

User's Manual

2012



Warranty

1-YEAR LIMITED WARRANTY ON miniDOT HARDWARE

Precision Measurement Engineering, Inc. (PME) warrant that the miniDOT Logger shall be free of defects in workmanship and materials, under normal use, for a period of one year from the date of shipment. This warranty is made only to the original purchaser. In the event a miniDOT Logger covered by this warranty fails to operate according to our published specifications, then return it freight pre-paid to PME or an authorized Service Provider. PME will repair the unit at no charge to the customer and bear the cost of return shipment. Carefully pack all components, as the customer is responsible for any freight damage.

This warranty does not apply to services or consumable / expendable items (such as batteries, fuses and ropes) required for general maintenance. Equipment manufactured by other companies (such as meteorology sensors, solar panels, etc) are warranted only to the limit of the warranties provided by their original manufacturer.

PME makes no warranty, either expressed or implied, that the sensors will be operable after they are exposed to adverse environmental conditions, such as bio-fouling, oil fouling, freezing temperatures or others.

This warranty is void if, in our opinion, the miniDOT Logger has been damaged by accident, mishandled, altered, or repaired by the customer, where such treatment has affected its performance or reliability. In the event of such treatment by the customer, costs for repairs plus two-way freight costs (no COD shipments will be accepted) will be borne by the customer. In such cases, an estimate will be submitted for approval before repair work is started. Items found to be defective should be returned to PME carefully packed, as the customer will be responsible for freight damage.

Incidental or consequential damages or costs incurred as a result of the product malfunction are not the responsibility of PME.

For all warranty or non-warranty returns please obtain, complete, and submit a RMA to PME. This RMA form may be obtained at

<http://www.pme.com/HTML%20Docs/RMAform.html>.

After submission of this form, then PME will respond with a RMA number. Please place this number on all shipments and related communications.

Safety Information

BURSTING HAZARD

Should water enter the miniDOT Logger and come into contact with the enclosed batteries, the batteries may generate gas causing the internal pressure to increase. This gas will likely exit via the same location where the water entered, but not necessarily. The miniDOT Logger is designed to release internal pressure as the end cap is unscrewed, prior to the disengagement of the end cap threads. If internal pressure is suspected, then treat the miniDOT Logger with extreme caution.

Revision History

Date	Revision Description
20-JUL-2010	Initial document
02-FEB-2011	Revised to show better Dataturbine screen, added Vega, misc changes
14-MAY-2011	Extensively modified due to simplification of logger software
06-JUN-2011	Modified to describe startup with no 3 flashes if no CAL.TXT file found. This to be consistent with logger software change
08-JUN-2011	Added o-ring and SD card information, multiple plot info
14-JUN-2011	Minor wording changes; coin cell discharge description changed
16-JUN-2011	Added no backspace instructions to command description
28-JUN-11	Now supplying cal.txt file
17-OCT-2011	Removed Export folder from miniDOT Plot software
14-DEC-2011	Corrected reference to section 2.9 to refer to section 3.9, added Sec 3.11 SD Card
15-DEC-2011	Corrected 19200 baud to 9600 baud in Appendix
19-DEC-2011	Corrected command instruction giving example for setting time
20-DEC-2011	Corrected correction of time instruction
10-JAN-2012	Added corrective action to flash description
12-JAN-2012	Added miniDOTControl information
19-JAN-2012	Added instructions concerning battery selection
06-FEB-2012	Updated for new Rev 2.09 firmware
10-FEB-2012	Revised to eliminate CAL.txt file and support new serial controls
17-FEB-2012	Revised to eliminate Hyperterminal instructions.

