.com](http://StaticControl.com)

**E-Mail:** [Service@StaticControl.com](mailto:Service@StaticControl.com)

We welcome any comments or suggestions you may have relative to the operation, performance, and/or quality of this product.

The SCS Charged Plate Analyzer is available in two models:

Item	Included Power Cord
770004	North America
770005	None (must be purchased separately)

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# Safety

Review the following safety precautions to maintain safety and prevent damage to the instrument or equipment connected to it.

The safety features of this instrument may be ineffective if the equipment is not operated in the manner stated in this manual.

Refer all maintenance procedures to qualified personnel.

## Safety Precautions

### ***Power***

Observe polarity of connections and use appropriate battery eliminator ratings for voltage and current.

### ***Avoid Electric Overload***

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

### ***Avoid Electric Shock***

To avoid electric shock, do not touch the charged-plate while the instrument is on.

### ***Do Not Operate Without Covers***

To avoid electric shock or fire hazard, do not operate this instrument with the covers removed.

### ***Fuses***

There are no user serviceable fuses inside this unit. Please refer all problems to SCS Customer Service.



## Safety Precautions (cont.)

### ***Indoor Use Only***

This instrument is intended for indoor use only.

### ***Do Not Operate in Wet or Damp Conditions***

To avoid electric shock, do not operate this instrument in wet or damp conditions.

### ***Do Not Operate in an Explosive Environment***

To avoid injury or fire hazard, do not operate this instrument in an explosive environment.

## Product Protection Precautions

### ***Use the Proper Power Source***

Do not operate this instrument from a power source that is different than the voltage specified on the serial number tag.

### ***Provide Proper Ventilation***

To prevent the instrument from overheating, provide proper ventilation.

### ***Do Not Operate with Suspected Failures***

If you suspect there is damage to this instrument, have it inspected by qualified personnel.

## Safety Terms and Symbols

### *Terms in the Manual*

These terms may appear in this manual:

**Warning:** Warning statements identify conditions or practices that could result in injury or loss of life.

**Caution:** Caution statements identify conditions or practices that could result in damage to this product or other equipment.

### *Symbols on the Product*

These symbols may appear on the instrument:



Warning, risk of electric shock



Caution, refer to Operator's Manual

### **CAT I**

Installation category I (overvoltage category): Classification for the operation of a unit using voltage systems or circuits with required standardized limits for transient voltages. Category I pertains to voltages supplied at the peripheral level, with smaller tolerances for transient voltages as specified by the Low-Voltage Safety standard (EN 61010-1).



This symbol refers to the compliance of the equipment to the European Council (E.C.) standards.

## Safety Precautions for the Charged Plate Analyzer

Please observe the following safety precautions when checking connections or providing maintenance procedures on the Charged Plate Analyzer:

1. Refer all maintenance procedures to qualified personnel.
2. Prior to performing maintenance procedures, turn off the Charged Plate Analyzer and disconnect the battery charger/eliminator from its power source. Failure to observe this precaution could result in an electrical shock.
3. Allow a cool-down period to reduce the danger of burns from heated parts such as transistors and heat sinks.
4. This instrument incorporates a rechargeable 7.2 V battery pack. Do not substitute a non-rechargeable battery because risk of fire or explosion could result. Please contact SCS or an authorized service organization for battery replacement information.

Please go to our website: [StaticControl.com](http://StaticControl.com) for a complete list of our sales and service representatives and distributors located in the United States and throughout the world.

# Preface

This manual provides user information for the Charged Plate Analyzer and contains the following chapters and appendixes:

- **Introduction** contains a brief product description and describes an incoming confidence test for the unit.
- **Installation** contains initial setup information for the Charged Plate Analyzer.
- **Operation** contains a description of the product's features and a detailed explanation of proper operating procedures.
- **Specifications** states the requirements, behavior, and performance of the instrument in a concise format.
- **Maintenance** contains proper care and preventative maintenance guidelines for the instrument.
- **Appendix A: Accessories** describes other products that are useful with the Charged Plate Analyzer.
- **Appendix B: Warranty Statement** describes terms and conditions of the SCS Warranty Statement.
- **Appendix C: Sales & Service** contains SCS contact information.  
*(Please go to our website: [StaticControl.com](http://StaticControl.com) for a complete list of our sales and service representatives and distributors located in the United States and throughout the world.)*



# Section I Introduction



***Danger:*** SCS high-voltage generating equipment, including SCS amplifiers and supplies are not designed, rated, or qualified to be operated in an environment or atmosphere which contains combustible or explosive materials or gases which may be ignited by electrical discharges.

