



**NIST Traceable – ISO 9001:2008**

# **Omni FT Manual**

Formerly the  
FRM Omni Ambient Sampler



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MK101-109 Rev. B

### **Notice**

**Beginning with Version 1.4.02 an important improvement to the “Run Programmed” screens was introduced. Operating instructions for these new screens are contained in Appendix B**

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## 1.0 Quick Start

If you have already set up the Omni FT to be placed in service as described in Section 3.0, you may run the instrument immediately. Referring to Figure 1 press the button labeled **I/O**.



Figure 1: Omni Keyboard

When the main idle display screen appears press **Enter**. The instrument will immediately begin running at 5 lpm. To stop the *Omni FT*, press **Enter**. The complete details of the run will be displayed on the screen as shown in Figure 2. To cancel this information press **Escape**.

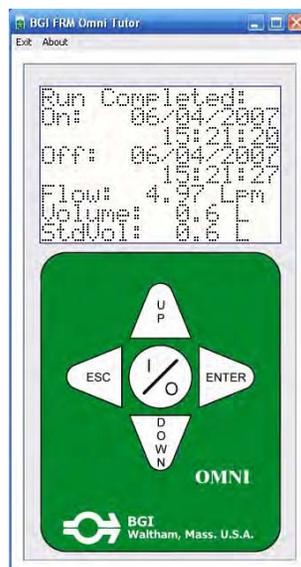


Figure 2: Image of a Completed Run

The Omni FT has been designed to be a highly interactive instrument. Investigators familiar with air sampling using microprocessor controlled hardware will have little difficulty following the critical paths without further instruction.

The second half of this manual comprises detailed operating instructions. As a further aid, it may be helpful to consult the instructions in conjunction with a virtual version of the instrument.

## 2.0 Specifications

Flow rate: 5 lpm ( $\pm 1\%$ )  
 Temp. operational range -30° C to 50° C  
 Temp. reading range -30° C to 50° C ( $\pm 0.5^\circ$  C)  
 Barometric pressure range 400 to 800 mm of Hg ( $\pm 5$ mm)

### Dimensions:

Control Module: 8.50 in. high (21.59 cm) x 7.00 in. wide (17.78 cm) X 5.75 in. deep (14.60 cm)

Weight: 9.0 lbs (4.08 kg)

### Inlet:

Dimensions: 3.25 in. max dia, (8.25 cm) 7.5 in high (19.05 cm)

Weight: 0.77 lbs (.35 kg)

### One complete instrument comprises:

Quantity	Description	Part Number
1	OmniFT Sampler w/ Power Supply	5012
1	miniPM Inlet - PM10	5010
1	Filter Holder (no cassette included)	M-5017
1	47mm Filter Cassette	F212
1	Instruction Manual	Download PDF from bgi.mesalabs.com
1	Software	Download Software from bgi.mesalabs.com

### Available Accessories:

1	OmniFT Tripod Mounting Stand	M-5006
1	Universal Mounting Bracket	5005
1	Bracket clamp	10141
1	TSP Jet (no color) for miniPM Inlet	2599
1	PM10 Jet (blue) for miniPM Inlet	2616
1	PM4 Jet (green) for miniPM Inlet (respirable)	2741
1	PM2.5 Jet (red) for miniPM Inlet	2617
1	PM1 Jet (black) for miniPM Inlet	2618

## 3.0 Hardware setup

### 3.1 Battery installation

The main control module is shipped complete ready to run. However, in some instances there may be regulations which require the battery to be removed for transportation or not connected. When you unpack the main module, open the front panel door by releasing the two latches and open the panel door. Press the I/O button. If the screen does not light up the battery must be installed/connected. Referring to Figure 3, four Phillips head screws will be observed securing the panel to the internal standoffs.



**Figure 3: View of Panel with Door Open**

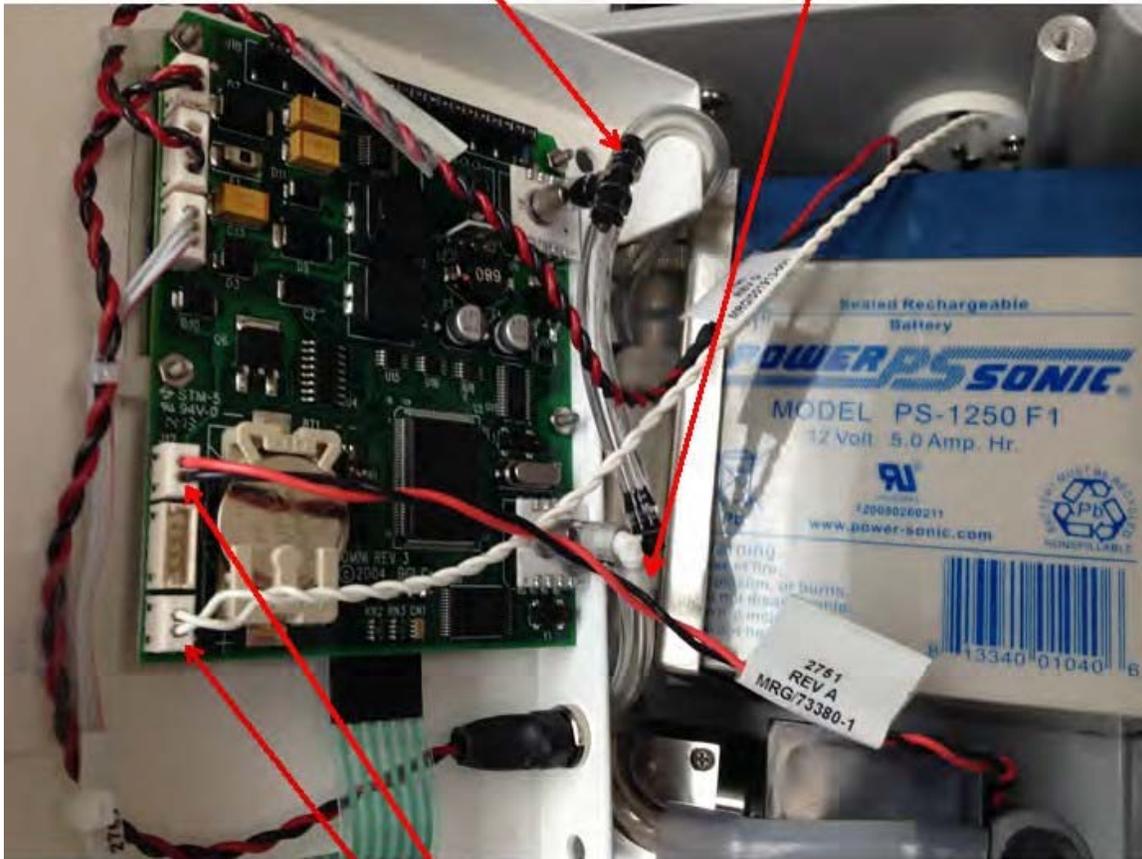
Remove the four screws and set them aside for reuse. Gently lift the panel forward, towards yourself and swing it to one side. You will find that it is attached to the panel with several wires. Be careful not to detach any. If the battery is in place but the wires are disconnected they may now be installed referring to Figure 4. **The Battery terminals are color coded and so are the wires.**

*They must match or serious damage could result. Red indicates positive (+) and Black indicates negative (-).*

If the battery was furnished separately remove it from its wrapping and visually inspect it to ensure that it is undamaged. (If a replacement battery is obtained locally and not from Mesa Labs it must be a sealed lead acid gel cell, 12 V, 5 Ah, of dimensions which will fit the recess provided).

To install (remove) a battery do the following:

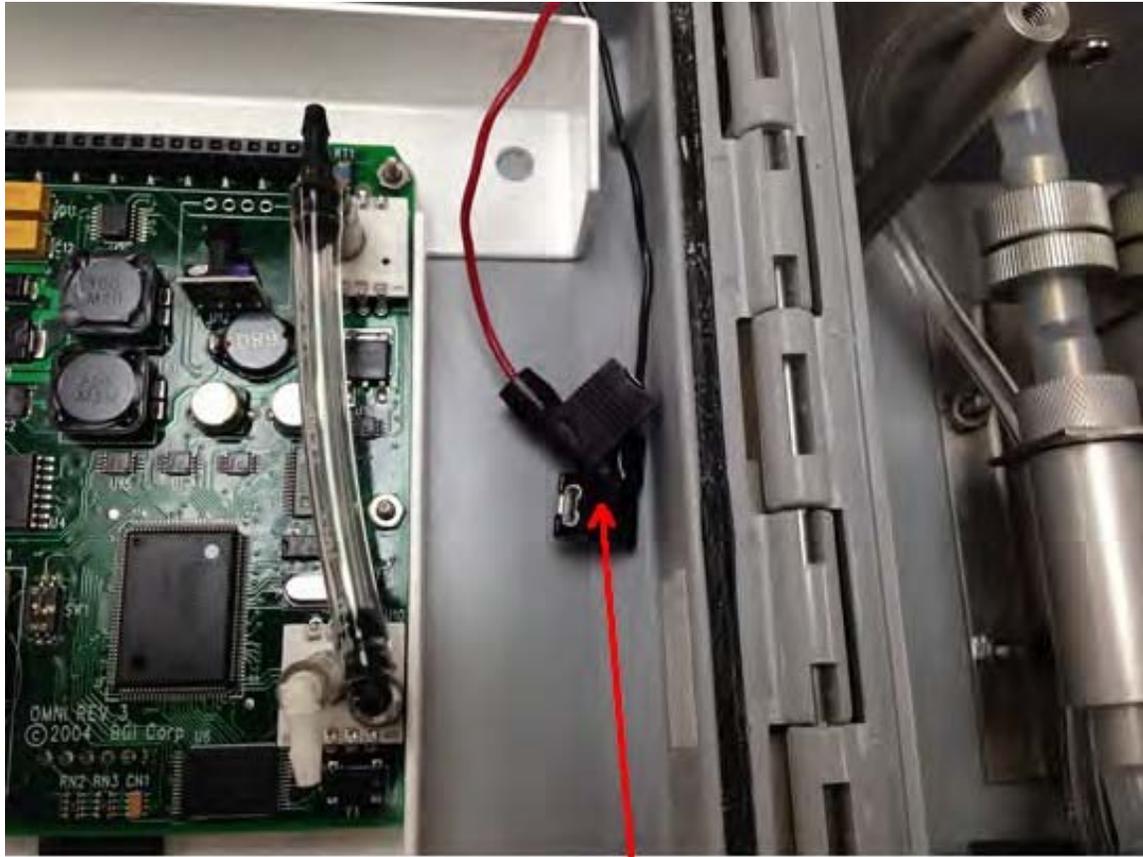
**REMOVE 2 HOSES AS SHOWN**



**REMOVE 2 CONNECTORS**

**Figure 3-A**

Remove the 2 connectors and hoses from the PCB as shown in Figure 3-A. The connectors are of a locking type so you must insert a very small wedge (screw driver) between the lock and the connector on the left side in order to remove. When removing the tubes be very care that you do not break the sensor on the PCB. Make sure that you hold onto the tube with one hand and the black tee or white elbow with the other hand and pull gently.



## BATTERY CONNECTORS (2)

Figure 3-B

Disconnect the 2 battery wires from the battery and place them aside as shown in Figure 3-B.