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Chapter 1: Quick Start

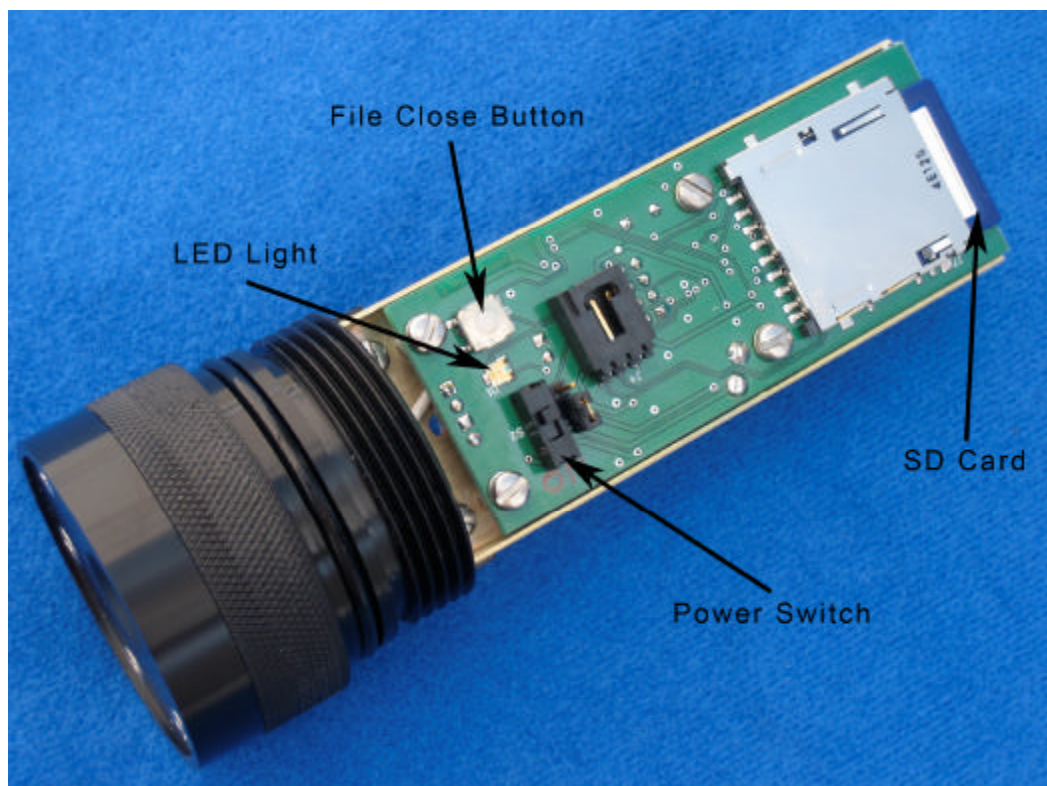
1.1 The Quickest Start Possible

Your miniDOT Logger has arrived completely ready to go. It is set to measure temperature and oxygen concentration once every 10 minutes and record 4 files of measurements daily. You need only turn on the power and deploy the logger. In this condition the miniDOT Logger will operate for most of a year before the internal battery is expended.

At the end of the deployment period you need only to open the logger, press the File Close button, switch off the power, and remove the SD card. Your temperature and oxygen concentration measurements, together with a time stamp indicating the time the measurement was made, are recorded in text files in the DATA directory on the SD card. These files can be copied from the SD card onto any host computer.

Follow these steps to start the deployment, logging DO & T once each 10 minutes:

- 1) Open the miniDOT Logger by unscrewing the white housing from the black end cap. Remove the housing completely. Inside you will see the circuit pictured below:



- 2) Slide the power switch to the ON position. The LED will flash once. The miniDOT will now delay to the start of the next minute. Observe the LED for up to 90 seconds. Sometime during this period it will flash 5 times indicating that logging has begun. If it flashes continuously, then see Section 1.2 of this manual.
- 3) Inspect the o-ring seal for debris.
- 4) Close the miniDOT Logger by screwing the white housing back onto the black end cap.
- 5) Deploy the miniDOT Logger.

Follow these steps to end the deployment

- 1) Recover the miniDOT Logger
- 2) Clean and dry all accessible surfaces except the 'foil'.
- 3) Open the miniDOT Logger by unscrewing the white housing from the black end cap. Remove the housing completely, taking care that water does not drip onto interior surfaces of circuits or other items inside the logger.
- 4) Press the File Close button. The LED should begin continuous flashing.
- 5) Slide the power switch to the OFF position.
- 6) Remove the SD card. Use a card reader and a host computer to copy the files located in the DATA directory onto the host computer. These text files contain the measurements.
- 7) (Optionally) Run PME's miniDOTPLOT.jar program to see a plot of dissolved oxygen, temperature and oxygen saturation, and to produce a concatenated file containing all the measurements.

