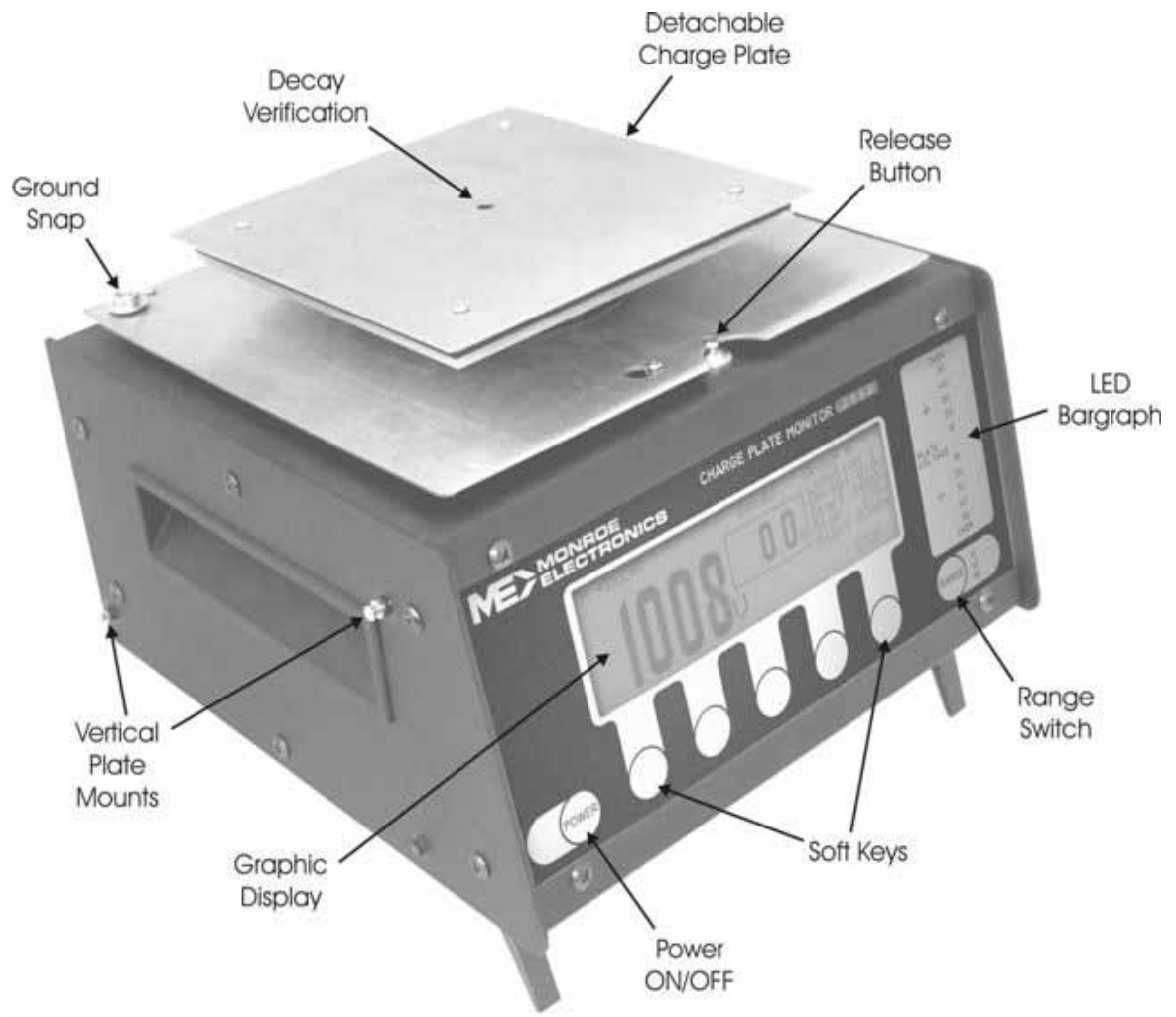


CONTENTS

Specifications	Section 1
Specifications	Page 4
Accessories included	Page 5
What this instrument does	Page 6
Physical description	Page 6
 General Information	 Section 2
CAUTION – SHOCK HAZARD	Page 7
 Setup –	 Section 3
First things first	Page 8
SETUP SYSTEM Menu	Page 9
SETUP for Manual Test Menu	Page 9
SETUP for Auto Sequence Menu	Page 9
SETUP OPTION Menu	Page 10
 Operation	 Section 4
Manual operation	Page 11
Programming features for manual test	Page 13
Automatic operation	Page 14
Programming features for auto sequence	Page 15
Additional features	Page 17
Group and location	Page 17
Test parameter setups	Page 17
Data storage and review	Page 17
Peak reset	Page 18
Plate voltage bar graph	Page 18
Power	Page 18
Charge plate	Page 18
Grounds	Page 18
Analog output	Page 18
 Maintenance	 Section 5
Precautions	Page 19
Cleaning	Page 19
Battery	Page 19
Charge state indicator	Page 19
Calibration	Page 19
 References	 Section 6
References	Page 20
 Warranty Information	 Page 21
 Repair Information	 Page 22

Copyright© 2008
Monroe Electronics, Inc.
Printed in USA

Specifications and procedures subject to change without notice



Section 1

Specifications

All specifications are referred to plate voltage unless otherwise specified.

