

TOXIRAE PRO PID



Citizen Science Operating Procedure

ToxiRAE Pro PID Citizen Science Operating Procedure

Ron Williams

**National Exposure Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Research Triangle Park, NC, USA 27711**

Amanda Kaufman

ORISE Participant

**Oak Ridge Institute for Science and Education
Oak Ridge, TN, USA 37831**

Sam Garvey

**Alion Science and Technology
Research Triangle Park, NC 27709**

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ToxiRAE Pro PID

ToxiRAE Pro PID



The ToxiRAE Pro PID measures total volatile organic compounds (VOCs) using a photoionization detector (PID). This sensor can be programmed to measure concentrations of a specified compound automatically and has a real-time reading of VOC concentrations in parts per million (ppm) or micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The manufacturer states that the ToxiRAE Pro PID can accurately detect and monitor more than 300 VOCs. It can operate either on its internal, rechargeable lithium-ion (Li-ion) battery or be plugged into a wall outlet, and it can collect data for more than 12 hours on a fully charged battery. Refer

to Figure 1 for detailed specifications. This operating procedure explains what you need to do to collect quality VOC data using the ToxiRAE Pro PID for your monitoring project.

What Are VOCs?

VOCs are common pollutants in both indoor and outdoor environments. VOCs are emitted as gases from many common household and office products including paints, floor wax, cleaning supplies, cosmetics, pesticides, building materials, home furnishings, copiers and printers, permanent markers, glues, and adhesives. Fuels are also made up of organic chemicals, increasing VOCs near roadways and urban areas. All of these products can release organic compounds during use and sometimes during storage and can have both short- and long-term adverse health effects.

What You Will Need

- ❖ ToxiRAE Pro PID sensor
- ❖ Charging cradle
- ❖ USB cable (mini-USB to standard USB)
- ❖ Power cable
- ❖ ProRAE Studio II software
- ❖ Computer running the Windows XP, Vista, Windows 7, or Windows 8 operating system with a 1 GHz Pentium processor, CD-ROM drive, 16-bit VGA monitor with resolution of at least 1024 x 768, 256 MB of RAM, and 10 MB of free disk space

Figure 1

ToxiRAE Pro PID Specifications	
Dimensions	118 mm x 60 mm x 30 mm (4.6" x 2.4" x 1.2")
Weight	235g (8.3 oz)
Battery	Internal rechargeable Li-ion
Charging Time	Less than 4 hours
Operating Time	More than 12 hours on full charge (normal operation)
Charger	Charging and PC communication cradle: AC / DC adapter with international prong kit (100 to 240V, 50/60 Hz AC to 12V DC)
	Multi-unit charging station for up to 5 units (data download from one): AC/DC adapter for the multi-unit charging station
Alarms	Audio alarm – 95 dB @ 30cm Visual alarm – 4 bright red LED lights Vibration alarm Activated display backlighting and on-screen indication of alarm conditions Wireless alarm notification sent to remote observers (wireless versions only)
Display	Monochrome dot-matrix graphical LCD display
Display Backlight	Manually and on alarm
Keypad	2 programming/operation keys
Direct Readout	Real-time reading of VOC concentrations in parts per million or mg/m ³ ; battery status; data logging on/off status; wireless reception quality; STEL, TWA, and peak values; calibration and measurement gases, correction factors
Sampling Method	Fan-assisted diffusion
Datalogging	Capacity: 3 months at 1-minute interval Datalog interval: user-configurable from 1 to 3,600 seconds
Calibration	Two-point field calibration of zero and standard reference gas Adjustable span value Maintains calibration date
IP Rating	IP-54
Docking Station	AutoRAE 2 Automatic Test and Calibration Station
Protection:	Password-protected calibration settings, alarm limits, and data
Hazardous Location Approvals	 Class I, Div. 1; Gr. A,B,C,D T4 Class I, Zone 0 A/Exia IIC T4 ATEX:  II 1G, Ex ia IIC Ga T4 IECEX: Ex ia IIC Ga T4 China: Ex ia IIC T4
CE Compliance (European Conformity)	EMC directive: 2004/108/EC R&TTE directive: 1999/5/EC ATEX directive: 94/9/EC
Operating Temperature	-4° to 131° F (-20° to 55° C)
Humidity	0 to 95% relative humidity (non-condensing)
Warranty	Two years on non-consumable components (per RAE Systems Standard Warranty); one year on fan, sensor, battery, and other consumable components

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Important Considerations

- ❖ The ToxiRAE Pro PID comes from the manufacturer pre-calibrated. Return it to the manufacturer after 6 months for recalibration.
- ❖ A PID is *not a selective detector*, which means it has limited ability to differentiate between compounds, and it can only roughly quantify total VOCs.
- ❖ The ToxiRAE Pro does not respond to certain low molecular weight hydrocarbons such as methane and ethane. Certain toxic gases and vapors, such as carbon tetrachloride and hydrogen cyanide, cannot be detected with a PID.

