

Quick Start Guide for the MiniRAE 3000 (PID)

This document serves as a quick reference guide and is not intended to replace the user manual. It is recommended to consult the user manual for more detail. Geotechnics has relied on the information in the user manual to develop this guide and makes no representation of warranty as to the accuracy of the guide.

1. About the MiniRAE3000

The MiniRAE 3000 is a Photoionization detector (PID) which measures volatile organic compounds in the range of 0 – 15,000 ppm. The PID is commonly used to screen for the presence of Volatile Organic Compounds (VOCs) and the built-in pump allows sampling from potential dangerous areas, up to 30 m away.

2. Turning the PID on

- a. Attach a water trap filter to the tip of the probe by pushing the plastic opening of the filter onto the metal probe tip of the PID. This equipment should never be used without a water trap filter.
- b. The MiniRAE3000 (PID) has the following 3 buttons (from left to right) under the screen and a circular flash light button.
 - Y/+
 - MODE
 - N/-
- c. Press and hold down the 'MODE' button until a beep sound is heard. The PID will run through its start-up sequence.

3. Zero Gas/Fresh Air Calibration

- a. Carry out a zero gas/fresh air calibration in a known atmosphere free of toxic or combustible gas.
- b. When prompted during start-up to 'apply zero gas', press the 'Y/+' button.

4. Normal Operation/Home Screen

- a. The home screen should display 0.0 ppm.
- b. The unit is now measuring and ready to use.

5. Turning the PID off

- a. Press and hold the 'MODE' button to start the shutdown sequence.
- b. A long beep will follow the shutdown sequence and the unit will turn off.

6. Alarms

The unit has audible and visual alarms set to trigger at specified concentrations. STEL is the short-term exposure limit and TWA is the time-weighted average. The alarm levels are outlined in the table below:

Sensor	HIGH	LOW	STEL	TWA
VOC ppb (ppm)	100,000 (100)	50,000 (50)	10,000 (10)	25,000 (25)

6.1 Testing the Alarms

- a. On the 'Home' screen, press and hold the 'Y/+' button to activate the audible and visual alarm.
- b. Release the button to stop the test.

7. Tips

7.1 Pump/Flow Integrity Test

- a. Place finger over the metal tip of the water trap filter. The PID will go into flow fail and pump will stop, activating the visual and audible alarms.
- b. Press the 'Y/+' button to restart the pump and reset the alarm.

7.2 Flash light

- a. Press the circular light button below the 'MODE' button to turn on the flash light.
- b. Press the light button again to turn the flash light off.

7.3 Testing the VOC sensor

- a. Expose the writing tip of a felt-tip sharpie and hold close to the watertrap filter inlet without touching it.
- b. Observe the readings rise.
- c. Place the cap over the sharpie and the readings should fall. Wait for readings to stabilise at close to zero before use.

8. How the PID operates

The PID is fitted with a standard lamp with an energy rating of 10.6 eV. 9.8 and 11.7 eV counterparts are available, but the 10.6 lamp is commonly used for its durability and broad detection range of common compounds.

The energy rating relates to the ionisation energy which is required to ionise a compound (i.e. to eject an electron from a molecule). The internal pump draws the gas or vapour sample in front of the PID lamp (figure 1). Here, the sample is ionised with a UV light source ejecting electron(s) and forming positively charged molecules that are drawn to the anode and cathode respectively.

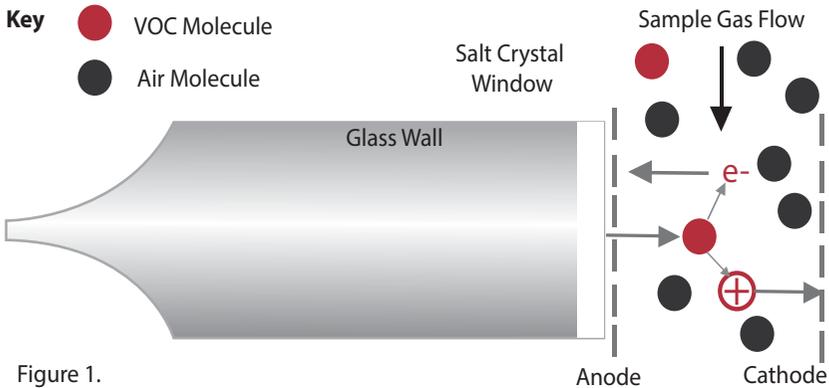


Figure 1.

The resulting current is measured and the amount is proportional to the vapour or gas concentration. In theory, any compound with an ionisation energy less than the lamp energy can be detected. This means the 11.7 eV lamp can detect all compounds that the 9.8 and 10.6 eV lamps can, but not vice versa. However, the 11.7 eV lamp has a much shorter lifetime and requires more maintenance. The 9.8 eV lamp is more selective, since it is limited to compounds with low ionisation energies.

9. Calibration and correction factors

Isobutylene (IBE) in the 100 ppm concentration is commonly used to calibrate the PID since it is readily available and has a low toxicity.

Theoretically, if the instrument is able to be zeroed perfectly and the response is perfectly linear, the concentration of calibration gas is not important. In practice, this is relatively true for using Isobutylene in the 100 – 2,000 ppm concentration since the response is quite linear at low-concentrations. It is important to note that calibrating a PID to any gas does not make it selective to only that gas. The PID will respond to all gases that the lamp can ionise and will give readings equivalent to the calibration gas.

Correction factors have been developed for this purpose to obtain readings in the units of the compound of interest. For example, the correction factor for Benzene (in relation to Isobutylene) is 0.53, thus in a Benzene-laden atmosphere a readout of 75 ppm is actually 39.75 ppm Benzene;
 $75 \text{ ppm (IBE)} \times 0.53 = 39.75 \text{ Benzene.}$

10. Troubleshooting

Symptom	Possible Cause(s)	Recommended actions
1. Cannot turn on	Flat/Defective battery	<ol style="list-style-type: none"> 1. Disconnect and re-connect battery pack 2. Charge the lithium-ion batteries 3. Use the alkaline battery pack
2. Abnormally high readings after turning on at Home screen	Dirty water-trap filter Incorrect calibration gas	<ol style="list-style-type: none"> 1. Replace water-trap filter 2. Dry-out sensor module (silver cap with black probe inlet) 3. Return to Geotechnics to recalibrate
3. Alarms are activated at Home screen Pump icon is flashing	Pump flow failed/ blocked	<ol style="list-style-type: none"> 1. Turn unit off 2. Replace water-trap filter, turn on 3. Check if inlet probe is blocked
4. 'NEG' flashing	Current atmosphere is 'cleaner' than fresh air calibration	<ol style="list-style-type: none"> 1. Turn unit off and on again, re-do fresh air calibration
5. Battery icon flashing	Low battery	<ol style="list-style-type: none"> 1. Charge battery or replace with alkaline battery pack
6. Lamp flashing	PID lamp failure	<ol style="list-style-type: none"> 1. Turn unit off & on 2. Return to Geotechnics to rectify
7. Readings not registering	Leak in the sample train Pump diaphragm damaged	<ol style="list-style-type: none"> 1. Check flow integrity 2. Return to Geotechnics to rectify