

HERMES

Personal Mercury Monitor™

2B Technologies



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CONTENTS

IDENTIFICATION RECORDS	iv
PRINTING HISTORY	v
WARRANTY STATEMENT	vi
WARNINGS	viii
1. INTRODUCTION: PERSONAL MERCURY MONITOR	1
1.1 Overview.....	1
1.2 Theory of Operation.....	1
2. SPECIFICATIONS	3
3. OPERATION	5
3.1 Shipping Box Contents.....	5
3.2 Operation of the HERMES Personal Mercury Monitor.....	5
3.3 Measurement of the Zero Offset.....	6
3.4 Collecting Data over the USB Port or Serial Port in Real Time.....	6
4. GPS	7
5. FRONT PANEL MENU	8
5.1 Menu Tree.....	8
5.2 Data Averaging and Data Logging Using the Menu.....	9
5.3 Navigating the Front Panel Menu.....	9
5.4 Entering the Front Panel Menu.....	9
5.5 Acquiring Data without Logging.....	9
5.6 To Begin Logging Data.....	10
5.7 To Stop Logging Data.....	11
5.8 To Average Data.....	12
5.9 Capturing the Transmitted Logged Data Using the USB or Serial Port.....	12
5.10 To Set the Calibration Parameters.....	12
5.11 To Set the Time and Date.....	14
5.12 To Set the Measurement Units.....	14
5.13 Viewing the Power Supply Voltage via the Front Panel.....	14
5.14 Viewing GPS Coordinates via the Front Panel.....	14
6. LAMP TEST	15
7. QUIET MODE	16
8. SERIAL AND USB MENU	17
9. USB INSTALLATION	18
9.1 Items Required if not using Windows 10.....	18
9.2 Driver Installation (if not using Windows 10).....	18
10. USING THE USB CONNECTION	21
10.1 Determine the Connection Port.....	21
10.2 Using the Connection.....	22

11. MAINTENANCE/TROUBLESHOOTING	23
12. LABELED INSTRUMENT PHOTOS	26
13. PARTS LIST	29
14. SERVICE LOG	30
Appendix A: Using the 2B Technologies Display and Graphing Software	32

IDENTIFICATION RECORDS

Record the following information for future reference:

Serial number: _____

Warranty start date: _____
(Date of receipt)

PRINTING HISTORY

This manual covers the HERMES Personal Mercury Monitor (PMM)[™] used for measurement of mercury concentrations in air. New editions of this manual are complete revisions that reflect updates to the instrument itself, as well as clarifications, additions and other modifications of the text.

Revision E	July 2016
Revision E-2	August 2017
<i>(Correction to Equation 2 on page 2; added information in Sections 5.6, 5.8, and 5.10; minor formatting changes.)</i>	
Revision E-3	April 2019
<i>(Updated USB instructions related to Windows 10 systems in Section 9. Updated Section 15. Updated URLs. Other minor edits.)</i>	
Revision F-1	October 2019
<i>(Correction to calculation of mercury concentration as described in Section 1.2 and as carried out by the firmware of the instrument, including adoption of OSHA and NIOSH protocols. Other minor edits.)</i>	
Revision F-2	October 2019
<i>(Correction to specify that the inlet fitting is stainless steel (Section 3.2 and photo 12.1).</i>	
Revision F-3	November 2019
<i>(Added missing equal sign in Equation 3 of Section 1.2.).</i>	

TRADEMARKS & PATENTS

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WARRANTY STATEMENT

2B Technologies, warrants its products against defects in materials and workmanship. 2B Technologies will, at its option, repair or replace products that prove to be defective. The warranty set forth is exclusive and no other warranty, whether written or oral, is expressed or implied. 2B Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Warranty Period

The warranty period is one (1) year from date of receipt by the purchaser, but in no event more than thirteen (13) months from original invoice date from 2B Technologies.

Warranty Service

Warranty Service is provided to customers via web ticket, email and phone support, Monday - Friday, from 9:00 a.m. to 5:00 p.m., Mountain Time USA. The preferred method of contacting us is through our web ticketing software at:

<https://www.twobtech.com/tech-support.html>

This way all technical staff at 2B Tech will be alerted of your problem and be able to respond. When you receive an email reply, please click on the Ticket link provided to continue to communicate with us directly over the internet. The web ticket approach to customer service allows us to better track your problem and be certain that you get a timely response. We at 2B Tech pride ourselves on the excellent customer service we provide.

You may also contact us by email at techsupport@twobtech.com or by phone at +1(303)273-0559. In either case, a web ticket will be created, and future communications with you will be through that ticket.

Initial support involves trouble-shooting and determination of parts to be shipped from 2B Technologies to the customer in order to return the product to operation within stated specifications. If such support is not efficient and effective, the product may be returned to 2B Technologies for repair or replacement. Prior to returning the product, a Repair Authorization Number (RA) must be obtained from the 2B Technologies Service Department. We will provide you with a simple Repair Authorization Form to fill out to return with the instrument.

Shipping

2B Technologies will pay freight charges for replacement or repaired products shipped to the customer site. Customers shall pay freight charges for all products returning to 2B Technologies.

Conditions

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance, adjustment, calibration or operation by the customer. Maintenance, adjustment, calibration or operation must be performed in accordance with instructions stated in this manual. Usage of maintenance materials purchased from suppliers other than 2B Technologies will void this warranty.

Limitation of Remedies and Liability

The remedies provided herein are the Customer's sole and exclusive remedies. In no event shall 2B Technologies be liable for direct, indirect, special, incidental or consequential damages (including loss of profits) whether based on contract, tort or any other legal theory. The HERMES Personal Mercury Monitor manual is believed to be accurate at the time of publication and no responsibility is taken for any errors that may be present. In no event shall 2B Technologies be liable for incidental or consequential damages in connection with or arising from the use of the HERMES Personal Mercury Monitor manual and its accompanying related materials. Warranty is valid only for the country designated on the 2B Technologies quote or invoice.

WARNINGS

ENGLISH

**WARNING:**

Any operation requiring access to the inside of the equipment, could result in injury. To avoid potentially dangerous shock, disconnect from power supply before opening the equipment.

WARNING:

This symbol,  on the instrument indicates that the user should refer to the manual for operating instructions.

WARNING:

If this instrument is used in a manner not specified by 2B Technologies, USA, the protection provided by the instrument may be impaired.

ESPAÑOL

**ATENCIÓN:**

Cualquier operación que requiera acceso al interior del equipo, puede causar una lesión. Para evitar peligros potenciales, desconectarlo de la alimentación a red antes de abrir el equipo.

ATENCIÓN:

Este símbolo,  en el instrumento indica que el usuario debería referirse al manual para instrucciones de funcionamiento.

ATENCIÓN:

Si este instrumento se usa de una forma no especificada por 2B Technologies, USA, puede desactivarse la protección suministrada por el instrumento.

FRANÇAIS

**ATTENTION:**

Chaque opération à l'intérieur de l'appareil, peut causer du préjudice. Afin d'éviter un choc qui pourrait être dangereux, déconnectez l'appareil du réseau avant de l'ouvrir.

ATTENTION:

Le symbole,  indique que l'utilisateur doit consulter le manuel d'instructions.

ATTENTION:

Si l'instrument n'est pas utilisé suivant les instructions de 2B Technologies, USA, les dispositions de sécurité de l'appareil ne sont plus valables.

DEUTSCH

**WARNHINWEIS:**

Vor dem Öffnen des Gerätes Netzstecker ziehen!

WARNHINWEIS:

Dieses,  auf dem Gerät weist darauf hin, daß der Anwender zuerst das entsprechende Kapitel in der Bedienungsanleitung lesen sollte.

WARNHINWEIS:

Wenn das Gerät nicht wie durch die Firma 2B Technologies, USA, vorgeschrieben und im Handbuch beschrieben betrieben wird, können die im Gerät eingebauten Schutzvorrichtungen beeinträchtigt werden.

DUTCH

**OPGELET:**

Iedere handling binnenin het toestel kan beschadiging veroorzaken. Om iedere mogelijk gevaarlijke shock te vermijden moet de aansluiting met het net verbroken worden, vóór het openen van het toestel.

OPGELET:

Het symbool,  geeft aan dat de gebruiker de instructies in de handleiding moet raadplegen.

OPGELET:

Indien het toestel niet gebruikt wordt volgens de richtlijnen van 2B Technologies, USA gelden de veiligheidsvoorzieningen niet meer.

ITALIANO

**ATTENZIONE:**

Qualsiasi intervento debba essere effettuato sullo strumento può essere potenzialmente pericoloso a causa della corrente elettrica. Il cavo di alimentazione deve essere staccato dallo strumento prima della sua apertura.

ATTENZIONE:

Il simbolo,  sullo strumento avverte l'utilizzatore di consultare il Manuale di Istruzioni alla sezione specifica.

ATTENZIONE:

Se questo strumento viene utilizzato in maniera non conforme alle specifiche di 2B Technologies, USA, le protezioni di cui esso è dotato potrebbero essere alterate.

CHINESE

**警告:**

任何需要接触设备内部的操作均可能造成人身伤害。为避免可能的触电危险，请在打开设备前切断电源。

警告:

这个符号  在仪器上表示用户应参考说明书上的操作指南。

警告:

如果仪器没有按照美国2B科技公司指定方式操作，仪器的保护性能会减弱。

JAPANESE

**警告:**

機器の内部で操作する時、怪我できます。危険な衝撃を回避するために、機器を開ける前に、電源を切断してください。

警告:

機器でこの記号  を見れば、マニュアルを読んでください。

警告:

この機器は2Bテクノロジー会社、USAの指定でなければ、機器の保護が損なえます。

1. INTRODUCTION: PERSONAL MERCURY MONITOR

1.1 Overview

The 2B Technologies HERMES Personal Mercury Monitor™ (PMM™) is designed to enable accurate measurements of mercury in air based on the well-established technique of atomic absorption of ultraviolet light at 254 nm. The HERMES is small (4.0" × 3.0" × 1.5"; 10.2 × 7.6 × 3.9 cm), lightweight (0.75 lb.; 0.34 kg.) and has a low power consumption (3.0 watt) relative to conventional instruments and is therefore well suited for applications such as:

- Monitoring of exposure to individuals in the workplace
- Monitoring and control of mercury in industrial settings
- Personal exposure monitoring for studies of health effects of air pollutants
- Long-term monitoring at remote locations where power is highly limited

1.2 Theory of Operation

Absorption of UV light has long been used for measurements of atmospheric mercury with high precision and accuracy. The mercury atom has a strong absorption at 254 nm, resonant with the principal emission wavelength of a low-pressure mercury lamp. Fortunately, few molecules found at significant concentrations in the atmosphere absorb at this wavelength. Ozone is the only significant potential interference in ambient air, but mercury vapor absorbs more than 1,000 times more strongly than ozone.