General Operation







Powering On

To turn on the ToxiRAE Pro, press the **Mode** key for 3 seconds (Figure 2). Startup takes a minute or two, during which time a series of feedback screens are displayed. A number of icons representing various sensor functions appear on these screens. Some common ones that display the operational status of the unit are listed in Table 1. Refer to the user's guide for a complete listing of the icons and their meanings.

Powering Off

When operating on battery power, the unit will turn itself off when the battery is depleted. To shut down the unit manually, press and hold the **Mode** key for 2 seconds to begin the 5-second countdown to shutoff, which is accompanied by one buzzer beep per second. You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the ToxiRAE Pro PID continues normal operation. Release the **Mode** key when you see the message “Unit Off”.



Icon	Function	Table 1
	Wireless status: radio is on	
	Wireless status: radio is off	
	Wireless strength	
	Battery status	
	Data logging status (shown when data logging is on, blank when off)	
	All sensors tested and calibrated according to intervals configured on the instrument	

Adapted from ToxiRAE Pro user's guide.

Running Device Self-checks

On startup, the ToxiRAE Pro PID performs self-checks of its functions and alerts the user of any errors. If you see either a “**Sensor error!**” or “**Wrong sensor!**” message, immediately shut off the sensor by pressing and holding the **Mode** key for 2 seconds.

If any of the following error messages occurs, you can either shut off the instrument by pressing the **Mode** key or continue to the next startup test by pressing **Y/+**:

- ❖ No fan or fan error!
- ❖ Real time clock error!
- ❖ Memory error!
- ❖ Sensor changed!
- ❖ Failed to turn on lamp!

If any of these error messages persist after five attempts to restart the instrument, contact the distributor from whom the instrument was purchased, or consult sections 18 through 20 of the user's guide provided by the manufacturer.

Navigating the ToxiRAE Menus

The **Mode** and **Y/+** keys (Figure 2) are used to scroll through the ToxiRAE menus and submenus. The **Mode** key is used to move forward and backward through the menus and downward and upward through the submenus. The **Y/+** key is used to select and save options.

The functions of the keys in the submenus might also correspond to instructions directly above the keys. For example, if it says “**OK**” above the **Mode** key, pressing **Mode** selects “**OK**”.

When entering numbers, the **Mode** key typically selects the highlighted digit and each press of **Y/+** increases the digit by 1.

ToxiRAE Pro PID

Preparing the Device

Before collecting data, make sure your ToxiRAE Pro unit has a fully charged battery. You must also install the ProRAE Studio II software on a computer and configure the device to measure a desired gas. The following procedures will guide you through preparing your device for routine data collection.

Charging the Battery

The ToxiRAE Pro PID sensor's lithium-ion (Li-ion) battery must be fully charged prior to use. This is done by placing the ToxiRAE Pro PID in its accompanying charging cradle as described in the procedure below. Before placing the device into the charging cradle, visually inspect the contacts to make sure they are clean. If they are not, wipe them with a soft, dry cloth. *Do not use solvents or cleaners.*

Procedure: Charge Battery

1. Plug the power cable into the ToxiRAE Pro's charging cradle and then into a wall outlet.
2. Place the device into the cradle, making sure the contacts on the bottom of the unit meet the charging cradle's contact pins, and press down until the unit is locked in place (Figure 3).

The ToxiRAE Pro PID will begin charging automatically. The LED on the charging cradle should glow red while charging and turn green when charging is complete.

To remove the device from its cradle, simply press down on the latch release on the back of the cradle while tilting the ToxiRAE Pro PID slightly toward the front of the cradle and lift it out.