Remove the battery if storing the miniDOT Logger for extended periods.

1.2 A Few Details

The previous section gives instructions for sampling at 10-minute intervals. However there are a few additional details that will enhance use of the miniDOT Logger.

Sampling rate – The miniDOT Logger measures and records dissolved oxygen concentration and temperature at equal time intervals. The default time interval is 10 minutes. If a formatted SD card is placed in the miniDOT Logger and the power is turned on, then the logger will record every 10 minutes. However, it is also possible to instruct the miniDOT Logger to record at different intervals. This is accomplished by running the miniDOTControl.jar program supplied with the miniDOT.

Sample intervals must be 1 or more minutes and must be less than or equal to 60 minutes. Sample intervals outside this range will be rejected by miniDOTControl.

Please refer to Chapter 2 for instructions on operating the miniDOTControl program.

Sample Time – The miniDOT Logger records the time that each measurement of dissolved oxygen and temperature is made. It does this based on an internal clock. When your miniDOT Logger arrives it is set by PME to UTC (formerly known as Greenwich mean time (GMT)). Subsequent PME software implements conversion to local time. The miniDOTControl.jar program allows you to set miniDOT time based upon the host computer's time. This is automatically translated to UTC based on settings within the host computer.

The miniDOT Logger internal clock will drift in the <10 ppm range (< about 30 seconds/month) so you should plan to reset it occasionally.

Please refer to Chapter 2 for instructions on operating the miniDOTControl program.

File Information – The miniDOT Logger software creates 4 files daily. The number of measurements in each file will depend upon the sample interval. Files are named by the time (Unix epoch 1970) that the file is opened based on the logger's internal clock and expressed in hexadecimal format.

Cleaning the Sensing Foil – The sensing foil may require cleaning from time to time depending upon deployment conditions. Clean these by gently wiping or brushing. The delrin case of the miniDOT Logger can be gently scrubbed.

AA Lithium Battery Life – The miniDOT Logger consumes battery power mostly from the measurement of dissolved oxygen, but also slightly from simply keeping track of time, writing files, sleeping, and other activities. The following table presents the approximate endurance of the miniDOT Logger when powered by the lithium battery supplied by PME:

SAMPLE INTERVAL (minutes)	Main AA Battery Life (days of sampling)	Samples
1	200 days	288K
5	400 days	115K
10	475 days	68K
15	500 days	48K
60	530 days	12K

Keep a general record of miniDOT Logger number of samples. It is not possible to tell the charge state of a lithium battery from measurements of its terminal voltage. If you have a general idea of the number of samples already obtained on a battery, then you can make a guess as to how many more samples remain. Err on the side of caution.

Coin Cell Battery Life – The miniDOT Logger uses a coin cell for backup of the clock when the power is switched off. This coin cell will supply roughly 2 years of clock operation, but this is only required if the main power is off. Should the coin cell discharge it must be replaced.

Recalibration – The miniDOT Logger will maintain its calibration without the necessity of adjustment by the user. Loggers should be returned to PME for recalibration. We suggest that this be done every ½ million samples.

O-Ring and Seal – When the cover is screwed on, it passes along the o-ring located in the end cap several revolutions. Keep this o-ring lightly lubricated with silicone grease or oil compatible with buna-N o-ring material.

When the miniDOT Logger is opened after deployment, a small number of water drops are deposited on the inner surface of the o-ring. When the pressure housing is screwed back on these drops become trapped inside the miniDOT Logger. Be sure to carefully dry the o-ring and adjacent surfaces (especially underneath) prior to closing the miniDOT. Re-lube the o-ring at this time.

SD Card – The SD card can be ejected from its socket if the miniDOT Logger is dropped on its pressure housing end. The logger will be unable to log should this occur. PME recommends that the SD card be secured in its socket in the normal way and then a small length of electrical tape added to hold the SD card in the proper place.