Figure 1.1 is a schematic diagram of the HERMES Personal Mercury Monitor. Mercury is measured based on the attenuation of light passing through a 15-cm absorption cell fitted with quartz windows. The 15-cm cell length is accomplished by using a "U" shaped cell with mirrors in the corners to transmit light from the lamp at one end to the absorption cell to the detector at the other. A low-pressure mercury lamp is located on one side of the absorption cell, and a photodiode is located on the opposite side of the absorption cell. The photodiode has a built-in interference filter centered on 254 nm, the principal wavelength of light emitted by the mercury lamp. An air pump draws sample air into the instrument at a flow rate of approximately 0.75 L/min. A solenoid valve switches every 2 seconds so as to alternately send this air directly into the absorption cell or through a mercury scrubber and then into the absorption cell. The intensity of light at the photodiode is measured in air that has passed through the mercury scrubber (I_o) and air that has not passed through the scrubber (I).

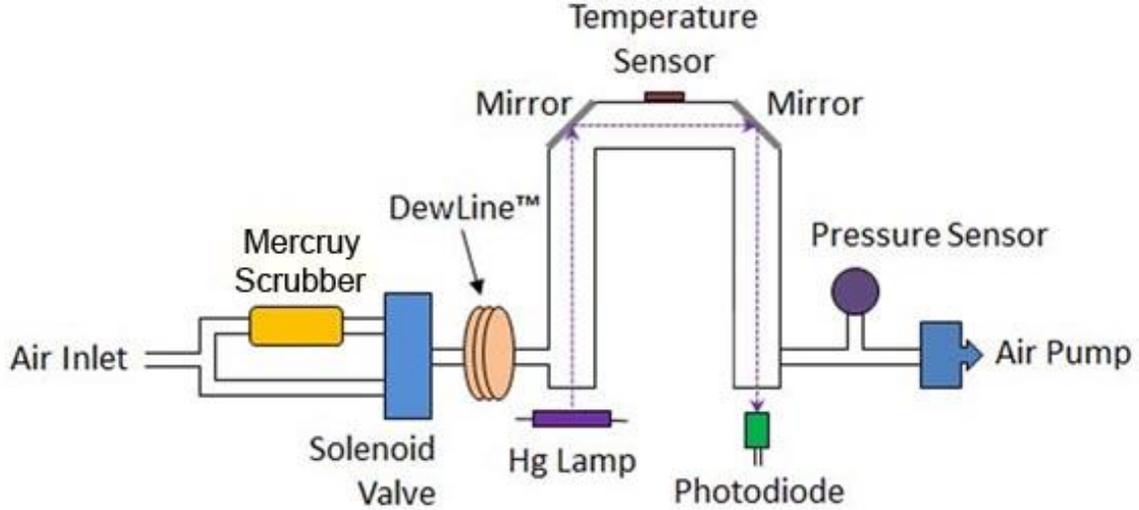


Figure 1.1. Schematic Diagram of the Personal Mercury Monitor.

Mercury concentration, $[Hg]$, in units of atoms/cm³ is calculated from the measurements of I_o and I according to the Beer-Lambert Law:

$$[Hg] = \frac{1}{\sigma l} \ln \left(\frac{I_o}{I} \right) \quad (1)$$

where l is the path length (15 cm) and σ is the empirically determined absorption cross section for mercury at 254 nm mercury emission ($1.15 \times 10^{-14} \text{ cm}^2 \text{ atom}^{-1}$).

In order to convert this concentration to a mixing ratio (fraction of total air molecules that are atomic mercury), we also measure the cell temperature and pressure, which determines the total concentration of air molecules. From the temperature and pressure, we use the ideal gas law to calculate the concentration of molecules, M , in the detection cell. Mercury in units of ppb (parts-per-billion by volume, also noted as ppbv) is then given by:

$$[Hg]_{ppb} = 10^9 \frac{[Hg]}{[Air]} = 10^9 \frac{RT}{N_A P l \sigma} \ln \left(\frac{I_o}{I} \right) \quad (2)$$

Where N_A is Avogadro's number ($6.02214129 \times 10^{23} \text{ atom/mol}$), R is the gas constant ($82.05746 \text{ cm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$), T is the absolute temperature in K, and P is the cell pressure in atmospheres.

The instrument displays and records the cell temperature and pressure in addition to the mercury mixing ratio. The cell pressure is displayed and logged in units of torr and the cell temperature in units of K.

Mercury concentration measurements are output as either ppb or $\mu\text{g}/\text{m}^3$. Here, $\mu\text{g}/\text{m}^3$ refers to micrograms of mercury per cubic meter of air at standard ambient conditions of temperature and pressure (SATP) of $T = 298.15 \text{ K}$ and $P = 1 \text{ atm}$ in accordance with OSHA and NIOSH protocols. The conversion factor used to convert between ppb (by volume) to $\mu\text{g}/\text{m}^3$ (at SATP) is:

$$[Hg]_{\frac{\mu\text{g}}{\text{m}^3}} = 1000 \frac{[Hg]_{\text{ppb}} MW_{\text{Hg}} P}{RT} = 8.199 [Hg]_{\text{ppb}} \quad (3)$$

where MW_{Hg} is the atomic weight of mercury ($200.59 \text{ g mol}^{-1}$). Shown on Fig. 1.1 is the DewLine™, which serves to make the humidity entering the detection cell identical during I and I_o measurements. Please see the 2B Technologies website for a technical discussion of the DewLine™ and its importance to ozone measurements: <https://www.twobtech.com/dewline.html>. The same principle applies to measurements of mercury.

In principle, the measurement of mercury by UV absorption requires no external calibration; it is an absolute method. However, non-linearity of the photodiode response and electronics can result in a small measurement error. Therefore, each instrument is compared with a NIST-traceable standard mercury generator in the laboratory over a wide range of mercury mixing ratios. These results are used to calibrate the HERMES PMM with respect to an offset and slope (gain or sensitivity). The corrections for offset and slope are recorded in the instrument Birth Certificate. These calibration parameters are entered into the microprocessor prior to shipment. The user may change the calibration parameters from the front panel if desired. It is recommended that the instrument be recalibrated at least once every year and preferably once every six months. The offset may drift due chemical contamination of the absorption cell. As discussed in Section 3.3 below, an accurate offset correction can be measured from time to time using the external mercury scrubber (Zeroing Cartridge) supplied with the instrument.

2. SPECIFICATIONS

2B Tech has taken the next step in miniaturization of UV-based mercury monitors by developing the HERMES Personal Mercury Monitor. The HERMES has dimensions of $4 \times 3 \times 1.5$ inches and weighs only 0.75 lb. (340 g). It has a built in GPS so that mercury measurements may be logged continuously along with geographic location. Its many possible applications include:

- Monitoring of exposure to individuals in the workplace
- Monitoring and control of mercury in industrial settings
- Personal exposure monitoring for studies of health effects of air pollutants
- Long-term monitoring at remote locations where power is highly limited

Detailed specifications are given in the table on the next page.

Table 2.1. HERMES Personal Mercury Monitor Specifications

Measurement Principle	UV Absorption at 254 nm
Linear Dynamic Range	0-2,000 $\mu\text{g}/\text{m}^3$
Resolution	0.1 $\mu\text{g}/\text{m}^3$
Precision (1σ; rms noise)	Greater of 0.1 $\mu\text{g}/\text{m}^3$ or 2% of reading
Accuracy	Greater of 0.1 $\mu\text{g}/\text{m}^3$ or 2% of reading
Limit of Detection (2σ)	0.2 $\mu\text{g}/\text{m}^3$
NIST-Traceable Calibration	Yes
Flow Rate (nominal)	~0.8 Liter/min
Flow Rate Requirement	>0.5 L/min
Baseline Drift	<0.1 $\mu\text{g}/\text{m}^3/\text{day}$; <0.3 $\mu\text{g}/\text{m}^3/\text{year}$
Sensitivity Drift	<1%/day; <3%/year
Measurement Intervals and Frequencies	Measurement mode: 10 s, 0.1 Hz Fast mode: 2 s, 0.5 Hz
Data Averaging Options	1 min, 5 min, 1 hr
Response Time, 100% of Step Change	For 2-s output: 4 s, 2 data points For 10-s output: 20 s, 2 data points
Data Storage	8,192 lines (2-s fast mode ~4.6 hrs; 10-s meas. mode ~1 day; 1-min avg ~6 days; 5-min avg ~1 mo; 1-hr avg ~1 yr)
Mercury Units	$\mu\text{g}/\text{m}^3$, ppb
Pressure Units	torr
Temperature Units	K
T and P Corrected	Yes
Operating Temperature/Pressure/Altitude Ranges	0 to 50°C; 150-1013 mbar; ~0-13.5 km [lower pressure range available as an option]
Power Requirement; Supplied by battery or 110/220 VAC Power Pack	7-24 V dc, nominally 250 mA at 12 V, 3.0 watt
External Battery	7.4 volt, 1.6 amp hour, Lithium Ion Battery, 5-8 hr
Size / Weight	4.0 x 3.0 x 1.5 inches (10.2 x 7.6 x 3.8 cm)
Weight	0.75 lb. (340 g)
Data Transfer Baud Rate	19200
DewLine™	Yes
GPS	Yes

3. OPERATION

Please read all the following information before attempting to operate the HERMES Personal Mercury Monitor. For assistance, please call 2B Technologies at +1(303)273-0559.

NOTE:

Save the shipping carton and packing materials that came with the HERMES Personal Mercury Monitor. If the HERMES must be returned to the factory, pack it in the original carton. Any repairs as a result of damage incurred during shipping will be charged.

3.1 Shipping Box Contents

Open the shipping box and verify that it contains all of the items on the shipping list. If anything is missing or obviously damaged, contact 2B Technologies immediately.