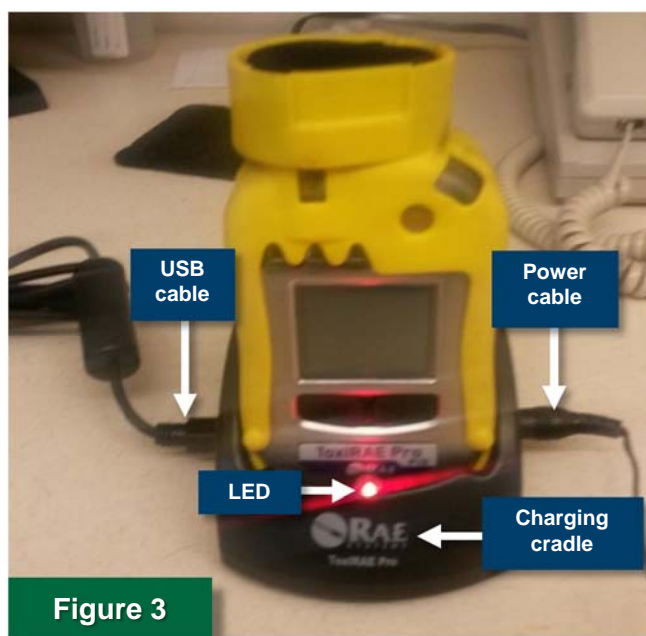


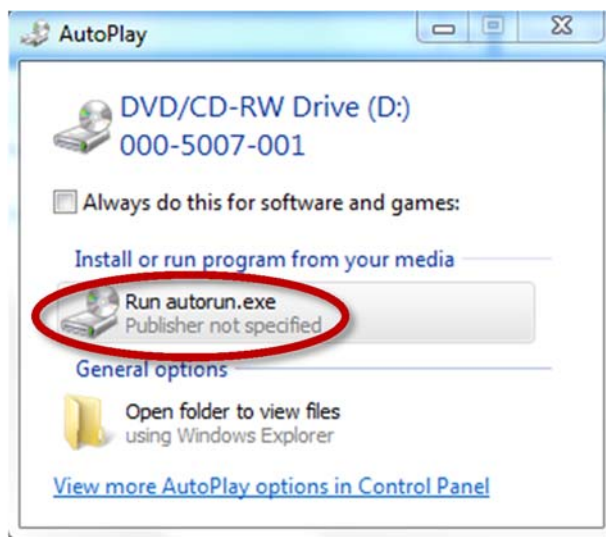
Figure 3

Installing the Software

To retrieve data from the ToxiRAE Pro PID, the ProRAE Studio II software must first be installed on a computer with the minimum requirements listed in “What You Will Need.” Install the ProRAE Studio II software from the CD included with the sensor using the following procedure.

Procedure: Install Software from CD

1. Insert the CD that accompanies your ToxiRAE Pro PID unit into your computer's CD drive tray and close the tray.
2. Click '**AutoPlay**' and then '**Run autorun.exe**'.

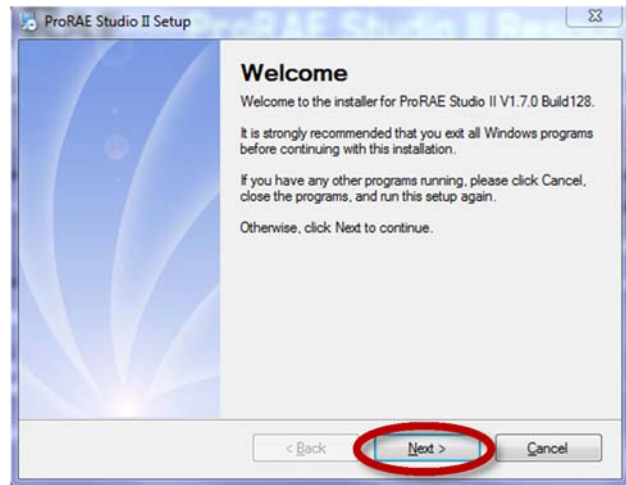


3. Select the '**ProRAE Studio II**' button.

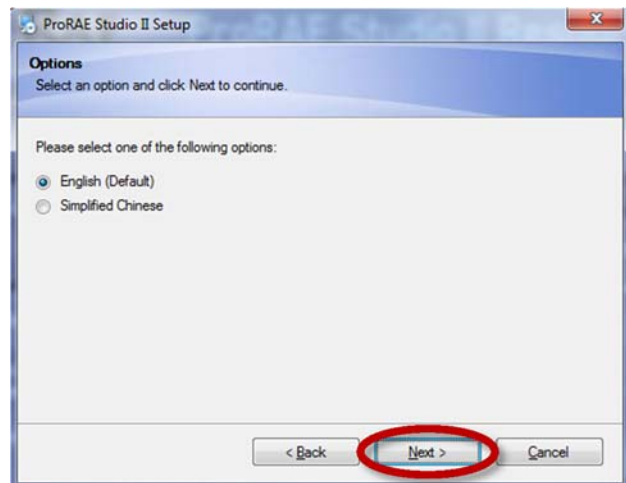


ToxiRAE Pro PID

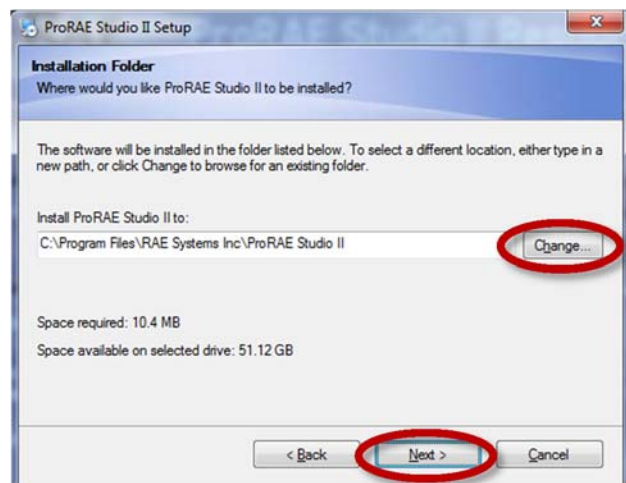
- Click '**Next**' at the bottom of the setup Welcome screen.