This manual provides instructions to install and operate the Charged Plate Analyzer. We recommend you take the time to read this manual to take full advantage of the features and benefits of the instrument.

## General Information

The Charged Plate Analyzer is designed to provide quantitative and accurate measurements for a variety of air ionization tests in any location. The OUTPUT MONITOR connector on the rear panel is a buffered output providing a low-voltage replica of the voltage on the ion collecting plate.

The Charged Plate Analyzer employs a revolutionary new charged-plate monitor design that utilizes an ultra-high-impedance high-voltage follower to monitor the ion collecting plate voltage. This technique provides very high accuracy and virtually infinite impedance loading of the plate, while allowing the ion collecting plate to be charged and monitored through the same small-diameter connection.

This technique also makes the measurement capacitance independent of the physical size and shape of the ion collecting plate. Therefore, the size and shape of an ion collecting plate, as well as the measurement capacitance, may be customer specified to match a particular ESD-sensitive device within a manufacturing process, or it may be made to conform to the ESD Association Standard ANSI/ESD-STM3.1.

## Modes of Operation

The Charged Plate Analyzer features three primary modes of operation: a negative (-) decay mode, a positive (+) decay mode, and a float mode. Decay mode START and STOP voltages are easy to program.

Use for Product Qualification and Compliance Verification testing of Ionizers per ANSI/ESD S20.20 testing per ANSI/ESD STM3.1 and ESD TR53. Use Decay mode to measure Discharge Times; the required limit is to be determined by the user. Use the Float Mode to determine the ionizer's offset voltage; the Offset Voltage required limit per ANSI/ESD S20.20 is  $\pm 35$  volts.

For DECAY mode operation, the ion collecting plate is pre-charged, either positively or negatively, to a level above the programmed START voltage. The time required to discharge the ion collecting plate from the programmed START voltage to the programmed STOP voltage is measured by the Charged Plate Analyzer. The discharge is due to 'incident ion flow' on the ion collecting plate.



**Warning:** Hazardous voltages may be present on ion plate during Decay mode operation.

For the FLOAT mode operation, the plate is initially discharged to zero and then allowed to float to the voltage level dictated by 'incident ion flow' on the ion collecting plate.

The simplicity of the design of the Charged Plate Analyzer makes it very reliable and completely portable. The Charged Plate Analyzer is powered by a rechargeable battery (supplied) that offers 8 hours of operation from a full charge. The unit can also be operated from a line supply using a battery eliminator/charger.



**Caution:** This instrument incorporates a rechargeable 7.2 V battery pack. Do not substitute a non-rechargeable battery because risk of fire or explosion could result. Please contact SCS or an authorized service organization for battery replacement information.

## Incoming Inspection

Visually inspect the instrument for physical damage such as dents, nicks, scratches, broken fittings, etc. External damage may indicate more serious damage has occurred within the instrument. In the event of damage, contact SCS Customer Service. Attempts to operate a damaged instrument may cause permanent damage to the instrument.



## Incoming Confidence Test

The Charged Plate Analyzer undergoes extensive checks and adjustments at the factory, and no initial calibration should be required. However, you may wish to perform an incoming confidence test as part of the incoming inspection on the instrument. An incoming confidence test of this nature is intended to confirm that the instrument was not damaged in transit.

We recommend that you familiarize yourself with the information in Section II and Section III before performing this test.

Placing a charged object near the ion collecting plate while the instrument is in the DECAY mode and measuring the decay time of the object would constitute a reasonable incoming confidence test. A simple source for a charged object is an ordinary pocket comb or a hard plastic screw driver. A pocket comb drawn through the hair will usually produce a negative charge on the comb. A hard plastic handle of a screw driver brushed against a pant leg will usually produce a positive charge on the handle of the screw driver.



**Warning:** Do not turn on the Charged Plate Analyzer until instructed to do so. To do so before the appropriate point in time could result in an electrical shock and/or damage to the instrument.

1. Ensure the power is OFF.
2. Connect the ion collecting plate to the ION COLLECTING PLATE connector on the rear panel.
3. Connect the GROUND jack to earth ground using the banana-alligator cable provided.
4. Place the MODE switch in the +DECAY position.
5. Turn on the power.
6. Momentarily press down on the TEST/RESET switch.
7. Move a negatively charged object (pocket comb) towards the ion collecting plate until the value indicated on the PLATE VOLTAGE display decreases below the programmed decay start voltage.

