



# **TEC Services, Inc.**

Controlled Environment Products  
Calibration and Services

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## **PHOTOMETER MODEL PH-4**

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## ***Operation & Instruction Manual***

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## **I. Introduction**

Congratulations on your purchase of the most highly advanced and easy to use aerosol photometer available! The PH-4 has been designed for reliability and ultimate user friendliness in mind. This manual provides instructions for operation, servicing and troubleshooting, references, warranty and service log/notes. For technical service, calibration and any other questions or comments, please feel free to contact the manufacturer.

## **II. Installation & Setup**

Unpacking:

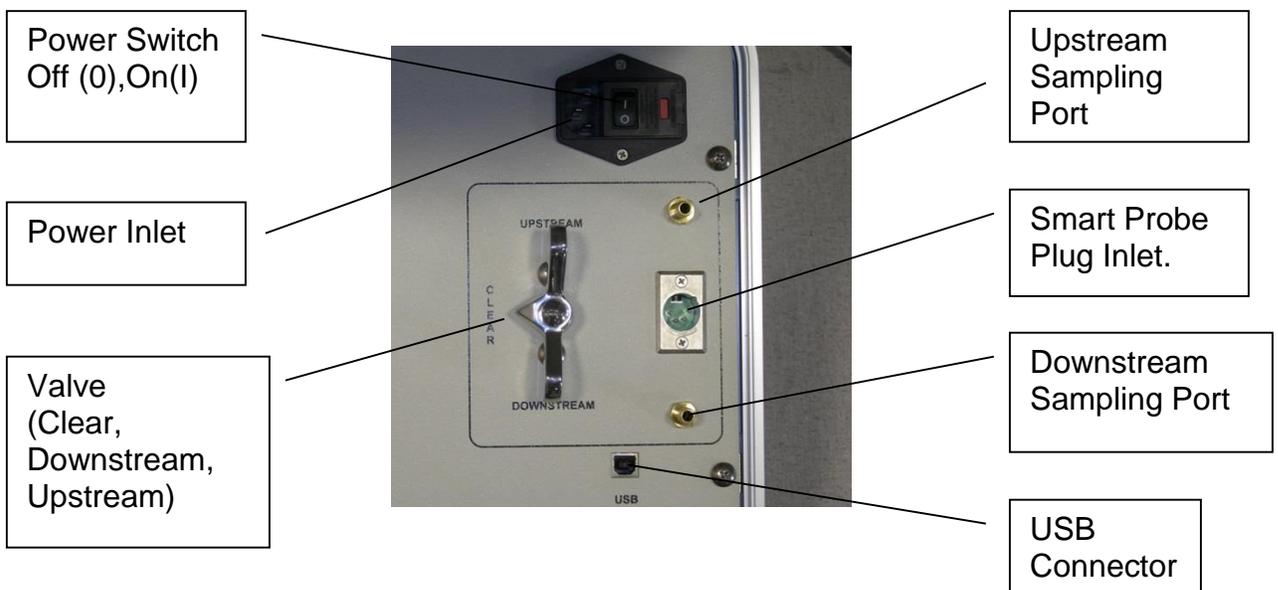
Remove the PH-4 from the shipping container and inspect for damage. Notify the shipper of any damages if necessary. Please save packaging material for shipping either to job-site or to manufacturer for calibration.

Checklist of Items Included:

- \_\_\_ Operation & Instruction Manual
- \_\_\_ Calibration Certificate
- \_\_\_ Detachable Shoulder Strap
- \_\_\_ PH-4 Smart Probe
- \_\_\_ Power Cord
- \_\_\_ Rectangular Nozzle
- \_\_\_ Spare Fuse 4A 250VAC (2 ea.)
- \_\_\_ Inline Filter Holders w/ screen (2 ea.)

*Note: If instrument is received with any damage or missing items please contact manufacturer immediately at 717-624-3191.*

## Front Panel Controls & Connections:



### **III. Operation**

#### ***Warm-Up:***

1. Connect Power Cord to Power Inlet.
2. Turn valve to 'Clear' position.
3. Connect Probe (connect clear hose to downstream port and the plug to front panel connector). *Note: Probe does not have to be connected prior to Power Up.*
4. Turn Power Switch to 'On' position (I), allow 5 - 10 minutes for complete warm up. In situations where the unit has been removed from a very cold environment (outdoor winter storage) it may be necessary to let the photometer warm up for as long as 15 - 20 minutes.

Note: The user may choose to install the inline filter screens on both the upstream and downstream sample ports. Two inline filter screens are included with the unit.

#### **Testing - Available Upstream Aerosol Concentration:**

1. After warm-up has completed the display will read, '**Sample Upstream to set 100%**'. Select the correct reagent (the oil being used in the Aerosol Generator for generating the challenge aerosol) by selecting the button corresponding to **REAGENT**. Continue selecting **REAGENT** until you locate the proper reagent (ex. **PAO, DOP, OND**, etc.). Once the correct reagent has been chosen, select '**YES**'.
2. The PH-4 will prompt, **Turn valve to 'Clear'**. Check that the valve is in 'Clear', and then press the 'CONT' (continue) button. The unit will establish zero.