**REMOVE 2 HOSES**

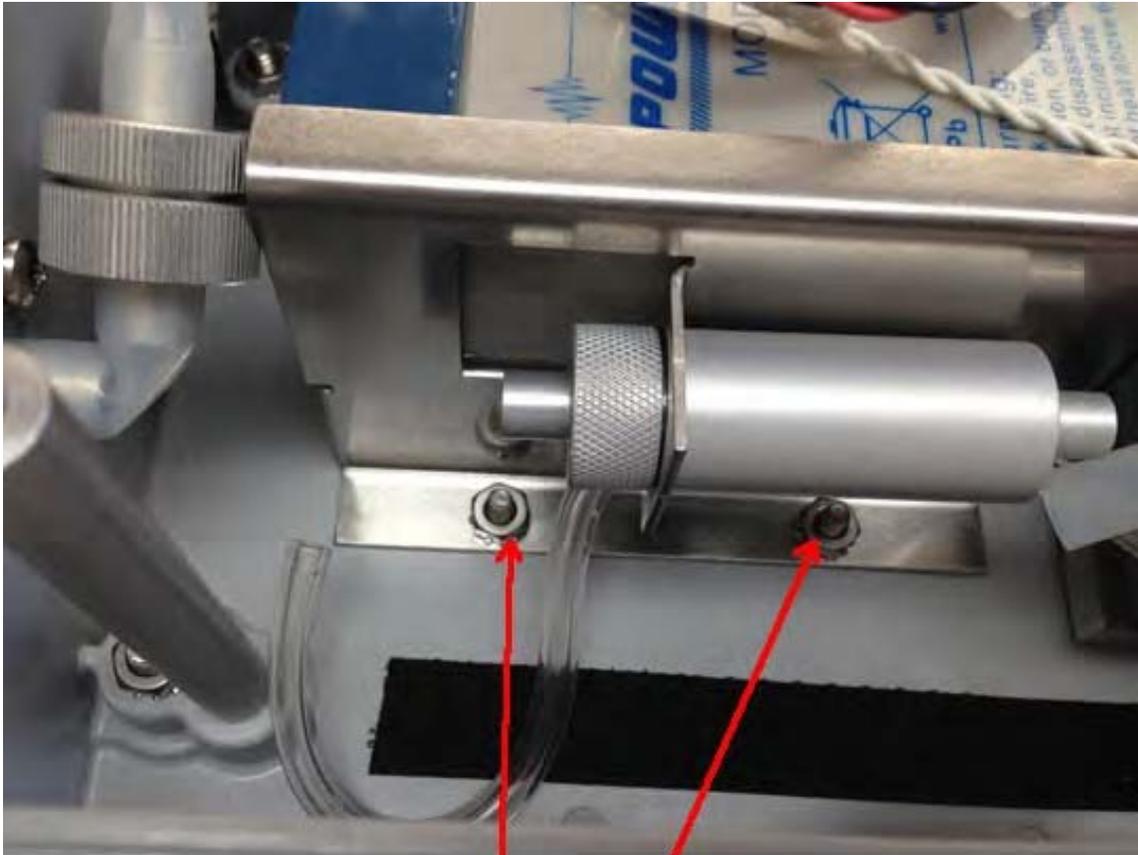
Figure 3-C

Remove the 2 hoses from the main flow sensor as shown in figured 3-C



Figure 3-D

You can now remove the rear mounting plate from the back of the instrument. You will need a 3/16" hex wrench and a 3/8" nut driver. Remove the (4) hex screws from the rear and place the mounting plate aside for now.



**REMOVE NUTS (2)**

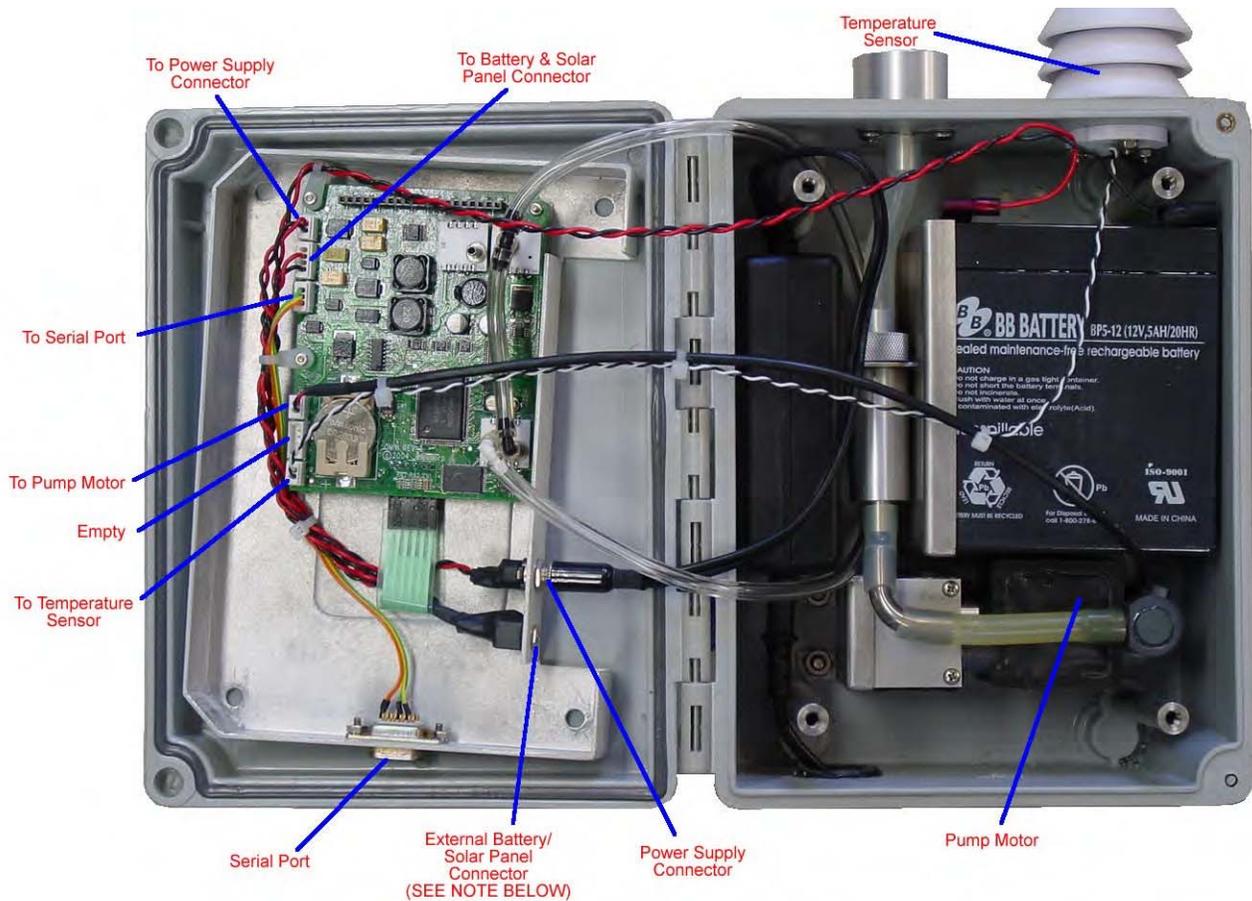
Figure 3-E

It is now possible to access the (2) screws that hold the battery mounting bracket in place. Remove the 2 nuts from the bracket shown in Figure 3-D using a 11/32" nut driver and a phillips head screw driver. Gentle remove the bracket and battery.

To finish installing the battery follow the previous instructions in reverse.

**WARNING:** The Battery terminals are color coded and so are the wires. *They must match or serious damage could result.* Red indicates positive (+) and Black indicates negative (-).

**Important Safety Notification:** *Do not plug/unplug any of the electrical connections on the Printed Circuit Board (PCB) without first disconnecting the battery. Electrical components can be damaged.*



**NOTE:** Early models have the External Battery socket as shown, later models do not. If your instrument does not have this socket you must unplug the power supply from it's socket and plug in your External Battery or Solar Panel into the Power Supply Socket.

**Figure 4: View of Electrical and Pneumatic Connections**

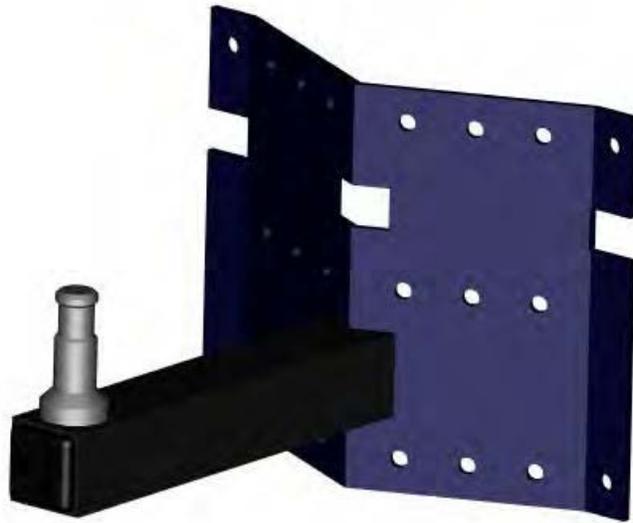
### 3.2 Mounting

Several methods have been provided for the mounting of the main control module. The most important methods are shown in Figures 5 and 6 and make use of the Stand Adaptor on the back of the module (p/n A2684). If it is desired to mount the unit on a Tripod (p/n 5006) it is first necessary to erect the Tripod. If it is in its final location, special feet have been provided which permit the use of wire tent pegs (used on bare ground) or screws (used on platforms). Both fasteners to be user supplied. The module socket may then be dropped over the pintle on the tripod and secured with the thumb screw (p/n SC10134).



Figure 5: Module on Tripod

The Universal Mounting Bracket (p/n 5006) shown in figure 6 is designed to be used on flat surfaces, utility poles and trees. It may be fastened utilizing the copious holes provided, with either screws or nails (user provided). An adjustable worm type Band Clamp (p/n 10141) is available which will allow fastening to poles up to 15 inches diameter (38.1cm.)



**Figure 6: Universal Mountain Bracket**

### **3.3 Filter Holder and Inlet**

The miniPM (p/n 5010) inlet comes with a PM10 jet installed. Similarly the Filter Holder (p/n 5017) and Filter Cassette (p/n F212) with test filter are furnished as an assembly. Screw the filter holder into the top mounting boss on the control module, and plunge the *mini*PM inlet onto the top tennon of the filter holder as shown in Figures 7 and 8.



Figure 7: Inlet on Module

If a Size Selective Jet (SSJ) other than PM10 was ordered/furnished with your instrument it was furnished as a separate item. The individual jets are hand detachable and removed/installed by screwing in and out. A light grease should be applied to the threads to prevent seizure. The jets are not marked. As a guide to their functional size refer to the table of approximate internal dimensions, below:

Size Selective Jet	Part Number
TSP (no color)	2599
PM10 (blue)	2616
PM4 (green)	2741
PM2.5 (red)	2617
PM1 (black)	2618

## 4.0 Calibration

New units are delivered set up and calibrated for Volumetric air flow rate (Q), Temperature T and Barometric Pressure (BP). All initial calibrations are performed during initial setup of a new instrument. All calibrations are performed using NIST traceable Standards. In the absence of physical or electrical damage it is not known what time interval will transpire, if any before a calibration is no longer valid. Therefore, the user should be guided by one or both of two philosophies.

1. It is generally held by air sampling experts throughout the world, that good practice requires a calibration audit at the beginning and end of a study. If the study is protracted in length, monthly or quarterly checks are considered adequate. If no significant change is observed, longer intervals can be considered.
2. It is very common for air sampling studies to be conducted under the aegis of a local, National or trade organization. It is very likely that a client or governing body will have specific rules or suggestions regarding audits and recalibration. In some cases highly detailed instructions will exist.