Display	240 x 64 character/graphic
Voltage -	3½ digit display (Decay and Peak reading)
Accuracy	±0.1% of reading ± 3 lsd
Resolution	1 volt for readings > 99 volts 0.1 volt for reading < 100 volts
Time -	4 digit display
Accuracy	0.1% of reading ± 1 lsd
Resolution	0.1 second for readings < 1000 seconds 1 second for reading > 999 seconds
Electrometer	
Dynamic range	±1200 volts
Follower error	< 10 mV
Speed of Response	< 10 msec for 1 kV to 0 volts (90% - 10%)
Bandwidth	-3db @ 1Khz 20V _{p-p} -3db @ 10Hz 2000V _{p-p}
Noise	<12 mV _{rms}
Monitor output	Divide by 200
Accuracy	0.1% of reading ± 12 mV
Output Impedance	1 kΩ
Start Voltages	1000 volts ±0.3% Standard
Range	±10 to ±1000 volts.
Resolution	settable to 1 volt
Accuracy	0.3% of setting ± 2.5 volts
Stop Voltages	100 volts ±3% Standard
Range	0 - ±995 volts
Resolution	settable to 1 volt
Accuracy	0.3% of setting ± 2.5 volts
Charge voltage	
Range	10 to 100 volts above the start voltage
Resolution	settable to 1 volt increments
Accuracy	0.3% of setting ± 2.5 volts

Charge Plate	
Capacitance	20 pF \pm 10%
Zero Drift	< 100 mV /sec (no incident ion flow)
Self Discharge	< 200 mV/sec
Peak Detector	
Balance Test	
Bandwidth	<10HZ (pulse width >50msec less 10% error typ.)
Temperature Sensor	
Range	0 - 50°C
Accuracy	\pm 2°C typ
Humidity Sensor	
Range	10% - 80% RH @ 25°C
Accuracy	\pm 5% typ
Operating	
Temperature	5°C to 35°C
Humidity	to 80%, non condensing
Battery life	6 hours
Charge time	< 8 hrs to > 90% capacity
Power	
Voltage	90 – 250 VAC 50/60 Hz
Wattage	< 12 watts operating
CPM	
Size	11" x 9" x 6" (280 x 229 x 152 mm)
Weight	12 ½ lb (5.7 kg)

Accessories Included:

CD containing: 288B Operator's Manual
288B Data Sheet
288COM Software
288COM Software Operator's Guide
288B Graph Data Sheet

110V Line Cord
220V Line Cord
DB9 M/F Straight-Thru Cable
Ground Cable w/snap
5ft Plate Ext Cable
Patch cord w/alligator clip & boot

What this instrument does —

This instrument is a charged-plate monitor for evaluating the performance of ionization systems. As such, it performs positive and negative decay tests, and balance (offset voltage) tests to determine if an ionization system is operating effectively. It can be used to test all types of ionization systems as described in ESD Association Standard ANSI/ESD STM3.1 Ionization.

Over the years new technologies have placed new demands on both ionization systems and on the capabilities and features of the charged-plate monitors used to evaluate them. Monroe Electronics has responded to these needs by incorporating many additional and improved features in the Model 288 Charged-Plate Monitor. The original Model 288 provided the following important capabilities for people evaluating ionization systems:

- Replacement of the fieldmeter normally used to monitor the plate voltage with a high-voltage follower amplifier to increase accuracy and reduce zero drift
- Wider bandwidth to evaluate AC ionization systems
- The ability to automate commonly-repeated sequences of tests and store their test results for future review
- Adjustable start and stop voltages for decay tests
- A serial interface and applications software to control ionization tests from a computer

The Model 288B has been improved to provide the following capabilities:

- The ability to resolve the plate voltage with 100 mV resolution
- Applications software to graphically display decay and balance waveforms in real time
- The ability to measure the performance of the latest high-frequency AC ionization systems

Section 2

GENERAL INFORMATION

Model 288 performs manual or automatic decay and balance tests for qualification and periodic verification of ionization equipment. It then stores the results and balance averages for manual tests and complete automatic test sequences up to a maximum of 1500 tests. Temperature and relative humidity are displayed real-time and recorded with the test data.