3.2 Operation of the HERMES Personal Mercury Monitor

To operate the HERMES Personal Mercury Monitor, connect it to an external power source and power the instrument by switching the power switch on. The instrument requires a 7-24 V DC source which can be supplied by: 1) the 100-240 V AC power adapter, 2) the 7.4-V DC lithium ion battery supplied with the instrument, 3) a cigarette lighter adapter plugged into a 12 V DC source such as found in an automobile or many light aircraft, or 3) a 7-24 V battery. The source can be in the range 7-24 V DC without any detrimental effects on the measurement. When using a battery, be certain to attach the positive (red) and negative (black) wires correctly. Batteries and battery chargers are available from 2B Technologies. A circuit breaker and diode are installed on the circuit board in case of an electrical short or incorrect battery attachment. If activated, the breaker will reset itself after a few minutes. Also, for safety purposes the provided 7.4-V lithium ion battery has its own protective circuit in case of a short.

Turn the instrument on with the small switch between the power connection and the GPS antenna (see Figure 12.2.). Once turned on, the instrument will display the version number of the software installed on the microprocessor. After a few seconds, the instrument will start displaying readings for mercury. The first dozen readings (requiring about two minutes) may be spurious, with large positive and negative swings due to the rapid warmup of the lamp and electronics. Also, mercury readings may be inaccurate during the 10-20 minutes required for the lamp, photodiode and internal temperature of the absorption cell to stabilize.

Inlet tubing may be attached to the metal inlet fitting on the front of the instrument (see Figure 12.1.). The inlet tubing should be made of PTFE (Teflon®), PFA, FEP, PVDF or some other inert material that does not destroy mercury and that does not desorb plasticizers and other organics that can contaminate the flow path. The length of tubing should be kept as short as possible (preferably not more than a few feet) to minimize mercury destruction within the inlet tubing. Tygon®, polypropylene (which may look like Teflon) and metal tubing should not be used. FEP-lined Tygon tubing, which is used inside the instrument, provides the flexibility of Tygon with the inertness of FEP. A Teflon or PVDF inlet filter is highly recommended to prevent internal contamination of the tubing and absorption cell by particulate matter. The filter should be tested for mercury loss by measuring ambient mercury with and without the filter attached. Filters and filter holders are available through 2B Technologies.

3.3 Measurement of the Zero Offset

The electronic zero of the instrument may be measured by attaching a mercury zeroing scrubber (2B Technologies part no. ZEREXTHG or other mercury destruction cartridge) to the air inlet for a period of 5-10 minutes. For an accurate measurement, the instrument must have been turned on long enough for the internal temperature to stabilize. The observed offset, which usually amounts to less than a few $\mu\text{g}/\text{m}^3$ (often $0.0 \mu\text{g}/\text{m}^3$) can be corrected for if necessary by changing the offset calibration parameter (Z) from the front panel, as described in Section 5.10 below.

3.4 Collecting Data over the USB Port or Serial Port in Real Time

To transmit data to a computer over the USB port or serial port in real time, connect the HERMES Personal Mercury Monitor to the serial port of the computer using the stereo plug-to-D9 serial cable provided. Start your data acquisition software, preferably using the 2B Technologies Display and Graphing Software (available as a free download from https://twobtech.com/docs/docs_software.htm; see Appendix A for a description of working with this software). Other terminal emulation software such as HyperTerminal (a program provided with earlier versions of Windows) or [Tera Term](#) (free download from the 2B Tech website) may be used as well.

The mercury concentration (ppb or $\mu\text{g}/\text{m}^3$), internal cell temperature (K), cell pressure (torr), time and date are sent as comma-delimited ASCII text to the serial and USB ports (19200 baud; 8 bits; no parity; 1 stop bit) every 2 s, 10 s, 1 min, 5 min, or 1 hr, depending on the averaging time selected from the microprocessor menu. Time is provided in 24-hour (military) format, and the date is given in European style (day/month/year).

A typical data line would read:

3.2,307.4,608.1,1.2740,12.1,4001.27765,-10513.0308,1591.20,1,23/03/19,16:39:14

where:

Mercury = $3.2 \mu\text{g}/\text{m}^3$

Cell temperature = 307.4 K
Cell pressure = 608.1 torr (1 atm = 760 torr)
Photodiode Voltage = 1.2740 volts
Power Supply Voltage = 12.1 volts
Latitude = 4001.27765
Longitude = -10513.0308
Altitude = 1591.20 meters
GPS Quality = 1
Date = March 23, 2019
Time = 4:39:14 pm

If outputting logged data, the output serial data line will be preceded by the log number; e.g.,

2893,3.2,307.4,608.1,1.2740,12.1,4001.27765,-10513.0308,1591.20,1,23/03/19,16:39:14

where 2893 is the log number.

In addition to data lines, messages are written to the serial port when logging is begun or ended, when transmission of data from the logger is begun and ended, when data collection is interrupted (e.g., due to a power failure) and when the averaging time is changed.

4. GPS

The HERMES Personal Mercury Monitor contains an on-board GPS unit that incorporates the u-blox 6 GPS position engine and an efficient antenna system to provide highly accurate and precise location data with each mercury measurement.

To acquire satellite signals, go outdoors away from tall buildings and trees. Acquiring satellite signals may take 1-5 minutes. For best results, stand still in an open area with the HERMES powered on until an asterisk appears on the liquid crystal display (LCD) as shown below. The **asterisk** denotes a valid satellite connection.

* Hg= 2.7 $\mu\text{g}/\text{m}^3$
T=305.4 P=682.3

As described in Section 5.14 (“Viewing GPS Coordinates via the Front Panel”) below, it is possible to view the GPS data in real time on the LCD by navigating to the GPS submenu. GPS coordinates, along with the GPS quality indication are also logged with each measurement when the HERMES is set to log.

The **GPS quality indication** can be translated as:

- 0 = Fix not available
- 1 = Non-differential GPS fix available
- 2 = Differential GPS (WAAS) fix available
- 6 = Estimated

5. FRONT PANEL MENU

5.1 Menu Tree

The following diagram summarizes the complete instrument Menu accessed via the LCD, Select, and Move buttons.

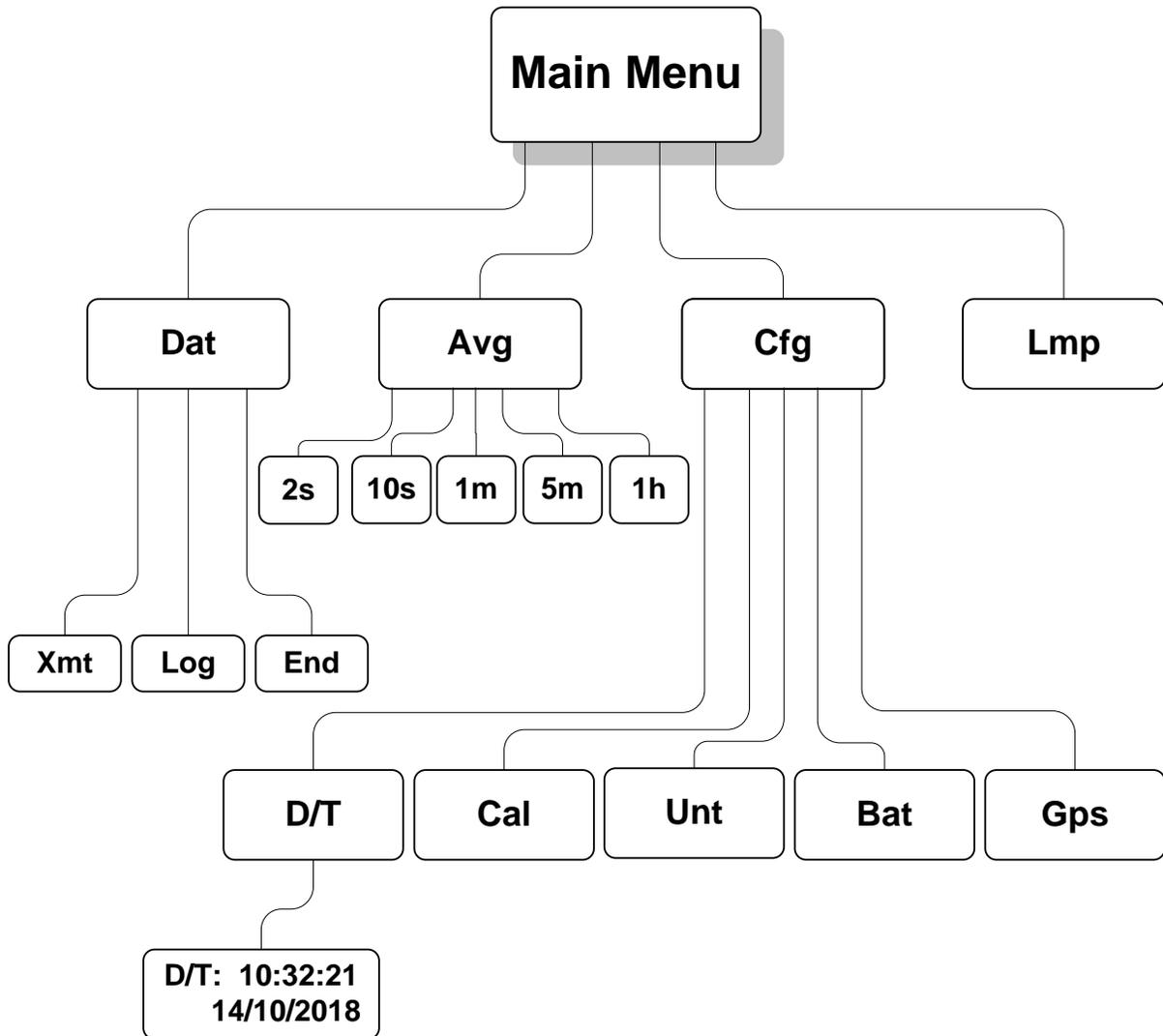


Figure 5.1. Instrument Menu.

5.2 Data Averaging and Data Logging Using the Menu

When first turned on, the instrument will start making measurements. Data may be logged in the internal data logger. Up to 8,192 data lines containing log number, mercury concentration, internal cell temperature, internal cell pressure, photodiode voltage, power supply voltage, GPS latitude, GPS longitude, GPS altitude, GPS signal quality, time and date may be stored in internal memory, corresponding to an operational time of 4.6 hours in the 2-s fast mode, and 22.8 hours in the 10-s measurement mode. Averaging times of 1 min, 5 min and 1 hr also may be selected from the menu, thereby increasing the logging capacity to 5.7 days, 28 days and 341 days, respectively, before filling the memory.