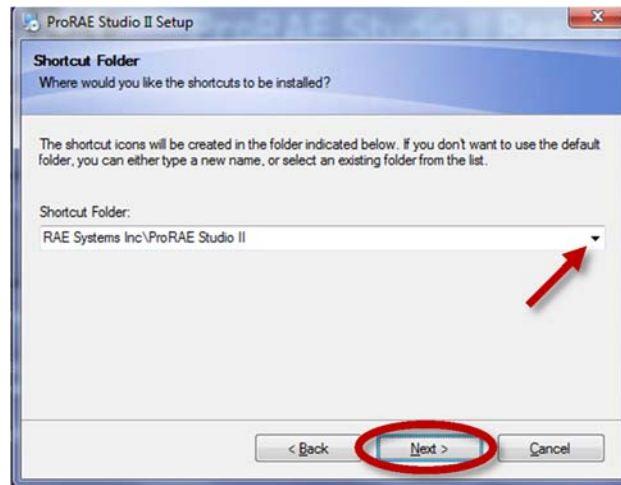
- Select your preferred language (English is selected by default), and then click '**Next**'.



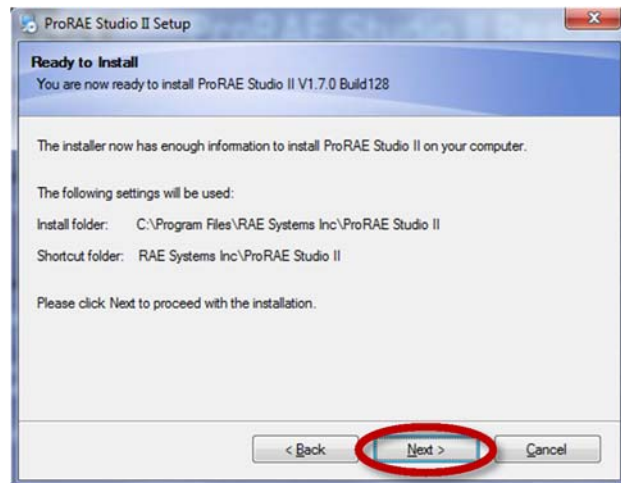
- To specify the folder where you would like to install the ProRAE Studio II software, click '**Next**' to select the default location or '**Change**' to pick a new location and then '**Next**'.



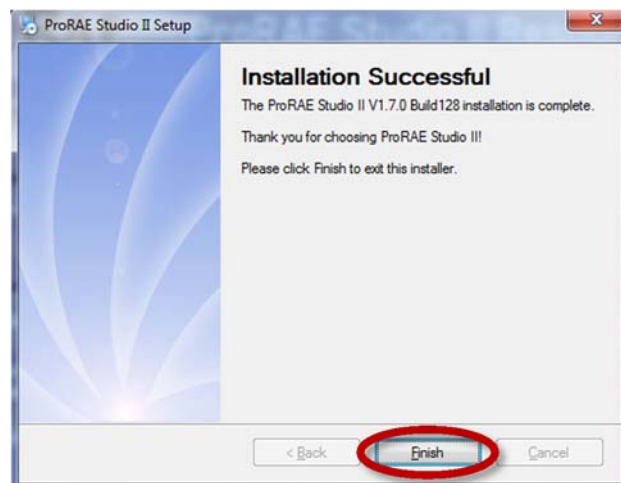
7. To specify the location of shortcuts created during the software installation, click **'Next'** to select the default location or click the drop-down menu arrow to pick a new location and then click **'Next'**.



8. Click **'Next'** to begin the installation.



9. When the **'Installation Successful'** screen appears, click **'Finish'** to exit the installation wizard.



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Selecting the Measurement Gas and Units

Before collecting data, you must first select the gas you want to measure and choose the measurement units. To do this, select the **Measurement** icon (Figure 4) and use its submenus, **Measurement Gas** and **Measurement Unit**.

Measurement gases are organized in the **Gas Library**, which consists of 190 compounds. Standard measurement units are parts per million (ppm) or milligrams per cubic meter (mg/m³).

Select the measurement gas and specify the measurement units as follows:

1. Press **Y/+** to scroll through the **Gas Library** until you are on the gas you want to measure.
2. Press the **Mode** key to highlight **Save**, and press **Y/+** to save the selected gas. (Alternatively press **Mode** to highlight **Quit** and then **Y/+**; the newly selected gas will not be saved.)
3. To choose the measurement unit for your selected gas, press the **Mode** key to highlight either **ppm** or **mg/m³**. Press **Y/+** to save your choice.
4. Press **Mode** until **Exit** is highlighted, and then press **Y/+** to exit. The device will exit the **Measurement** menu, and the **Alarm Setting** (bell with exclamation point icon) will be highlighted.

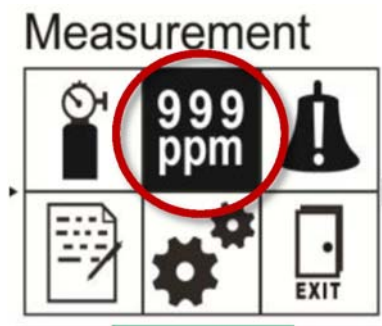


Figure 4

Routine Data Collection

Collecting Data

The ToxiRAE Pro PID is set to record real-time data internally as soon as it has finished its startup self-testing (see “General Operation”). One data point is recorded every 20 seconds. The sampling screen (Figure 5) displays an image of a floppy disk while recording data internally and an image of signal strength when transmitting to a receiver (see Table 1).