Mesa Labs manufactures two instruments for audit/calibration purposes. They are NIST traceable and will provide readings for Volumetric flow rate, Barometric Pressure and Temperature. They can be found on the internet at the following locations:

[bgi.mesalabs.com/tetracal-air-flow-calibrator/](http://bgi.mesalabs.com/tetracal-air-flow-calibrator/)  
[bgi.mesalabs.com/deltacal-air-flow-calibrator](http://bgi.mesalabs.com/deltacal-air-flow-calibrator)

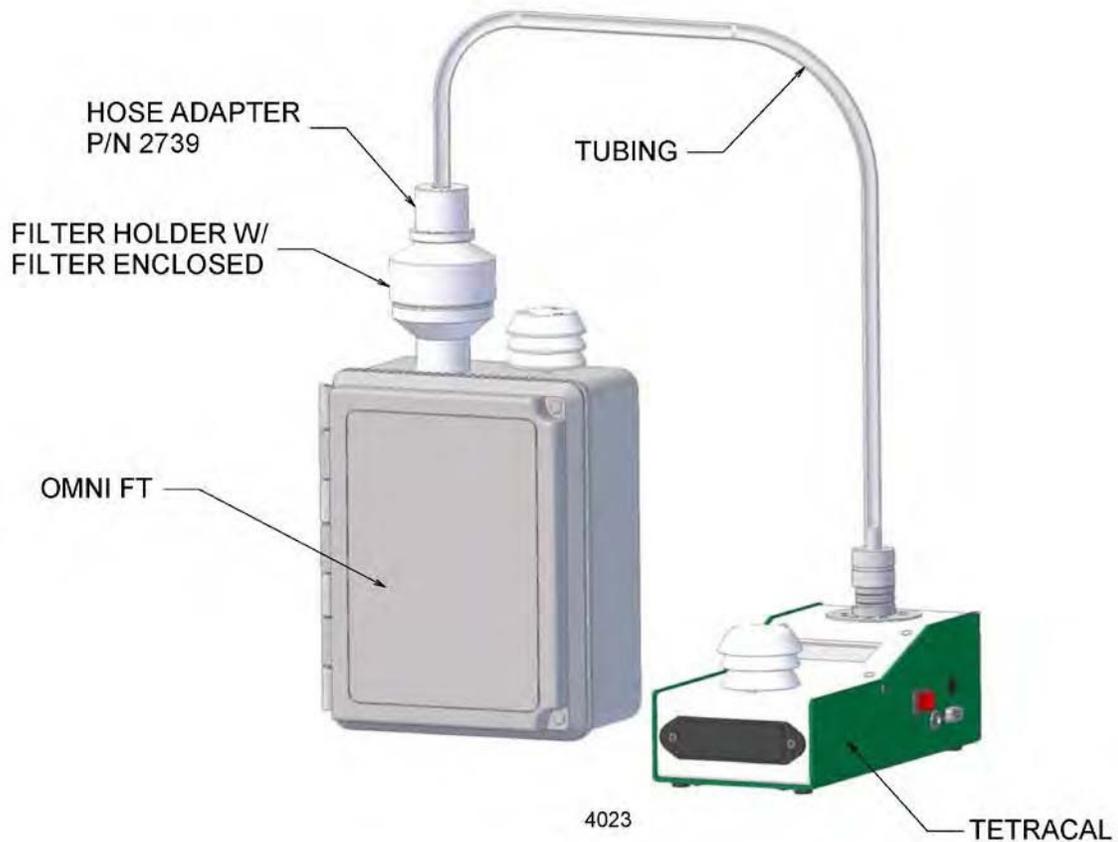
Any user provided BP or Temp. instruments which are satisfactory to the investigator may be utilized as no direct connection to the Omni FT is required.

When performing a flow audit other conventional volumetric flow measuring devices are suitable providing they do not impose very high static pressures on the instrument. Calibrators which introduce a pressure spike into the system are not suitable for use with the Omni FT. If there is any doubt regarding the device to be used contact Mesa at: [csbutler@mesalabs.com](mailto:csbutler@mesalabs.com)

Always perform a flow calibration using a clean filter of the type to be utilized in your sampling study. Suitable filters are fiberglass, quartz and the type of PTFE which is labeled 2 $\mu$ m pore size and has a plastic ring surrounding it. (Note: the pore size has nothing to do with the filtration efficiency of the material. For further information on this topic see:

[Bgi.mesalabs.com/accessories/](http://Bgi.mesalabs.com/accessories/)

A typical schematic of the setup for performing a volumetric flow rate calibration is shown below in Figure 8. While an investigator may attach BGI or other calibrators to the filter tennon stub of the Omni FT after removing the inlet with user provided hoses and adaptors, BGI provides two useful appliances: p/n 2738 for use with the deltaCal p/n 2739 for any other calibrator



**Figure 8: Schematic Drawing of Flow Calibration Arrangement**

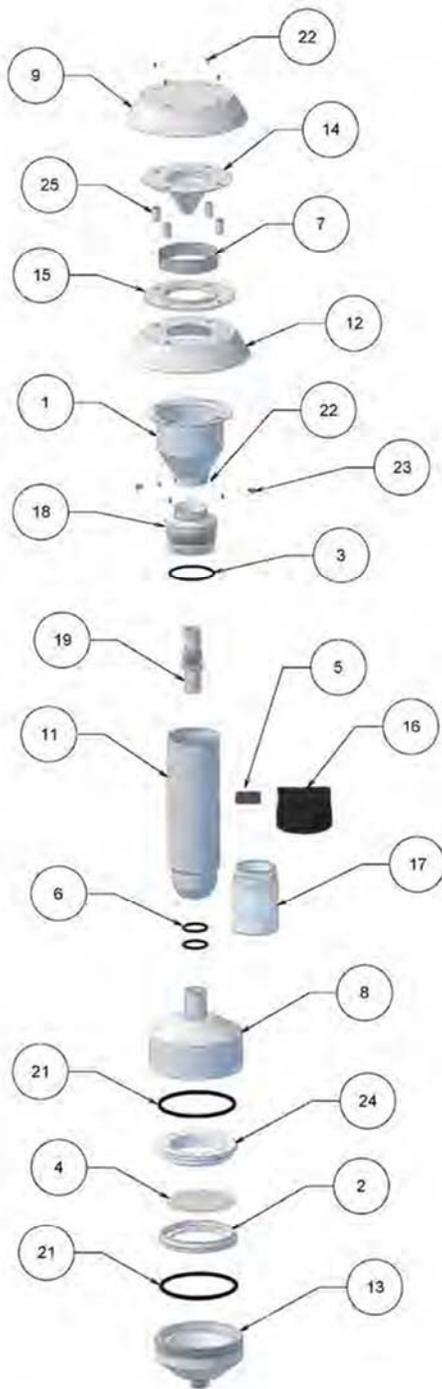
The exact screen/button sequence for performing a calibration is detailed in the printed instructions in the second half of this publication.

## **5.0 Maintenance**

Items which require cleaning and maintenance are common to all ambient air sampling devices fitted with size selective inlets. The inlet and the sampler may be considered two separate items for cleaning and maintenance purposes.

### **5.1.1 Size selective inlet**

The size selective inlet furnished with the Omni FT will be familiar to all who have had experience with the Standard EPA Louvered Inlet in its original 16.7 lpm configuration. The only two differences are that it has been scaled down to 1/3 its original dimensions and the acceleration jet in the impactor is changeable over five size ranges. An exploded diagram of the inlet is shown in Figure 9 with all parts identified.



Detail #	Part #	Qty.	Description
1	2583	1	2583 NOZZLE ENTRY
2	1729-L29	1	1729-L29 CASSETTE LOWER SECTION
3	024BUNA	1	024 ORING
4	1728-L28	1	1728-L28 FILTER SCREEN
5	OM10123	1	NIPPLE
6	015BUNA	2	015 ORING
7	2589	1	2589 SCREEN
8	2672	1	2672 UPPER FILTER HOLDER
9	2584	1	2584 TOP
10	2596	3	2596 RECEIVER TUBE
11	2597	1	2597 OUTER TUBE
12	2586	1	2586 LOWER PLATE
13	1425	1	1425 FILTER HOLDER
14	2585	1	2585 WIND DEFLECTOR
15	2587	1	2587 RAIN DEFLECTOR
16	OM10120	1	JAR TOP
17	OC13	1	JAR
18	2598	1	2598 IMPACTOR NOZZLE
19	2617	1	2617 NOZZLE INSERT, PM 2.5
20	2595	1	2595 TARGET PLATE
21	135BUNA	2	135 ORING
22	10002	8	4-40 x 1/4 PAN HEAD
23	OM10124	3	2-56 x 1/8 PAN HEAD
24	1727-L27	1	1727-L27 CASSETTE UPPER SECTION
25	2588	4	2588 SPACER
26	2602	1	2602 EXIT ADAPTER

4015

Figure 9: Exploded Diagram of Inlet with Filter Holder

Cleaning should occur once every 90 days or sooner in highly polluted environments. Until such time as sufficient experience has been gathered, the unit should be inspected once a month. In order to perform an inspection, it is only necessary, after removing the inlet from the top of the filter holder to unscrew the top from the bullet as shown in Figure 10.



**Figure 10: Photo of Initial Disassembly of Inlet**

The jet may also be removed from the top of the inlet as shown in Figure 11.



**Figure 11: Photo of Jet Removed for Cleaning or Size Change**

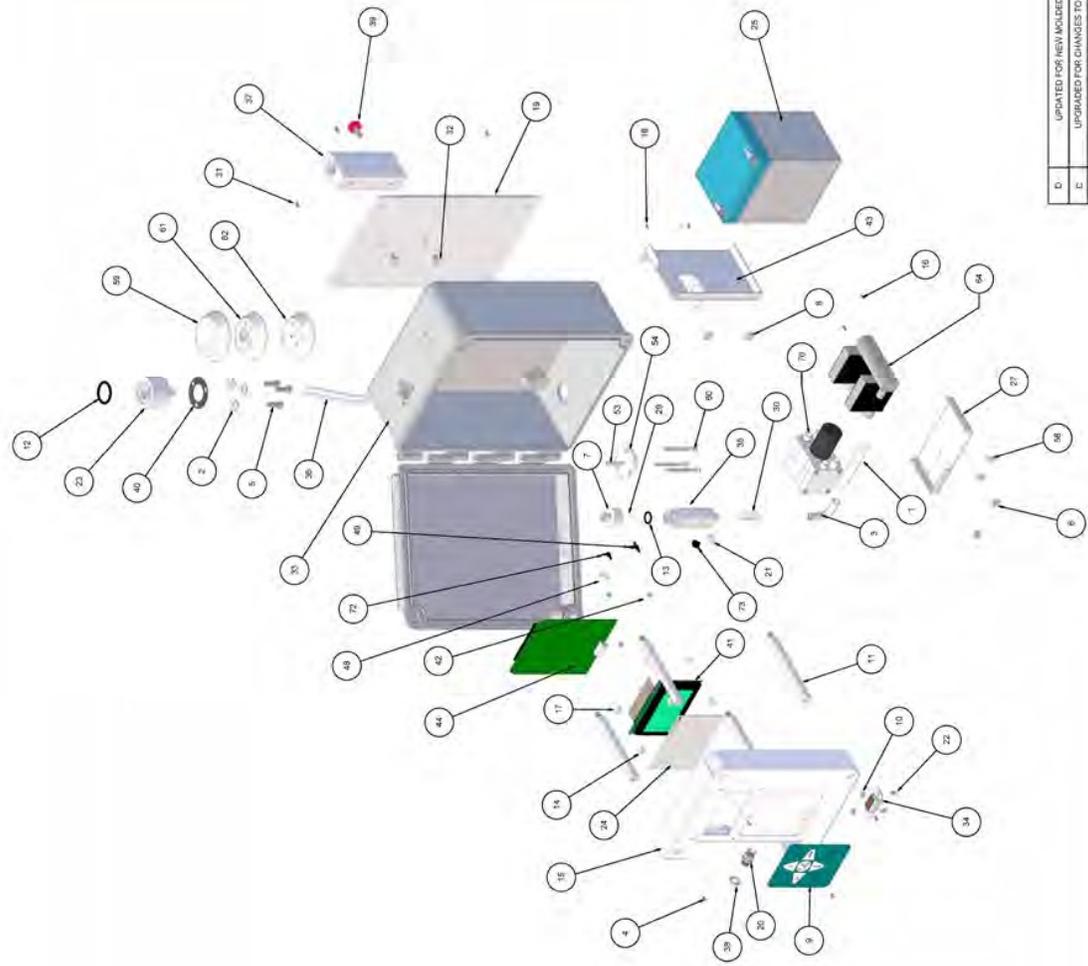
Normal cleaning of air sampling inlets is generally, best done with clean water and lint free wiping cloths. If an ultrasonic cleaner is available it is the preferred device as it will remove dirt from deep corners and pockets, avoiding the need for further disassembly. After ultrasonic or any liquid cleaning, be certain to dry thoroughly before reassembling and placing in service.