The decay timer will start when the plate voltage passes the programmed decay start voltage.

**Note:** The decay start voltage is factory programmed for 1000 V. (See 'Programming the START voltage' on page III-4 for information on changing the decay start voltage.)

## Incoming Confidence Test (cont.)

8. Continue to move the negatively charged object towards the ion collecting plate until the value indicated on the PLATE VOLTAGE display passes through the programmed decay stop voltage.

**Note:** *The decay stop voltage is factory programmed for 100 V. (See 'Programming the STOP voltage' on page III-5 for information on changing the decay stop voltage.)*

At the programmed stop voltage the decay timer will stop and the decay time will be indicated on the DECAY TIME display.

This completes the incoming confidence test. Turn OFF the Charged Plate Analyzer.

## Section II Installation

### Mounting

The Charged Plate Analyzer is designed to be operated as a portable bench top instrument. There are no special mounting requirements.

### Battery Operation

Initially charge the Charged Plate Analyzer for 3 hours before operating the instrument. The FULL CHARGE indicator will illuminate when the battery is fully charged.

The Charged Plate Analyzer will operate for at least 8 hours with a full charge.

The LOW BATTERY indicator will illuminate when the battery is approximately 30 minutes from total discharge.



**Caution:** This instrument incorporates a rechargeable 7.2 V battery pack. Do not substitute a non-rechargeable battery because risk of fire or explosion could result. Please contact SCS or an authorized service organization for battery replacement information.

### Battery Charger/Eliminator Connection

The Charged Plate Analyzer is designed to be battery operated or operated while connected to a line voltage source. A battery charger/eliminator is available for all nominal line voltages.

1. Ensure the power is OFF.
2. Plug the battery charger/eliminator to the CHARGER receptacle on the rear panel.
3. Plug the free end of the AC line cord into the power source.



Figure 2-1: Battery Charger/Eliminator connector polarity.

## Initial Setup Connections

Before operating the Charged Plate Analyzer, the following connections should be made:

### **Ground Connection**

The Charged Plate Analyzer must be connected to a solid ground reference to ensure accurate and repeatable measurements. All voltage measurements will be made with respect to this ground reference point. The power to the unit should be OFF when connecting the ground on the rear panel of the unit to a ground reference.

### **Ion Collecting Plate Connection**



Ensure that the power to the unit is OFF when connecting the plate cable to the ION COLLECTING PLATE receptacle on the rear panel.



**Note:** Hazardous voltages may exist in the plate receptacle if the power to the unit is ON. See warning below under OUTPUT MONITOR CONNECTION.

### **Output Monitor Connection**



**Warning:** Exercise extreme caution while connecting a BNC connector cable to the OUTPUT MONITOR BNC receptacle. Do not confuse the OUTPUT MONITOR BNC cable connector for the ION PLATE BNC cable connector. Inserting the OUTPUT MONITOR connector into the ION PLATE connector could deliver a voltage of 1100 volts to the BNC shell.

The OUTPUT MONITOR connector on the rear panel is a buffered output providing a low-voltage replica of the voltage on the ion collecting plate.

The voltage at this output represents 1/200th the voltage on the ion collecting plate. Connect a monitoring device, such as an oscilloscope, to this connector to monitor the voltage on the ion collecting plate. The signal at this connector can also be used as a feedback signal in a closed-loop system.