All instrument functions are controlled by five key pushbuttons.

In DECAY mode a built-in high voltage generator charges the plate to a voltage specified by the user – up to 1100 volts. During the test the plate will discharge toward zero in the presence of ionization. The elapsed time of decay between a selected start voltage and a selected stop voltage is displayed.

In the BALANCE mode, the plate is first grounded then released from ground and allowed to float to any voltage in response to air ion imbalances. It displays the plate voltage, test duration, and minimum and maximum peak voltages. (Nearby charge sources will also induce a voltage on the floating plate.)

Self-tests include battery check and tests for functional errors.

Memory is non-volatile. Setup and data are retained during storage.

CAUTION

When charged, the plate voltage can be in excess of 1100 volts with respect to ground. Although the charges and potentials are below those that are normally detected by human senses, A SHOCK HAZARD EXISTS.

- If you are handling the plate assembly or conducting a test, which involves touching the plate, expect a shock.
- Do not charge large capacitors with this device.

Section 3

SETUP

First things first

Upon power up, you are presented momentarily with an identification screen, which includes the software revision level and serial number of your unit.

Within a few seconds, the MAIN screen (Figure 1) is presented. This screen should show current date and time, ambient factors, power source information and current test number and prompt the operator to “Select Operation”. The test-numbering scheme begins with 1500 and displays the number of remaining tests.

Figure 1. Main Screen

MAIN	288B	2.00	06/18/08	11:23:02A
	S/N 012345		AC Power	28C 36%RH
Select Operation			Test Avail. 1500	
MANUAL	AUTO	DATA	SETUP	

One of the menu options is **SETUP**. Once significant programming has been done and data taken **the SETUP mode should not be tinkered with!** There is no BACK button. Thus, **SETUP** is probably the first thing the user should become familiar with. Press the “SETUP” key.

Figure 2. Setup Screen

SETUP	06/18/08	11:23:02A		
	AC Power	28C 36%RH		
SYSTEM	MANUAL	AUTO	OPTION	MAIN

The present menu is identified in the upper left corner of the screen as “SETUP”.

Menu items are: SYSTEM, MANUAL, AUTO, OPTION and (back to) MAIN. Select SYSTEM to go to the SETUP SYSTEM menu.

Press the “SYSTEM” key.

SETUP SYSTEM Menu:

Figure 3. Setup – System:

SETUP	06/18/08	11:23:02A		
	AC Power	28C 36%RH		
CLOCK	HUMI/TEMP	RAM/EE	S/N	RETURN

CLOCK – Sets the system’s real time clock. This should be set to the present local date and time in order for all future tests to be properly stamped. Once new data (if any) has been entered, press EXIT and elect to SET the clock to the time shown on the SETUP

SYSTEM CLOCK screen or EDIT to change the settings or CANCEL to change nothing and return to the MAIN menu.

HUMI/TEMP – Simply displays the present temperature and relative humidity. These can only be changed via connection to a PC.

RAM/EE – The first screen under this option asks, “Clear all test data – Y/N?” A “Y(es)” response will permanently erase all accumulated test data from memory. The next two windows prompt a similar decision for whether to restore defaults to Group/Location names and test setups. These decisions should not be taken lightly as deletions are irreversible.

S/N – Displays software revision number and instrument serial number. These cannot be modified.

RETURN – Returns to SETUP Menu

SETUP for Manual Test Menu:

Figure 4. Setup – Manual Screen: In the Setup screen (Figure 2), press “MANUAL” key.

The first three setups can be modified. M.Setup 1 is current selected as default setup for use.

```
SETUP M.TEST
D> M.Setup 1
  M.Setup 2
  M.Setup 3
  Factory
  Test

NEXT  DISPLAY  DEFAULT  SETUP  MAIN
```

This screen displays a list of five user selectable manual test options. Three of them; M.Setup 1, M.Setup 2 and M.Setup 3 may be modified. The “Factory” option uses “standard” settings and the “Test” option has settings used during factory testing of each unit. These two may not be changed.

The parameters of any of the manual tests may be viewed or those of the first three edited to meet user requirements by highlighting the test and pressing the **DISPLAY** key. To change these parameters, see **Programming Features for Manual Tests**.

A symbol “D>” indicates which one is selected as the default test. To change the default, scroll to highlight one of the options using the **NEXT** key and press the **DEFAULT** key. The selected test will remain the default test until re-selected. Previously stored test results are not affected by a new default setting but all subsequent tests will be made with the new default until changed by this method.

SETUP for Auto Sequence Menu:

The Auto Sequence Setup screen works the same. It displays a list of five user selectable manual test options. Three of them; A.Setup 1, A.Setup 2 and A.Setup 3 may be modified. The “Factory” option uses “standard” settings and the “Test” option has settings used during factory testing of each unit. These two may not be changed.