### **5.1.2 Main Sampler Assembly**

A complete, detailed illustration of the OmniFT is shown on the next page. If further assistance is required regarding acquiring parts, contact Mesa Labs' customer service at [csbutler@mesalabs.com](mailto:csbutler@mesalabs.com).

Principal maintenance items, in decreasing order of importance are: no. 48, Omni pump assembly, no. 7, Pulsation dampner assembly, no. 38, orifice and no. 28, battery.

Detail #	Part #	Qty	Description
1	DM10113	1	HOSE 1
2	DM10127	3	M8 FLAT
3	DM10112	1	ELBOW
4	SC10132	4	19.32 x 3/8 PAN HEAD
5	10081	3	8.32 x 1/2 PAN HEAD
7	A2544	1	2844 SCREEN TUBE (FRM QMNI)
8	H83W	4	8.32 NUT
9	A2484	1	KEY PAD
10	NT3006	2	4.40 NUT
11	A2682	4	2882 Panel Standoff (FRM QMNI)
12	118 BUANA	1	118 O-RING
13	012 BUANA	1	012 O-RING
14	A2928	4	2888 Display Spacer (Qmni)
15	C2953	1	2883 Display Panel (FRM QMNI)
16	DM10128	4	8.32 x 1/2 FLAT HEAD
17	A2095	4	2895 PCB Spacer
18	B2706	1	2706 BRACKET PLATE
20	DM10108	1	SWITCHDRAFT POWER SOCKET
21	DM10137	1	DM10137 Elbow, White (Threshold 1 End)
22	SC2028	2	4.40 1/4 FLAT HEAD
23	A2686	1	2886 Inlet Adapter (FRM Qmni)
24	A2685	1	2885 Display Cover (Qmni)
25	DM10115	1	BPS-12 BATTERY
27	B2087	1	2877 PUMP CLAMP (FRM QMNI)
30	DM10140	1	SCREEN
35	DM10113	1	HOSE 2
31	SC10132	4	19.32 x 1/2 PAN HEAD
32	SC10133	2	19.32 x 3/8 FLAT HEAD
33	DM10123	1	FRM QMNI BOX
34	DM10111	1	D89_M
35	A2543	1	2543 OFFICE (FRM QMNI)
36	DM10113	1	HOSE 3
37	A2684	1	2884 Stand Adapter (FRM Qmni)
38	N/A	1	NUT - SWITCHDRAFT POWER SOCKET
39	SC10104	1	STAND LOCKING SCREW
40	A1529	1	1529 INLET ADAPTER GASKET PG 100
41	DM10109	1	DISPLAY
42	NT10028	4	2.56 NUT
43	B2086	1	2886 Battery Clamp (FRM Qmni)
44	C2717	1	PCB
46	NOT SHOWN	1	3.02 TUBING CONNECTS TO OFFICE TAPS
48	DM10148	1	DM10148 Elbow, White (Behind Both Ends)
49	DM10147	2	DM10147 Tee, Black (Behind All Ends)
53	2883	1	2883 THERMISTOR TUBE (FRM QMNI)
54	2858	1	2858 THERMISTOR HOLDER (FRM QMNI)
58	DM10178	2	8.32 x 1/4 PAN HEAD
59	3065	1	3065 TOP PLATE, MOLDED (80 R.S. FRM QMNI)
60	SC10103	3	4.40 x 1/2 PAN HEAD
61	3067	1	3067 MIDDLE PLATE, MOLDED (80 R.S. FRM QMNI)
62	3068	1	3068 BOTTOM PLATE, MOLDED (80 R.S. FRM QMNI)
64	A2674	1	2674 DAMPER CONNECTOR (FRM QMNI)
70	2796	1	2796 PUMP ASSEMBLY QMNI - (FRM QMNI)
72	DM10138	1	DM10138 Elbow, Black (Behind Both Ends)
73	DM10139	1	DM10139 Elbow, Black (Threshold One End)



BREAK ALL SHARP EDGES TO MAX TOLERANCES	
2 P/LCS	3 P/LCS
010	005
ANGLE	15°
DATE	05/04
DWN BY:	KED
CHKD BY:	Kgvin
C NUMBER:	2737
SCALE:	1:4

BG INSTRUMENTS	
WALTHAM, MA 02451	FRM QMNI
EXPLODED VIEW	PARTS
C NUMBER:	2737

REVISIONS	
SYM	DESCRIPTION
A	UPDATED
B	ADDED THERMISTOR & SCREEN
C	UPDATED FOR CHANGES TO PN 82807
D	UPDATED FOR NEW MOLDED SHIELD
DATE	
RHPDS	
15/08	

### 5.1.3 Pump Assembly

It is highly recommended that repairs and service are carried out at Mesa Labs, by trained personnel. Nevertheless, it is recognized that there may be reasons or need for user performed servicing.

Replacement intervals for pump parts are difficult to predict due to variations in severity of service. Nevertheless, it is possible to offer a general guide:

<b>Part</b>	<b>Replacement Interval in Hours</b>
Valves	2000
Pump diaphragm	2500
Dampner	2500
Ball Bearing on eccentric	4000
Motor	4500

Utilizing the exploded diagram in Figure 12, follow the steps below to rebuild the pump:

1. Remove the double valve chest. Note position and method of securing valves and discard, unless they are in reusable condition.
2. Examine valve seat C. Use non-metallic probe- for example, wooden toothpick to remove dirt. Use care at valve edge.
3. Fit new valves, or replace old ones.
4. Replace valve chest. Do not use too much pressure when tightening screws.
5. If, when the valve chest was removed, the slightest damage to the diaphragms was observed, then the following operations are to be performed.
6. Withdraw the screw, now visible in the center of the support disk. Withdraw the diaphragm and both support disks. Note direction of convolution in diaphragm and replace new diaphragm in the same direction. This is to be done on both sides of the assembly.
7. If for any reason the motor or eccentric bearings are suspect due to age, reduced performance or increasing noise then they must be serviced/replaced. It is not recommended that the replacement of the bearings on the bearings on the eccentric shaft be attempted. The bearings and eccentric are available as a complete assembly.
8. Remove valve chests, clamp rings and diaphragm as above and draw away the plastic yoke assembly.
9. Loosen set (Grub) screw and withdraw eccentric and bearings as a complete assembly.
10. Remove three screws holding motor in place and withdraw motor from chassis.
11. Carefully unsolder electrical leads from old motor and transfer to new motor.
12. Reassemble in reverse order.

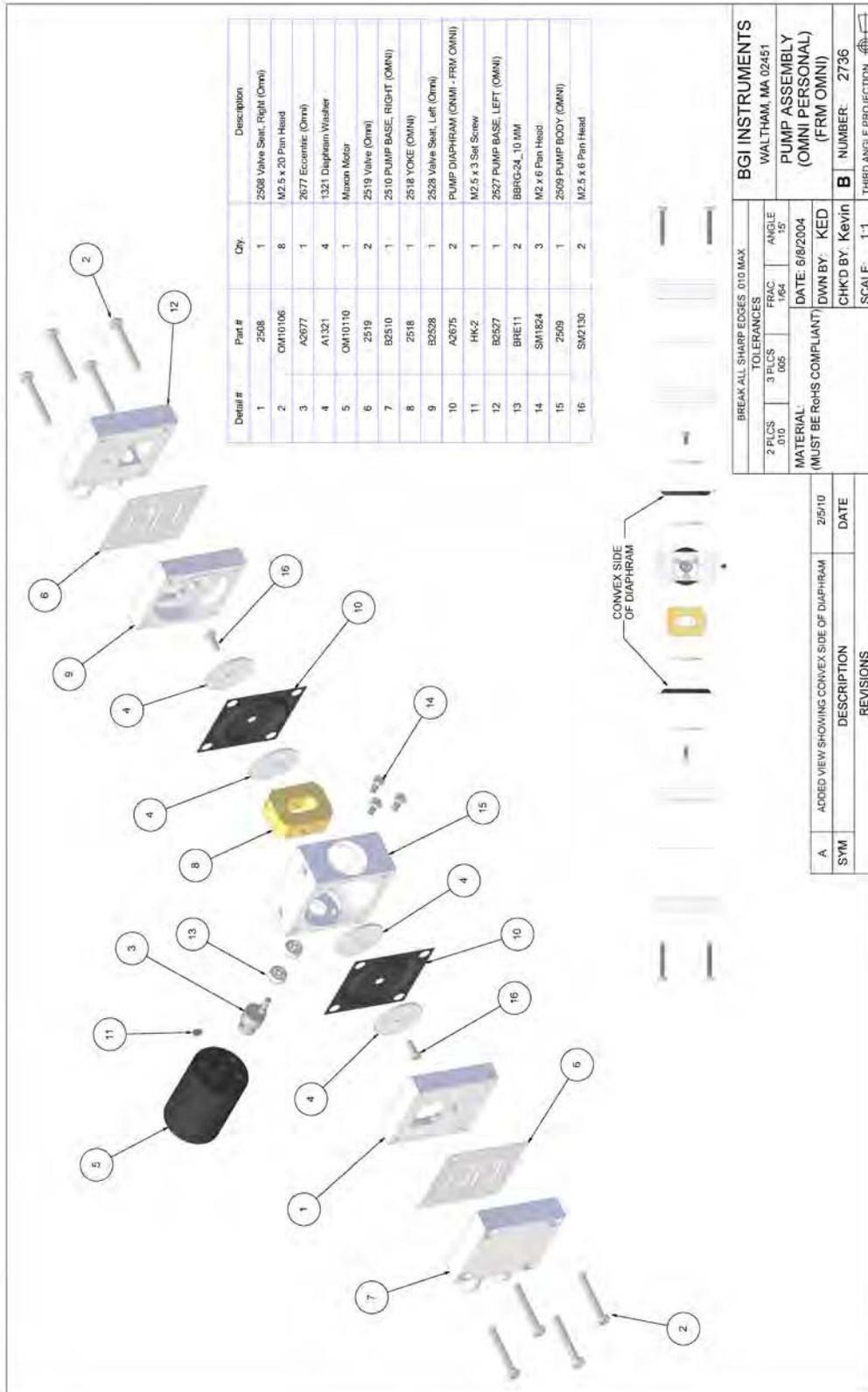


Figure 12: Exploded Diagram of Pump Assembly

## **5.2 Pulsation Dampner**

The Dampners, no. 6 are a glued up assembly and are not user reparable. The complete dampner assembly may be returned to the factory for rebuilding or a complete new assembly acquired.

