

APC Portable Airborne Particle Counter



Airborne Particle Counter



Model P2610
Model P3610
Model P5610
Model P5210

Operations Manual Version 2.01

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I. INDIVIDUAL PARTS AND FUNCTIONS

Figure 1: APC Portable Front View



1 – APC Portable Airborne Particle Counter

2 – Isokinetic Probe with Tubing Connected - 1.2 meters (4 ft) (Article No. 942435)

3 – Display and Touchscreen

4 – Air Inlet

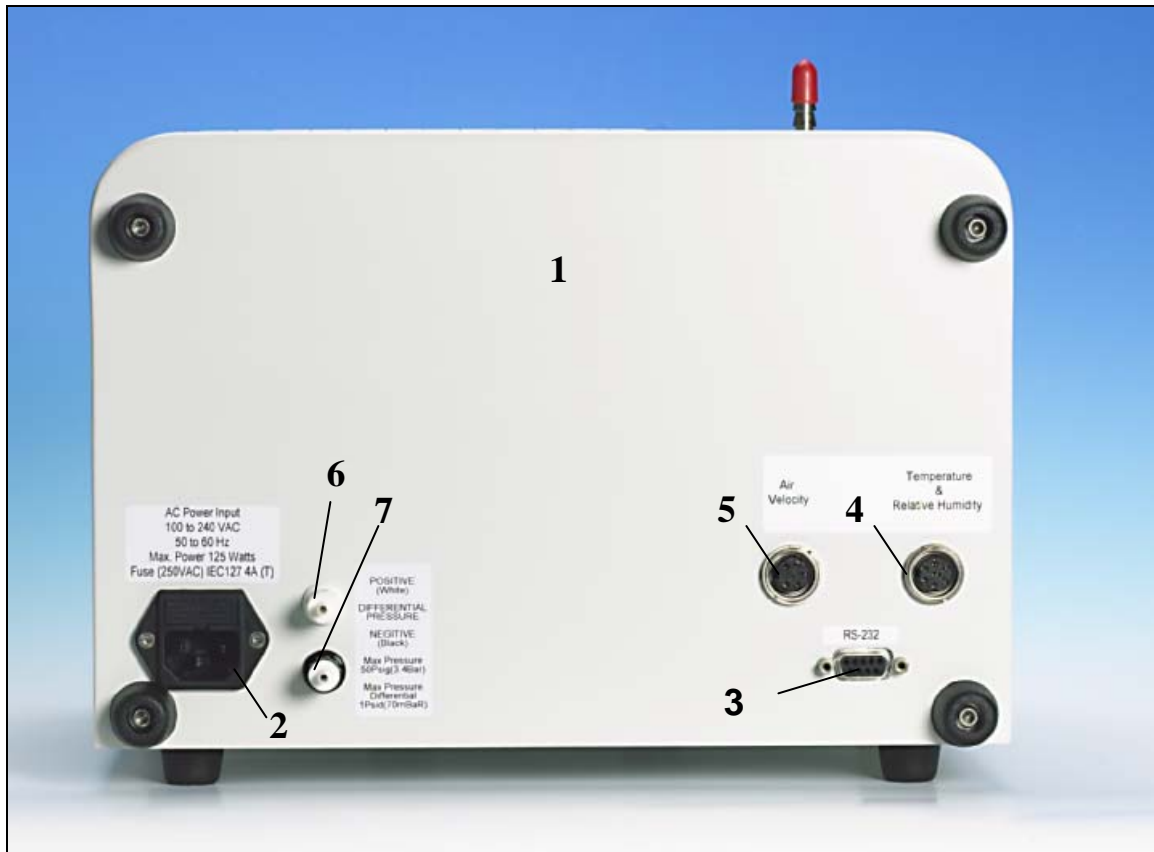
5 – Power Switch

6 – Thermal Printer (Optional)

7 – Hytrell[®]-lined Sample Tubing up to 10 meters (33 ft) (Article No. 942430)

8 – Stylus Pen

Figure 2: APC Portable Rear View



- 1 – Rear View of the APC Portable
- 2 – AC Mains Connection
- 3 – RS232 Connection
- 4 – Temperature and Relative Humidity Probe Connection
- 5 – Air Velocity Probe Connection
- 6 – Differential Pressure Sensor Input - Positive (Optional) (Article No. 942450)
- 7 – Differential Pressure Sensor Input - Negative (Optional) (Article No. 942450)

Figure 3: APC Portable Accessories

- 1 – Thermal Printer Paper (Article No. 942100)
- 2 – Purge Filter (Optional) (Article No. 942425)
- 3 – Isokinetic Probe with Tubing (Article No. 942435)
- 4 – Tripod Adaptor (Article No. 940331)
- 5 – Table-top Tripod Stand (Article No. 942330)
- 6 – AC Line Cord (Europe)
- 7 – AC Line Cord (USA)
- 8 – Temperature and Relative Humidity Probe (Optional) (Article No. 942440)
- 9 – RS232 Cable 3 meters (9 feet) (Article No. 942031)
- 10 – Air Velocity Sensor (Optional) (Article No. 942445)
- 11 – Carrying Case (Optional) (Article No. 942455)

II. OPENING THE SHIPPING CARTON AND ASSEMBLING THE APC PORTABLE

Open the shipping box by removing the tape (DO NOT DAMAGE THE BOX). This box along with the packing material should be saved for storing the instrument or for shipment. Remove the standard accessory box on top of the instrument. Remove the instrument by lifting using the handles on either side. Place the instrument on a table and remove the foam. Replace the foam inside the shipping box.

Open the standard accessory box. This box contains the AC Line Cord, RS232 Cable, Isokinetic Probe/Tripod, Tubing, and Software/Owners Manual CD.

- 1) Read the Owners Manual supplied on the CD. If you should require a hard copy please contact Biotest customer service.
- 2) Plug the AC line cord in to the AC input in the back of the APC Portable. The battery packs will begin charging. It is recommended to charge the unit overnight.
- 3) Remove the rubber cap on the inlet nozzle located on top of the APC Portable. Connect the isokinetic probe/tripod tubing to inlet nozzle on your APC Portable (refer to Section 6). Position the probe/tripod in the area you wish to sample.
- 4) The included software is used for uploading/downloading information to/from the computer/APC Portable, it is not necessary for operation of the APC Portable. Run Setup.exe on the CD to install the software on your computer. The manual may be viewed by using Adobe Acrobat™ 4.0 or higher.
- 5) Connect the RS232 cable in the RS232 I/O connector in the rear of the APC Portable.
- 6) Connect the other end of the RS232 cable to a COM port on your computer.
- 7) Refer to the owner's manual Appendix C for installation of optional accessories.

Note: The Particle Counter is thoroughly inspected and tested at the factory and is ready for use upon receipt. When received, inspect the shipping carton for damage. If the box is damaged notify the carrier and save the carton for carrier inspection. Inspect the counter for broken parts, scratches, dents, or other damage.

III. SAFETY PRECAUTIONS

Note: Refer to Appendix B for General Safety Summary.



WARNING: Airborne Particle Counters are sensitive instruments. They should not be used in a manner that is inconsistent with their intended use. This includes using the proper line cord, plugging the line cord into the intended power receptacle, and connection to a computer. It also includes using the counter only in a non-explosive environment, and not using the counter in environments other than atmospheric pressure air.

Laser Optics

APC Portable Airborne Particle Counters comply with FDA Laser Performance Standard 21 CFR 1040.10 and 1040.11.

These instruments contain a class IIIb laser diode with a rated power output of 50 milliwatts at a wavelength in the range of 650 to 690 nanometers. The laser diode is in a closed assembly inside the sensor case. *Warning* labels cover all parts that may allow exposure to class IIIb laser radiation if disassembled.



WARNING: There are no user serviceable components inside the APC Portable. Send the complete instrument to an authorized Biotest service center for repair.

AC Power (Mains Supply)

The APC Portable requires an AC Voltage range of 100 to 240 VAC at 50 to 60 Hz, 125 watts. The correct power cord for any given country must also be used. The input power is converted to 15VDC to power the instrument and charge the batteries. Power will always be applied to the battery packs when the unit is plugged into an AC power source.

1. INTRODUCTION

The APC Portable Airborne Particle Counter is a simple yet sophisticated data collection and storage instrument. The quickest way to learn the basics of operation is to review the general counting procedure and operation sections of this manual, Sections 10 and 11, while operating some of the touchscreen functions. However, we recommend you review the entire manual to familiarize yourself with all the capabilities of the APC Portable.

2. APC Portable DESCRIPTION

The APC Portable precisely measures the quantity of airborne particles at fixed particle sizes. It simultaneously provides sample information, operational status, as well as optional environmental sensor readings. The APC Portable can be used to generate data to determine trends in a cleanroom or clean facility. It also is capable of reporting data in accordance with International Standard ISO14644 and Federal Standard FS209E. The instrument is composed of four modules: the sensor, flow system, power supply, control and data acquisition and display system.

The sensor module contains the optical components. Within the sensor, light emitted from a laser diode is transmitted and shaped by a series of lenses to a particle-sensing zone. The beam is then absorbed in a light trap. When a particle enters the sensing zone, it scatters light from the beam. The light that is scattered is then collected by a mirror and focused onto a photo detector. The amplitude of the electrical signal produced by the photo detector is dependent on the size of the particle in the sensing zone.

The flow module draws air through the isokinetic probe and into the lens tube. The pump pulls in 1.0 cubic foot per minute (28.3 Liters per minute) of air. The flowrate is sensed and held constant by a control loop.

The power supply module supports operation of the APC Portable for up to four hours without a recharge, depending on the duty cycle of sampling. The NiMH battery packs have an output voltage of 12 volts at 4.5 amp hours. The batteries are charged using internal chargers and automatically charge when plugged in.

The central processing electronics module monitors the battery packs and displays a graph on the LCD to indicate the battery's capacity. The electronics also process the signals from the sensor module, and processes and stores the data. The electronics also simultaneously maintain communications when connected to a PC.

3. FLOW RATE

The APC Portable operates at a sampling flow rate of 1.0 cubic foot per minute (28.3 liters per minute). The flowrate is sensed internally and adjusted by a control circuit to keep the flow constant. The flowrate is displayed on the LCD display. If the flowrate exceeds $\pm 5\%$, for example if the sample tubing is pinched or the airflow inlet blocked, the APC Portable will audibly alarm and the actual flowrate will display on the LCD screen. The air that is exhausted from the flow system is filtered to 0.2 μm .