Figure 5. Setup – Auto screen: In the Setup screen (Figure 2), press the “AUTO” key.

```
SETUP A.TEST
D> A.Setup 1
  A.Setup 2
  A.Setup 3
  Factory
  Test

NEXT  DISPLAY  DEFAULT  SETUP  MAIN
```

The parameters of any of the manual tests may be viewed or those of the first three edited to meet user requirements by highlighting the test and pressing the **DISPLAY** key. See **Programming Features for Auto Sequence Tests** later in this manual.

A symbol “D>” indicates which one is selected as the default test. To change the default, scroll to highlight one of the options using the **NEXT** key and press the **DEFAULT** key. The selected test will remain the default test until re-selected. Previously stored test results are not affected by a new default setting but all subsequent tests will be made with the new default until changed by this method.

SETUP - OPTION Menu:

Options are for display backlighting, power off, and beep settings. The first two options will apply when the 288 unit is running on battery.

Figure 6. Setup – Option

```
SETUP OPTION

Backlight
Auto DC Power Off
Beep On Test & Key

NEXT      EDIT      EXIT
```

The first two options apply to when the 288 unit is using battery power.

Highlight and press EDIT to view further options.

Figure 7. Setup – Option - Backlight

```
Backlight DC

Continuous
A> Auto Shut Off (5 minutes)
Off

NEXT      ACTIVE      EXIT
```

The (A>) symbol indicates the current choice. Highlight desired choice and press ACTIVE. Then press EXIT change.

The backlight of the display can be set to continuous lighting or shut off in 5 minutes when it is using battery.

Figure 7b. Setup – Option – Auto DC Power Off

```
Auto DC Power Off

Continuous
A> Auto Shut Off (15 minutes)

NEXT      ACTIVE      EXIT
```

When the 288 unit is running on battery, it can be set to run Continuously or auto shut off in 15 minutes.

Highlight the option by pressing the NEXT key, then press ACTIVE.

In Figure 6, highlight the option, then press the EDIT key.

The Beep has three options:

Beep On Test & Key ____ Beep when a key is pressed and mode change during the test.

Beep On Test Only. ____ Beep only during the test when the mode changed.

Beep Off.

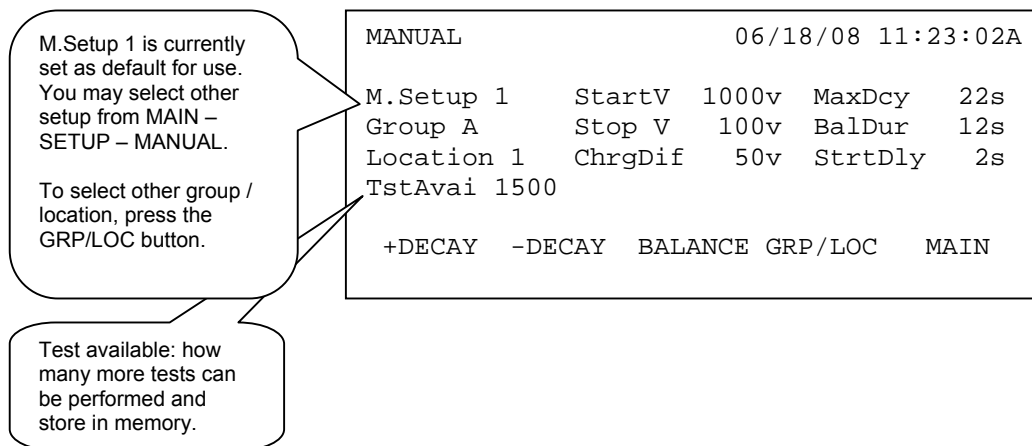
Section 4

OPERATION

MANUAL OPERATION:

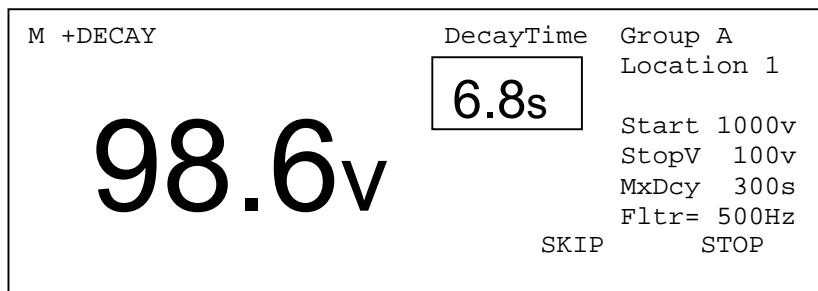
From the manual screen the user can choose to run a positive decay, negative decay or balance. Also the option exists to enter the group and location screen to select the proper designation for the ionizer under test. See Figure 8 below:

Figure 8. Manual Test Screen. From the MAIN screen (Figure 1), press MANUAL key:



+/- Decays – Once a decay test is selected the unit switches screens displaying the plate voltage, timer, group/location and test parameters.