## **5.3 Orifice and Inlet Fittings**

The orifice and fittings leading to it from the inlet should not require any maintenance, provided an inlet filter has always been utilized. If upon inspection dirt has found to have accumulated in the internal passages, then careful disassembly and cleaning is required. The only recommended cleaning materials are lint free cloths and clean water. If necessary a pipe cleaner may be utilized on the orifice. Be careful not to loose part no. 29. This is a fine screen to prevent the ingress of foreign objects. While this segment of the pump is apart be certain to check for cracked tubing, gaskets or "O" rings. Replace damaged components as required.

*It is utterly vital to reassemble all components in a manner completely free of leaks.*

## **5.4 Battery**

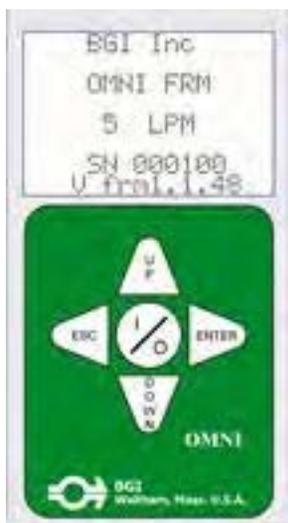
The battery used in the Omni FT is a lead acid gel cell. It should provide years of maintenance free service. The end of the batteries useful life will reveal itself by a consistent inability to provide at least 30 hours of service under moderate sampling conditions in temperate climates. However, there is one service item that must be observed if the unit has not been used for more that two months. Full performance may not be achieved until the battery has been charged and discharged 2-4 times.

## INSTRUCTIONS: *Omni FT*

June 2007 rev. 3

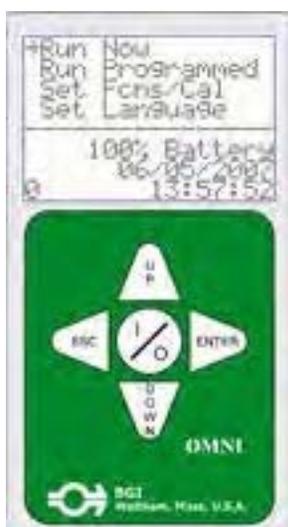
### Introduction

### Operating the *Omni FT*



#### Turning ON the *Omni FT* :

1) Press the I/O button. An initiation screen will briefly appear and then advance to the "Main Menu". This screen will have the serial number and the code version number.

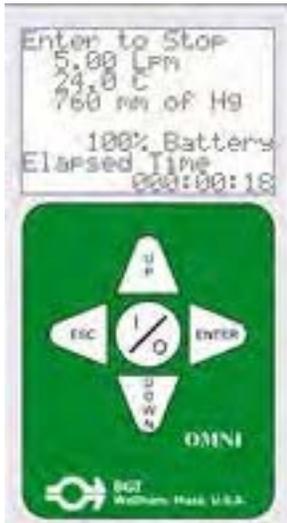


#### At the Main Menu:

1) Scroll using the up and down buttons to make a selection. Position the → in front of the selection and press the enter button.

- **Run Now** Initiates a sampling event.
- **Run Programmed** Setup and initiate a programmed sampling event.
- **Set Fcns/Cal** Setup Time, Units and calibration Functions.

Note: Prior to using the *Omni FT*, it is wise to set up the Date, Time and Preferences. Advance to the "Set Preferences" section of this manual.

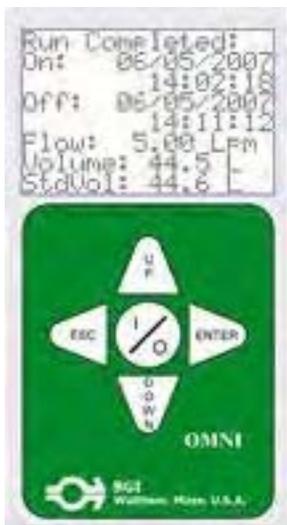


### >Stopping the Run:

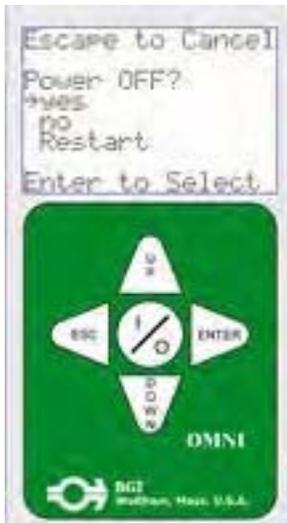
- 1) While the pump is running, press the "Enter" button, to stop the run.
- 2) The final run data will be displayed on the LCD.

Note: After the "Run", pressing "ESC" will cause the elapsed run data to disappear. Pressing "ESC" will cause it to reappear. Run information is not lost until overwritten by a new run.

Total volume is displayed as Actual volume or as Standard volume, corrected to sea level and Standard temperature.



Total volume is displayed as Actual volume or as Standard volume, corrected to sea level and Standard temperature.



### Power Off:

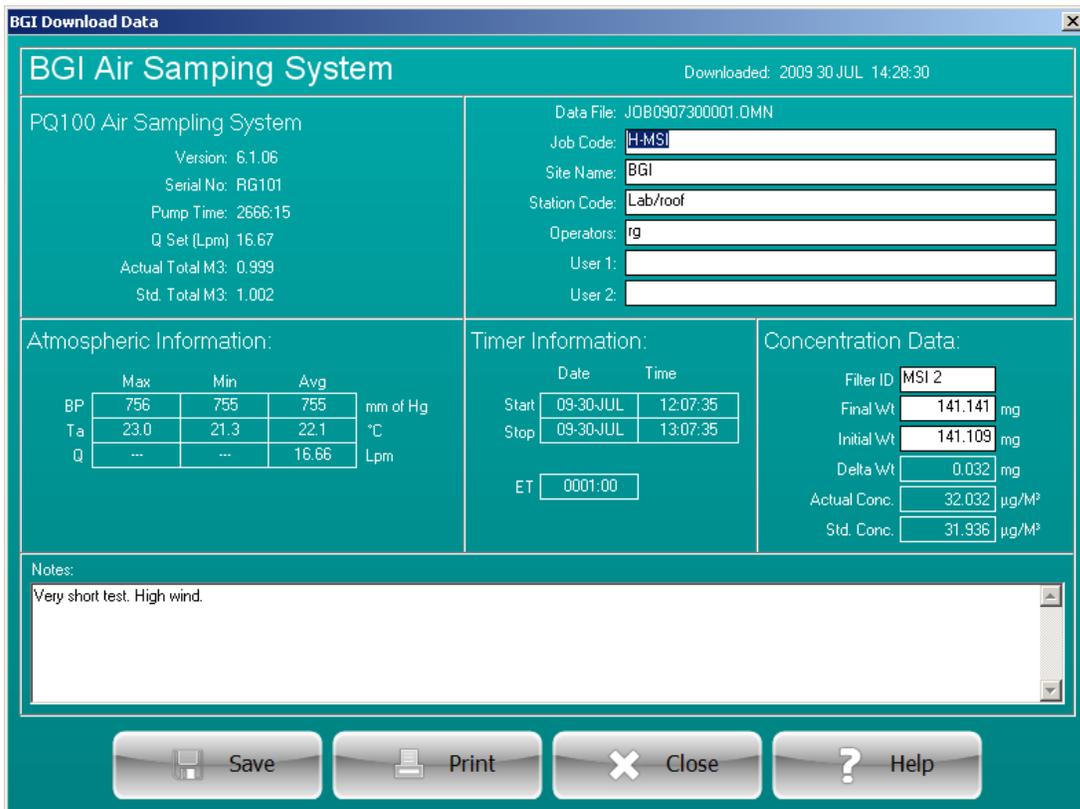
- 1) Press the I/O button to turn "OFF" the Omni and save the data for downloading later.
- 2) At the Power "OFF" screen, select "yes" and press the Enter button to turn "OFF" the unit. When the Omni is turned "ON" the next time, the data will be available for download or it can be recalled from the main idle display screen (screen 2) by pressing "ESC".

### Download the Data to a computer:

1. Connect Omni FT to computer using a standard serial cable.
2. Open BGI Link.
3. Select the screen shown below.

**Download**  
Connect to the Omni unit using the configured communications port and retrieve the data from the last run.

If you have selected the com port already, you will be switched to the next screen. If you have not, go to the [instructions](#) for BGI Link.



**BGI Air Sampling System** Downloaded: 2009 30 JUL 14:28:30

PQ100 Air Sampling System  
Version: 6.1.06  
Serial No: RG101  
Pump Time: 2666:15  
Q Set (Lpm): 16.67  
Actual Total M3: 0.999  
Std. Total M3: 1.002

Data File: JOB0907300001.OMN  
Job Code: H-MSI  
Site Name: BGI  
Station Code: Lab/roof  
Operators: ig  
User 1:  
User 2:

**Atmospheric Information:**

	Max	Min	Avg	
BP	756	755	755	mm of Hg
Ta	23.0	21.3	22.1	°C
Q	---	---	16.66	Lpm

**Timer Information:**

	Date	Time
Start	09-30-JUL	12:07:35
Stop	09-30-JUL	13:07:35

ET: 0001:00

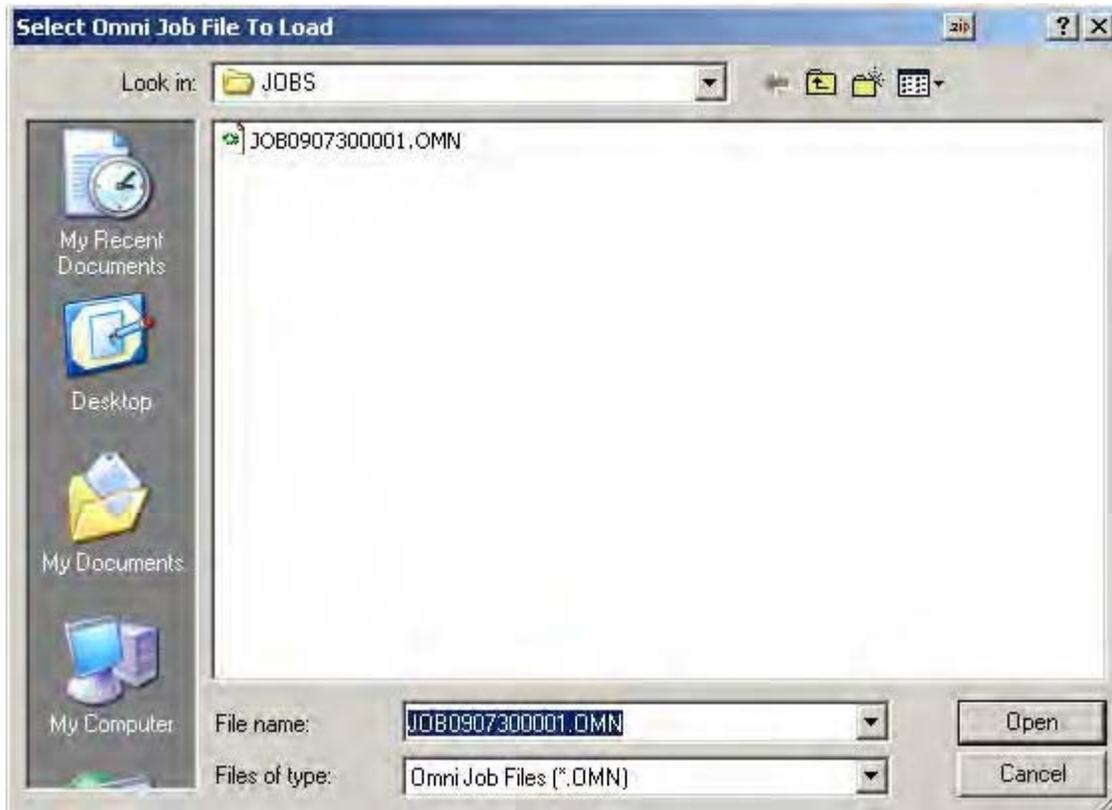
**Concentration Data:**

Filter ID	MSI 2
Final Wt	141.141 mg
Initial Wt	141.109 mg
Delta Wt	0.032 mg
Actual Conc.	32.032 µg/M³
Std. Conc.	31.936 µg/M³

Notes:  
Very short test. High wind.