The ToxiRAE Pro PID records a summary report of the sensor’s operational characteristics during the data collection period along with the VOC measurements (ppm) in a text file (*.txt), as shown in Figure 6. In this text file, the measurements recorded in 20-second intervals appear in the **Datalog** section with the measurements and date/time of collection separated, or delimited, by tabs. Most spreadsheet programs are able to read data from a text file in a delimited format. To process the collected data, you will need to transfer the text file created by ToxiRAE Pro PID software to spreadsheet software such as Microsoft Excel, as explained in the “Processing Data” section.



Figure 5

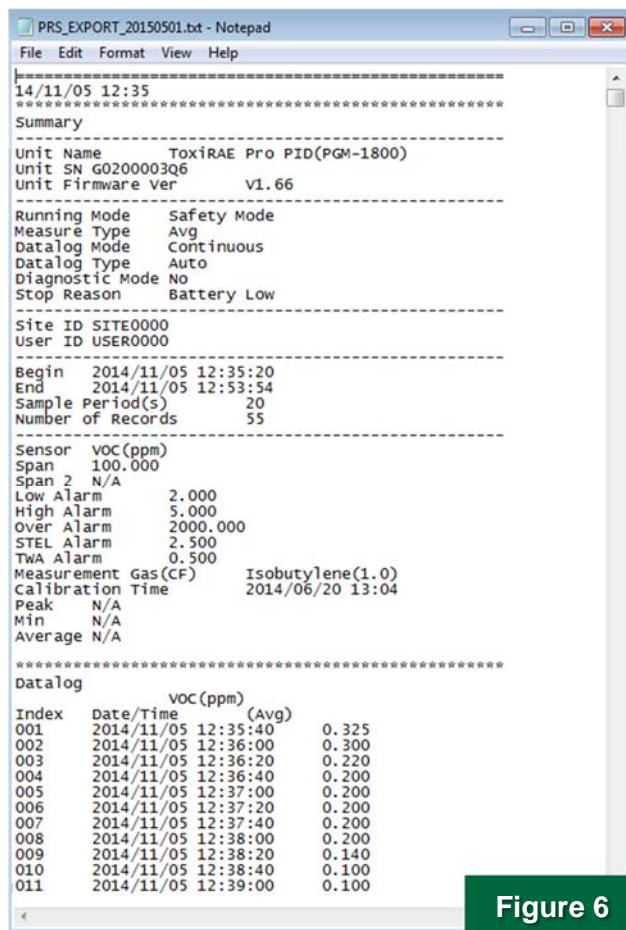


Figure 6

Retrieving Data

You will need the ToxiRAE Pro charging cradle and ProRAE Studio II software to retrieve the collected data for processing, as described in the following procedure.

Procedure: Retrieve Data

1. Plug the charging cradle into power using the included power cable and into a computer using the included mini-USB cable (Figure 7).

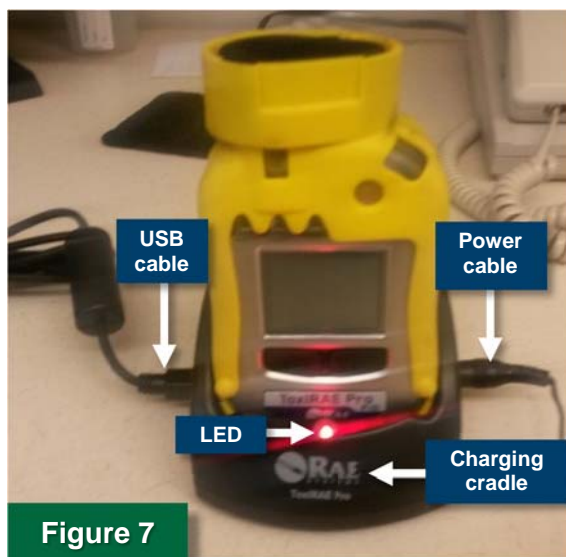


Figure 7

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2. Insert the ToxiRAE Pro sensor into the charging cradle until it fits snugly and the LED indicator light on the front of the cradle lights up.
3. Power up the sensor by holding down the **Mode** key until the screen lights up. Wait approximately 1 minute while the sensor completes its self-diagnostics.
4. Press the **Mode** key on the sensor until the message “**Enter Communications and Stop Measurement?**” appears on the screen.
5. Press **Y/+** once to enter communications mode. The message “**Communications Mode Ready**” should appear (Figure 8).
6. Double-click the ‘**ProRAE Studio II**’ icon on your desktop to start the program. The program starts and the **Login** dialog box shown in Figure 9 appears. There are three access levels for login: **Basic** allows viewing only and requires no password, **Data Manager** allows for reading the datalog and configuration but does not allow changes to be made, and **Administrator** has full functionality.