Figure 9. +Decay test

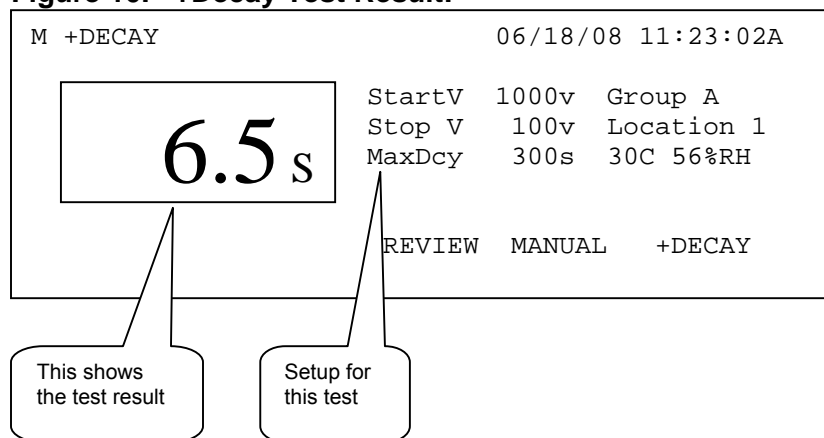


SKIP: Allows user to skip test delay time.

STOP: abort the test. Or When the decay test ends, the plate voltage reading will be continuously shown until the STOP key is pressed.

Once the test is complete a summary screen appears displaying the time of decay, test parameters, time, date, temperature, humidity and test number. From the summary screen another decay test can be run, test data history screen can be accessed or a return to the manual test screen can be selected.

Figure 10. +Decay Test Result:



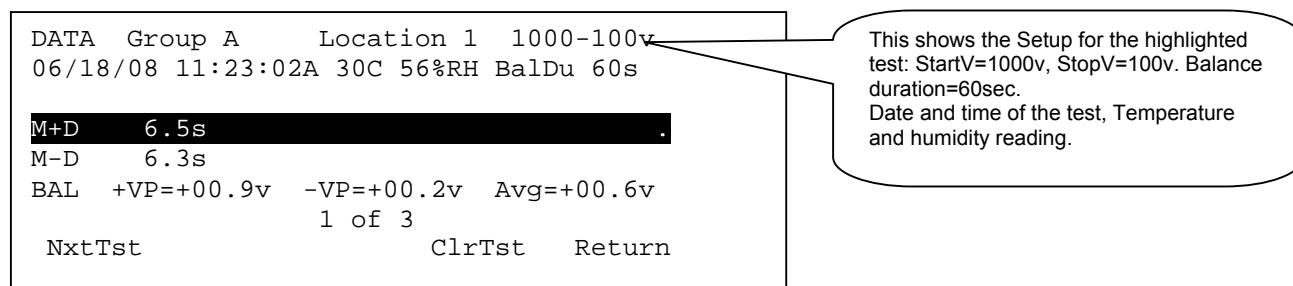
REVIEW: review the test results.

MANUAL: go back to MANUAL screen.

+DECAY: start a +Decay test.

REVIEW: displays the manual test results and settings as in Figure 11.

Figure 11. Review manual



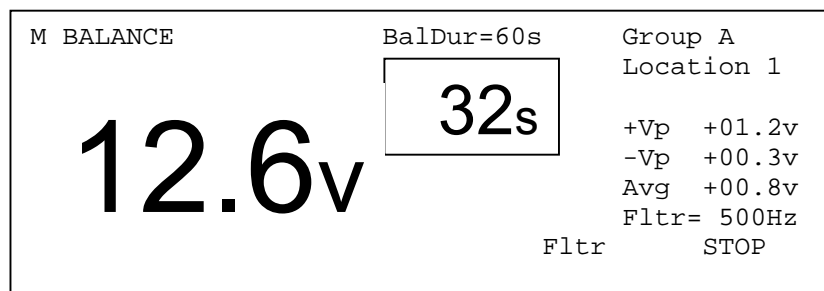
NxtTst: scroll down to highlight the next test.

ClrTst: delete the highlighted test data.

Return: to MANUAL screen.

Balance – During the balance test the screen displays the plate voltage, test time, group/location, test parameter, average voltage and positive/negative peak voltage readings. Once the test is completed the summary screen appears with the same type of data and options available in the manual decay summary screen.