Save Print Close Help

Click on the **Save** icon and the data will be given a code number and saved for you in a JOB file:

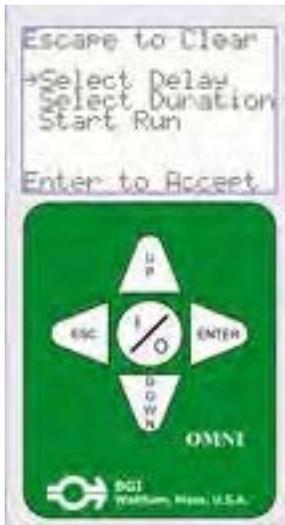


**If your Version Number is 1.4.02 or higher follow the instructions in Appendix B**



#### > Programming the Run:

- 1) Scroll the → to "Run Programmed" using the Up and Down buttons then press the Enter button.

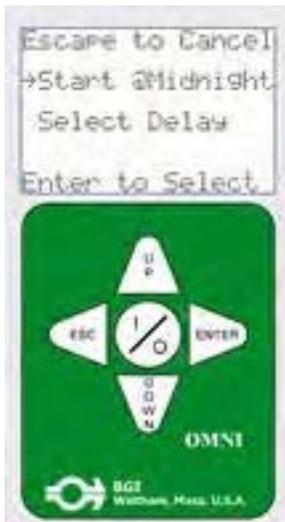


### Program Menu:

- ➔ **Select Delay**      **The amount of time before the sample event begins.**
- ➔ **Select Duration**      **Sample Run Time.**
- ➔ **Start Run**      **Start the program.**

### > **Select Delay:**

- 1) Scroll to "Select Delay", then press the Enter button.



### > **Selecting a "delay start time":**

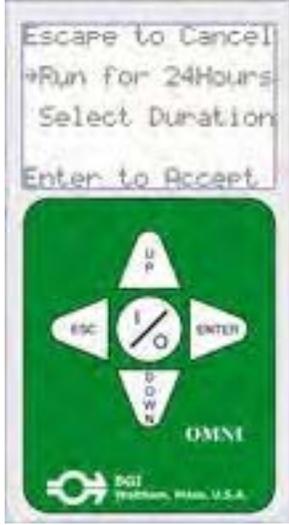
The Delay start menu offers 2 options.

- ➔ **Start @Midnight**  
**Select Delay**

### **Option 1:**

### > **Start @Midnight:**

- 1) Select, "Start @ Midnight", then press the Enter button.

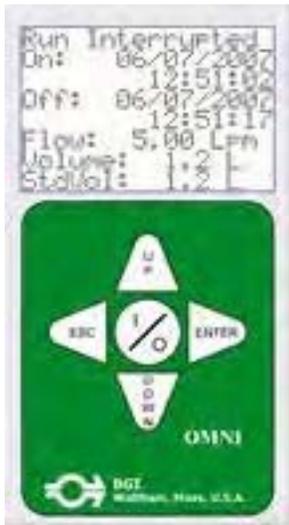


>Selecting a run time duration offers 2 Options:

- Run for 24 Hours                      Automatically sets the run time for 24 hours.
- Select Duration                        Allows for setting a customized run time duration.

>Run for 24 Hours:

- 1) Select, "Run for 24Hours", then press the Enter button. At this point the programmed run begins.



>The "Delay Start" Data Screen provides information about the run and the time counts down until the start time is reached.

>Stopping the "Run" before the Pump turns "ON":

- 1) Press the "Escape" Button. The Display returns to the "Main Menu".

>Stopping the "Run" after the Pump turns "ON":

- 1) After the pump is running on a delay program, press the following code to stop the run: Up, Down and Enter. The run will be aborted and snap to screen 11
- 2) The final run data will be displayed on the LCD.

User Aborted:

The "User Aborted" screen displays information up to the moment the run was halted. Pressing the Enter button will return to the main screen.



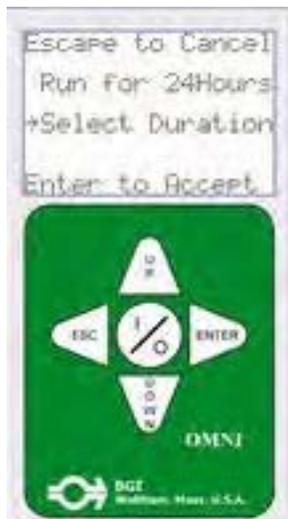
Delay Start, Option 2:

>Selecting a custom "delay start time":

- 1) Scroll to "Select Delay", then press Enter button.

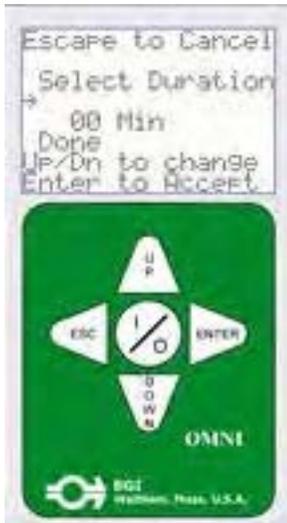
> Select Delay:

- 1) If you need to change any item on this menu. Use the Up or down buttons to scroll, then press the Enter button.
- 2) To change the number, use the Up or Down buttons and press the Enter button to advance to the next item.
- 3) Pressing the Enter button "Done", advances to the "Select Duration" screen.



Select a custom "Run Duration" time:

- 1) Scroll to "Select Duration", then press Enter button.



### Selecting a "Run Duration Time":

- 1) The "000 Hrs" selection should be flashing. To change the number of hours use the Up or Down buttons then press the Enter button. This moves the (→) to "00 Min".
- 2) To change the number of minutes use the Up or Down buttons then press the Enter button. This moves the (→) to "Done".
- 3) To accept the "Sample Duration or Run Time", press the Enter button.

This returns you to the Program menu, where you will be prompted to start the run.



### Start Run:

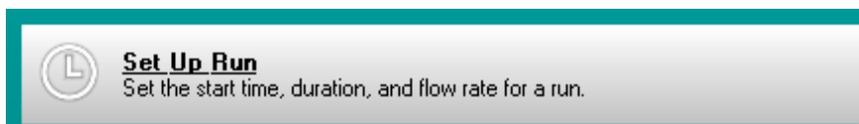
- 1) Press the Enter button, to start the run.

## Appendix B Replacement set up instructions end here

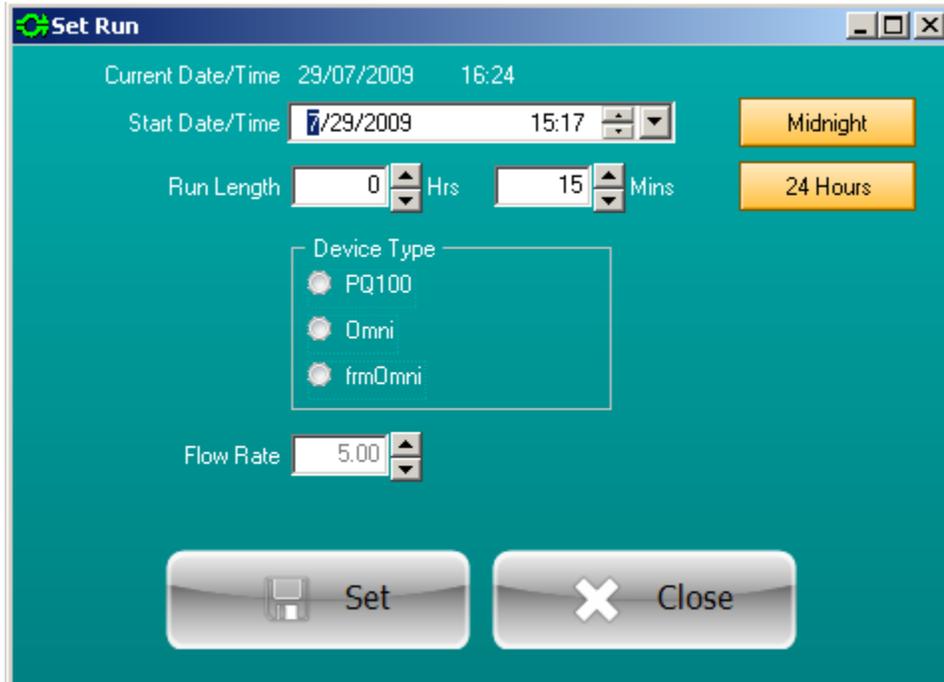
### > Setup via computer.

A single or multiple number of *Omni FT* Instruments may be programmed to run at any future time through a computer.

- 1) Connect a computer to the *Omni FT* via a standard serial cable and RS232 port and *turn it on*.
- 2) Open BGI Link and select the Setup Run screen:



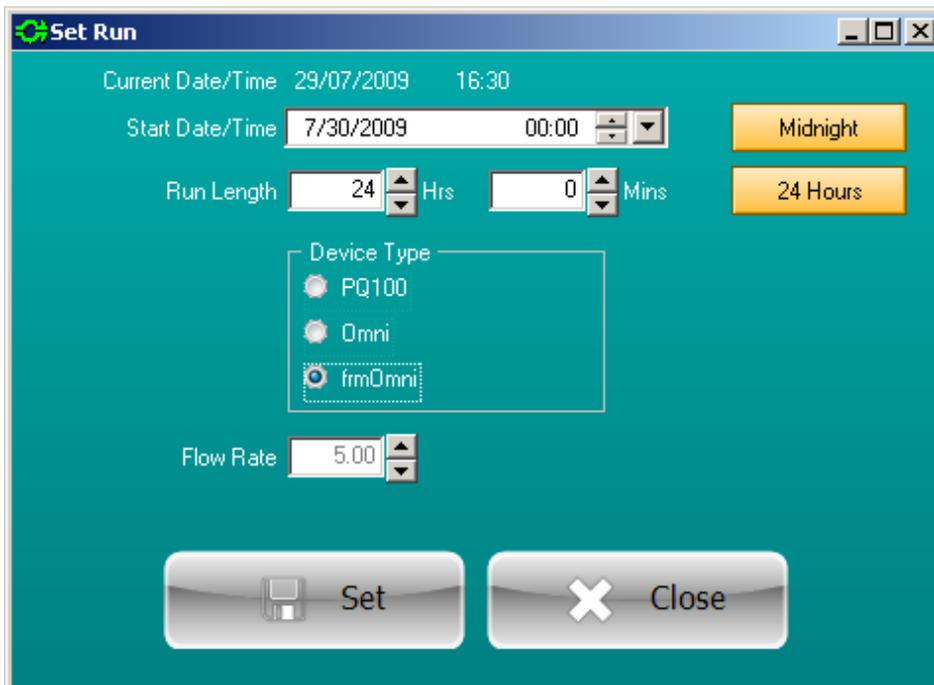
Double clicking on this screen will open the program section dealing with this function



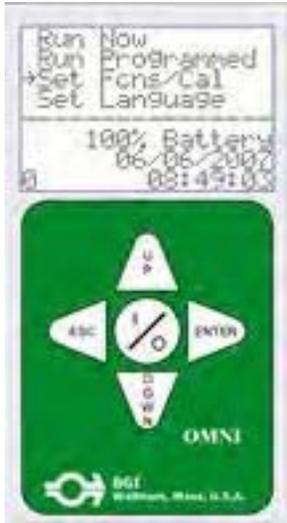
Device type should be selected first, immediately followed by Flow Rate. If the Omni FT is selected the flow rate is locked at 5 lpm. It is not possible to set the PQ100 or Omni above or below their built in limits. The flow rate may be highlighted or selected with the up/dn button:



Midnight is a popular start point for many applications, as is a 24-hour duration. They may be selected by clicking on the icons and the display will instantly display your selections as shown below:

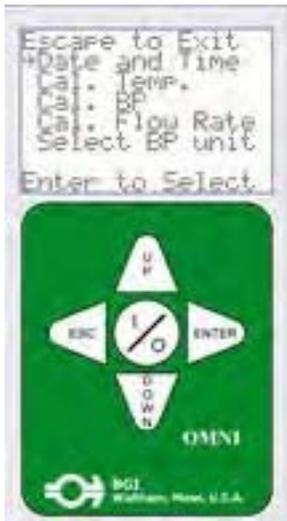


In order to insert other dates and times you may use the arrow selection buttons , or  by highlighting the values and typing in new ones.