5.3 Navigating the Front Panel Menu

The front panel consists of a 2-row by 16-character LCD screen and two push buttons that are located below the LCD screen (see Fig. 12.1 in Section 12 below). The curved arrow, or “Select” button, is used to enter and exit menus and for selecting values. The right-pointing arrow or “Move” button is used to move the cursor from left to right.

5.4 Entering the Front Panel Menu

The menu is accessed via the Select button (curved arrow) on the front panel of the instrument. To reach the main **Menu**, *hold in* the Select button until

Menu

is displayed, then release the Select button. After a few seconds the main **Menu** will appear:

Menu
Dat Avg Cfg Lmp ←

where **Dat**, **Avg**, **Cfg** and **Lmp** are submenus that may be selected. A blinking cursor will show across the **D** of the **Dat** submenu. Clicking on the Move button will move the cursor under the first letter of one of the other submenus. To select a particular submenu, move the cursor under the first letter of a submenu by pressing the Move button and press the Select button to select the submenu. To exit the main Menu and begin making measurements again, move the cursor to the left arrow (←) and press the Select button.

5.5 Acquiring Data without Logging

Select the **Dat** submenu from the main **Menu** using the Select button. The display will now show:

Dat Menu
Xmt Log End ←

To make measurements without logging data, move the cursor to **End** and click to end the logging mode. Select ← to return to the main **Menu** and select ← again to exit the

Menu and start making measurements. Note that “←” always takes you up one level in the menu.

If the 10-s measurement mode has been selected (see Section 5.8 below), for example, the HERMES Personal Mercury Monitor will then alternate every 5 seconds between displaying the most recent 10-s measurement and the current average value. The units for Hg concentration can be selected (ppb or $\mu\text{g}/\text{m}^3$) as described in Section 5.12 below. For example, the display might read

Hg= 3.2 ug/m3
T=303.3 P=689.7

where the current measurement is $3.2 \mu\text{g}/\text{m}^3$ (by volume), the internal cell temperature is 303.3 K and the internal cell pressure is 689.7 torr. If 10-second averaging has been selected, five seconds later, this display might be followed by

Hg= 2.2 ug/m3
19:55 23/05/18

showing that the time of the measurement is 7:55 pm and the date is 23 May, 2018. If averaging of 1-min, 5-min, or 1-hr has been selected (see Section 5.8 below), the above display will be replaced by

Avg Hg= 24.1 ug/m3
19:55 23/05/18

for example, where the most recent average value of mercury computed is $24.1 \mu\text{g}/\text{m}^3$. At the end of an averaging period, a new average value will be displayed along with the internal cell temperature and internal cell pressure. For example:

Avg Hg= 25.3 ug/m3
T=303.5 P=688.1

5.6 To Begin Logging Data

Select the **Dat** submenu from the main **Menu** using the Select button. The display will now show:

Dat Menu
Xmt Log End ←

To start logging data, move the cursor to **Log** and click to select the logging mode. You will then receive the prompt:

Overwrite Data?
No Yes ←

Warning: If you start logging, all data previously stored in the logger will be irretrievably lost.

If you have data in the logger that you want to keep, be sure to download it (see below) before starting logging. Select **Yes** if you are sure you want to start logging

new data. This will return you to the **Dat** submenu. Select ← to return to the main **Menu**, and select ← again to exit the Menu and start making measurements. As previously mentioned, note that “←” always takes you up one level in the menu.

If data are being logged, the log number and the number of new measurements made for the next average (minus 1) are displayed in place of the date and time; e.g.,

Avg Hg= 24.1 ug/m3
Log= 193:4

where **Avg Hg** is the average mercury value most recently written to the logger, and the current log number is 193. The “4” in 193:4 refers to the number of 10-s data points that have been measured so far for inclusion in the next average to be displayed and logged. If 1-min averaging is used, this number will increment from 0 to 5; for 5-min averaging, the number will increment from 0 to 29; and for 1-hr averaging, it will increment from 0 to 359. This number is displayed so that the user will know how many more 10-s measurements need to be made before a new average is displayed and logged.

Note that if the menu is entered while an average is in progress, that average will be lost. Averaging will begin again when the menu is exited.

If there is a power failure while the instrument is in the logging mode, logging will resume after power is restored. A note of “Data Interruption” will be written to the logger prior to writing the first new data line. The instrument can accommodate multiple data interruptions due to power failures. For example, one can purposely switch the instrument off, move to another location and restart logging simply by turning the instrument back on. Data sets will be separated by the data interrupt message.

5.7 To Stop Logging Data

Hold in the Select button to obtain the main **Menu**. Go to the **Dat** submenu by clicking on **Dat**. Select the **End** function. This will end data logging. You may now return to the **Dat** menu to transmit the data to a computer by selecting **Xmt**. The stored data will reside in memory (even when new measurements are being made) and can be transmitted using the **Xmt** function as often as you like.

Note: All stored data are lost once logging is started again using the **Log function. Thus, you should always transmit your data to a computer before restarting logging.**

If you fail to **End** logging prior to transmitting the data using the **Xmt** function, the instrument will automatically execute the **End** function for you prior to transmitting the data.

5.8 To Average Data

Hold down the Select button to obtain the main **Menu**. Select **Avg** to obtain the **Avg** menu:

Avg Menu
2s 10s 1m 5m 1h ←

Use the Move button to move the cursor to **2s**, **10s**, **1m**, **5m** or **1h** for times of 2 s (fast mode), 10 s (measurement mode), 1-min averaging, 5-min averaging, or 1-hr averaging, respectively. Then select the time you want to use. You will be returned to the main **Menu**. To exit the main **Menu** and start acquiring data, select ← again.

While in an averaging mode, the current 10-s measurement is displayed alternately with the average value at 5-s intervals, as discussed above. Averaged data may be logged, thereby greatly extending the length of time that the data logger can be used.

Note that if the menu is entered while an average is in progress, that average will be lost. Averaging will begin again when the menu is exited.

5.9 Capturing the Transmitted Logged Data Using the USB or Serial Port

Connect the USB or serial port of the instrument to your computer using the appropriate cable. Enable a data acquisition program on the computer such as the 2B Technologies Display and Graphing Software, which can be downloaded at:

https://twobtech.com/docs/docs_software.htm

See Appendix A for a description of working with this software. Alternatively, HyperTerminal can be used (available on most earlier Windows® platforms, usually in Start/All Programs/Accessories/Communications/Hyper Terminal) or Tera Term, which can be downloaded at <https://twobtech.com/teraterm-4.100.exe>

The correct settings for receiving data are: chosen baud rate 19200; 8 bits; no parity; 1 stop bit.

Enter the main **Menu**. Go to the **Dat** submenu by clicking on **Dat**. Next, select **Xmt**. The message “Transmitting logged data” will be written to the serial port, followed by a carriage return and all of the lines of logged data. After all data are transmitted, the message “End Logged Data” and a carriage return are written. After transmission is complete, you can return to any position in the menu or resume mercury measurements without logging. The previously logged data continues to be available for transmission until a new data logging session is started.

5.10 To Set the Calibration Parameters

The instrument is calibrated at the factory where slope (S) and offset (Z) parameters are entered into the instrument’s memory. These preset calibration parameters are

given in the instrument's Birth Certificate and recorded on the calibration sticker on the bottom of the instrument. However, the calibration parameters may be changed by the user. Because of noise and/or an inherent offset, some measured values will be below zero at very low mercury mixing ratios or while zeroing the instrument with an external scrubber. Also, the instrument zero may drift by a few tenths of $\mu\text{g}/\text{m}^3$ over time. For this reason, frequent zeroing of the instrument using an external mercury scrubber to determine the offset is recommended. Any change in the slope (gain) of the instrument is likely due to a serious problem such as contamination, an air leak, obstruction of air flow, or saturation of the internal mercury scrubber, but it also can be adjusted. Once the zero of the instrument is corrected, the slope may be adjusted so that the instrument readout agrees with a standard mercury source or with the readout from another instrument whose calibration is considered to be accurate.

To change the calibration parameters, choose the **Cfg** submenu from the main **Menu** and click on **Cal** to obtain the display

Cal Menu
Z= -0.1 S= 1.01

Here Z is the offset applied in units of $\mu\text{g}/\text{m}^3$ (in this case $-0.1 \mu\text{g}/\text{m}^3$) and S is the slope applied (in this case 1.01). The value of Z is added to the measured mercury value, and the value of S is then multiplied by the measured mercury value. During calibration, Z is set to 0 and S set to 1.00. If the instrument then reads an average of $0.3 \mu\text{g}/\text{m}^3$ with the external scrubber in place, the value of Z should be set to -0.3 . If after correction for the zero, the instrument consistently reads 2% low, the value of S should be set to 1.02.

When the **Cal Menu** first appears, the **Z** will be underlined with a cursor. You may move the cursor to choose the calibration parameter **S** or **Z**. Selecting **S** or **Z** will select that parameter for change and activate a blinking cursor. Once **S** or **Z** is selected, its value can be changed by pressing the Move button to increase the value. The value will roll-over to negative values after reaching the maximum allowable offset (-50 to $+50$ for Z; 0.5 to 1.5 for S). After choosing the desired value, press the curved arrow to exit stop editing mode. The cursor can then be moved by pressing the right pointing arrow to the **S** to edit the slope or to the \leftarrow to exit the submenu. Once the values of **Z** and **S** are set, selecting \leftarrow will return the display to the **Cfg** menu, and again selecting \leftarrow will return to the main **Menu**. The calibration parameters reside in non-volatile memory and are not affected by power failures.

In order to adjust the zero offset, after the instrument has warmed up for at least 20 minutes attach the external mercury scrubber and make measurements for a few minutes. If the average of those measurements is $0.4 \mu\text{g}/\text{m}^3$, for example, subtract 0.4 from the current value of Z; e.g., if Z was set to 0.3 during the measurements, change Z to -0.1 . If the offset has been determined in units other than $\mu\text{g}/\text{m}^3$, convert it to units of $\mu\text{g}/\text{m}^3$ before entering the Z value.