Figure 12. Balance test:



Confidence Test – One of the major weaknesses in all CPM's has been the inability to properly verify the main function of these devices, DECAY. In all the existing instruments it is possible to test the plate voltage, timer performance and other parameters but not the actual decay function. In the 288 charge plate (available in the 6 x 6 plate only) there is a test hole in the center of the plate. Simply remove the knurled thumbscrew from the back panel of the unit and insert it into this hole making sure that the head of the screw is making contact with the plate. Then run a +Decay test and a –Decay test in a non-ionized environment. Both decays should be within a 4 to 6 second range, typical. By performing this test periodically the user can be assured the unit is operating correctly.

Programming features for Manual Test:

Start Voltage – Range of 10V to 1000V, adjustable in 1V increments

Charge differential – This is the difference between the start decay voltage and how much over charge the unit puts on the plate. It ranges from 10V to 100V and is adjustable in 1V increments.

Stop voltage – Range of 0V to 995V, adjustable in 1V increments

Test Start Delay – Range of 0sec to 15sec, adjustable in 1sec intervals. This is the time delay from when you push the start key and when the test actually begins. This allows the user to exit the area to minimize their impact on the readings.

Max decay time – Range 10sec to 9999sec adjustable in 1sec intervals. If the unit does not reach the stop voltage within this time the unit will abort the test. This timer can be turned off.

Balance Duration – Range of 10sec to 9999sec, adjustable in 1sec intervals. This can also be set for continuous readings with no time out.

From the MAIN Screen (Figure 1), press SETUP – MANUAL. Then highlight the M.Setup 1, press DISPLAY. The following screen will appear:

Figure 13. SETUP – MANUAL – M.Setup 1:

SETUP M.TEST				
M.Setup 1	StartV	1000v	MaxDcy	22s
Last enter	Stop V	100v	BalDur	12s
06/12/08	ChrgDif	50v	StrtDly	2s
10:20A				
NEXT	PREV	EDIT	CANCEL	SAVE

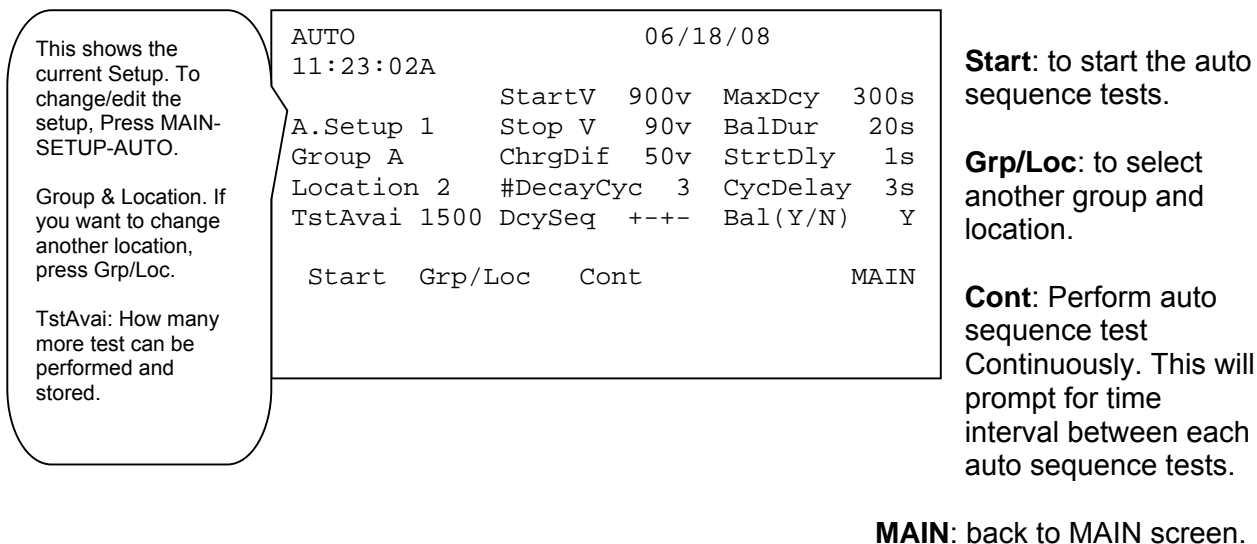
Press NEXT or PREV to highlight the item, then press EDIT to make changes.

When finish, press SAVE to store the new settings. Or press CANCEL to discard the changes.

AUTOMATIC OPERATION:

Once the desired test parameters are set up, the user simply selects the “start” button to begin the tests. All the parameters are shown in the automatic screen.