4. PARTICLE COUNTS

Model P2610: 0.2, 0.3, 0.5, 1.0, 5.0 and 10 -- The APC Portable counts particles in six channels. Each channel is calibrated for a given size (0.2, 0.3, 0.5, 1.0, 5.0, and 10 μm) and will count all particles greater than the calibrated size. For example, a 0.9 μm particle would increase the count in the 0.2, 0.3, 0.5 μm channels, but not the 1.0, 5.0, and the 10 μm channels. The information is gathered for all particle thresholds simultaneously. All channels are displayed on the LCD at the same time.

Model P3610: 0.3, 0.5, 0.7, 1.0, 5.0 and 10 -- The APC Portable counts particles in six channels. Each channel is calibrated for a given size (0.3, 0.5, 0.7, 1.0, 5.0, and 10 μm) and will count all particles greater than the calibrated size. For example, a 0.9 μm particle would increase the count in the 0.3, 0.5, 0.7 μm channels, but not the 1.0, 5.0, and the 10 μm channels. The information is gathered for all particle thresholds simultaneously. All channels are displayed on the LCD at the same time.

Model P5610: 0.5, 0.7, 1.0, 5.0, 10 and 20 -- The APC Portable counts particles in six channels. Each channel is calibrated for a given size (0.5, 0.7, 1.0, 5.0, 10 and 20 μm) and will count all particles greater than the calibrated size. For example, a 0.9 μm particle would increase the count in the 0.5 and 0.7 μm channels, but not the 1.0, 5.0, and the 10 μm channels. The information is gathered for all particle thresholds simultaneously. All channels are displayed on the LCD at the same time.

Model P5210: 0.5 and 5.0 -- The APC Portable counts particles in two channels. Each channel is calibrated for a given size (0.5 and 5.0 μm) and will count all particles greater than the calibrated size. For example, a 0.9 μm particle would increase the count in the 0.5 μm channel, but not the 5.0 μm channels. The information is gathered for all particle thresholds simultaneously. All channels are displayed on the LCD at the same time.

5. TOUCHSCREEN

Various operating parameters can be set on the APC Portable using the touchscreen keypad with graphic LCD. Functions are selected directly through the touchscreen on the front panel. Via a menu tree (See Appendix F) the touchscreen contains the following functions: Start/Stop, Concentration Mode, Review and Mode, Print, Time, Status, Calculations and Alarms. In addition to the functions the display shows all six particle counts simultaneously along with the time, date, flowrate, memory location, area and sample location, status (purging, holding or counting) and battery life remaining, as well as optional temperature/relative humidity, differential pressure, and air velocity. The following sections describe each of the separate functions.

If the unit is left on, but is inactive for 10 minutes, the display will shut off (standby mode). Touching the display pad anywhere on the pad will restore the graphic display. The display will not go into standby mode if the APC Portable is counting, holding, purging or is active in auto or count cycle mode.

Note: In this document “touchscreen” is interchangeable with “touch panel” and “touchpad.”

6. ISOKINETIC PROBE AND SAMPLE TUBING

Remove the isokinetic sampling probe from the package and assemble it with the tripod adaptor onto the tripod stand, being careful not to over tighten. Attach one end of the sample tubing to the open end of the isokinetic probe then insert the other to the top receptacle of the APC Portable. Place the probe at the sampling site. The probe is designed to isokinetically sample an air stream with a velocity of 0.5 meters per second $\pm 20\%$ (100 feet per minute $\pm 20\%$).

7. POWER SUPPLY

The APC Portable contains three NiMH battery packs each with an integrated charger. When the APC Portable is plugged in to the AC Mains, power is applied to the battery packs, regardless of whether the power is switch is on or off. The packs will automatically charge when they become discharged, and will trickle charge otherwise. The battery pack supplies power to the vacuum pump, to the optical system, and to all of the electronics.

The normal charge time for the batteries is about 3 hours, depending on how deeply discharged the battery is. An overnight charge is recommended when possible. When the packs are discharged, the remaining power icon will indicate Empty. At this point, the unit will not start. The battery packs must then be charged. In an emergency, the unit may be operated when plugged into the AC power source, although fluctuations in the pump speed may be noticed.

The power cord should not be disconnected while the unit is charging. It is recommended to wait until the remaining power meter reads “full” before unplugging the power cord. If the unit is disconnected while charging, the battery monitor detects the change in voltage and assumes the batteries have a full charge. This will give a false charge value. The unit will then need to be discharged and recharged fully to reset the remaining power meter.

Note: It is recommended to charge the unit overnight prior to use after an extended period of disuse (greater than one month).



WARNING: Replace the battery packs only with packs manufactured by Biotest. This should be performed by an authorized Biotest service center.

Note: The battery packs consist of NiMH cells. These cells must be disposed of properly when they are replaced. It is recommended to recycle them.

8. ACCESSORIES

The APC Portable airborne particle counter has a selection of accessories to tailor the counter to meet your needs.

8.1 Purge Filter Assembly

The 0.2 µm purge filter assembly allows you to check the background readings of the APC Portable to determine if the system has a leak or if the optics need to be cleaned. It is recommended to purge the system between sampling in a fairly dirty environment and then a very clean environment. To attach the purge filter assembly, push the tubing over the hose barb on the inlet nozzle until the hose barb cannot be seen.

The purge filter assembly is used to clean the system. By running the APC Portable for about ten minutes with the purge filter assembly installed, any loose particles which might have been deposited in the system due to use in a dirty environment will be cleaned. If particles are still registering, continue to purge the particle counter.

To test the background reading of the system, turn on the APC Portable with the purge filter assembly in place. Allow the unit to run for about ten minutes to clear any loose particles from the system. Turn the APC Portable off and restart it in the total particles mode. The reading at 0.3 microns should remain low (less than 10). If the unit registers considerably higher readings, charge the battery. If the unit still fails, try another purge filter. If it fails once again, the unit may require service.

9. OPTIONAL EXTERNAL SENSORS

The APC Portable has connectors on the rear panel for attaching optional environmental sensors for temperature and relative humidity, differential pressure, and air velocity. See APPENDIX C – for Optional Equipment Installation.

9.1 Temperature and Relative Humidity Sensor (Optional)

The APC Portable contains an external probe that measures temperature (in degrees Celsius) and relative humidity (in %). The probe connects into the sensor port in the back of the instrument. The cable is approximately 30 cm (12 in.) in length.

Note: For maximum accuracy, allow about 10 minutes for the temperature and relative humidity readings to stabilize when moving into an area with a significantly different temperature or humidity.

Note: With extensive usage the particle counter emits heat which in turn may affect the temperature and humidity reading.

9.2 Differential Pressure Sensor (Optional)

The APC Portable can measure differential pressure between cleanrooms or clean zones. There are two input probes on the rear of the APC Portable, the white input is for the more positive area (higher pressure area) and the black input is for the negative, lower pressure area (less positive). A cleanroom should be more positive than an adjacent corridor or support room.

To measure the differential pressure between an area and its surroundings, leave the higher pressure sensor open or connect tubing to the white input with the end open to the area of higher pressure. To measure the less positive pressure, attach tubing to the lower pressure, black input with the tubing open to the adjacent area. The APC Portable will measure the difference in the two pressures and report the differential between in millibars. The length of the tubing does not affect the readings.

Note: The readings will stabilize after a few seconds.

CAUTION: Do not exceed the maximum pressure difference of 25.0 mBars. Doing so could permanently damage the pressure sensor.

9.3 Air Velocity Sensor (Optional)

The APC Portable can measure the velocity of the air flowing in a cleanroom. The air velocity probe connects into the connector on the back of the instrument. The arrows on the sample probe must line up with the direction of the air flow. Position the air velocity sensor at the measurement site. Clamping the probe to a ring stand in the airflow is recommended. Air velocity is measured in meters per second.

Note: The readings will stabilize after a few seconds.

10. GENERAL COUNTING PROCEDURE

To begin counting, switch the power switch to the ON position (☉) to power up the unit. The LCD display should light up. If the LCD display will not turn on, it's likely your unit needs charging. When the APC Portable is turned on, the count data will display as "*****" since there is no valid count data yet collected. The last set Area, Location, Concentration and Counting Modes will be displayed.

Select the appropriate operating options using the touchscreen and this operating manual to select the concentration mode (total particles, particles per cubic foot, per liter or per cubic meter), the sampling mode (single, automatic or continuous), and set alarms if desired. Update the count time, hold time and purge time as well as the date and time as necessary and select area and location for sampling.

Assemble the isokinetic probe (see number 14 of the parts list) per section 6 then connect the tubing to the top receptacle on your APC Portable. Position the probe in the area you wish to sample. To begin counting, press the **[START/STOP]** button.



WARNING: Do not use the APC Portable for sampling air under pressure.

11. OPERATION

The operation of the APC Portable is described in this section.

11.1 Power Switch

The power switch does not disconnect the internal circuitry from the mains supply (AC outlet) as a typical power switch does. Instead, it energizes the actual particle counter circuitry when switched to the on position. This small difference allows the mains power to be present at the battery packs when the instrument is plugged into the mains supply. This allows the battery packs to be charged whenever the unit is plugged in.

As a result, the following symbols are used for the power switch:

- ☉ Press this side of the switch down to turn on the counter;
- Press this side of the switch down to turn off the counter.

Note that when the instrument is turned on, and is idle for 10 minutes, it will go into standby. In standby, the display and other systems are turned off to conserve the battery power. To exit standby, touch the display, and the unit will return to normal operation. If there is any question regarding whether the instrument is on or off, simply touch the display prior to changing the switch. If the unit is on, touching the panel will turn on the display. If the display does not turn on, the instrument was off.

CAUTION: Always turn off the power (On/Off switch) to the APC Portable Airborne Particle Counter before connecting or disconnecting any cables.

Note: The time and date as well as the last settings of the APC Portable (Area, Location, Concentration and Counting Modes) will be maintained in the instrument even when it is switched off.