## Section III Operation

### Front Panel Features

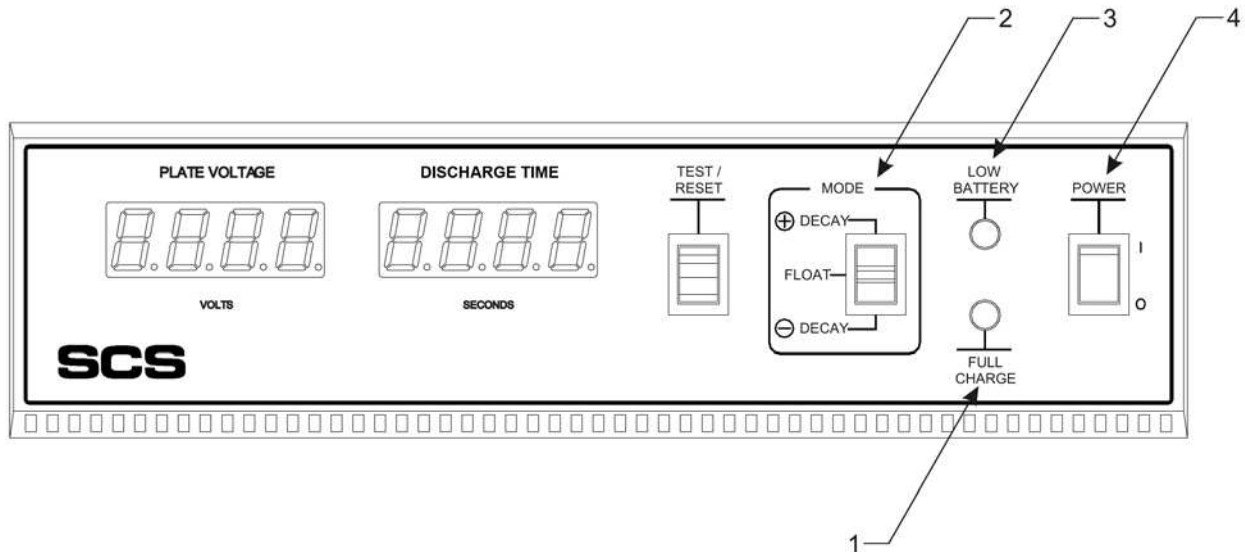


Figure 3-1: Front Panel Features

1. **FULL CHARGE Indicator:** This indicator will illuminate when the battery is fully charged. At least 8 hours of operation can be expected from a fully charged battery.
2. **MODE Switch:** This switch selects either the (+) DECAY, the (-) DECAY or the FLOAT mode of operation. This switch is also used in combination with the TEST/RESET switch to program the start and stop voltages.
3. **LOW BATTERY Indicator:** This indicator will illuminate when the battery is approximately 30 minutes from being fully discharged.
4. **POWER Switch:** This switch turns the power ON and OFF and may enable initial high-voltage to the plate.



**Warning:** The Charged Plate Analyzer is battery operated and high-voltage may be present at the ion collecting plate or ion plate connector whether or not the battery charger/eliminator is connected to the rear panel when the POWER switch is ON.

## Front Panel Features (cont.)

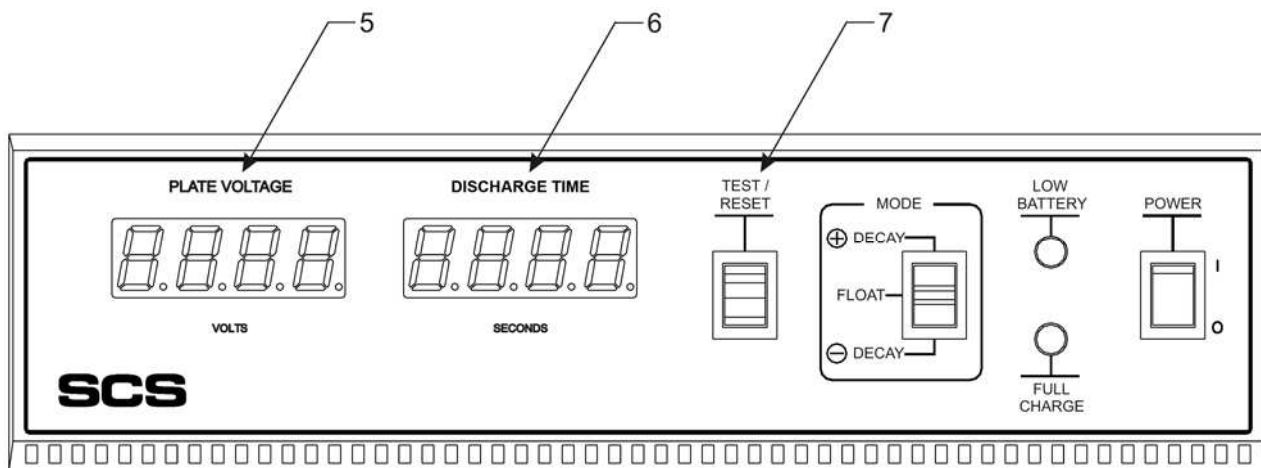
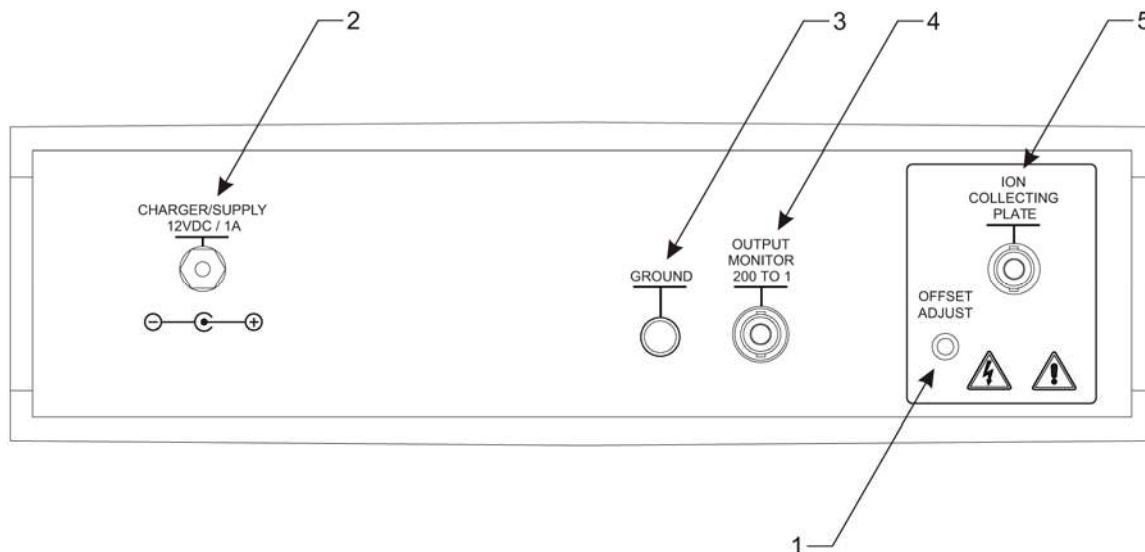