Figure 8

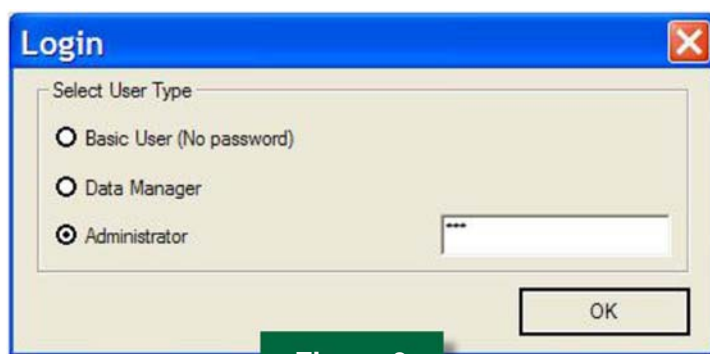


Figure 9

7. Select ‘**Administrator**’, type the password, and click ‘**OK**’ (the default password “**rae**” will provide full access).
8. Next select the automatic sensor detection tool (Figure 10). It will find and access the ToxiRAE Pro PID (Figure 11).



Figure 10

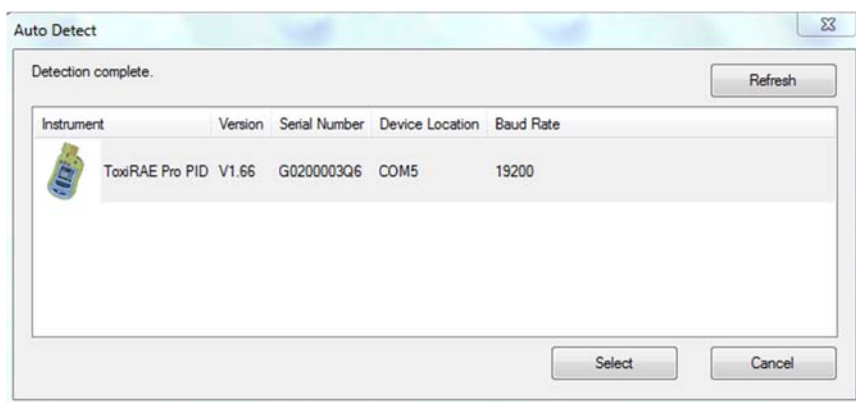


Figure 11

9. Then select '**Datalog**' from the panel on the left and then click the '**Download All**' icon from the row of icons shown in the resulting window (Figure 12). All data files stored on the ToxiRAE Pro PID will be displayed in the column on the left organized by date (Figure 13).