Note: The data stored in the 1000 data locations in memory is not affected when the unit is turned off. When the unit is turned back on, the data will again be accessible, stored in the memory, and additional data will be added to the next unused memory location (unless it is at the last sample location, location 1000, where no more data will be written until the memory is cleared, see Section 11.5 on clearing the memory).

11.2 Start/Stop

START/STOP -- When the unit is on, press the **[START/STOP]** button to begin or end a counting sequence. The **[START/STOP]** button is located on the upper right corner of the display.

11.3 Particle Concentration Display Modes

Particle counts can be displayed either as an actual count in number of particles, or as concentration in particles per cubic foot, particles per cubic meter or particles per liter. The APC Portable recalls the last setting for concentration mode. Any result over 15,000,000 will display as all asterisks (*****).

The particle counter draws air at a rate of 1.0 cubic foot per minute. The particle counts are converted to the concentration modes of particles per cubic foot, particles per liter or particles per cubic meter. Considering the duration of the sample the APC Portable converts the total count results to each concentration mode using approximations of the following conversion factors: 1 liter = 0.0353 ft³ (1 ft³ = 28.3 liter) and 1 m³ = 35.31 ft³ (1 ft³ = 0.0283 m³.) The approximated conversion factors are accurate to at least 99.994%.

Mode	Actual Conversion Factor	Approximated Conversion Factor
/ft ³	1.0	1.0
/L	0.035315	0.0353135
/m ³	35.3147	35.316667

The concentration values are calculated using the following formulas. The final result is truncated to the integer.

$$\text{Particles per Cubic Foot} = \frac{\# \text{ Total Particles}}{\text{Time (min)}} \times \frac{1 \text{ min}}{1 \text{ ft}^3}$$

$$\text{Particles per Liter} = \frac{\# \text{ Total Particles}}{\text{Time (min)}} \times \frac{1 \text{ min}}{1 \text{ ft}^3} \times \frac{0.0353135 \text{ ft}^3}{1 \text{ L}}$$

$$\text{Particles per Cubic Meter} = \frac{\# \text{ Total Particles}}{\text{Time (min)}} \times \frac{1 \text{ min}}{1 \text{ ft}^3} \times \frac{35.316667 \text{ ft}^3}{1 \text{ m}^3}$$

For example, if 1350 total particles are recovered at 0.5 μm in a one minute sample, there would be 1350 particles per cubic foot since in one minute a single cubic foot of air is collected. There would be 46 particles per liter, and 47,677 particles per cubic meter based on the approximated conversion factors.

$$\text{Particles/ ft}^3 = \frac{1350 \text{ particles}}{1 \text{ min}} \times \frac{1 \text{ min}}{1 \text{ ft}^3} = 1350$$

$$\text{Particles/L} = \frac{1350 \text{ particles}}{1 \text{ min}} \times \frac{1 \text{ min}}{1 \text{ ft}^3} \times \frac{0.0353 \text{ ft}^3}{1 \text{ L}} = 46$$

$$\text{Particles/ m}^3 = \frac{1350 \text{ particles}}{1 \text{ min}} \times \frac{1 \text{ min}}{1 \text{ ft}^3} \times \frac{35.316667 \text{ ft}^3}{\text{m}^3} = 47677$$

In the concentration mode [**CONC MODE**], from the first screen, the following options are available:

COUNTS -- To display the total number of particles counted, press the [**COUNTS**] button.

COUNTS/FT³ -- To display particles per cubic foot, press the [**COUNTS/FT³**] key. The /FT³ icon will be displayed at the right of the results to indicate that the instrument is displaying counts in particles per cubic foot.

COUNTS/LITER -- To display particles per liter, press the [**COUNTS/LITER**] key. The /L icon will be displayed at the right of the results to indicate that the instrument is displaying counts in the particles per liter.

COUNTS/METER³ -- To display particles per cubic meter, press the [**COUNTS/METER³**] key. The /M³ icon will be displayed at the right of the results to indicate that the instrument is displaying counts in the particles per cubic meter.

To select a concentration mode, select [**CONC MODE**] from the main menu then desired mode, then press [**BACK**] to return to the main menu.

Note: Although the particle concentration information is correct, displaying the data in the concentration mode may cause erratic readings at the beginning of the sample period because of statistical variations due to short sample times.

Note: The particle counter must perform a calculation to convert the particle counts to concentration. The calculation for concentration in counts per cubic foot is exact. However, the concentration calculation for particles per liter and particles per cubic meter uses an approximation that has a maximum error of -0.004% (/L) and 0.006% (/m³), respectively in the final value. This is because of the nature of the integer calculations used inside the microcontroller in the APC Portable.

11.4 Review and Counting Modes

The **[REVIEW & MODE]** button is used to review the memory, sample locations and area, as well as to program the counting mode (single count, auto count or continuous counting). Pressing this button will change the displayed buttons to read **[MEMORY]**, **[SAMPLE]**, **[AREA]**, **[COUNTING MODE]** and **[BACK]**.

11.5 Viewing Stored Sample Data

The APC Portable has the capacity to store 1000 samples in memory. The count information is automatically stored after each sample. Data storage will also take place if the instrument is manually stopped without completing the full sample time. The actual sample time will be stored and can be reviewed along with the particle count data for each location.

MEMORY –

To view data stored in memory, the particle counter must not be in the counting mode. To review counts already stored in memory, press the **[REVIEW & MODE]** button then **[MEMORY]**, then **[REVIEW MEMORY]**. From this screen you can navigate the memory in increments of one, **[NEXT]** or **[PREVIOUS]**, or increments of 25 data locations **[+25]** or **[-25]**. “Reviewing” will be displayed on the lower left hand corner to let you know you are reviewing stored data. The number of the location in memory is displayed in the “Mem: XXX” section on the left side of the LCD indicating the memory location (000 to 999) currently being displayed. The data appears as it did when originally sampled.

The **[ERASE MEMORY]** key will clear the data stored in memory and erase all the stored data from samples previously tested. It will not erase the settings programmed in the instrument. Erasing the memory will display asterisks (*) on the screen until new data is created. Pressing the **[ERASE MEMORY]** key will ask, “ARE YOU SURE?” Pressing **[OK]** will erase the memory, **[CANCEL]** will return to the previous menu.

*Note: Be careful not to erase the memory until you have completed reviewing the data. Clearing the memory locations in the APC Portable resets the counter to Mem: *** for storage of the next data set! The next data sample will be stored at memory location 000.*

11.6 Mode Functions

The APC Portable allows the operator to program facility-specific airborne particle monitoring. Up to 1000 Cleanroom Areas can be chosen as well as up to 1000 user-defined sample locations inside the areas. For example, in Area 001 there are three sampling locations, each location can be sampled under its own user-defined name. This will facilitate further trending and standards calculations, Federal Standard 209E or ISO14644-1.

For example, your facility has cleanroom suite with one cleanroom and a gowning room (See Figure 4 below). In the cleanroom, designated Area 015, there are four sample locations: Hood 1, Hood 2, Hood 3, and Workcart location 4. In each location particle counts are measured using the APC Portable. In the Gowning Area two sample locations are tested, location 1, near the hand dryer, and location 2 near the entrance. The APC Portable is able to sort the data collected into each area, from which the FS209E and ISO14644 calculations are performed.

Figure 4: Cleanroom Suite Diagram



SAMPLE --

The sample location names can be programmed via the accompanying software and uploaded into the APC Portable, see Section 14 for the software instruction. There are 1000 locations available allowing 22 alphanumeric characters for each location name. The sample number is indicated on the upper left hand area of the LCD and has a colon after the number. For example, "2:" would designate the 3rd sample location. If the sample location name is uploaded into the APC Portable, it might say, "2: Filling".

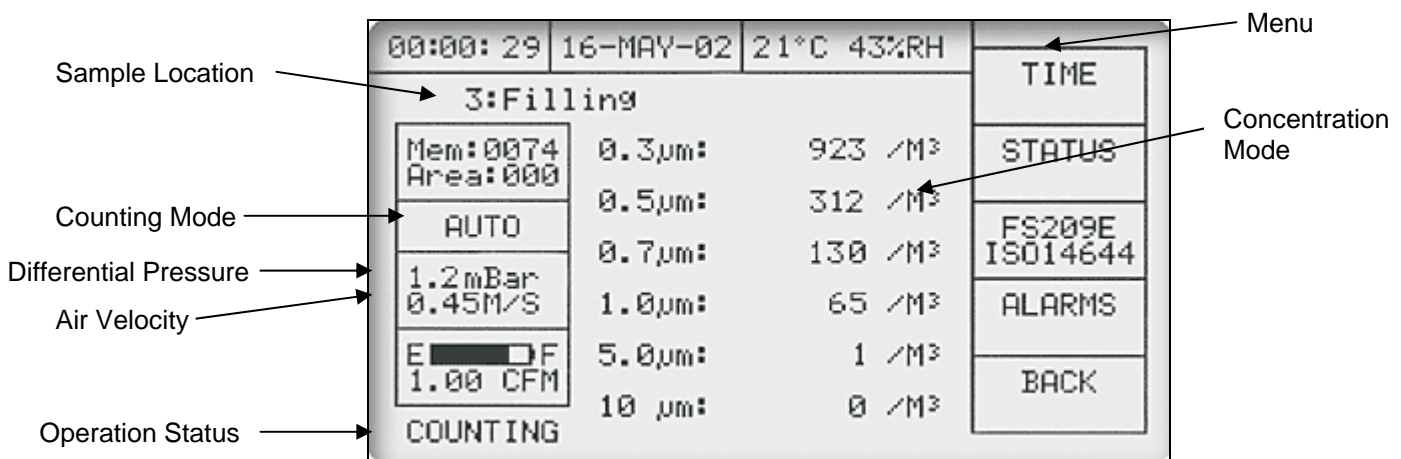
To choose the pre-programmed sample location, press the **[REVIEW & MODE]** button then **[SAMPLE]**. From this screen you can choose which sample location in increments of one, **[NEXT]** or **[PREVIOUS]**, or increments of 25 data locations **[+25]** or **[-25]**. Pressing the **[BACK]** key will save the choice in the instrument and display it on the LCD.