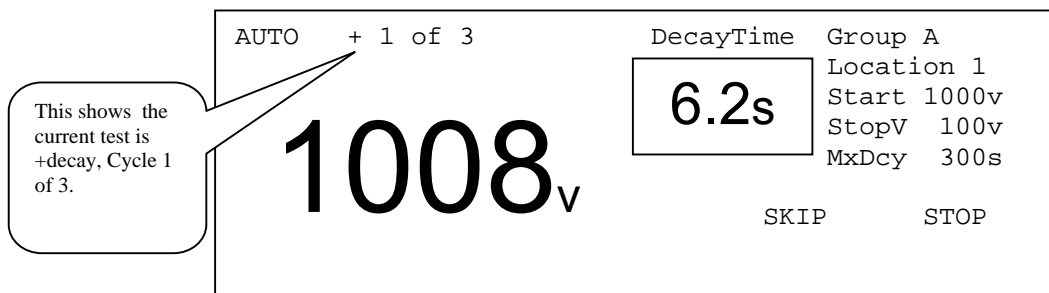
Figure 14. Auto Sequence Test ____ From the MAIN screen, press AUTO:



As soon as the start button is pushed the screen switches to the auto test screen and proceeds to run the prescribed number of decays and balance (only if balance is set to run via the setup). The unit moves automatically from one test to another until it has completed the programmed sequence. At the end of the tests the screen changes to display, individual decay times, average decay time, balance results, including +/- peaks and average voltage, as well as date, time, temperature, humidity, group/location. From this point you can select to run another test sequence or return to the automatic screen.

As in the manual mode, the group/location button will allow you to select the appropriate label for the ionizer under test.

Figure 15. Auto sequence tests:



SKIP: Allows user to skip start delay time.

STOP: stop the test.

When the auto sequence tests are finished, data will be shown as follows:

Figure 16. Auto Sequence Test Review:

Group A Location 2 06/22/08 03:32:56P 30C 62%RH NxtCyc	3	+Decay	EndV	-Decay	EndV
	1	6.5s		6.5s	.
	2	6.5s		6.5s	
	3	6.4s		6.5s	
	Av	6.5s		6.5s	
	+Vp=+22.6 -Vp=-12.3 Vav=+04.5				
	MAIN AUTO				

NxtCyc: highlight the next data row.

MAIN: back to MAIN screen.

AUTO: start another auto sequence test.

Programming features for Auto Sequence Test:

Start voltage – Same as manual

Charge Differential – Same as manual

Stop voltage – Same as manual

Test Start Delay – Same as manual

Max Decay Time – Same as manual

Balance Duration – Same as manual

Decay Cycle – Range from 1 to 10, adjustable in increments of 1. This is the number of + and – decays the unit will run in an automatic sequence.

Decay Sequence – Select either the decay sequence of + – + – or + + – – for the number of cycles selected in Decay Cycle.

Cycle Delay – Range from 2sec to 15sec, adjustable in 1sec increments. This is the amount of time from the finish of the last decay cycle to the start of the next.

Balance (Y/N) – Select whether or not you want a balance test to automatically run at the end of the decay cycle.

Continuous – This feature allows you to perform a continuous series of tests on a selectable time basis. For example, you want to run a series of decay and balance every hour for the next day. From the automatic screen select CONT, then select the desired test time interval from 1 minute to 24 hours. Once you have programmed the time, press EXIT and you will advance to the next screen. From this screen you have the option of pressing CANCEL or START. The START key begins the default automatic test sequence and will repeat that test sequence at the time interval selected. This continuous testing will continue until you stop the tests or the memory becomes full.

From the MAIN Screen (Figure 1), press SETUP – AUTO. Then highlight the A.Setup 1, press DISPLAY. The following screen will appear:

Figure 17. Setup for Auto Sequence Test:

SETUP A.TEST 1				
	StartV	1000v	MaxDcy	22s
A.Setup 1	Stop V	100v	BalDur	12s
Last enter	ChrgDif	50v	StrtDly	2s
06/12/08	#DecayCyc	3	CycDelay	3s
10:20A	DcySeq	+-+-	Bal(Y/N)	Y
NEXT	PREV	EDIT	CANCEL	SAVE

Press NEXT or PREV to highlight the item, then press EDIT to make changes.

When finish, press SAVE to store the new settings. Or press CANCEL to discard the changes.

ADDITIONAL FEATURES:

Group and Location –

By accessing this screen the tests can be organized to reflect the ionizers' locations. There are up to 17 Groups available, with a maximum of almost 700 locations. The total number of group/locations available will vary depending on how extensive the tests are for the individual locations (i.e. how many decays are run for each ionizer). Up to 1500 tests may be run. By using a PC connected to the units RS232 port it is possible to custom label these group/locations (i.e. Building 10 - Bench 2E). Via the same link it is then possible to download all the test results stored in the unit into a spreadsheet on the PC.