> Set Fcns/Cal:

1) Scroll to "Set Fcns/Cal", then press Enter button.

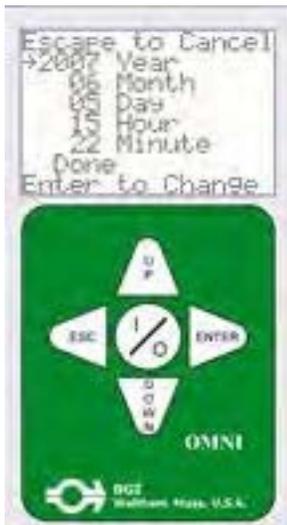


#### Setup and Calibration Menu:

- Date and Time** Set current date and time.
- Cal. Temp.** Adjust temperature to match a tetraCal temp. reading.
- Cal. BP** Adjust Barometric Pressure to match the tetraCal BP Reading.
- Cal. Flow rate** Adjust flow rate to match a tetraCal Flowmeter.
- Select BP unit** Set the units preference for Barometric Pressure, (mm of Hg is the default value).

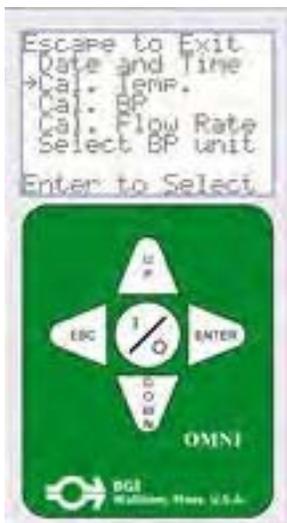
#### >Making a Selection:

- 1) To select "Date and Time", scroll using the Up and Down buttons, then press the Enter button to accept.



### Setting the Date and Time:

- 1) Move the (→) using the Up and Down buttons.
- 2) Press the Enter button to select the item. The item will then flash.
- 3) Use the Up and Down buttons to correct the numeric value. Press and hold to accelerate the speed of the numeric change.
- 4) Press the Enter button to accept the value and the (→) will automatically advance to the next item.
- 5) Select "Done" to return to the "Setup and Cal Menu".



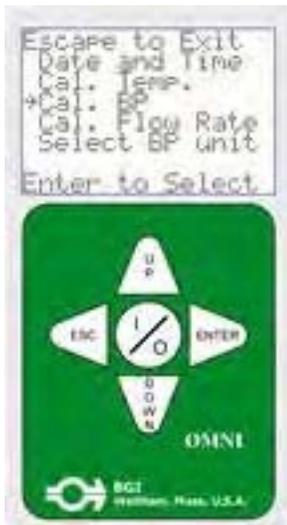
### > Calibrate Temperature:

- 1) To select "Cal. Temp.", scroll using the Up and Down buttons, then press the Enter button to accept.



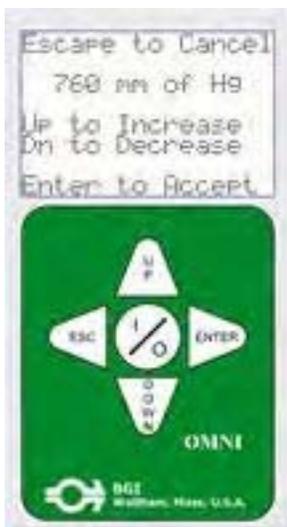
### Adjusting the Temperature

- 1) Compare the temperature reading from the Omni to a tetraCal or other standard.
- 2) If they differ, change the numeric value on the Omni using the Up and Down buttons.
- 3) Press the Enter button to accept the value and return to the "Setup and Cal Menu".



### Calibrate Barometric Pressure:

- 1) To select "Cal. BP.", scroll using the Up and Down buttons, then press the Enter button to accept.



### Adjusting the Barometric Pressure

- 1) Compare the Barometric Pressure reading from the Omni to a tetraCal or other standard.
- 2) If they differ, change the numeric value on the Omni using the Up and Down buttons.
- 3) Press the Enter button to accept the value and return to the "Setup and Cal Menu".



### Calibrate Flow rate:

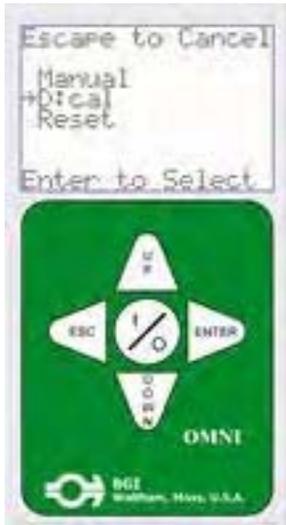
The preferred way to calibrate the *Omni FT* is to use the tetraCal Direct Cal mode. (note: do not use a standard serial cable, a nul modem serial cable is required.)

The tetraCal Direct Cal works as follows:

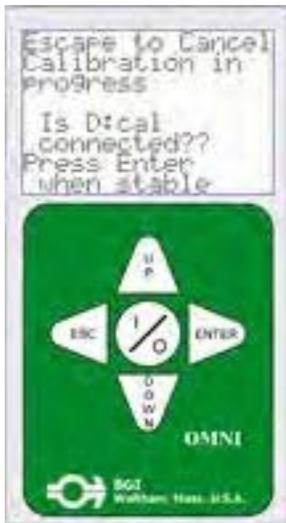
The tetraCal puts out a continuous stream of flow rate information in ascii format. When the tetraCal Direct Cal mode is selected on the pump menu (D:cal), the pump is instructed to look for the stream of flow rate data. It then compares the tetraCal flow rate data to it's own flow rate information and calculates an offset and then automatically adjusts the pump motor speed to match the data coming from the tetraCal.

At the Setup and Calibration Menu:

- 1) Scroll using the Up and Down buttons to the "Cal. Flow Rate" position. Press the Enter button to accept.



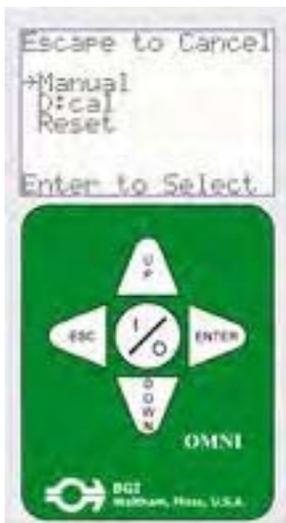
At D:cal menu  
Connect the Pump and calibrator using tubing and filter.



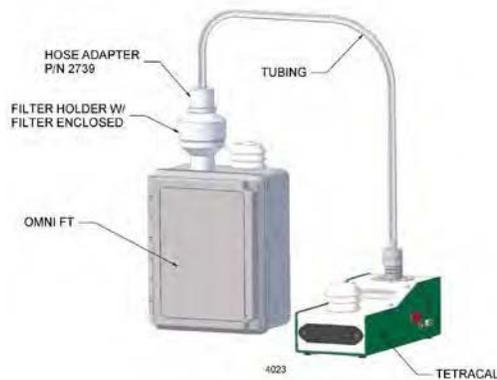
- 1) Turn the tetraCal "ON" and allow it to zero, itself.
- 2) Using the Up and Down buttons, scroll to the "tetraCal" position and press the Enter button. The pump will automatically begin to run.

At this point the pump instantaneously compares it's data to the tetraCal data and calculates an offset.

- 3) When the flow readings on the Omni FT is stable press the "Enter" button.



### Manual Calibration

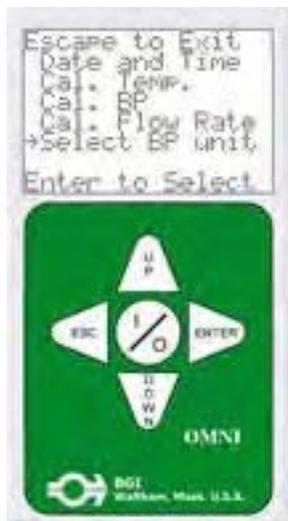


- 1) Using the Up and Down buttons, scroll to the "Manual" position and press the Enter button. The pump will automatically begin to run.



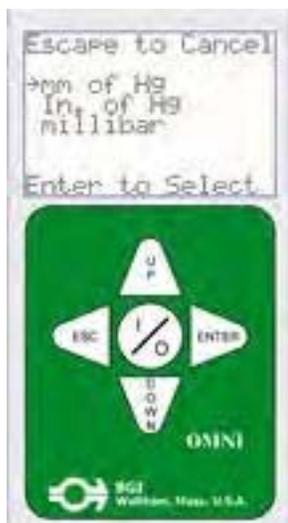
### Adjusting Flow:

- 1) Adjust the flow reading on the tetraCal or any other calibration device, to match the reading on the *Omni FT*, using the Up and Down buttons. One button push is approximately equivalent to a change of 0.1 lpm. Either button may be held down to effect large changes.
- 2) Press the Enter button to accept the Calibration.



### Selecting Barometric Pressure Units:

- 1) Scroll using the Up and Down buttons, to the "Select BP unit" position, then press the Enter button to accept.



### Setting the Barometric Pressure Units

- 1) Move the (→) using the Up and Down buttons to select the barometric pressure units that are correct for you.
- 2) Press the Enter button to accept the units.

**Installation and Operating Instructions  
BGI Solar Panel  
for  
Omni FT**

**Appendix A**

Mesa Labs  
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bgi.mesalabs.com

# APPENDIX A. SOLAR PANEL POWER SUPPLY

## Introduction

The FRMSOLAR, solar panel kit is intended to permit the Omni FT to run for extended or, indefinite periods of time depending on the available sunlight (solar radiation) at a given location.

Because of the low current draw of the instruments they are highly amenable to this technique. Given sufficient sunlight, they may be deployed in locations where no line power is available. The basic components of the solar kit are:

1. 32-watt solar panel with mounting brackets.
2. Voltage regulator.
3. 18+ amp hour (approx.) ballast battery.  
(Battery must be purchased separately)

The purpose of the external high capacity battery is to provide back up power on days when there is little or no sunlight. The recommended battery capacity will provide 4-5 days run time with little or no sunlight. It will recharge, almost completely, after one days' use during a day of full sunlight while the instrument is non-operational. Complete recharging of a fully depleted system would require 10 days.

This type of system should not be considered for latitudes higher than 45-50° N or S, or particularly overcast regions.