AREA --

The area is a number between 000 and 999. It allows locations to be grouped together. To scroll through the available areas, from 0 - 999, press the **[REVIEW & MODE]** button then **[AREA]**. From this screen you can choose an area in increments of one, **[NEXT]** or **[PREVIOUS]**, or increments of 25 data locations **[+25]** or **[-25]**. Pressing the **[BACK]** key will save the choice in the instrument and will be displayed on the left side of the LCD.

For example, as in Figure 5 below, if there are 3 sample locations within Area 000, and the one was the Filling location, the LCD will indicate:

Figure 5: Display Screen Example



COUNTING MODE – SINGLE COUNT, AUTO COUNT, CONTINUE COUNTING and COUNT CYCLE

To select the mode, simply press the appropriate key. From the first screen press **[REVIEW & MODE]** then **[COUNTING MODE]** then choose **[SINGLE COUNT]**, **[AUTO COUNT]**, **[CONTINUE COUNTING]** or **[COUNT CYCLE]**. The currently selected mode is displayed on the left side of the LCD. Pressing the **[BACK]** key will save the choice in the instrument that will be displayed on the left side of the LCD.

In **[SINGLE COUNT]** (single) mode the instrument will sample for the pre-selected counting time then stop.

In **[AUTO COUNT]** (automatic) mode the instrument will sample for the pre-selected counting time, hold for the preprogrammed hold period in standby mode, then repeats this sequence continually. This standby/sample time sequence will be repeated automatically until data is stored at the 1000th memory location, or until pressing the **[START/STOP]** key stops the unit.

In **[CONTINUE COUNTING]** (continuous) mode the instrument will sample continuously until **[START/STOP]** is pressed.

In **[COUNT CYCLE]** (cycling) mode the user can program a cycle of counts at the set count and hold time. For example, one can program the APC Portable to sample 3 one-minute counts at 5-seconds apart, and then stop. The instrument will sample sets of counts for the pre-selected counting time, hold for the preprogrammed hold period, and then repeat this sequence until the sampling set is completed. To restart the cycle press **[START/STOP]**. If the sampling is stopped mid-cycle pressing **[START/STOP]** again will initiate the next cycle.

When **[COUNT CYCLE]** is pressed for the first time the display will indicate “00/01”. The first two numbers are a status meter which will increment as each sample is collected. The second set of numbers designates the number of samples in a count cycle which can be programmed from 01 to 99. A menu will appear to select the number of tests in a count cycle: pressing **[NEXT]** or **[PREVIOUS]** will increment or decrement the count cycle by one, pressing **[+25]** or **[-25]** will select the count cycle in increments of 25. From the example above, if the Count Cycle is set to 3, the display will read “00/03”. When the display reads “03/03” the count cycle is complete. The selected Count Cycle will be stored in memory until changed by the user.

11.7 Thermal Printer

If the printer is not installed, pressing the **[PRINT]** key will display the error message “INVALID” in the bottom left hand corner of the touchscreen.

11.7.1 Loading the Printer Paper

Turn on the power. Enable the printer (see Section 11.7.2). Cut the tip of the paper straight across. Open the paper cover. Push the tip of the paper into the inlet at the bottom of the paper holder until it catches. Repeatedly press line-feed to advance the paper through the printer.

11.7.2 Enabling the Printer

ON-LINE --

Enable the printer by pressing **[PRINT]** then **[ON-LINE]**. This will display a small printer icon in the lower left hand corner of the LCD. Begin sampling. When the printer is enabled each time the particle counter pauses or stops, a printout of the data will be generated automatically. The printout consists of a header, which contains the date, the count time and sampling parameters and the time, temperature, relative humidity, and counts by particle size. For example, if the count time is set to one minute, after the one-minute particle count is complete, the particle counter will printout the data as below:

```

Filling
Area: 002          MEMORY:512
12:05:52          28-MAY-02
T: 21° C          RH: 49%
P: 10.0 mBAR      V: 0.50 M/Sec
FLOWRATE: 1.00 CFM
COUNT TIME: 00:01:00
CALIBRATION DATE: 22-MAY-02
-----
0.3um:            312 /FT3
0.5um:            29  /FT3
0.7um:            6   /FT3
1.0um:            2   /FT3
5.0um:            0   /FT3
10um:             0   /FT3

```

Note: While the printer is printing the touchscreen becomes inactivate.

Note: Shutting off the particle counter during printing will stop the printing. Printing will not resume when the counter is turned back on. To print the last count data from the stored memory refer to section 11.7.3.

Note: Shutting off the particle counter switches the printer off-line. To resume printing, you must turn the printer on-line.

11.7.3 Printing Stored Data

MEMORY RANGE --

To print stored data from the memory press the **[PRINT]** key from the first screen then the **[MEMORY RANGE]** button. A screen will indicate "Select Print Range, From: XXXX, To: XXXX." To choose the starting data memory location press **[FROM]** and scroll through the stored memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your choice then return you to the "Select Print Range" screen. To choose the ending data memory location press **[FROM]** and scroll through the stored memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your selection and return you to the "Select Print Range" screen. The selected range will be displayed on the screen, press **[GO]** to start printing.

SAMPLE NAMES --

To print a list of the sample location names stored in the APC Portable press the **[PRINT]** key from the first screen then the **[SAMPLE NAMES]** button. A screen will indicate "Location Name Range, From: XXXX, To: XXXX." To choose the starting location press **[FROM]** and scroll through the stored memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your choice then return you to the "Location Name Range" screen. To choose the ending location press **[FROM]** and scroll through the stored memory in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your selection and return you to the "Select Print Range" screen. The selected range will be displayed on the screen, press **[GO]** to start printing.

LINE FEED –

The **[LINE FEED]** key will advance the printer paper when the printer is online.

11.8 Programming Times

11.8.1 Time – Set Clock, Date, Count Time, Hold Time, and Purge Time

The **[TIME]** function allows the user to set the clock, and date as well as the count time, hold time, and purge time.

SET CLOCK --

To set the clock press the **[MORE]** button from the main LCD screen then **[TIME]** then **[SET CLOCK]**. The clock will appear on the screen as Hour:Minutes:Seconds. Pressing the keys on the right will change each highlighted section by increments of one, increasing, **[INCR]**, or decreasing, **[DECR]**. Pressing the **[NEXT]** key will scroll through the numbers and store your final choice, **[CANCEL]** will cancel any changes.

SET DATE --

To set the date press the **[MORE]** button from the main LCD screen then **[TIME]** then **[SET DATE]**. The date will appear on the screen in the DD/Month/YY format. Pressing the keys on the right will change each highlighted section by increments of one, increasing, **[INCR]**, or decreasing, **[DECR]**. Pressing the **[NEXT]** key will scroll through the numbers and store your final choice, **[CANCEL]** will cancel any changes.

Note: When the APC Portable is turned off, the time and date are kept by a circuit with a back-up battery. If the unit fails to keep the correct time and date when it is turned off, the back-up battery will need to be replaced.

Note: The APC Portable handles leap years correctly.

COUNT TIME --

To set the count time press the **[MORE]** button from the main LCD screen then **[TIME]** then **[MORE]** then **[COUNT TIME]**. The time will appear on the screen in the Hours/Minutes/Seconds format. Pressing the keys on the right will change each highlighted section by increments of one, increasing, **[INCR]**, or decreasing, **[DECR]**. Pressing the **[NEXT]** key will scroll through the numbers and store your final choice, **[CANCEL]** will cancel any changes. Valid count times range from 1 second to 7:59:59 (just under 8 hours).

HOLD TIME --

To set the hold time press the **[MORE]** button from the main LCD screen then **[TIME]** then **[MORE]** then **[HOLD TIME]**. The time will appear on the screen in the Hours:Minutes:Seconds format. Pressing the keys on the right will change each highlighted section by increments of one, increasing, **[INCR]**, or decreasing, **[DECR]**. Pressing the **[NEXT]** key will scroll through the numbers and store your final choice, **[CANCEL]** will cancel any changes. The maximum hold time is 23:59:59 (one second less than 24 hours). The minimum hold time is one second.

PURGE TIME --

The purge function starts the pump prior to counting to allow both the pump and the laser to stabilize. A minimum of two seconds is recommended for purging. To set the purge time press the **[MORE]** button from the main LCD screen then **[TIME]** then **[MORE]** then **[PURGE TIME]**. The time will appear on the screen in the Hours:Minutes:Seconds format. Pressing the keys on the right will change each highlighted section by increments of one, increasing, **[INCR]**, or decreasing, **[DECR]**. Pressing the **[NEXT]** key will scroll through the numbers and store your final choice, **[CANCEL]** will cancel any changes. Valid purge times range from two seconds to 23:59:59.

11.9 Status

The status screens allow the user to access information regarding the battery as well as the ability to change the LCD display.

11.9.1 Battery

Refer to Section 7 in this manual for information regarding the APC Portable Battery Packs.

REMAINING POWER --

The display includes a battery icon that shows the remaining power left in the battery packs. This ranges from empty to full in 16 steps.

BATTERY STATE --

Pressing **[MORE]** from the main LCD screen then **[STATUS]** then **[BATTERY STATE]** will display the battery status screen. The charging status of battery packs is displayed as well as the voltage of each battery pack. The charging status is FAST, TRICKLE, or NONE. If a pack is fast charging the pack will be charged in about 3 hours. If the battery is trickle charging, the battery is slowly charging or being topped off. If "none" is displayed, the unit is unplugged from the AC power line, and the batteries cannot be charged.

Note: If the battery packs are deeply discharged, one or more packs may fail to track of the amount of energy actually in each pack. This may result in the display showing more charge than is actually in the battery. When this occurs, a pack may fast charge for a few moments, then switch to trickle charge, even though the battery pack is not fully charged. This may also occur on more than one pack. If this occurs, please see the troubleshooting guide for a procedure to restore the proper capacity of the battery pack(s).

11.9.2 Display

To change or refresh the display of the LCD press the **[MORE]** button from the main LCD screen then **[STATUS]** then **[DISPLAY]**. From this screen the operator can choose to increase or decrease the contrast of the screen, or invert the screen colors. Pressing the keys on the right will change the contrast in small increments **[INCREASE CONTRAST]**, or decreasing, **[DECREASE CONTRAST]**. Pressing **[INVERT]** will reverse the colors of the screen. Pressing the **[RESET]** key will refresh the screen. Pressing the **[BACK]** key will retain the selections.