Figure 18. Select Group/Location for the test

GRP/LOC	Default Grp/Loc Name			
	Grp#	Name	#ofLoc	AMTest
Current:	1	Group A	99	00
Group A	2	Group B	99	00
Location 1	3	Group C	99	00
MaxGrp 17	4	Group D	99	00
NEXT	NXTLOC	CANCEL	SELECT	

Group A has 99 locations.
AMTest: A(uto sequence) /
M(annual) test Setup for
this Group:
0=Use Default setup
1=Use A/M Setup 1;
2=Use A/M Setup 2;
3=Use A/M Setup 3;
4=Factory
5=Test
AMTest can be set in the
PC software when entering
the Group/locations..

NEXT: to highlight the next Group.

NXTLOC: Select the same group, next location from the current one.

CANCEL: Cancel the selection.

SELECT: Select the highlighted group. This will lead to select location screen.

Test Parameter Setups –

In both the Manual and Automatic Modes there are five distinct setups. Three of these are available to the user to customize as needed. The other two are the factory and test settings, which are not adjustable. Any of these can be selected as the default test setup.

Data Storage and Review –

All test results are stored in the internal memory of the unit. They can be viewed through the screen or downloaded to a PC. Each test records the time, date, temperature, humidity and test results.

Figure 19. Review Data: From MAIN screen (Figure 1), press DATA

```
DATA

Group A
Location 1
TstAvai 1450

RvwMan RvwAuto GRP/LOC CLR MAIN
```

RvwMan: Review Manual test data. See Figure 11.

RvwAuto: Review Auto sequence data. See Figure 16.

GRP/LOC: Select group/location.

CLR: Erase data.

MAIN: Back to MAIN screen.

Peak Reset –

During a manual balance test where **Balance Duration** has been disabled the M BALANCE will show *BalDur=XXXXs* which means that the test will run continuously until STOPped. Pressing the PkRst key at any time will reset the displayed peak values to zero and the timer will continue to run until it reaches 999.9s then the decimal point will shift and the display will run to 9999s (or about 2 hours and 47 minutes). Beyond that, an overrun error is displayed.

Plate Voltage Bar graph –

Three ranges are provided with a maximum resolution of less than 10 volts for making very fast assessments of plate voltage and polarity around zero.

Power –

The unit will run on either AC or battery power. The internal rechargeable battery will supply up to six hours of operation.

Charge Plate –

A 6" X 6" plate comes standard with the 288. When it is detached from the base unit it comes with the ground plane plate or can be taken off as a separate item. Mounting hardware allows the plate to be attached to the side of the unit, connected to a tripod via ¼ -20 threaded insert or put into any variety of situations to measure ionization. A 5-foot extension cable comes standard with the unit.

To release the detachable charge plate only, slide it forward. To remove the complete charge plate and ground plane assembly, press the release button with a suitable tool and swing the assembly slightly to the right.

For those space restricted applications, there are several optional plate sizes available down to 1" x 1". Consult factory for other sizes and availability.

Grounds –

A ground snap is provided on one corner of the ground plane and a ground jack is provided on the back panel. The instrument chassis is normally connected to ground via the power cord during AC operation and the ground plane is connected to the chassis when the unit is assembled. Grounding is essential to proper operation.

Analog Output –

An analog output jack is provided on the back panel.

Section 5

MAINTENANCE

Precautions —

User maintenance should normally be limited to keeping the instrument clean and free from physical damage. Store the instrument in its protective carrying pouch when not in use.

Cleaning —

Fingerprints and other contaminants may be removed from the case with a clean lint-free cloth dampened in a 70%/30% mix of clean technical grade isopropyl alcohol and de-ionized water. DO NOT use soap or detergent.

Battery —

Battery voltage is monitored and displayed on the MAIN screen. Normal range of operation is between 10 and 15 volts. When the battery has discharged to below 10 volts, a warning message is displayed and the instrument shuts down 15 seconds later terminating any activity in progress. Battery charge life depends on type of tests being run and the settings selected in the OPTION menu. Testing may be resumed using AC power.

A complete re-charge cycle takes 4-6 hours with power off.

Charge State Indicator —

While the unit is connected to an AC power line and in an inactive state, the upper half (red) of the PLATE VOLTAGE bar graph serves as a battery state-of-charge indicator with maximum being a float condition and minimum implying that the battery requires further charging. The “x1” and “x2” range lights will be lit. If the power cord becomes disconnected, the LED's will continue to report the battery status for several minutes.

Calibration —

Calibration is not a user function and is beyond the scope of this manual. Calibration information is available from the factory. Monroe Electronics recommends annual calibration and/or when the instrument is damaged or repaired or where called for more often by contract. We offer repair and calibration services for a fee.