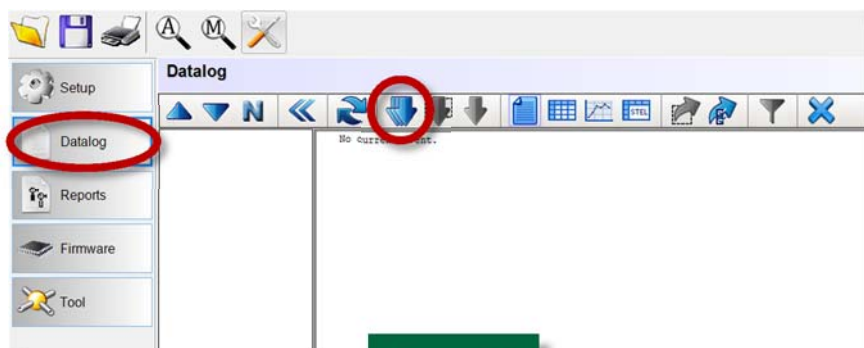


Figure 12

ToxiRAE Pro PID

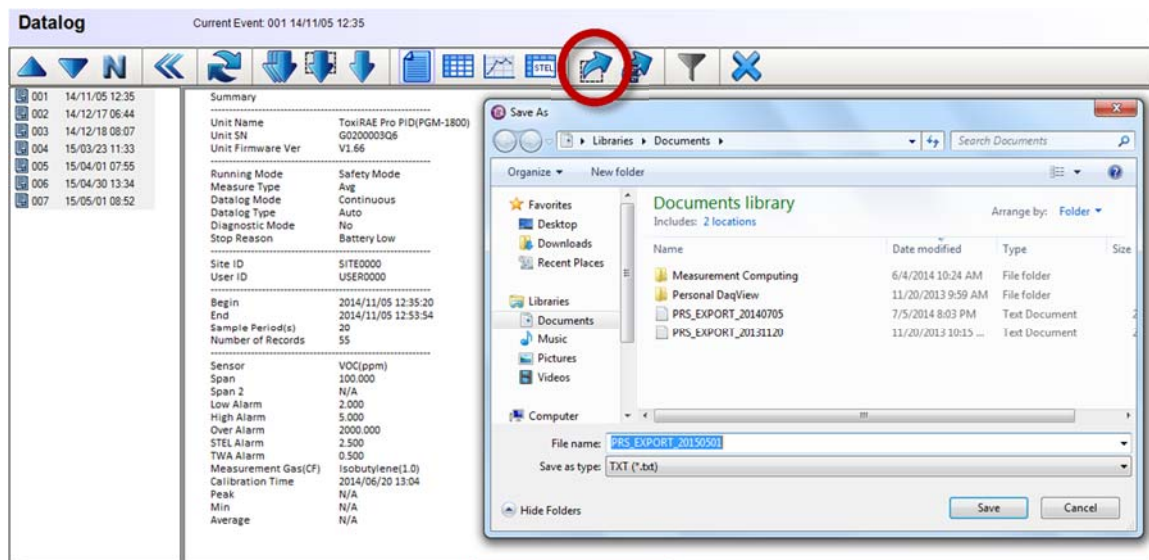


Figure 13

10. Select the file or files to be exported and click the **'Export'** icon (Figure 13) to export the data as a text (*.txt) file. The selected files can then be imported into spreadsheet software for processing, as described in the next section.

Processing Data

To process the data collected with the ToxiRAE Pro PID, you will need to import the text files saved when retrieving the collected data from the sensor. Microsoft Excel 2013 is used here to illustrate this procedure, but the process is similar in versions of Excel dating back to 2003.

Procedure: Process Data

1. Open Microsoft Excel on the computer where your data text files were downloaded.
2. In Excel, under the **'Data'** tab, click **'From Text'** (Figure 14).
3. Select the data text file you want to import and click **'Open'**.
4. Click **'Delimited'** (Figure 15) to indicate that the data are delimited and then click **'Next'** to proceed to the next Import Wizard screen.
5. On this screen, specify that the data are tab-delimited, and then click **'Next'** (Figure 16).