11.10 FS209E/ ISO14644

The APC Portable calculates the statistical reports required for compliance with Federal Standard 209E or ISO14644 documentation: average count by area sampled, standard error, and 95% upper confidence limit. This feature is accessed through the **[FS209E ISO14644]** button.

The APC Portable can analyze the data from up to 8 areas at one time. If more than 8 areas are included in the selected memory range to calculate, an error will occur in the instrument. To analyze more than 8 areas at one time, sample the areas in blocks and utilize the select memory range function to block off sections of 8 or less areas.

As an added feature, the APC Portable can perform a statistical analysis of data from only one location. This would be advantageous in a situation where the APC Portable is stationary in a single location inside a single area. In this case the FS209E and ISO14644 calculations provide an overall location average, a standard error of the samples, and the upper confidence level of the samples (using the UCL factor for the calculation mode chosen see Table 1 or Table 2, respectively).

11.10.1 FS209E Calculations

Federal Standard 209E was officially retired November 2001 but many firms may still use the defunct standard to analyze cleanrooms. FS209E requires a minimum of 5 samples per area in at least 2 locations inside that area. The APC Portable calculates the mean at each location, the mean of these averages, standard error of the mean, and upper confidence limit. The FS209E analyses are reported in per cubic feet and are calculated as follows:

Calculation	Formula
Average particle concentration at a location	$A = \frac{(C_1 + C_2 + \dots + C_N)}{N}$
Mean of the averages	$M = \frac{(A_1 + A_2 + \dots + A_L)}{L}$

Standard deviation of the averages	$SD = \sqrt{\frac{(A_1 - M)^2 + (A_2 - M)^2 + \dots + (A_L - M)^2}{L - 1}}$
Standard error of the mean of the averages	$SE = \frac{SD}{\sqrt{L}}$
95% Upper Confidence Limit	$UCL = M + (UCL\ Factor \times SE)$

The **average particle concentration at a location**, A, is the sum of the individual sample particle concentrations, C₁, divided by the number of samples taken at the location, M, as shown in the table above.

The **mean of the averages**, M, is the sum of the individual averages, A, divided by the number of locations, L, as shown in the equation above. All locations are weighted equally regardless of the number of samples taken.

The **standard deviation of the averages**, SD, is the square root of the sum of the squares of differences between each one of the individual averages and the mean of the averages, (A₁ – M)², divided by the number of locations, L, minus one, as shown above.

The **standard error** of the mean of the averages, SE, is determined by dividing the standard deviation, SD, by the square root of the number of sample locations, L, as shown above.

The 95% **upper confidence limit**, UCL, of the mean of the averages, M, is determined by adding the mean to the product of the appropriate UCL factor (see table below “UCL Factor for 95% Upper Confidence Limit”) and the standard error, SE. The APC Portable performs the UCL calculation when there are more than one and less than nine locations sampled. With more than nine locations sampled, the UCL is equal to the average. (When only one location is sampled the UCL equals the location mean for one sample or more than nine, or it equals the regular 95% UCL using the factors in Table 1.)

Table 1: FS209E – UCL Factor for 95% Upper Confidence Limit:

# of Locations, L	2	3	4	5	6	7	8	9	>9
95% UCL factor	6.31	2.92	2.35	2.13	2.02	1.94	1.90	1.86	N/A

Pressing the **[FS209E CALCS]** key will display a screen for the operator to select the range of data with which to perform the FS209E calculations. The screen will indicate “Select Memory Range, From: XXXX, To: XXXX.” To choose the starting data memory location press **[FROM]** and scroll through the stored memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your choice then return you to the “Select Memory Range” screen. To choose the ending data memory location press **[FROM]** and scroll through the stored

memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your choice then return you to the “Select Memory Range” screen.

Pressing **[GO]** will begin the FS209E calculations: the Average, Standard Error and Upper Confidence Level per Area sampled. On the bottom left of the touchscreen a progress indicator will be displayed, **A#** and **L#** which displays the number of Areas in the calculation (starting at 000) and the last location number in the area under evaluation. As the instrument is sorting and tabulating the data the **A#** and **L#** will advance until the final value is reached. The calculation results will be displayed on the touchscreen. To view all the results on the touchscreen, press **[NEXT]** or **[PREVIOUS]** to scroll through the data. At the last data screen press **[BACK]** to return to the main calculations screen (pressing **[NEXT]** or **[PREVIOUS]** from this screen will not be a valid action.)

Pressing **[PRINT]** will print the calculated data when the printer is enabled. Ensure that the printer is enabled before performing the calculations. (To halt the printing, once initiated, the instrument must be switched off.)

Figure 6: Example of FS209E Calculations:

```

AREA # 1 RESULTS
NUMBER OF LOCATIONS: 005
AREA 001 AVERAGE
-----
0.3um: 10290.0/FT3
0.5um: 1145.0/FT3
0.7um: 572.5/FT3
1.0um: 143.5/FT3
5.0um: 79.0/FT3
10 um: 24.5/FT3

AREA 001 STD. ERROR
-----
0.3um: 28.2/FT3
0.5um: 14.1/FT3
0.7um: 7.0/FT3
1.0um: 4.2/FT3
5.0um: 2.8/FT3
10 um: 1.4/FT3

AREA 001 95% UCL
-----
0.3um: 10350.2/FT3
0.5um: 1175.1/FT3
0.7um: 587.5/FT3
1.0um: 152.5/FT3
5.0um: 85.0/FT3
10 um: 0.5/FT3

```

11.10.2 ISO14644-1 Calculations

In accordance with ISO14644-1 the APC Portable calculates the mean of each sample location, the mean of the averages, standard error of the mean, and upper confidence limit of an area where at least 2 locations are sampled inside that area. The calculations for ISO14644 are reported in cubic meters.

Calculation	Formula
Average particle concentration at a location	$A = \frac{(C_1 + C_2 + \dots C_N)}{N}$
Standard deviation of the averages	$SD = \sqrt{\frac{(A_1 - M)^2 + (A_2 - M)^2 + \dots (A_L - M)^2}{L - 1}}$
Standard error of the mean of the averages	$SE = \frac{SD}{\sqrt{L}}$
95% Upper Confidence Limit	$UCL = M + (UCL\ Factor \times SE)$

The **average particle concentration at a location**, A, is the sum of the individual sample particle concentrations, C₁, divided by the number of samples taken at the location, M, as shown in the table above.

The **mean of the averages**, M, is the sum of the individual averages, A, divided by the number of locations, L, as shown in the equation above. All locations are weighted equally regardless of the number of samples taken.

The **standard deviation of the averages**, SD, is the square root of the sum of the squares of differences between each one of the individual averages and the mean of the averages, (A₁ – M)², divided by the number of locations, L, minus one, as shown above.

The **standard error** of the mean of the averages, SE, is determined by dividing the standard deviation, SD, by the square root of the number of sample locations, L, as shown above.

The 95% **upper confidence limit**, UCL, of the mean of the averages, M, is determined by adding the mean to the product of the appropriate UCL factor (see table below “Student’s t Factor for 95% Upper Confidence Limit”) and the standard error, SE as shown above. The APC Portable performs the UCL calculation when there are more than one and less than nine locations sampled. With either one sample location, or more than nine locations sampled, the UCL is equal to the average. (When only one location is sampled the UCL function reports a statistical analysis of the data collected.)

Table 2: ISO14644 – Student’s t Factor for 95% Upper Confidence Limit:

# of Locations, L	2	3	4	5-6	7-9	>9
95% UCL factor	6.3	2.9	2.4	2.1	1.9	N/A

Pressing the **[ISO14644 CALCS]** key will display a screen so operator can select the range of data with which to perform the ISO14644-1 calculations. The screen will indicate “Select Memory Range, From: XXXX, To: XXXX.” To choose the starting data memory location press **[FROM]** and scroll through the stored memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your choice then return you to the “Select Memory Range” screen. To choose the ending data memory location press **[FROM]** and scroll through the stored memory locations in increments of one with **[NEXT]** or **[PREVIOUS]**. To navigate through the data in increments of 25 memory locations use the buttons for **[+25]** or **[-25]**. The **[BACK]** key will note your choice then return you to the “Select Memory Range” screen.

Pressing **[GO]** will begin the ISO14644 calculations: the Average, Standard Error and Upper Confidence Level per Area sampled. On the bottom left of the touchscreen a progress indicator will be displayed, **A#** and **L#** which displays the number of Areas in the calculation (starting at 000) and the last location number in the area under evaluation. As the instrument is sorting and tabulating the data the **A#** and **L#** will advance until the final value is reached. The calculation results will be displayed on the touchscreen. To view all the results on the touchscreen, press **[NEXT]** and **[PREVIOUS]** to scroll through the data. At the last data screen press **[BACK]** to return to the main calculations screen (pressing **[NEXT]** or **[PREVIOUS]** from this screen will not be a valid action.)

Pressing **[PRINT]** will print the calculated data when the printer is enabled. Ensure that the printer is enabled before performing the calculations. (To halt the printing, once initiated, the instrument must be switched off.)

Figure 7: Example of ISO14644 Calculations

AREA # 5 RESULTS
 NUMBER OF LOCATIONS: 005
 AREA 005 AVERAGE

0.3um:	391661.5/M3
0.5um:	54563.9/M3
0.7um:	27281.7/M3
1.0um:	9305.4/M3
5.0um:	5614.9/M3
10 um:	2277.4/M3

AREA 005 STD. ERROR

0.3um:	998.9/M3
0.5um:	499.4/M3
0.7um:	249.7/M3
1.0um:	149.6/M3
5.0um:	99.8/M3
10 um:	49.8/M3

AREA 005 95% UCL

0.3um:	393759.2/M3
0.5um:	55612.6/M3
0.7um:	27806.0/M3
1.0um:	9619.7/M3
5.0um:	5824.6/M3
10 um:	2382.1/M3

11.11 Alarms

The APC Portable can be programmed to alarm when the count in any channel exceeds a limit, or if the external sensors go outside an acceptable range. An alarming value will sound an audible noise, highlight the value on the display, and mark an asterisk (*) next to the alarming result on the printout. (To stop the audible signal, touch the LCD display.)

Note: No alarms will activate until [START/STOP] is pressed for the first time after turning on the APC Portable.