5.11 To Set the Time and Date

From the main **Menu**, select the **Cfg** submenu. Next, select the **D/T** submenu. The display will read, for example:

D/T: 14:32:21 ←
17/10/2018

meaning that it is 21 seconds after 2:32 p.m. on October 17, 2018 (military time and European date). To change a number in the date and time, move the cursor to underline the numeral you want to change. Pressing the Select button then causes a blinking cursor to cover that numeral. The number can then be changed by pressing the Move button. Once the number is correct, press the Select button to turn off the blinking cursor. You may now use the Move button to choose another numeral to change. Once the time and date is correct, selecting ← will set the internal clock to that time and return the display to the **Cfg** menu. As in setting a digital watch, the seconds should be set in advance of the real time since the clock starts to run again only when the set time is entered; in this case by selecting ←.

5.12 To Set the Measurement Units

From the main **Menu**, select the **Cfg** submenu. Next, select the **Unt** submenu. The display will read, for example:

Mercury:ppb ←

meaning that the mercury measurement will be in parts per billion by volume (ppb). The blinking cursor will appear under the first “p” of ppb. To change the units, press the Move button. The units “ $\mu\text{g}/\text{m}^3$ ” will then appear. Once the desired units are showing, press the Select button to turn off the blinking cursor. You may now use the Move button to select ← and return the display to the **Cfg** menu. The user is advised to make a separate note of the chosen units, as they are not given in the data stream.

5.13 Viewing the Power Supply Voltage via the Front Panel

To view the power supply voltage in real time, select **Bat** from the **Cfg** Menu. Exit this view by pressing the Select button.

5.14 Viewing GPS Coordinates via the Front Panel

To view real-time Latitude, Longitude and Altitude data, select **GPS** from the **Cfg** Menu. Latitude and Longitude are constantly shown and Altitude (in meters) is available by pressing and holding the Move button. Exit this view by pressing the Select button.

6. LAMP TEST

If the instrument is excessively noisy (standard deviation greater than $0.1 \mu\text{g}/\text{m}^3$) when measuring clean or zero air or always reads near zero in the presence of mercury, it is useful to perform the lamp test to make sure that the lamp is turning on and does not fluctuate too rapidly. Before performing the lamp test, allow the instrument to warm up for at least twenty minutes.

Choose **Lmp** from the main **Menu**. The display will momentarily read "**Lamp Test**". The photodiode voltage will then be displayed, and after a few lamp measurements have been made, the electronic offset and standard deviation also will be displayed as, for example:

PDV= 0.89801 V
1.2+/-1.85 ←

The photodiode voltage (PDV) is a measure of the lamp intensity and should be in the range 0.6-2.2 volts. Since absorbance is a ratio measurement, the absolute value of the voltage is not particularly important. However, above 2.5 volts, which could occur if the instrument is allowed to become too hot, the photodiode is saturated and the calculated mercury concentration will be zero. Photodiode voltage less than 0.6 volts is indicative of either a weak lamp or a dirty detection cell and may result in a noisy measurement. The photodiode voltage will typically increase as the instrument warms up. Lamp drift is continuously monitored and corrected for in the firmware and thus has very little effect on the measured mercury concentration.

Once the instrument is warmed up, fluctuations in photodiode voltage should be limited primarily to the last digit displayed. The lamp test also calculates an electronic offset and standard deviation of the measurement itself, displayed in the above example as 1.2 for the electronic offset and ± 1.85 for the standard deviation. The standard deviation is a quantitative measure of the lamp and associated electronic noise. Electronic offsets should normally be in the range -10 to 10 . After running the lamp test for a few minutes, values above 10.0 for the standard deviation usually indicate an excessively noisy lamp. Lamps seldom "burn out" but may become noisy with time and need to be replaced. Some lamps become noisy after only a short period, while others will be extremely stable for years. If your lamp fails the lamp test during the first year of operation, contact us for a new lamp under the instrument warranty. Contamination of the detection cell may also cause a high standard deviation, in which case the flow path should be cleaned with methanol and the internal mercury scrubber replaced. Please contact us to return the instrument to 2B Tech for cleaning and/or lamp replacement.

To exit the Lamp Test, press and hold the Select button.

7. QUIET MODE

The HERMES firmware allows the user to select a “quiet mode” where the pump will be throttled down to decrease the high pitch frequency sound output. This can be done one of two ways. The user can press and hold the Select button while powering on the HERMES to display

Pump Mode
Quiet Fast ←

where the user can select “**Quiet**,” which will slow the pump down and change the instrument flush cycle time from 2 seconds to 4 seconds. Note that the sampling flow rate will decrease to about 0.49 L/min. This setting will also change the 10 second averaging time to 20 seconds.

Restarting the instrument and changing back to “**Fast**” will reset the flush time to 2 seconds. The other way to change back to the fast mode is through the serial or USB menu as described in the next section.

8. SERIAL AND USB MENU

Measurements and logging tasks can be accessed via the serial port or the USB using the 2B Technologies Data Display software (see Appendix A) or a terminal emulator such as Tera Term or HyperTerminal running on an attached computer. Commands can be sent using the terminal emulator set with the properties listed in Section 3.4 of this manual, "Collecting Data over the USB Port or Serial Port in Real Time." Listed below are the lower-case letters that are commands for performing certain operations while the instrument continues to measure:

l	Start logging and write over existing logged data
t	Transmit logged data
e	End logging
h	Output serial data line header
m	Serial menu

If the letter **m** is sent as a command, **menu>** will be displayed in the terminal emulator window. When the serial menu is accessed, the instrument is no longer making measurements; it is waiting for the next command to be entered. The following is the list of menu items accessible from this point:

l	Start logging and write over existing logged data.
t	End logging and transmit logged data.
e	End logging.
h	Output serial data line header.
a	Displays list of possible averaging times and waits for the user to enter the number to change to the desired averaging time.
z	Displays current zero calibration setting and waits for new setting followed by a carriage return.
s	Displays current slope calibration setting and waits for new setting followed by a carriage return.
c	Asks user to enter the time in HHMMSS format.
d	Asks user to enter date in DDMMYY format.
g	Outputs GPS data sentences as read from GPS device (enter x to return to the menu and then to measuring).
n	Outputs the serial number of the instrument.
f	Sets pump mode to FAST (2-second cycles).
q	Sets pump mode to QUIET (4-second cycles).
p/o	Toggles the LCD backlight on and off.
u	Performs a lamp test (enter x to return to the menu and then to measuring).
?	Prints the help menu.
x	Exit menu and return to measuring.

9. USB INSTALLATION

The following procedure describes how to install the USB connection for the Model HERMES Personal Mercury Monitor. For computers with the Windows 10 operating system, it is not necessary to install a driver (i.e., skip Section 9 below, and proceed to Section 10). Windows 10 systems will automatically load a driver for the USB.

9.1 Items Required if not using Windows 10

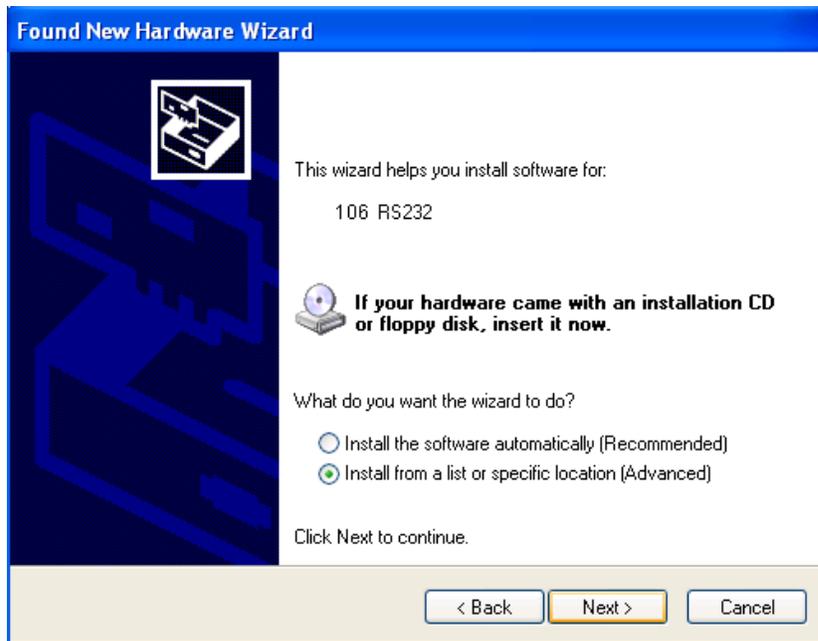
1. HERMES Personal Mercury Monitor
2. USB Cable (supplied with HERMES)
3. PC Computer with Windows 10, 2000, XP, Vista, 7 or 8
4. USB to UART Driver Disk (or download from 2B Tech website here: https://twobtech.com/docs/docs_software.htm)

9.2 Driver Installation (if not using Windows 10)

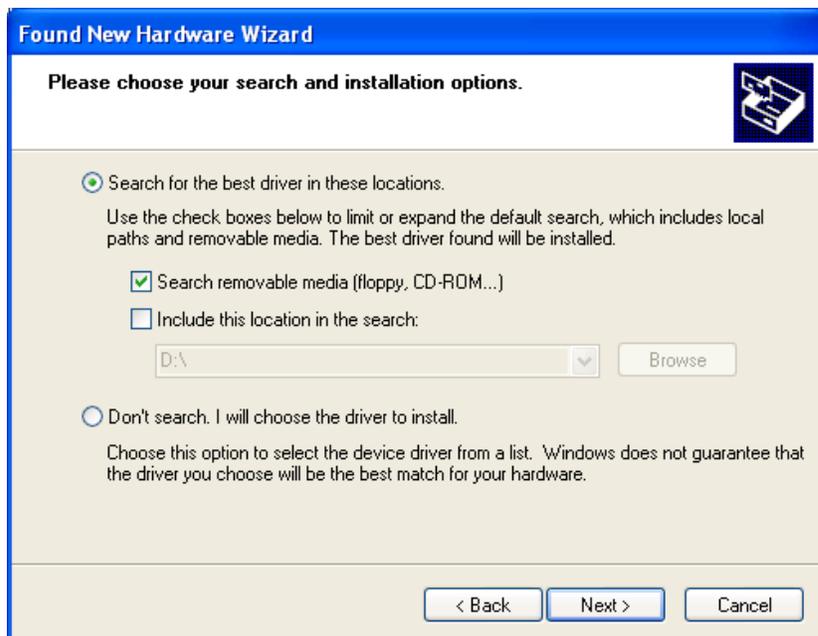
1. Insert USB to UART Driver Disk in the computer's CD ROM drive or download the Model HERMES PMM USB Driver from the 2B Tech website.
2. The installation files are located in a zip folder. Navigate to the folder labeled "cdc_NTXP" and double click on it.
3. Unzip the contents to a folder on the desktop or any area you wish.
4. With the HERMES off, attach USB cable from the HERMES to a USB port on the computer.
5. Turn on the HERMES. The install wizard should pop up as follows. Select "No, not this time" and click "Next".