3. The unit will now display '**Connect hose to Upstream-Turn valve to Upstream**'. The PH-4 will also display the concentration being detected upstream in micrograms per liter. Once you turn the valve to 'upstream' it is recommended to let the concentration stabilize as much as possible before selecting '**CONT**' (continue). Select '**CONT**', the unit will display a scrolling message '**Reading Upstream Concentration**'. If concentration is  $\geq$  to 5 micrograms per liter the PH-4 displays '**Setting 100%**'.
4. If the concentration is too low ( $< 5$  micrograms per liter), the PH-4 will alert the user to this condition with the message '**Concentration below 5 ug/L**'. You must now press '**CONT**' (continue) and repeat this process using a higher upstream concentration if possible or manually set the aerosol concentration.

**Note: Most standards require 10 micrograms per liter.**

5. The PH-4 now displays '**Turn valve to 'Clear**'. Press 'Cont'. Unit establishes Zero and displays the 'Run Mode' display screen (shown below).



6. Turn valve to 'Downstream' and begin scanning filter.
7. Turn valve to 'Upstream' at any time to verify the upstream concentration is now reading approximately 100.

Note: The PH-4 will retain the last upstream reference setting when powered off.

## **Testing - Upstream Aerosol Concentration Not Available:**

1. After warm-up has completed the display will read, '**Sample Upstream to set 100%**'. Select the correct reagent (the oil being used in the Aerosol Generator for generating the challenge aerosol) by selecting the button corresponding to **REAGENT**. Continue selecting **REAGENT** until you locate the proper reagent (ex. **PAO, DOP, OND**, etc.). Once the correct reagent has been chosen, select '**NO**'.
2. Determine total airflow of the system to be tested in cfm (cubic feet per minute). Then use the following formula:

$$\text{Calculated concentration} = \frac{\# \text{ of Laskin Nozzles} * 13,500}{\text{Total Flow (cfm)}}$$

Example: You are pressurizing one Laskin Nozzle with 20 psi (pounds per square inch) and testing a system with a known airflow of 500 cfm (cubic feet per minute).

$$13500 \text{ cfm} \div 500 \text{ cfm} = 27 \text{ micrograms per liter}$$

\*Concentration is derived from aerosol output of generator used. Please reference your aerosol generator specifications. Laskin nozzle generators give the following known output - 1 nozzle @ 20 psi when diluted with 135 cfm of air volume = 100 micrograms/liter concentration.

3. The display will now show the last concentration that was set. Press the buttons for **'UP'** or **'DOWN'** to select 27.  
Note: The concentration can be set from 5-125 micrograms per liter. To hyper scroll quickly through the setting, press the 'Up' or 'Down' button and do not release until the desired number is reached.
4. Once you obtain the calculated concentration, select **'OK'**.
5. The PH-4 now displays **'Turn valve to 'Clear'**. Press **'Cont'**. Unit establishes Zero and displays the 'Run Mode' display screen (shown below).



6. Turn valve to 'Downstream' and begin scanning filter.

Note: The PH-4 will retain the last reference setting when powered off.

## **Alarm Functions:**

The PH-4 is equipped with 3 separate alarms: visual, audible, and vibrating. All alarms alert the user when the selected percent penetration is exceeded.

1. From the 'Run Mode' display screen select '**ALARM**'.
2. A new screen will appear with the last alarm set point. Press the '**UP**' or '**DOWN**' buttons to adjust. Note that the set point can be adjusted from .001 to 100 percent penetration. To hyper scroll quickly through the set point hold the button down. Press '**OK**' when your desired level is displayed.
3. A new screen will appear showing the 3 alarm options: '**VIB**' (vibrating), '**AUDIO**' (audible), and '**VIS**' (Visual). Press the menu button corresponding to each option to toggle the option on or off. Press '**CONT**' when you have selected your alarm options.
4. If one or any combinations of alarm options are enabled, then the word '**ALARM**' will be highlighted in the 'Run Mode' display screen (shown below).



5. If the alarms are disabled, either by following the above procedure or disabling from the probe 'Alarm' On/Off toggle button then the word '**ALARM**' will *not* be highlighted in the 'Run Mode' display screen.

### **Using the Smart Probe:**

The PH-4 allows the user to turn the alarm functions on and off and adjust the probe display brightness from the scanning probe. The alarms can be disabled by the user at any time by pressing the Alarm On/Off toggle button. To enable the alarms press the toggle button again. You will notice the word, 'ALARM' is only highlighted in the 'Run Mode' display screen only when the alarm is enabled and not highlighted when the alarm is disabled. This will ensure the user is aware that the alarm functions are either on or off.

To adjust the probe display brightness press Display Bright/Dim toggle button. This alternates the Probe display between Bright/Dim.