The alarms can be set via the touchpad or the APCOne.exe software from a PC and upload the information to the APC Portable. Please refer to section 14.1.3 for more PC-APC Portable communications instruction.

11.11.1 Count Alarms

COUNTS/ CONC. --

The operator can program and enable values for each particle size that, when exceeded, will generate an alarm. The deviating value will also become highlighted on the LCD display. From the main screen press **[MORE]** then **[ALARMS]** then **[COUNTS/ CONC.]**. From this screen press the desired particle size channel to set

the alarm values: **[0.3 um]**, **[0.5 um]**, **[0.7 um]**, or **[MORE]** then **[1.0 um]**, **[5.0 um]**, or **[10 um]**.

Use the **[NEXT]** key to navigate through the digits to program the alarm value in increasing, **[INCR]**, or decreasing, **[DECR]**, increments at each place up to 14,999,999, any result over 15,000,000 will display as all asterisks (*****). Pressing the **[ON/ OFF]** key will enable or disable the alarm, which is noted on the LCD. Pressing **[CANCEL]** will go back to the previous screen without changing the alarm.

11.11.2 External Sensor Alarms (Optional)

If external sensors are not installed, pressing their respective keys will display the error message "Invalid" in the bottom left hand corner of the touchscreen.

EXT. SENSORS --

The operator can enable and program values for each environmental parameter that when exceeded will alarm. The deviating value will generate an alarm. From the main screen press **[MORE]** then **[ALARMS]** then **[EXT. SENSORS]** From this screen press the desired environmental parameter to set the alarm values: **[TEMP.]**, **[REL. HUMIDITY]**, **[PRESSURE]**, or **[VELOCITY]**. Pressing **[CANCEL]** will go back to the previous screen without changing the alarm.

Temperature [TEMP] --

The temperature screen shows the temperature limits, "T Limits," and the High, "Hi," and Low, "Lo," values in degrees Celsius, (°C). The maximum alarm setting is 50°C, the minimum is 0°C. Use the **[NEXT]** key to navigate through the digits to program the alarm value by increasing, **[INCR]**, or decreasing, **[DECR]** the values. Pressing the **[ON/ OFF]** key will enable or disable the alarm, which is noted on the display. Pressing **[NEXT]** will store your selection. Pressing **[CANCEL]** will go back to the previous screen without setting the alarm value.

Relative Humidity [REL HUMIDITY] --

The relative humidity screen displays the relative humidity limits, "RH Limits," and the High, "Hi," and Low, "Lo," values by percentage (%). The maximum alarm setting is 99, the minimum is 0. Use the **[NEXT]** key to navigate through the digits to program the alarm value by increasing, **[INCR]**, or decreasing, **[DECR]** the values. Pressing the **[ON/ OFF]** key will enable or disable the alarm, which is noted on the display. Pressing **[NEXT]** will store your selection. Pressing **[CANCEL]** will go back to the previous screen without setting the alarm value.

Pressure [PRESSURE] --

The screen displayed shows the relative air pressure limits, “P Limits,” and the High, “Hi,” and Low, “Lo,” values in millibars, (mBar). The maximum alarm setting is 25.0 mBar, the minimum is 0 mBar. Use the **[NEXT]** key to navigate through the digits to program the alarm value by increasing, **[INCR]**, or decreasing, **[DECR]** the values. Pressing the **[ON/ OFF]** key will enable or disable the alarm, which is noted on the LCD display. Pressing **[NEXT]** will store your selection. Pressing **[CANCEL]** will go back to the previous screen without setting the alarm value.

Velocity [VELOCITY] --

The screen displayed shows the relative air velocity limits, “V Limits,” and the High, “Hi,” and Low, “Lo,” values in meters per second, (M/S). The maximum alarm setting is 2.00 M/S, the minimum is 0 M/S. Use the **[NEXT]** key to navigate through the digits to program the alarm value by increasing, **[INCR]**, or decreasing, **[DECR]** the values. Pressing the **[ON/ OFF]** key will enable or disable the alarm, which is noted on the display. Pressing **[NEXT]** will store your selection. Pressing **[CANCEL]** will go back to the previous screen without setting the alarm value.

12. OPERATING THE APC PORTABLE IN PRESSURIZED ENVIRONMENTS

The APC Portable may be used in pressurized cleanrooms provided the air inlet and outlet are at the same pressure. Essentially, this means keeping the inlet of the isokinetic probe in the same environment as the rest of the APC Portable. Placing the inlet at a different pressure than the outlet will affect the airflow through the counter and alter the calibration. If the pressure difference is small (< approx. 20 millibars), and the flowrate is still accurate ($1.00 \text{ CFM} \pm 0.05 \text{ CFM}$), this configuration may be tested. However, if the flowrate alarm is indicated, the pressure difference is too large.

An example of incorrect use might involve measuring the particle counts in a laminar flow hood that was modified with access ports. If only the isokinetic probe was placed into the access port, and if the hood was operating at positive pressure, the airflow through the particle counter might be altered. If the counter cannot hold the flowrate of $1.00 \pm 0.05 \text{ CFM}$, an alarm will sound. However, if the entire particle counter was placed in the hood, the inlet and outlet pressures would be equal, and there would be no error introduced.

13. CLEANING THE PARTICLE COUNTER

The particle counter may be cleaned by using isopropyl alcohol or most commercial disinfectants. Gently wipe the exterior with a moistened wipe. The stickers on the back of the instrument are also resistant to commercial disinfectants and bleach.



WARNING: Under no circumstances should liquids be poured into or onto the APC Portable, or should the unit be submerged in any liquid. Do not autoclave the particle counter. Any of these procedures will cause extensive damage to the unit and will require factory servicing or replacement.

14. COMPUTER INTERFACE

An RS-232 cable is required to link the APC Portable to a PC. This cable is included with the APC Portable. The particle counter connects directly to a PC through the serial port. No additional hardware is required.

To connect the APC Portable to the computer, turn off the power. Attach the male end of the cable to the APC Portable. Attach the other end of the interface cable connector directly to the PC through any valid windows COM port up to COM 9.

For computers with 25 pin connectors, use a cable or adapter of the “null modem” type. You will need a cable or adapter with DB-25 female and DB-9 male connectors.

14.1 Windows™ Software

APCOne.exe and **APCOne11.exe** program runs on Windows 9X™, Windows 2000™, Windows NT™ or Windows XP™. It allows you to view and save parameter configurations (count times, concentration modes, and counting modes), display the counts, temperature, humidity, and clock/calendar data on the computer screen. It also allows you to upload clock information, sample location names and alarm limits as well as download data from the particle counter memory. This data may then be saved to a file, or copied to the Windows™ clipboard, where it may then be pasted into any other application that uses the clipboard. A help system is included to answer potential questions.

The software requires Windows 9X™, Windows 2000™, Windows NT™ or Windows XP™, 10 megabytes of hard disk space, and an SVGA monitor. This program is a 32 bit program, therefore it will not install on Windows 3.X.

14.1.1 Installation

The software is supplied on one CD. To install the program, insert CD into the CD drive (usually the E: drive). Click on the “Start” button, and then Run. In the edit box that is displayed, type in **e:setup** (substitute the drive letter for “e” if the CD drive is different, e.g., **d:setup** if the CD drive is the d: drive). The installation wizard will guide you through the installation. Depending on the program downloaded either APCOne or APCOne11 software icon will appear on your desktop.

14.1.2 Running APCOne.exe or APCOne11.exe

Click on the software icon or from the “Start” button, open “Programs”, and then the Biotest program group (or the group that you selected if you renamed the folder during the installation procedure). Then click on the software item to start the program. When starting the program, you should have the APC Portable connected to the computer with the serial cable, and the particle counter turned on.

The first time the program is run, you must select the COM port to use. If it is unable to communicate with the particle counter, or it cannot find a particle counter, it will display a message of “Wrong # of Bytes,” or that the port is not set up properly. Check which COM port the APC Portable is connected to then click on **Data Transfer** in the menu row then **Set-up COM Port**. Choose which port the APC Portable is connected to.

If the program still is not communicating with the particle counter, check that the cable is securely and properly connected to the serial port and plugged into the particle counter. Turn off the particle counter and turn it back on. If this fails, quit the program and start it again.

Note: If the remaining power meter reads empty, and it is known that the batteries are charged, then it is likely there is a communication error between the main microcontroller and the secondary microcontroller. To restore the power meter to proper operation, turn the unit off, wait about 3 seconds, then turn it back on. If the power meter is still malfunctioning, turn off both the APC Portable and the download utility software. Restart the APC Portable, and then start the program.

14.1.3 APC Portable – PC Communications

It is recommended to configure the APC Portable via the Download Utility Software. The software allows the user to easily program and save counter configurations. There are two ways to upload data to the APC Portable, through the Data Transfer function or through a Configuration setting.

SET CLOCK --

To set the clock/calendar on the particle counter, simply click on **Clock** from the menu, then **Set Clock**. This will set the time and date on the APC Portable to that on the computer. Make sure the clock on the computer is properly set. The application can also be updated with the PC's clock, to accomplish this, go to **Clock**, then **Read Clock**.

SET SAMPLE LOCATION NAMES --

To set the sample location names select **Edit** then **Location Names**. A window will pop-up prompting you to open a saved text file of location names. If a file is not selected, or none are available to select, a message will read "File not opened, using default data." A table will open with some default data pre-programmed. This table can be modified and stores up to 1,000 locations. Enter the sample location name data in the Location Name field (the field on the right). The **Save to File** key will allow the user to save this set of sample location names to a text file. **Write to APC** will upload the sample location names to the APC Portable. **Clear Names** will clear the existing sample location names from this table (unless the sample location names are saved in a file, clearing the data is final and can not be recovered). **Quit** will end the program.

Another way to communicate the location information to the APC Portable is to click on **Data Transfer** from the main menu, then **Data TO Counter** then **Location Names**. The programmed location names will display on the APC Portable.

SET ALARM LIMITS --

To set the alarm limits select **Edit** then **Alarm Limits**. A window will pop-up that enables the user to set the limits for count and environmental alarms. The alarms can also be enabled from this window. Enter the data in the fields as needed. Pressing **OK** will save this information; **Cancel** will revert to the previous setting, **Defaults** will default to the factory-set alarm conditions. To communicate the alarm information to the APC Portable, you must set a configuration then transfer the information to the APC Portable. See **SET CONFIGURATIONS** below.