6. Select the "Install from a specific location" option and click "Next".



7. Navigate to folder where you unzipped the cdc_NTXP.



8. Select "Continue Anyway" when this window appears.



9. After a few seconds, the driver will be finished installing.

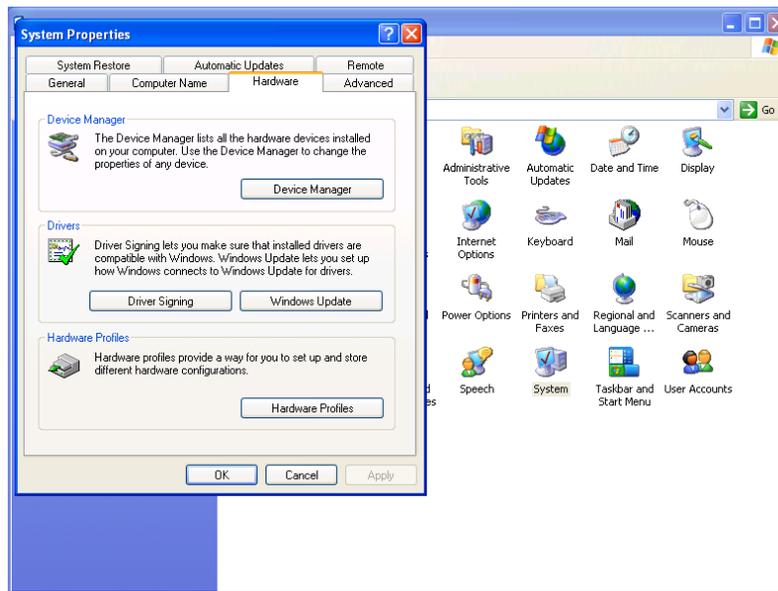


10. USING THE USB CONNECTION

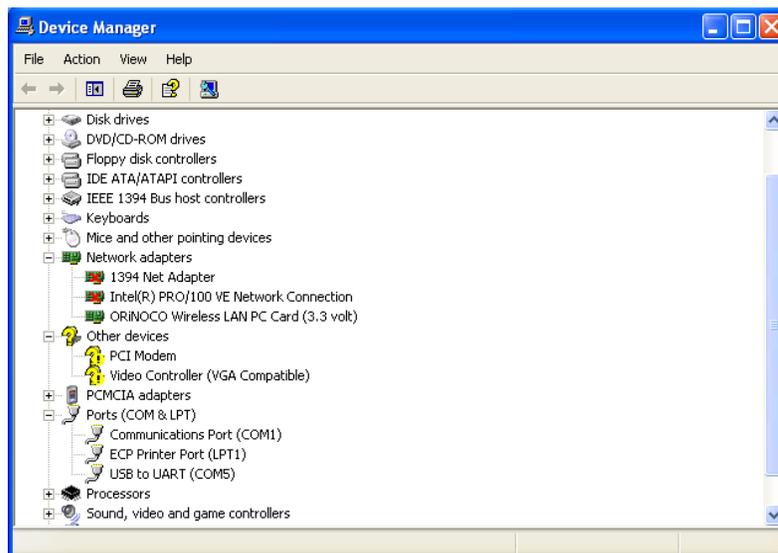
10.1 Determine the Connection Port

After the USB driver installation is complete (Section 9), determine which COM port the connection is using. This can be done by the following procedure.

1. If using Windows (10, XP, Vista, 7, 8), go to the control panel and select “System”.
2. Click on the “Hardware” tab.



3. Click the “Device Manager” button.
4. Press the “+” sign next to “Ports”.



-
5. In Parenthesis, next to the “USB to UART” listing is the assigned COM port number. This number will be used for the settings for the 2B Tech software or terminal emulator (such as Tera Term) used to read data from the HERMES PMM.

10.2 Using the Connection

- Plug the USB cable in after the powering the HERMES PMM to ensure correct functionality.
- When setting up your software or terminal emulator, choose the correct COM port listed in the Device manager.
- Use these baud rate settings: 19200, 8 bits; no parity; 1 stop bit.
- Use 2B Technologies Display and Graphing Software (free download from https://twobtech.com/docs/docs_software.htm) to read measurement data from the HERMES PMM. Other software such as [Tera Term](#) may also be used (free download from <https://twobtech.com/teraterm-4.100.exe>).

11. MAINTENANCE/TROUBLESHOOTING

The HERMES Personal Mercury Monitor is designed to be nearly maintenance-free. The only component that requires routine maintenance is the internal mercury scrubber, which should be changed at least once every six months (~4,000 hours) of operation. Return the instrument to 2B Technologies for replacement of the internal mercury scrubber.

Also, the inlet filter (user supplied) should be changed as recommended by the filter manufacturer.

Other components with a limited lifetime are the air pump (~3,000 hours), lamp (~20,000 hours) and solenoid valve (rarely fails). It is recommended that the instrument be returned to 2B Technologies if any of these components fail.

The following are indications of various instrument malfunctions.

Air Pump Failure: The instrument will not make a humming sound. Also, the circuit breaker may prevent the instrument from powering up if the motor in the air pump develops a short.

Lamp Failure: The mercury measurements will be erratic and the Lamp Test will show 0.0 volts for the photodiode voltage.

Solenoid Valve Failure: The mercury readings will be low and average to close to zero if the solenoid valve is not switching. Partial switching of the solenoid valve will cause the instrument to read low but not zero.

Contaminated Flow Path: The instrument will typically have a large positive or negative offset, and the mercury readings will be low once corrected for the measured offset.

Help with trouble shooting is provided in the following table. Because the HERMES instrument is constructed to be extremely compact, we recommend returning it to 2B Technologies for any repairs or diagnostics that require disassembly (including cleaning of the flow path and/or replacement of the internal mercury scrubber, pump, lamp or solenoid).

Table 11.1. Troubleshooting the HERMES Personal Mercury Monitor for performance problems.

Problem/symptom	Likely cause	Corrective action
<i>Instrument does not turn on.</i>	Power not connected properly or circuit breaker open.	Check external power connection for reverse polarity or a short and wait a few minutes for the thermal circuit breaker to reset.
<i>Instrument turns on then powers off.</i>	Burned out air pump.	Return the instrument to 2B Tech for replacement of the air pump.
<i>Readings are noisy with standard deviations greater than 0.1 µg/m³ for zero air.</i>	Lamp output is weak, below 0.6 V on Lamp Test.	Return the instrument to 2B Tech for replacement of the lamp.
	Flow path is contaminated.	Return the instrument to 2B Tech for cleaning.
<i>Required calibration parameters are large (>±0.5 µg/m³ offset and/or >±9% slope) when calibrated using a standard mercury source or reliable mercury instrument.</i>	Mercury scrubber is contaminated.	Return the instrument to 2B Tech for replacement of the mercury scrubber.
	Flow path is contaminated.	Return the instrument to 2B Tech for cleaning.
	Solenoid valve is contaminated and not opening and closing properly.	Return the instrument to 2B Tech for replacement of the solenoid valve if not working properly.
	Air pump is not drawing sufficient flow.	As a first check, hold your finger over the air inlet to determine whether air is being drawn in. If there is flow, measure the flow rate by attaching a high conductance flow meter to the air inlet. Air flow should be greater than 0.5 L/min when making measurements. If flow is lower, check for leaks. If there are no leaks, return the instrument to 2B Tech for replacement of the air pump.

2B Technologies offers reasonably priced customer service for instrument repairs. The calibration service includes cleaning of the entire flow path with methanol, testing of all components for proper function, installation of a new internal mercury scrubber and calibration against a NIST-traceable standard. The best way to contact us for service is to log a customer service ticket at <https://www.twobtech.com/tech-support.html>. Normally, you will hear back from us by email within a few hours. Or, call us at +1(303)273-0559.

There is a great deal of technical information about our instruments posted as technical notes at https://www.twobtech.com/docs/docs_tech_notes.htm. Manuals, brochures, software, technical notes and scientific papers may be downloaded at https://www.twobtech.com/docs/docs_HERMES.htm.