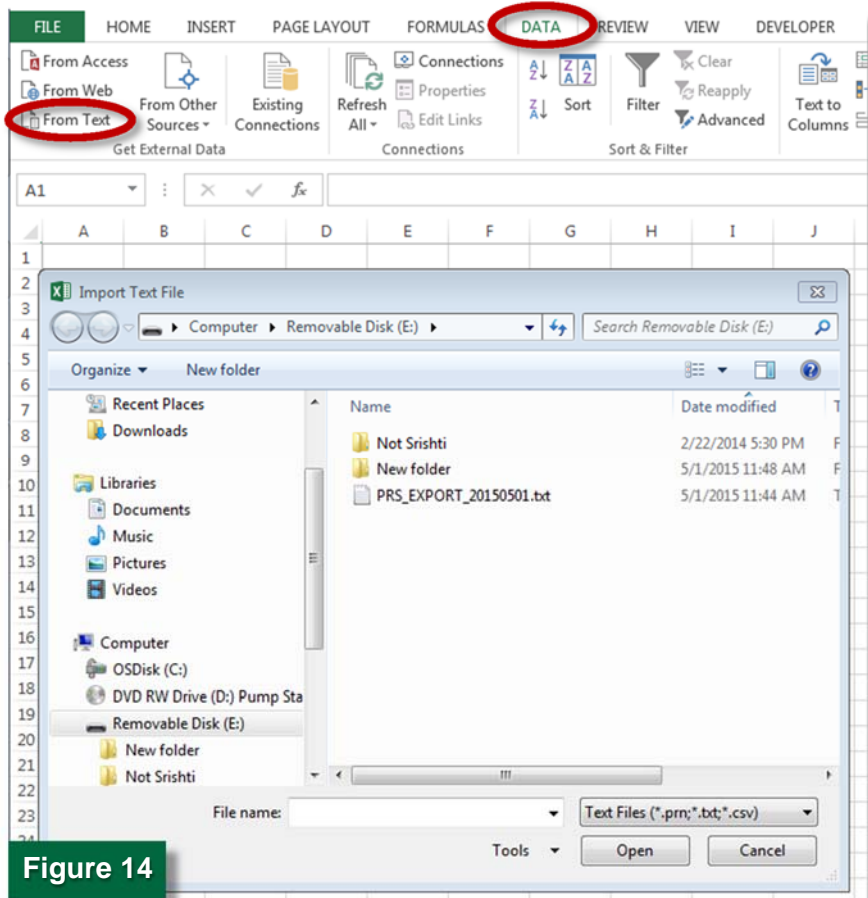


Figure 14

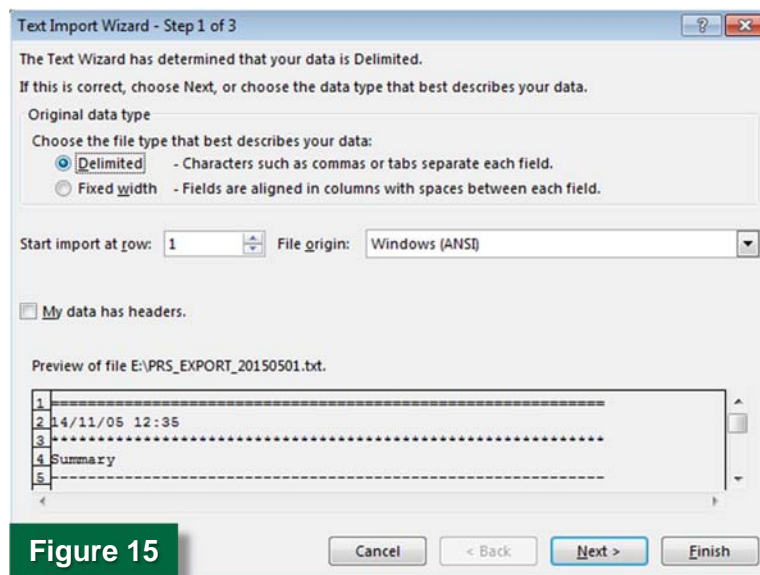
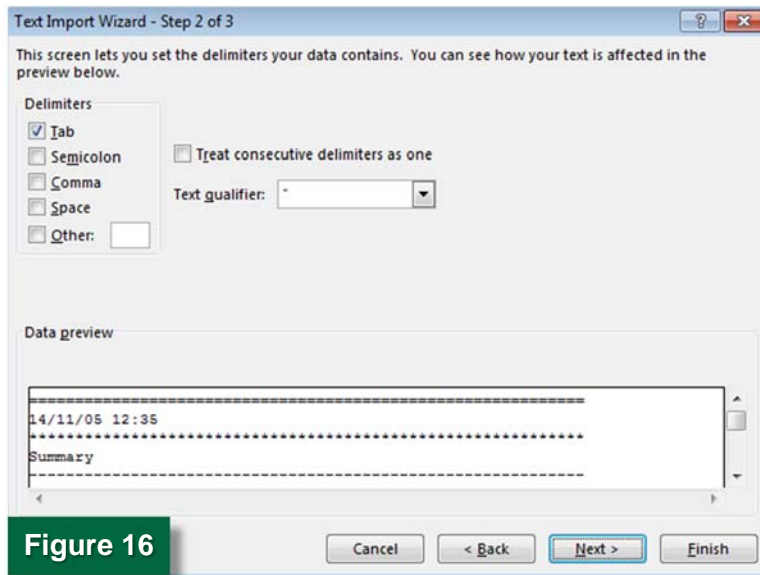


Figure 15

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- In the **Existing worksheet** field, select cell **A1** (Figure 17), and click 'OK' to import the data, which will appear in the Excel worksheet, as shown in Figure 18, following the summary information.

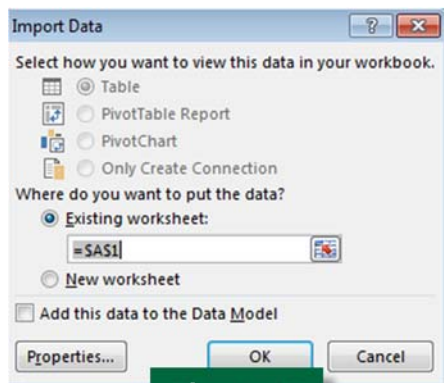


Figure 18

37	Average	N/A	
38			
39		
40	Datalog		
41			VOC(ppm)
42	Index	Date/Time	(Avg)
43	1	11/5/2014 12:35	0.325
44	2	11/5/2014 12:36	0.3
45	3	11/5/2014 12:36	0.22
46	4	11/5/2014 12:36	0.2
47	5	11/5/2014 12:37	0.2
48	6	11/5/2014 12:37	0.2
49	7	11/5/2014 12:37	0.2
50	8	11/5/2014 12:38	0.2
51	9	11/5/2014 12:38	0.14
52	10	11/5/2014 12:38	0.1
53	11	11/5/2014 12:39	0.1
54	12	11/5/2014 12:39	0.1
55	13	11/5/2014 12:39	0.1
56	14	11/5/2014 12:40	0.1
57	15	11/5/2014 12:40	0.1
58	16	11/5/2014 12:40	0.1
59	17	11/5/2014 12:41	0.1
60	18	11/5/2014 12:41	0.1
61	19	11/5/2014 12:41	0.1
62	20	11/5/2014 12:42	0.1

Maintenance and Troubleshooting

A number of routine maintenance procedures are required to keep the ToxiRAE Pro PID collecting quality data. Regular maintenance includes replacing the battery or filter, sending the unit for calibration, cleaning or replacing the PID, replacing the fan, and cleaning the exterior of the device. It is highly recommended that you consult Section 17 of the user's guide for the required frequency and procedures for maintaining the ToxiRAE Pro PID.

Section 18 of the user's guide outlines troubleshooting procedures for some common operational problems that might be encountered with the unit. If problems persist, contact the distributor or the RAE Systems technical support (see Section 19 of the user's guide).

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For Additional Help

ToxiRAE Pro PID User's Guide, P/N G02-4008-000 Rev. C, March 2013. RAE Systems, Inc., 3775 N. First St., San Jose, CA 95134-1708 USA. http://www.raesystems.com/sites/default/files/content/resources/Manual_ToxiRAE-Pro-PID_RevC_4.pdf, last accessed May 27, 2015.

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