SET CONFIGURATIONS

The APCOne and APCONE11 software can save parameter configurations including location names, alarm limits, and sample time information. To set a configuration, from the main menu click on **File**, then **New Configuration**. A screen will pop-up displaying the Configuration Editor. From the configuration editor, the user can program Concentration Mode, Counting Mode, Alarm File Name, Location Names, Count Time, Hold Time, and Purge Time. The **Concentration Mode** and **Counting Modes** are selected using the radio buttons. The **Count Time**, **Hold Time**, and **Purge Time** are edited with keystrokes. The **Alarm File Name** and **Location**

Names must be selected from saved files (see **SET SAMPLE LOCATION NAMES** and **SET ALARM LIMITS** above.) When the alarm limits and sample location names are selected, data will appear in the “Alarm Limits Data” and “Location Name Data” boxes. Once all the parameters are set, the configuration can be saved by clicking on **Save to File**. To upload the data to the APC Portable, click on **Write to Ctr**. **Close** will cancel any changes.

Read/Save Configuration downloads the data as stored in the APC Portable. After the data is downloaded it can be saved to a file.

DOWNLOAD DATA

To download count data from the particle counter’s memory to the computer, from the menu, click on **Data Transfer**, then **Data FROM counter**, then **Count Data**. This will open a download data window. To start the data download click on **Download** (or **Download, Go**). The program will indicate the status of the download in the status report at the bottom of the window. To abort the download right click on the screen during the download. When the download is completed, the data can be copied to the clipboard and pasted into a spreadsheet program. The data may also be saved to a file through **File, Save** then selecting a filename. The data is saved in the comma separated values format. The default delimiter is a comma (,). To change this, select **Edit, Delimiter Character** and enter the new character (e.g. “;” is the character used in Europe).

Note: The count data will download in the same concentration mode the APC Portable is currently set. For example, if you need results in cubic meters but the APC Portable is displaying the data in total particles, the concentration mode must be changed to m^3 before downloading the data.

Note: The APC Portable will download data with decimals according to the user’s appropriate designation “.” or “,” by reviewing the global attributes set on the user’s PC.

The downloaded data is still saved on the APC Portable until the memory is erased, see Section 11.5.

CALIBRATE TOUCH PANEL

In the unlikely event that the touchpad stops working properly it could be in need of calibration. To re-calibrate the touchpad, click on **Edit, Calibrate Touch Panel**. To perform the calibration, the APC Portable will display two dots, one in the upper right hand corner of the screen and one in the bottom left. Using a stylus pen (or the end of a pen cap) first touch the upper right dot, then the lower left dot to calibrate the touchpad.

15. TROUBLESHOOTING GUIDE

CAUTION: Always turn off the power to the APC Portable before connecting or disconnecting any cables.



WARNING: There are no user serviceable components in the APC Portable. The instrument contains a high power (class IIIb) laser and should only be opened by an authorized technician as authorized by Biotest Diagnostics Corporation. Send the complete instrument to an authorized Biotest service center for repair or calibration. Failure to follow the manufacturer’s recommendations may damage the APC Portable and will void the warranty.

Table 3: Troubleshooting Guide

Observed Problem	Possible Solutions
Any and all problems experienced...	Turn the unit off, and then back on.
The unit will not turn on, even when plugged into the AC supply...	<p>The battery pack may need to be replaced. If the unit has not been charged for several months, the battery may be deeply discharged, and will not be able to be recharged. Try charging the unit overnight.</p> <p>If successful, test the battery by running in the AUTO mode with a count time of 1 minute, and a hold time of 15 seconds. If the unit runs less than 2½ hours, the batteries may need to be replaced.</p>
The APC Portable will not take any more samples, START/STOP key is not functioning...	<p>Check that you have not reached the 1000th memory location (mem: 999). After filling the memory, it must be erased before the APC Portable will continue sampling. (See Sections 11.5).</p> <p>Check that the battery is not empty. The instrument will not sample until connected to the AC outlet. The unit should be allowed to charge overnight.</p>
If there are unfamiliar characters on the display...	<p>Turn the unit off, and then back on.</p> <p>Reset the display.</p>
If no characters appear on the display after the instrument is connected to the AC outlet for at least one Hour...	Unplug the unit from the AC outlet for at least twelve hours. Then, reconnect the unit to the AC outlet, wait five minutes and attempt to restart the instrument.
If * appears on the LCD...	That particular memory location has no valid data. The count result is >15,000,000.

Table 3: Troubleshooting Guide, *continued*

Observed Problem	Possible Solutions
If the particle count is erratic...	<p>You may be sampling in a concentration mode (see Section 11.3).</p> <p>There is a possible obstruction in the flow path or contamination of the system. Use the purge filter assembly to attempt to clear the path as described in Section 8.1.</p> <p>The batteries may require charging (see Section 7).</p>
If there are no communications between the computer and the APC Portable ...	<p>Exit communication program and turn off the APC Portable. Turn the APC Portable back on and restart the program.</p> <p>Check the RS-232 interface cable connections. Make sure the APC Portable is turned on.</p> <p>Try running the program with no command line parameters. If not successful, try running with the correct command line parameters (see Sections 5.1 or 5.2).</p>
If the flow sounds unstable...	<p>If the batteries are being FAST charged, and the unit is running, the pump may sound unstable. Try to avoid running the unit during a FAST charge.</p>
The unit acts like the batteries are dead, but the display shows that the unit has sufficient charge.	<p>This can happen if the battery packs are deeply discharged. Plugging the unit in sometimes results in one or more packs not fully charging. To fix this, follow this procedure:</p> <ol style="list-style-type: none"> 1) Turn the unit off, unplug it, and let it sit for about 2 minutes. 2) Plug in the unit. DO NOT turn it on for at least ½ hour. 3) After at least ½ hour, turn the unit on and go to the battery status screen. If all three packs are not charging, go back to step 1). 4) If the packs are charging, turn the unit off, and let it charge another 2 ½ hours to fully charge. 5) When all packs are fully charged, they must be completely discharged. Unplug the unit and run it in AUTO mode until the unit does not start counting, and “LOW BATTERY” is indicated on the screen. Then, switch it to the continuous counting mode, and turn off the instrument. Let the instrument stabilize for a few seconds. 6) Turn the instrument back on, and <u>immediately</u> press the Start/Stop button to start the unit counting. Go back to 5) if the unit does not start. It may be necessary to set the purge time to 1 second. 7) Once the instrument starts counting, switch the display to the battery status screen. Let the instrument run until all of the battery voltages are below about 10 volts. Stop the instrument. 8) Turn off the instrument. Plug the instrument into the mains power, and let the instrument charge for six hours. The battery capacity should now be accurate.

16. Service Information



WARNING: There are no user serviceable components in the APC Portable. Send the complete instrument to an authorized Biotest service center for repair and calibration. Failure to follow the manufacturer's recommendations may result in personal injury, or damage to the APC Portable, and will void the warranty. There is also a high power laser in the lens tube that can cause blindness if the optics are opened and mishandled.

Note: The APC Portable is calibrated at the factory using isotropic polystyrene spheres according to the procedures outlined in ASTM F-328 and ASTM F-649. It is recommended that the instrument be returned to the factory or authorized service center yearly for calibration.

APPENDIX A - Specifications

Illumination Source	50 mW laser diode at approximately 685 nm
Particle Size Ranges	0.3, 0.5, 0.7, 1.0, 5.0 10.0 microns
Flow Rate	1.0 cubic foot per minute \pm 5%
Calibration	NIST traceable with polystyrene spheres as per ASTM F-328 or ASTM F-649
Display	Graphic LCD display/Touchscreen
Data Display	<ul style="list-style-type: none"> • Total particles, particles per m³, ft³, or particles per liter • (Optional) Temperature Sensor: 10°C to 50°C \pm 2°C • (Optional) Relative Humidity Sensor: 20 to 90% RH \pm 10% • (Optional) Velocity Sensor: m/s \pm 10% • (Optional) Pressure Sensor: mbar \pm 3%
Sampling Mode	Single, automatic, or continuous
Count Time	One second up to eight hours
Purge Time	One second up to 24 hours
Hold Time	Two seconds up to 24 hours
Memory	Automatic storage of 1000 samples
Output	Serial RS232C. Baud rate of 9600. Optional thermal printer.
Power	100 – 240 VAC \pm 10%, 50 to 60 Hz power input from mains supply. Internal 12-volt NiMH battery packs with integral charger. Overvoltage Category 2, Pollution Degree 2.
Operating Environment	Temperature: 10° to 40 °C (50° to 104°F) Humidity: 0 to 90% (noncondensing)
Storage Environment	Temperature: -40°C to 70°C (-40°F to 158°F) Humidity: 0 to 60%
Dimensions	30x30x20 cm (12x12x8 inches)
Weight	8.6 Kg (19 pounds)

APPENDIX B – General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any product connected to it. To avoid potential hazards, use this product only as specified.



To Avoid Fire or Personal Injury:

- **Use Proper Power Cord.** Use only the power cord specified for the product and certified for the country of use.
- **Connect and Disconnect Properly.** Connect the power cord only when the unit is not running.
- **Ground the Product.** When operating with the AC power, this product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to the earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.
- **Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.
- **Replace Batteries Properly.** Service on this product should be performed by an authorized technician. Contact Biotest Diagnostics Corporation at 800-522-0090 or 973-625-1300 for an authorized service center in your area, or refer to www.BiotestUSA.com.
- **Do Not Operate Without Covers.** Do not operate this product with covers or panels removed.
- **Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.
- **Do Not Operate With Suspected Failures.** If you suspect there is damage to the product, Contact Biotest Diagnostics Corporation at 1-800-522-0090 or 973-625-1300 for an authorized service center in your area.
- **Do Not Operate in Wet/Damp Conditions.**
- **Do Not Operate in an Explosive Atmosphere.**
- **Keep Product Surfaces Clean and Dry.**
- **Provide Proper Ventilation.** Do not block any of the air vents in this product.

APPENDIX B – General Safety Summary, *Continued*

Safety Terms:

Terms in this 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 property.
- *Note:* Note statements identify general information.