12. LABELED INSTRUMENT PHOTOS

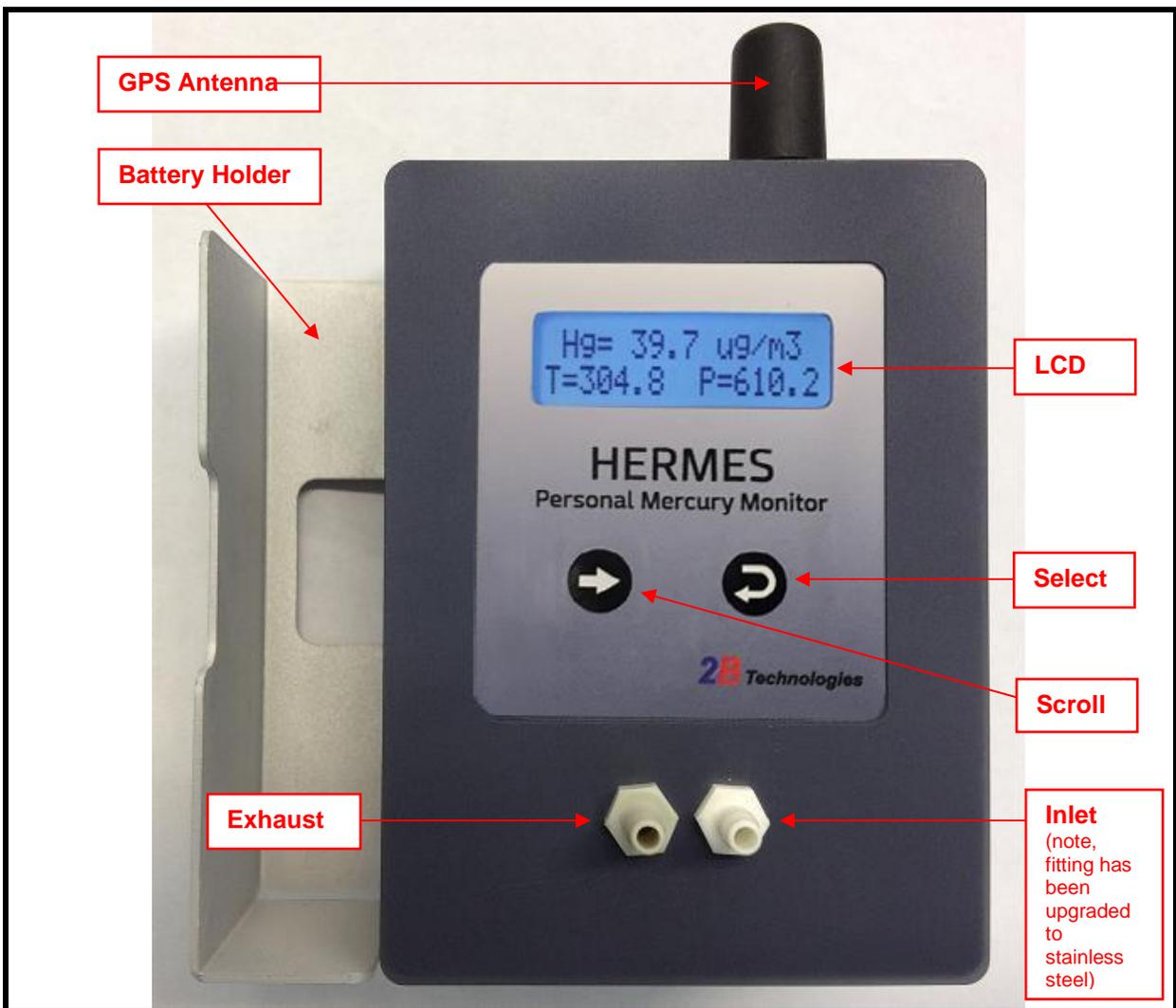


Figure 12.1. Front Cover of the HERMES Personal Mercury Monitor.

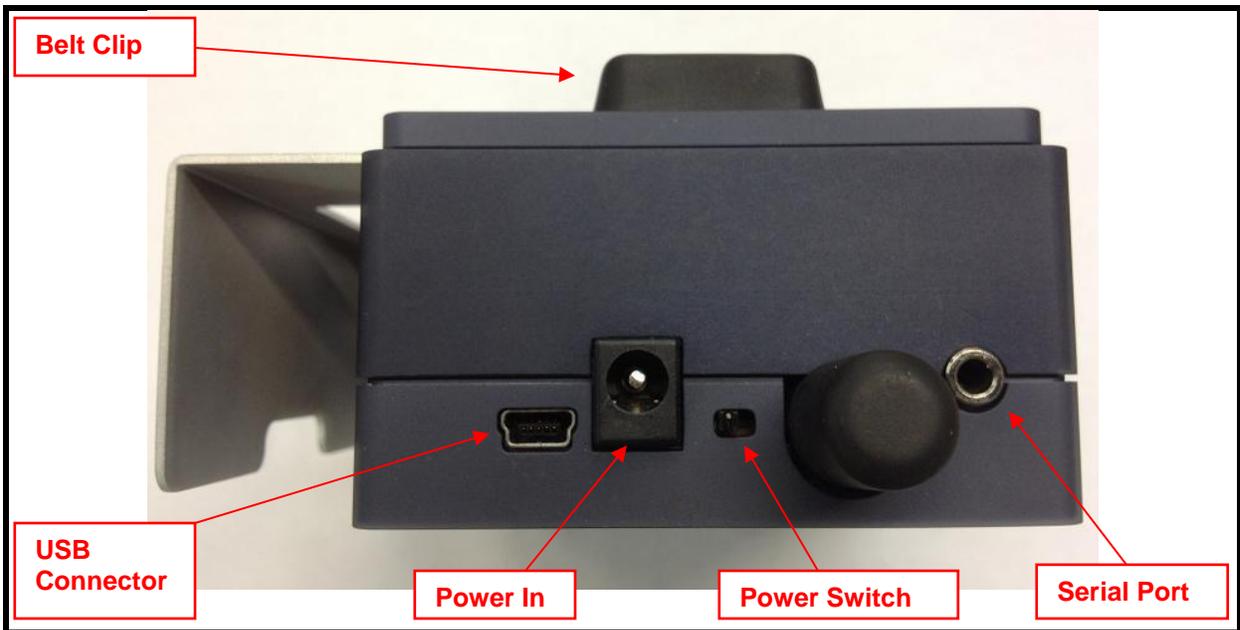


Figure 12.2. Top View.

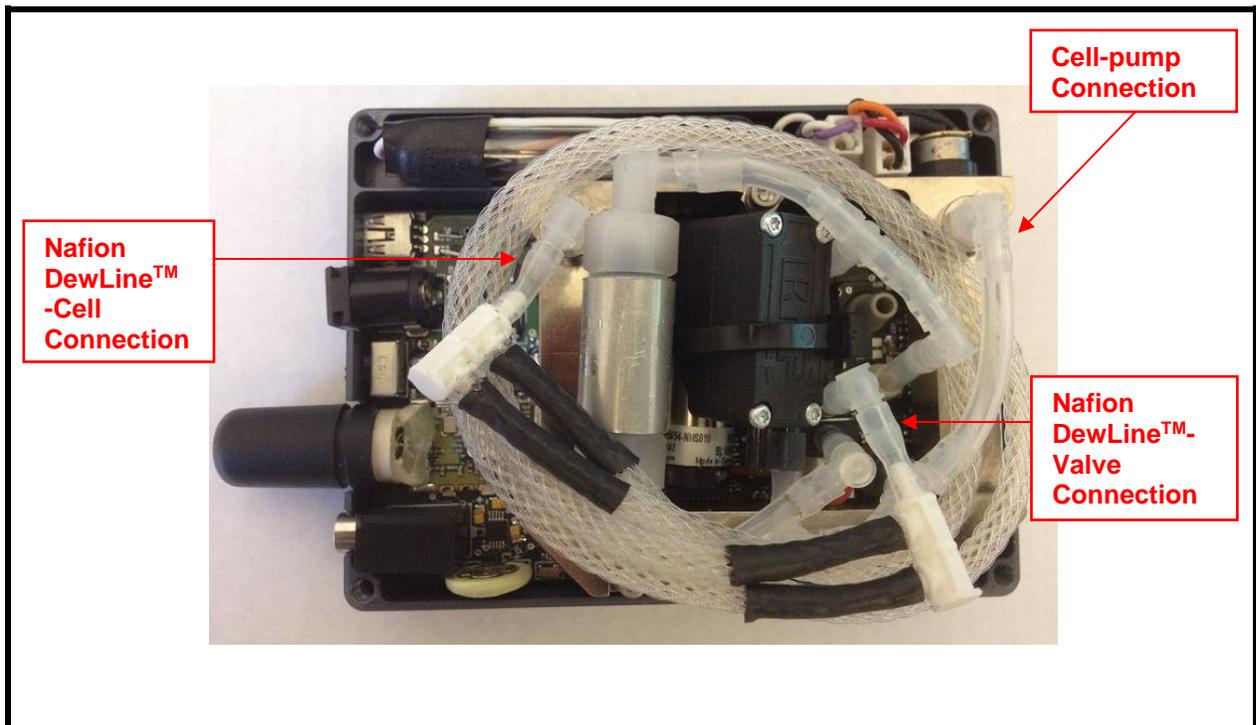


Figure 12.3. Inside View.

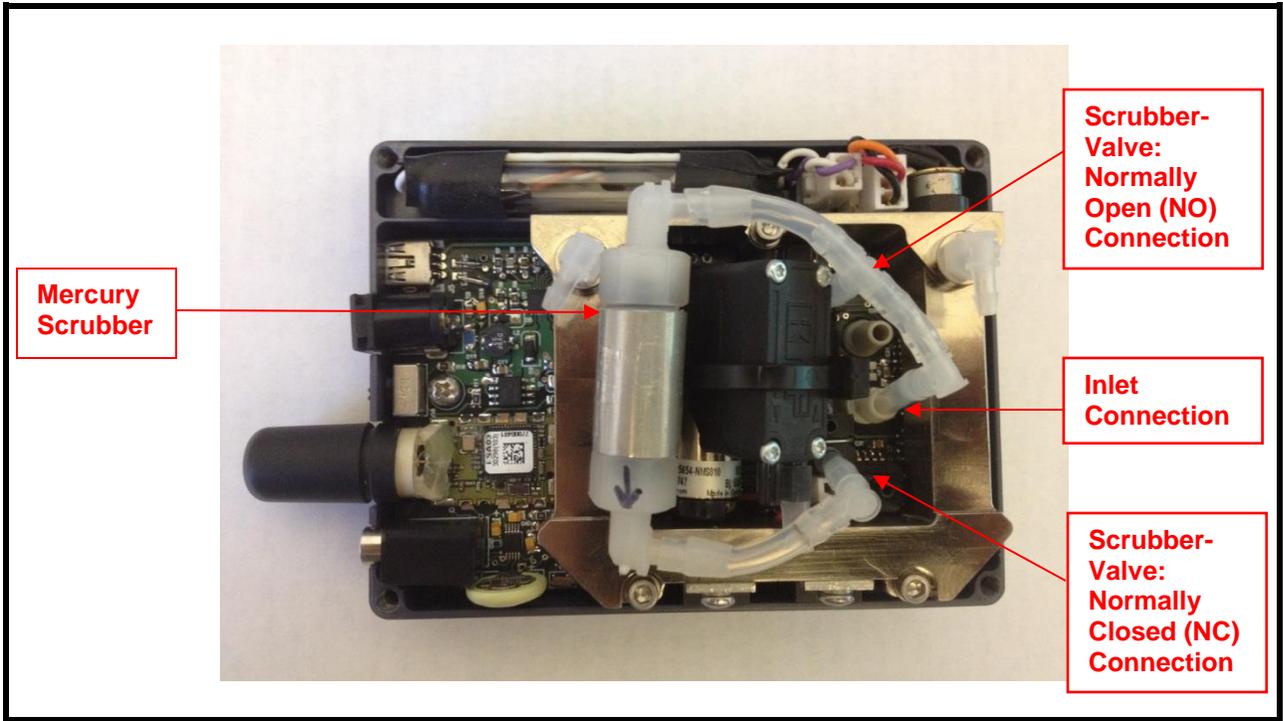


Figure 12.4. Inside view without Nafion DewLine™.