Figure 3-2: Front Panel Features (cont.)

5. **PLATE VOLTAGE Display:** This digital display indicates the plate voltage in volts.
6. **DECAY TIME Display:** This digital display indicates the time in seconds for the ion collecting plate to discharge from the programmed START voltage to the programmed STOP voltage.
7. **TEST/RESET Switch:** This switch sets the plate voltage to greater than the programmed START voltage when the instrument is in the (+) DECAY or (-) DECAY mode. This switch sets the plate voltage to 0 volts when the instrument is in the FLOAT mode.

This switch is also used in combination with the MODE switch to program the START and STOP voltages.

## Rear Panel Features



**Figure 3-3: Rear Panel Features**

1. **OFFSET ADJUST:** This adjustment minimizes plate voltage drift. The calibration is factory set and should not need adjustment.
2. **CHARGER/SUPPLY Receptacle:** This receptacle is for connection of the battery eliminator/charger.
3. **GROUND Jack:** This banana jack is for connection to a ground reference point.
4. **OUTPUT MONITOR Connector:** This BNC provides a buffered, low-voltage replica of the voltage on the ion collecting plate. The voltage at this output is 1/200th of the voltage on the ion collecting plate.



**Warning:** Exercise extreme caution while connecting a BNC connector cable to the OUTPUT MONITOR BNC receptacle. Do not confuse the OUTPUT MONITOR BNC cable connector for the ION PLATE BNC cable connector. Inserting the OUTPUT MONITOR connector into the ION PLATE connector could deliver a voltage of 1100 volts to the BNC shell.

5. **ION COLLECTING PLATE Receptacle:** This BNC receptacle is for connection of the ion collecting plate.



**Warning:** The Charged Plate Analyzer is battery operated and high-voltage may be present at the ion collecting plate or ion plate connector whether or not the battery charger/eliminator is connected to the rear panel when the POWER switch is ON.



## FLOAT Mode Operation

In the FLOAT mode, the Charged Plate Analyzer monitors the voltage on the plate caused by air ion imbalance.

1. Place the ion collecting plate in the area to be monitored.
2. Place the MODE switch in the FLOAT mode.
3. Press down and release the TEST/RESET switch to apply 0 volts to the plate. Upon releasing the TEST/RESET switch, the plate will “float” to a voltage as dictated by air ion imbalances.

## DECAY Mode Operation

In the positive (+) DECAY and negative (-) DECAY modes, the Charged Plate Analyzer monitors the time taken for the ion collecting plate to decay from the programmed START voltage to the programmed STOP voltage.