Terms on the Product. These terms may appear on the product.

- **DANGER** indicates an injury hazard immediately accessible as you read the marking.
- **WARNING** indicates an injury hazard not immediately accessible as you read the marking.
- **CAUTION** indicates a hazard to property including the product.

APPENDIX C - Optional Equipment Installation

Optional equipment list:

- 1) Printer Assembly (See 1 below)
- 2) Temperature and Humidity Probe – Article Number 942440
- 3) Air Velocity Probe – Article Number 942445
- 4) Purge Filter – Article Number 942425
- 5) Pressure Sensor – Article Number 942450

CAUTION: Turn off the APC Portable while installing optional equipment.

1) Printer Assembly

If the printer assembly option is not purchased with the original equipment, the unit will need to be sent to an authorized service center for subsequent installation.



WARNING: The printer assembly must be installed by an authorized technician. Contact Biotest Diagnostics Corporation at 800.522.0090 or 973.625.1300 for an authorized service center in your area.

2) Temperature and Humidity Probe

The temperature and humidity probe is connected in the back of the APC Portable. There is a receptacle labeled Temp/Hum. Line up the cable end and push it into the receptacle and turn the locking nut clockwise until tight.

3) Air Velocity Probe

If the air velocity option is not purchased with the original equipment, the unit will need to be sent to an authorized service center for subsequent installation.



WARNING: The air velocity option must be installed by an authorized technician. Contact Biotest Diagnostics Corporation at 800.522.0090 or 973.625.1300 for an authorized service center in your area.

The air velocity probe is connected in the back of the APC Portable. There is a receptacle labeled Air Velocity. Line up the cable end and push it into the receptacle and turn the locking nut clockwise until tight.

4) Purge Filter

The purge filter is connected to the inlet nozzle on the top of the APC Portable. Push the tubing over the inlet nozzle until the hose barbs on the inlet nozzle cannot be seen.

5) Pressure Sensor

If the pressure sensor option is not purchased with the original equipment, the unit will need to be sent to an authorized service center for subsequent installation.



WARNING: The pressure sensor must be installed by an authorized technician. Contact Biotest Diagnostics at 800.522.0090 or 973.625.1300 for an authorized service center in your area.

APPENDIX D – Product Warranty

Biotest (hereinafter "Seller") warrants that the manufactured products delivered under this order will be free from defects in material and workmanship under normal use and service for a period of one (1) year from date of shipment of the product to Buyer's plant.

Seller's sole obligations under this Warranty, are to replace, repair or give credit for, at Seller's option, at its factory, any of said products which shall within one (1) year after shipment, be returned to Seller's factory of origin, transportation charges prepaid, clearly marked with Return Material Authorization (RMA) number obtained from Seller, and which are, after inspection, discovered to Seller's satisfaction to be defective. The original warranty is extended as a result of the repair or replacement of any product.

THIS WARRANTY IS STATED IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, STATUTORY, OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON SELLER'S PART, AND IT NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR SELLER ANY OTHER LIABILITIES IN CONNECTION WITH THE SALE OF THE SAID ARTICLES.

This Warranty shall not apply to any product which shall have not been maintained in accordance with any handling or operating instructions supplied by Seller, or which shall have been subjected to unusual physical or electrical stress, misuse, abuse, negligence or accidents. Parts of any product consumed or subject to replacement from normal wear and tear or usage, including (but not limited to) the filter are not subject to this Warranty.

This Warranty is given to Buyer only and may not be assigned to any third party without the prior written consent of Seller.

SELLER SHALL NOT, UNDER ANY CIRCUMSTANCES, BE LIABLE TO BUYER FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOSS OF USE, OR OTHER COMMERCIAL LOSS OF WHATEVER NATURE ARISING OUT, CONNECTED WITH, OR RESULTING FROM THE SALE BY SELLER OF ANY PRODUCT ORDERED HEREUNDER, INCLUDING WITHOUT LIMITATION, ANY LIABILITY OF BUYER TO A CUSTOMER TO WHOM BUYER SOLD A PRODUCT OR EQUIPMENT CONTAINING A PRODUCT SOLD HEREUNDER.

APPENDIX E – Quick Reference Guide

All directions start from the first screen as the APC Portable is turned on.

TO BEGIN COUNTING	Press [START/STOP]
SET CONCENTRATION MODE	Press [CONC MODE] then [COUNTS] , [COUNTS/FT3] , [COUNTS/LITER] , or [COUNTS/METER3]
SET SAMPLING MODE SINGLE - single count, hold AUTO - count, hold, count, etc. CONTINUE - continuous count until STOP is selected COUNT CYCLE – cycles for programmed amount of tests in an auto mode	Press [REVIEW & MODE] → [COUNTING MODE] → [SINGLE COUNT] or [AUTO COUNT] or [CONTINUE COUNTING] or [COUNT CYCLE]
TO SET COUNT, HOLD and PURGE TIME	Press [MORE] → [TIME] → [MORE] then choose [COUNT TIME] , [HOLD TIME] , or [PURGE TIME]
TO SET COUNT OR PARAMETER ALARMS	Press [MORE] → [ALARMS] → [COUNTS/CONC.] or [EXT. SENSORS]
TO SET SAMPLE AREA AND LOCATION	Press [REVIEW & MODE] → [SAMPLE] or [AREA]
TO SET OR CHANGE THE CLOCK	Press [MORE] → [TIME] → [SET CLOCK]
TO SET OR CHANGE THE DATE	Press [MORE] → [TIME] → [SET DATE]
TO RECALL COUNT FROM MEMORY	Press [REVIEW & MODE] → [MEMORY] → [REVIEW MEMORY]
TO ENABLE PRINTER AND/OR PRINT STORED DATA	Press [PRINT] then choose [ON-LINE] , or [MEMORY RANGE] , [SAMPLE NAMES] , [LINE FEED] ,
TO ERASE AND RESET MEMORY	Press [REVIEW & MODE] → [MEMORY] → [ERASE MEMORY]
TO CHECK THE STATUS OF THE BATTERY	View the bar graph on the lower left of the display.
TO ADJUST THE DISPLAY	Press [MORE] → [STATUS] → [DISPLAY]
TO PERFORM FS209 AND ISO14644 CALCULATIONS	Press [MORE] → [FS209E ISO14644] → [FS209E CALCS] or [ISO14644 CALCS]

APPENDIX F – MENU TREE: MODEL P3610

Main Screen

- Start/Stop
- Concentration Mode Screen
- Review & Mode Screen
 - Memory Screen
 - Review Memory Screen
 - Erase Memory Screen
 - Sample Screen
 - Area Screen
 - Counting Mode Screen

Print Screen

- Memory Range Screen
- Sample Names Screen

More Screen

- Time Screen
 - Set Clock Screen
 - Set Date Screen
 - More Screen (2)
 - Time Screen (2)
 - Count Time Screen
 - Hold Time Screen
 - Purge Time Screen
 - Status Screen
 - Battery State Screen
 - Display Screen
 - FS209E/ISO14644 Screen
 - FS209E Calculations Screen
 - ISO 14644 Calculations Screen
 - Alarms Screen
 - Counts Alarm Screen
 - 0.3 μm Alarm Screen
 - 0.5 μm Alarm Screen
 - 0.7 μm Alarm Screen
 - More Screen (3)
 - 1.0 μm Alarm Screen
 - 5.0 μm Alarm Screen
 - 10 μm Alarm Screen
 - External Sensors Screen
 - Temperature Alarm Screen
 - Relative Humidity Alarm Screen
 - Differential Pressure Alarm Screen
 - Air Velocity Alarm Screen

APPENDIX G – EUROPEAN DECLARATION OF CONFORMITY

We

Biotest Diagnostics Corporation
66 Ford Rd., Suite 131
Denville, NJ 07834 USA

Declare under sole responsibility that the

**APC Portable Airborne Particle Counter Models P2610, P3610,
P5610, and P5210**

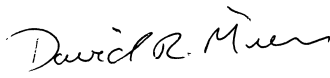
Conforms to Directive(s): 89/336/EEC//93/68/EEC. Compliance was demonstrated to the following specifications as listed in the official journal of the European Communities:

EN61010-1:95
EN50082- 1:95

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directives and Standards.

Place: Biotest Diagnostics Corporation, Denville, NJ

Date: June 17, 2002



David R. Miers – Director of Research and Development Instrumentation

APPENDIX H – APC Portable Accessories

**APC Airborne Particle Counter**

APC Portable Accessories

Airborne Particle Counter

Article No.	Description
942 425	Purge filter assembly for the APC Portable <ul style="list-style-type: none"> ▪ Used to verify zero counts on your APC Portable Airborne Particle Counter. The filters are composed of a double layer hydrophobic polyvinylidene fluoride (PVDF). The filters are 0.2 micron absolute filters and are 0.01 micron rated for air and gas.
942 440	Temperature and relative humidity sensor <ul style="list-style-type: none"> ▪ Used for stable and reliable measurement of temperature and relative humidity. ▪ Measurement range: Temperature 0°C - 50°C ± 2°C; Relative humidity 10% - 90% ± 5% RH
942 445	Air velocity probe <ul style="list-style-type: none"> ▪ Used for high accuracy measurement of low air velocities. ▪ Operates on an innovative hot film anemometer principle. This guarantees excellent accuracy for air velocity down to 0 meters/second, which is not possible for conventional anemometers with commercial temperature sensors or NTC bead thermistors. ▪ Measurement range: 0.0 – 2.0 meters/second ± (0.1 m/s + 5% of measured value)
942 450	Differential Pressure sampling probe <ul style="list-style-type: none"> ▪ Used to determine the pressure differential between the pressure within the cleanroom (at the particle counter location) and outside the cleanroom using remote tubing. The sensor is temperature compensated and gives accurate and stable readings over a 0°C to 50°C temperature range. ▪ Measurement range: 00.0 – 25.0 millibars ± 3%
942 456	Carrying case with wheels and handle <ul style="list-style-type: none"> ▪ Used to store and transport your APC Portable Airborne Particle Counter. The hard-walled case is made of double angle construction and is designed to maximize protection of the APC Portable.
942 700	APCOne11 21 CFR Part 11 Compliant Download Utility Software