***Note: The Smart Probe is plug and play and can be plugged into the photometer at any time. It does not need to be plugged in prior to start up.***

### **Zeroing:**

If display is erratic in the clear mode or oil residue has been drawn into the scattering chamber, the display may become unstable when the selector valve is in the 'Clear' mode. From the 'Run Mode' screen (pictured on page 7), press the button corresponding to '**ZERO**' on the display. Turn valve to 'Clear' and press '**CONT**' (continue). This will re-zero the unit and restore the display to all zeros in the clear mode. It is recommended not to leave the scanning probe or sample tube lie on a floor or on top of a biological safety cabinet while sampling as these areas can be extremely dirty.

### **Date/Time/Machine Hours:**

The PH-4 is equipped with a real time clock enabling the user to monitor machine hours and access current date and time. When in the Run Mode screen (pictured on page 7) you can toggle between these functions by pressing the right-most menu button. You may adjust the date and/ or time by holding the corresponding menu button down for 2 seconds underneath the date or time display. This will bring you into a 'set-up' screen where you will be able to make the appropriate adjustments and then press 'Save' after making the necessary changes.

### **Reagents:**

The PH-4 may be used with the following reagents.

1. PAO-Poly Alpha Olephin-Emery 3004
2. DOP-Di [2-ethyhexyl] phthalate
3. OND- Shell Ondina EL
4. PAR-Paraffin Oil
5. DOS- Dioctyl-Sebacate
6. MIN-Mineral Oil
7. KAY-Kaydol
8. COR-Corn Oil.

From the 'Run Mode' (pictured on page 7), screen choose the button corresponding to '**REF**' to access your reagent settings when setting your reference concentrations. The PH-4 will retain the last reagent selected. It does not have to be selected during each reference setting process.

## **IV. Maintenance and Troubleshooting**

### **Maintenance:**

The Smart Probe has a filter screen built into the probe nozzle inlet. Unscrew the flexible knuckle base and locate screen inside threaded hex inlet. Remove screen, clean, and replace.

Note: It is recommended that very high concentrations (>100 micrograms per liter) not be sampled for extended periods of time (> 5 minutes continuous). Doing so will cause oil to build up in the sampling train/scattering chamber and cause an unstable or erratic zero display and may also require unit recalibration and service.

### **Troubleshooting:**

<i>Symptom</i>	<i>Check</i>
Instrument Inoperative	Not plugged in; Power inlet fuse blown
No audible alarm heard.	Alarm set point not exceeded. Alarm not set to 'AUDIO'
No vibration felt (Probe body)	Probe not plugged into base unit. Alarm set point not exceeded. Alarm Options not set to 'VIB'
No illumination (Probe LED)	Probe not plugged into base unit. Alarm set point not exceeded. Alarm not set to 'VIS'
Vacuum Pump Labors	Line kinked – probe hose, upstream sample or (internal*); Valve not set properly – clear, upstream or downstream
Unstable '0' Reading	Valve not in clear; *Large amount of debris sucked into unit. Return unit to manufacturer for recalibration. *Dirty or leaking '0' reference filter; *Leak in sampling system tubing.
No response on % penetration display screen	Selector Valve in clear mode. Turn the valve to upstream or downstream to sample air.

*\*Note: The above items are not possible to be serviced by the owner. If any repairs cannot be made or you need assistance please call the manufacturer.*

## **V. Warranty**

TEC Services, Inc., as the manufacturer, warrants each product to be free from defects in material and workmanship under normal use and service for a period of one year after shipment to the purchaser. The manufacturer's obligation under this warranty being limited to repairing or replacing, at its option, any part which shall, within one year after delivery of product to its purchaser, be returned by the purchaser to the manufacturer's factory, and is determined to be defective upon the manufacturer's inspection. The warranty shall cover all parts and labor necessary to facilitate repairs for a period of one year. Shipping and delivery charges are to be paid by the purchaser. This warranty is non-transferable unless the manufacturer gives written approval, after inspection of said products.

This warranty shall not apply to any product which has been subject to misuse, negligence or accident in its operation or which have been repaired, or altered, or serviced in any manner by the purchaser not specified by the manufacturer. This warranty also shall not apply to any product that has been subject to misuse, negligence or accident in shipping or storage by the purchaser or shipping agency. If the warranty shall not apply, the purchaser shall pay all repair and replacement costs incurred by the manufacturer to return the product to the purchaser. Components or parts not manufactured by the manufacturer are subject to the warranty of their manufacturer.

TEC Services, Inc., in no event assumes any liability for loss, damage or expense directly or indirectly from the use of its products. TEC Services, Inc., reserves the right to make changes in the design of its equipment at any time and to exclude components from this warranty without prior notice.

*For Purchaser Records:*

Purchaser \_\_\_\_\_ Date \_\_\_\_\_  
Equipment Model # \_\_\_\_\_ Serial # \_\_\_\_\_

**VI. Service Log**

<u>Date</u>	<u>Action Taken</u>	<u>Performed by:</u>

*Notes:* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

***Recommended Factory Calibration: 12 months***