## Operational Considerations

While the use of solar power is highly desirable from the standard of utilizing a renewable energy source and being freed from the need to locate a source of power in difficult situations, there are some preliminary considerations. Clearly, the Omni FT is not operating directly from the received energy of the sun but rather from a battery, which has been charged by that energy. If an Omni FT were to be run continuously from the internal and (recommended) external battery, 4 to 5 days run time could be achieved. However, considering only EPA type ambient sampling conditions, i.e. sampling from midnight to midnight, then it would be possible to run on alternate days yielding one day to replenish the energy used. Given that this is accomplished in full sunlight while the instrument is running, the extra day recovery reduces the need for full sunlight by 50%. If the popular, one in 3 days, or one in 6 days schedule is utilized, the probability of complete replenishment is greatly increased

Experience has shown that on cloudless days in the Boston area, 5 Kwh/M2 insolation will replenish the energy used by an Omni FT. In order, to determine the suitability of the Omni FT solar system for a given location check the following referenced handbook:

**Reference**

(1) Stand-Alone Photovoltaic Systems, A Handbook of Recommended Design Practice. Available from National Technical Information Service

US Department of Commerce  
 5285 Port Royal Road  
 Springfield, VA 22161  
 Document No. SAND87-7023

It gives the insolation index for 54 locations in the US and other places throughout the world. Given a one in 6 day sampling schedule; only Fairbanks Alaska is unsuitable for solar application in the months of November, December and January. These are clear sky tables and seasonal overcast must be considered in individual locals. Table N1 comprises locations at various US latitudes and indicates operational months vs. sampling schedules.

TABLE N1. Clear Sky Insolation Data from Northernmost to Southernmost U.S. cities<sup>1</sup>.

*Months wherein full charge can be maintained.*

City	N. Latitude	Continuous Sampling	Every other day Sampling	Third day Sampling	Sixth day Sampling
Caribou, ME	46E 52'	Mar-Aug	Jan-Oct	Jan-Dec	Jan-Dec
Boston, MA	41E 40'	May-Sept	Jan-Nov	Jan-Dec	Jan-Dec
Raleigh-Durham, NC	35E 52'	Apr-Aug	Jan-Dec	Jan-Dec	Jan-Dec
Miami, FL	25E 48'	Feb-Sep	Jan-Dec	Jan-Dec	Jan-Dec

NOTE: This approximation is based upon 5 Kwh/M<sup>2</sup> received, as being necessary to fully restore the *Omni FT* system whilst running.

There are other factors which will reduce the energy replenishment of the system and make accurate performance predictions difficult. Amongst these are:

1. Dirt on the solar panel.
2. Extreme cold weather affecting battery performance.
3. Extremely high particulate loadings causing high filter resistance and consequent high current drain.
4. Old "used up" batteries -- more than two years old.

While all the preceding factors are to be considered in the deployment of a solar powered *Omni FT*, they are not easy to quantitate. The effect of too little sunlight will be noticed on the "fuel gage" of the *Omni FT* screen. Given perfect replenishment, it will always read "charged". If at any time it falls below 50% it is well to consider replacing the large battery with a fully charged one. At a minimum, given winter gloom, a fully charged battery and an every other day sampling schedule, a one month operating period is achievable at any location below 45E latitude.

### Setting up

Subsequent to unpacking a new unit, it is attached to the main stanchion of the *Omni FT* as shown in Figure N2.



Figure N2

## **Direction**

The direction of the solar panel will be with its main axis from the north to south, with the foot (low) end of the panel to the south. The overall set up and positioning is as illustrated in Figure N3.

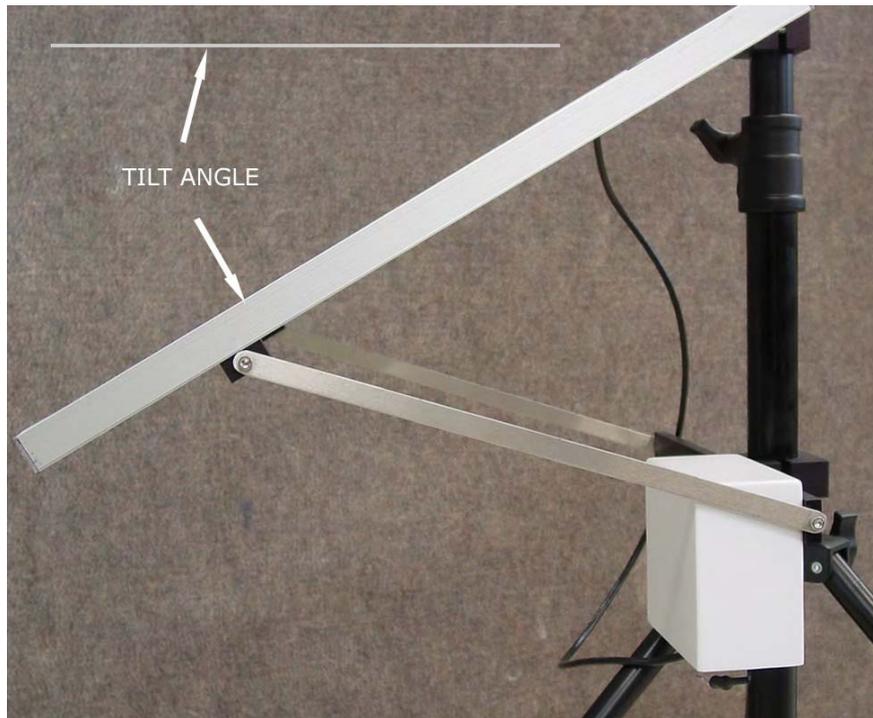


**Figure N3**

## **Tilt Angle**

The tilt angle is defined as the angle of inclination of a solar collector measured from the horizontal. The reason for tilt angle is because the sun's elevation will vary over a range of  $47^{\circ}$  from winter solstice to summer solstice <sup>(1)</sup>.

For the greatest annual energy production, the tilt angle should equal the latitude at the location of deployment. For best energy production, the wintertime angle should be the latitude plus  $15^{\circ}$ . The maximum summertime production is obtained at latitude minus  $15^{\circ}$ . The tilt angle is shown in Figure N4.



**Figure N4**

It may be set with a user supplied protractor/bubble level.

### **Wiring Connections**

Located on the mounting bar is a rectangular box from which two cables exit. The cable with the spade lugs is intended to connect to the external battery. The white wire is positive (+). The black wire is negative (-). The other wire emanating from the box is equipped with a jack plug connector. This wire is plugged into the vacant socket on the *Omni FT* panel.

### **Cautionary Notes:**

*Connect the solar panel to the battery before connecting to the Omni FT . This is to prevent a current imbalance which may cause damage.*

*Do not use the battery charger when the solar panel is connected. Remove the charger from the instrument so that it can not be used when in solar mode.*

## Overall Operation and Troubleshooting

Prior to deploying an *Omni FT* with solar panel, it is prudent to ensure that the internal battery is fully charged. This is accomplished by plugging the *Omni FT* power supply into a source of line current for 16 hours. Full internal battery charge will be indicated on the main menu display as 99% or charged when the battery is full charged and the power supply is disconnected.

The external solar panel battery may be initially charged from any automotive battery charger. Alternatively, the *Omni FT* may simply set in a sunny location or the actual field sampling site and not run for 10 days. The solar panel will fully charge both batteries.

### Troubleshooting

Battery is not maintaining at least 50% charge – caused by inclement weather or excessive current drain. Excessive current drain is caused by an excessively dirty filter or a worn out pump. After installing a new filter, if problem persists, check for worn pump valves or diaphragms.

If either battery is in excess of two years old – replace.

### Solar Panel Parts List (see Figure N5)

Quantity	Part Number	Description
1	SPFRM	Omni FT Solar Panel (includes tripod mounting stand)
1	M-5006	Omni FT mounting stand



Figure N5

## Appendix B Run Set up instructions for Firmware 1.4.02 and higher

With the introduction of firmware Version 1.4.02 in August of 2009, setting up a programmed run became simpler. The need to calculate the number of days, hours and minutes prior to the start of a run was eliminated. A run will now commence upon the exact date and time selected.

From the main menu screen select **Run Programmed** by using the **Up/Dn** buttons and press **Enter**.

```
Run
→Run Programmed
Set Fcns/Cal
Set Language
```

The screen will change to the one shown below with **Select Start** as the default choice, press **Enter**.

```
Escape to Clear
→Select Start
Select Duration
Start Run

Enter to Accept
```

The screen will change to the one shown below with **Select Start** as the default choice, press **Enter** unless you wish to start at Midnight, in which case use the **Up/Dn** buttons to select **Start @ Midnight** and then press **Enter**.

```
Escape to Cancel
Start @Midnight
→Select Start

Enter to Select
```

If you selected Start at Midnight, you have completed the set-up choice. If you selected Select Start, you will be taken to the following screen.

```
Escape to Cancel
+2009 Year
  08 Month
  06 Day
  00 Hour
  00 Minute
Done
Enter to Change
```

Press enter in order to select the year. If it is correct, press enter again to select the month. If it is incorrect, use the Up/Dn buttons to correct the year and press enter to select the month.

If the month is correct, press enter again to select the day. If it is incorrect, use the Up/Dn buttons to correct the day and press enter to select the day.

If the day is correct, press enter again to select the hour. If it is incorrect, use the Up/Dn buttons to correct the day and press enter to select the hour.

If the hour is correct, press enter again to select the minute. If it is incorrect, use the Up/Dn buttons to correct the hour and press enter to select the minute.

If the minute is correct, press enter again to select the minute. If it is incorrect, use the Up/Dn buttons to correct the minute and press enter to select Done.

Press Enter. The screen will change to the one shown below with **Select Duration** as the default choice. If you desire to run for 24 hours, use the **Up/Dn** buttons to select it. If you wish a custom run time choose **Select Duration** and press **Enter**. This will take you to the following screen.

```
Escape to Cancel

Select Duration
+ 001 Hrs
  00 Min
Done
Up/Dn to change
Enter to Accept
```

Press **Enter** to select Hrs. and use the **Up/dn** keys to select the number of hours required. Press **Enter**.

Use the **Up/dn** keys to select the number of hours required. Press **Enter**.

This leads to the **Done** selection, press **Enter** to complete the set up procedure. This action leads to the Start screen.

```
Escape to Clear
  Select Start
  Select Duration
+Start Run
```

```
Enter to Accept
```

When the **Start Run** Key is selected, the countdown to the initiation of the run begins, resulting in a screen like the one shown below.

```
Escape to Cancel
0.00 LPM
22.1 C
755 mm of Hg

Charging
Start in
08:12:45
```

Once the countdown screen appears the run may still be canceled, by simply pressing the **Esc** Key. After the run commences it may only be canceled by pressing, in sequence:



If the error message "SP TOO LOW" appears, the user can select to override this error message and continue sampling. Certain filter media will not create the necessary minimum pressure drop, thus operators using these styles of filters are able to override this command to commence sampling.

## Revision List

Rev.	Change	Date
1	Creation	August 2004
1.0.1	Released	Sept. 8, 2004
1.1	Added Appendix A	August 3, 2005
1.1.1	Updated Fig. 4 Wiring Connections	September 13, 2005
1.1.2	Delete Virtual Manual	June 1, 2007
1.1.3	Updated ISO Registration	March 11, 2009
1.1.4	Changed Run Time Set Up Screen	August 2009
1.1.5	Added Omni FT name, added serial cable types.	November, 2013
1.1.6	Added more photos and details to battery install	November, 2013
1.1.7	Updated Fig. 4 and added note	December, 2013
1.1.8	Updated to Mesa PNs, contact information, and included information on "SP TOO LOW" warning override	December, 2016