1. Place the ion collecting plate in the area to be monitored.
2. Place the MODE switch in either the positive (+) DECAY or negative (-) DECAY mode:

In the positive (+) DECAY mode the ion collecting plate is charged to a positive voltage. In the negative (-) DECAY mode the ion collecting plate is charged to a negative voltage.

3. Press and release the TEST/RESET switch.

The ion collecting plate will charge to a value slightly greater than the programmed START voltage. The decay timer will start when the plate voltage reaches the programmed START voltage. The decay timer will stop when the plate voltage reaches the programmed STOP voltage.

## Programming Operation

The Charged Plate Analyzer can be operated in any one of three modes, the (+) DECAY mode, the (-) DECAY mode, and the FLOAT mode.

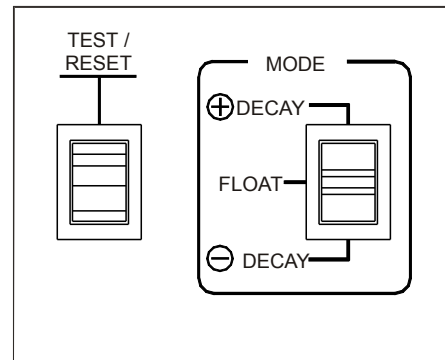
**Note:** When the instrument is first turned on, it will indicate the revision level of the program in the DECAY TIME display. The unit will also flash the (previously) programmed START voltage in the PLATE VOLTAGE display and the (previously) programmed STOP voltage in the DECAY TIME display. The START and STOP voltages are initially factory set to 1000 V and 100 V, respectively.

### Programming the START voltage

1. Ensure the power is OFF.
2. Place the MODE switch to the FLOAT position.
3. Press and hold down the TEST/RESET switch. Keep the switch down when turning ON the POWER switch.
4. After the POWER switch is turned on, the letter 'S', representing START voltage, appears in the PLATE VOLTAGE display.
5. Release the TEST/RESET switch. The DECAY TIME display will indicate the present START voltage.
6. Place the MODE switch in the positive (+) DECAY position to increase the START voltage. The START voltage will automatically *increase* in 1 volt increments.

Place the MODE switch in the negative (-) DECAY position to decrease the START voltage. The START voltage will automatically *decrease* in 1 volt increments. Select the voltage value desired for testing. When the desired START voltage parameter is obtained, place the MODE switch in the FLOAT position.

**Note:** The START voltage cannot be set above 1000 V or below the programmed STOP voltage



## Programming Operation (cont.)

### ***Programming the STOP voltage***

1. After the START voltage has been programmed, press and hold down the TEST/RESET switch. The letter “E”, representing “END” (STOP) voltage, appears in the PLATE VOLTAGE display.
2. Release the TEST/RESET switch. The DECAY TIME display will indicate the present STOP voltage.
3. Place the MODE switch in the positive (+) DECAY position to increase the STOP voltage. The STOP voltage will automatically *increase* in 1 volt increments.

Place the MODE switch in the negative (-) DECAY position to decrease the STOP voltage. The STOP voltage will automatically *decrease* in 1 volt increments. Select the voltage parameter desired for testing. When the desired START voltage is obtained, place the MODE switch in the FLOAT position

**Note:** *The STOP voltage cannot be set above the programmed START voltage or below 0 V.*

4. Press and hold down the TEST/RESET switch. The letter “P”, representing ‘PROGRAM’, appears in the PLATE VOLTAGE display.

Release the TEST/RESET switch. The Charged Plate Analyzer stores the new settings for START and STOP voltages and resets itself to begin testing for the newly chosen parameters.

The Charged Plate Analyzer will display the ‘revision level’ of the command program and then will flash the new START voltage in the PLATE VOLTAGE display and the new STOP voltage in the DECAY TIME display. The unit will then go into the normal operating mode as set by the MODE switch.

## Monitoring the Plate Voltage using the Output Monitor

The OUTPUT MONITOR receptacle provides a low-voltage replica of the plate voltage. The OUTPUT MONITOR voltage is 1/200th of the plate voltage. The OUTPUT MONITOR can be connected to an oscilloscope for visual representation of the ion tests.

For example, if the plate voltage is 500 V, the voltage at the OUTPUT MONITOR receptacle would be:

$$500 \text{ V} \times 1/200 = 2.5 \text{ V}$$