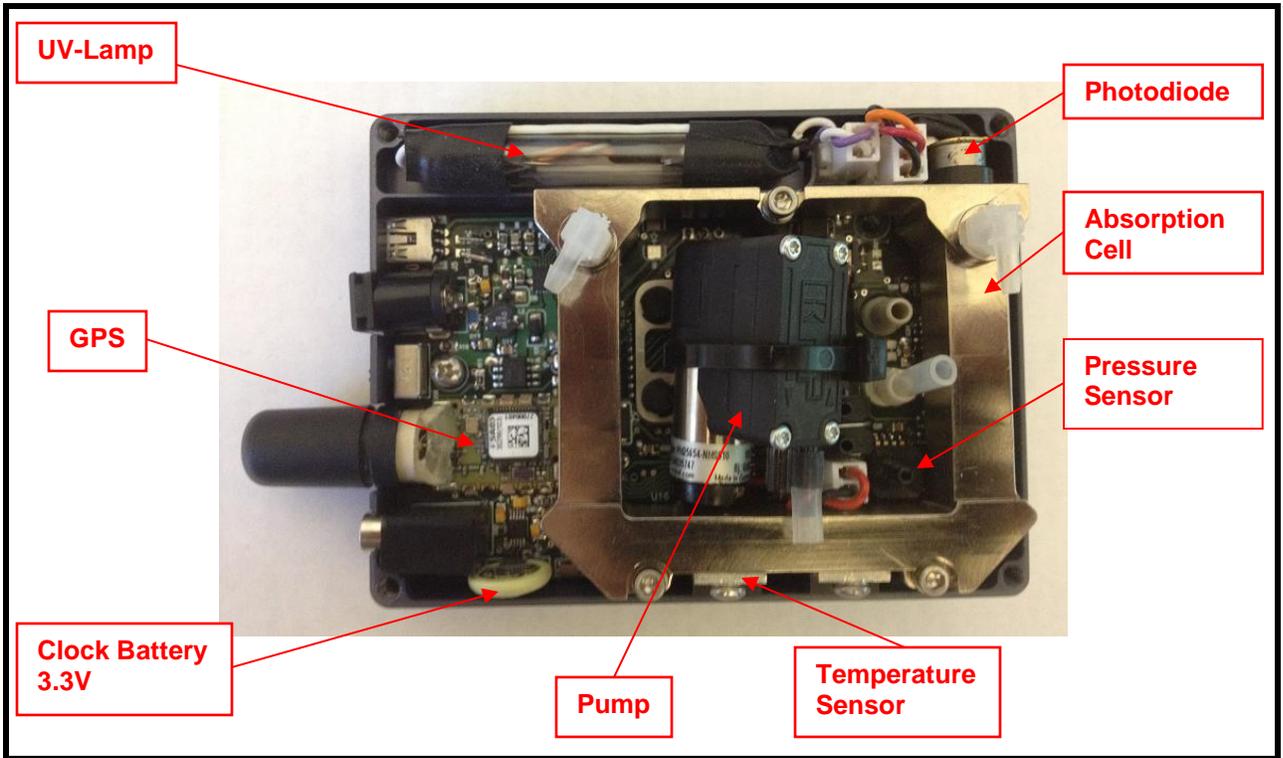


Figure 12.5. Inside view without Scrubber or Nafion DewLine™.

13. PARTS LIST

The following list includes those parts that are serviceable by the user. They may be ordered by contact us via email at sales@twobtech.com.

It is recommended that the instrument be sent to 2B Technologies servicing of any internal parts.

Part Number	Description
ZEREXTHG	Mercury zeroing scrubber (external)
STRSERCABL	Stereo serial port cable (to computer)
USBMNICABL	Mini USB Cable (to computer)
PROBE	Sampling probe
12VADP	12 V DC cigarette lighter adapter
TEFTYG25	Teflon-lined Tygon® tubing (25 ft)
TEFTYG05	Teflon-lined Tygon® tubing (5 ft)
SILTUB05	Silicone tubing (5 ft)

Appendix A: Using the 2B Technologies Display and Graphing Software

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Introduction

2B Data Display® is an easy way to display and save data from your serial or USB connection.

With easy one-click operations, data are read from your instrument and displayed on an extremely versatile chart. Two items, such as Ozone and Temperature, can be displayed simultaneously on the chart with multiple zoom levels. Data are automatically saved to a .txt file and can optionally be saved to a .CSV file to be read in Excel. Saved data can be restored for later viewing and analyzing on the chart. By requesting an account with 2B Technologies, you can upload your data and view it on a Google Earth overlay.

Downloading the Software

Go to <http://twobtech.com/downloads.html> and select the Software tab. Click the link for “2B Tech Display and Download Software.” Follow the instructions, doing the two installations if needed and choosing to save the “setup.exe” file. Double-click the setup.exe download to launch the 2B Data Display application.

Connecting Devices

Connect to a Monitor

1. Select the device you are connecting to from Settings: Select Device...
2. Click OK.
3. Select the Connection you will be using from Settings: Connection...
Choose the settings as follows:
 - a) Port:
 - The default port is “COM1” for computers with a serial port.
 - If using a USB connection, check for the correct port in the “Device Manager” under “Ports” located in: Control Panel : System : Device Manager.
 - If using a USB to Serial adapter, check for the correct port the same as for a USB connection and look for the name of the adapter (e.g., Belkin, Prolific, or other USB to Serial adapter manufacturers).
 - b) Baud Rate: The Default baud rate of the software is 2400. Check your monitor’s settings in the “Cfg / I/O” menu and match the software with the monitor’s setting (19200 for the HERMES). Note that for the USB port, the baud rate must match the baud rate of the Monitor at the Monitor’s startup.
 - c) Parity: None
 - d) Data Bits: 8
 - e) Stop Bits: One

-
4. Click Start button in the Instrument Data Capture section in the upper left corner of the main screen.
 - a) The “Save As” window will appear. A default file name will appear which is made of the date and time. You may change the filename and change where it is saved if you wish.
 - b) Click the “Save” button. This will start the data capture software and data will fill into the chart as they are transmitted from the device.
 - c) The red OFF text will change to green ON text. The text: Waiting for data... will appear until data arrives from the instrument. If the instrument measurement frequency is set to 2 seconds, you will see a data point every 2 seconds. Averaging frequencies can be set to 10 seconds, 1 minute, 5 minutes, and 1 hour in the Avg submenu on the instrument.

Connect to Weather Station (Davis Vantage Pro)

1. Be sure the weather station is physically connected to the USB port or Serial port of the computer.
2. Select the COM port for the weather station from *Settings : Weather Connection Settings...*
3. Select “Retrieve Weather Data” from the “Weather Link” menu. A window will appear and the software will try to retrieve the weather station data. If the connection is good, weather data will be displayed in the window. If not, an error message will appear. Try a different com port if the error message appears. You may move this window so it is out of the way or you may close it. The weather data is updated every 5 seconds.
 - Since the Monitor and the Weather Station both use COM ports, you may have to unplug one of the USB adapters from the PC to determine which device is using which COM port.
4. To bring up the window again if you have closed it, select “Display Weather Data.”

Viewing Data

The Data Grid Tab

1. Make sure the application is connected to a device or that you have opened a previously saved data file.
2. Click the *Data Grid* tab on the right side of the screen.
3. The data lines received from your instrument will be listed in a grid with the latest point at the top.
4. The header contains the device specific variables (e.g., Mercury, Cell Temp...). Log Number is always listed even if your instrument is not set to log.

The Charts Tab

1. Make sure the application is connected to a device or you have opened a previously saved data file.
2. Click the *Charts* tab on the right side of the screen.
3. Select which data items to display from the drop down windows “Data 1” and “Data 2.”
4. The data points will appear in a graph window in the middle of the screen.

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5. Adjust the zoom level by pressing the + or – buttons under the *Settings* button (upper right side of screen).
 6. Adjust the Y scale or set the *Auto Range* feature by pressing the *Settings* button
 - a. Check the *Auto Range* box to use autoscaling.
 - b. Uncheck the *Auto Range* box to manually set Y max and Y min for the Data 1 and Data 2 fields.

The Buffer Tab

- Selecting the Buffer tab brings up a buffer window, similar to Tera Term or HyperTerminal, where all data from the serial port are displayed.
- From this tab, the user can also send commands through the serial port by typing on the keyboard. This is only applicable if the device that is connected accepts serial commands. See the instrument manual for a list of the serial commands.
- This buffer window can also be used for troubleshooting for instances when: the baud rate, device, or serial port is unknown. For example, if the status bar in the “Instrument Data Capture area states “Receiving...” and no data appear in the Data Grid or the Charts, click on the Buffer tab to view the serial data. If the correct device is not selected, no data will be displayed in the Data Grid or the Charts, but data will be displayed in the Buffer window.

Saving Data

Saving Data to a .txt File

1. Click the *Start* button in the Instrument Data Section to begin collecting data from the instrument.
2. A window will pop up to prompt for the name and location of the file.
3. Click Save to begin the data collection.
4. All data read from the monitor through the COM port are written to the .txt file in real time until *Stop* is clicked.

Saving Data to a .CSV or an Excel File

NOTE: Weather data are NOT saved to the .txt file. In order to save weather data, be sure to save a .CSV file after *Stop* is clicked.

1. After collecting data, click the *Stop* button in the Instrument Data Capture Section on the main screen.
2. A window will pop up to ask you if you would like to save to a CSV file as well. Click Yes.
3. A default name appears from the date and time of the data capture. You may change the name and path of the file if you wish.
4. Click on the *Save* button.

Opening Files

1. To open a file, click *Open* from the *File* menu.
2. Navigate to the folder where the file was stored.
3. Select either the .txt file or the excel file and press *Open*.
 1. NOTE: To view weather data, you must open the corresponding .CSV file.

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4. Choose the correct device associated with the file.
 - a. If you are unsure, open the file in a text editor or Excel to determine which device.

Serial and USB Commands

The menu commands are the same as given in Section 8 of this manual.