LED Indications – The miniDOT Logger performs various tests as it begins logging operations. If any test fails the software flashes the LED light and re-conducts the test. In general if a test fails once it will continue to fail and the LED light will continue to flash. The following table gives the number of flashes and the reason these flashes appear.

LED Flash #	Reason	Corrective Action
1	Normal. Presented immediately after power is switched on. Indicates that the CPU has started its program.	None required. Normal operation.
2	Error. No SD Card or SD card not completely plugged in.	Plug SD card correctly. Install new SD card. Re-format SD card (Sec 3.7)
3	Error. Requested sampling interval less than 1 minute or greater than 1 hour.	Contact PME
4	Error. Clock not initialized.	Reset clock using miniDOTControl program (Sec 2.2)
5	Normal, presented once after roughly one minute, indicating that the miniDOT Logger is starting logging operation.	None required. Normal operation

Chapter 2: Software

2.1 miniDOTPlot

The miniDOT Accessory Kit includes software to concatenate and display miniDOT Logger data files, miniDOTPlot.jar. This software provides a plot of the measurements recorded by the miniDOT logger. Most important, it also concatenates all the miniDOT files into one large file and produces a better expression of sample time than is available in the original miniDOT files.

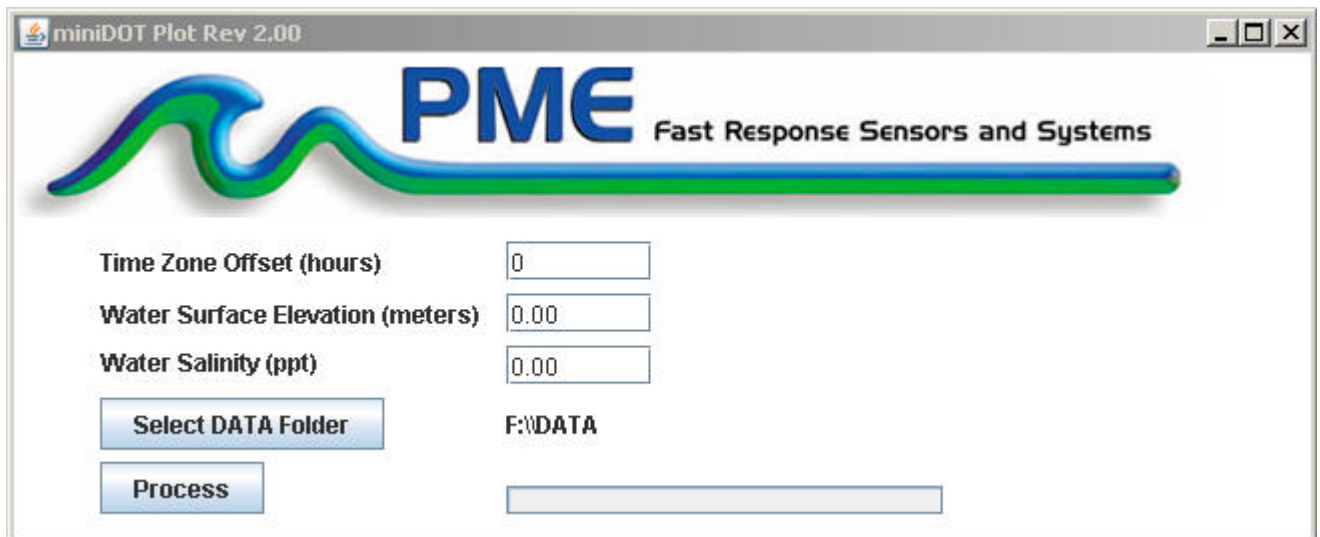
miniDOTPlot.jar is a Java program that requires the Java Run Time Engine (JRE) 1.6 or later. The JRE is commonly used and likely to already be installed on your computer. If not, then download the current JRE from:

<http://www.oracle.com/technetwork/java/javase/downloads/index.html>

No special installation is required for this program.

Begin program operation by clicking on miniDOTPlot.jar.

When miniDOTPlot runs it presents the screen shown below.

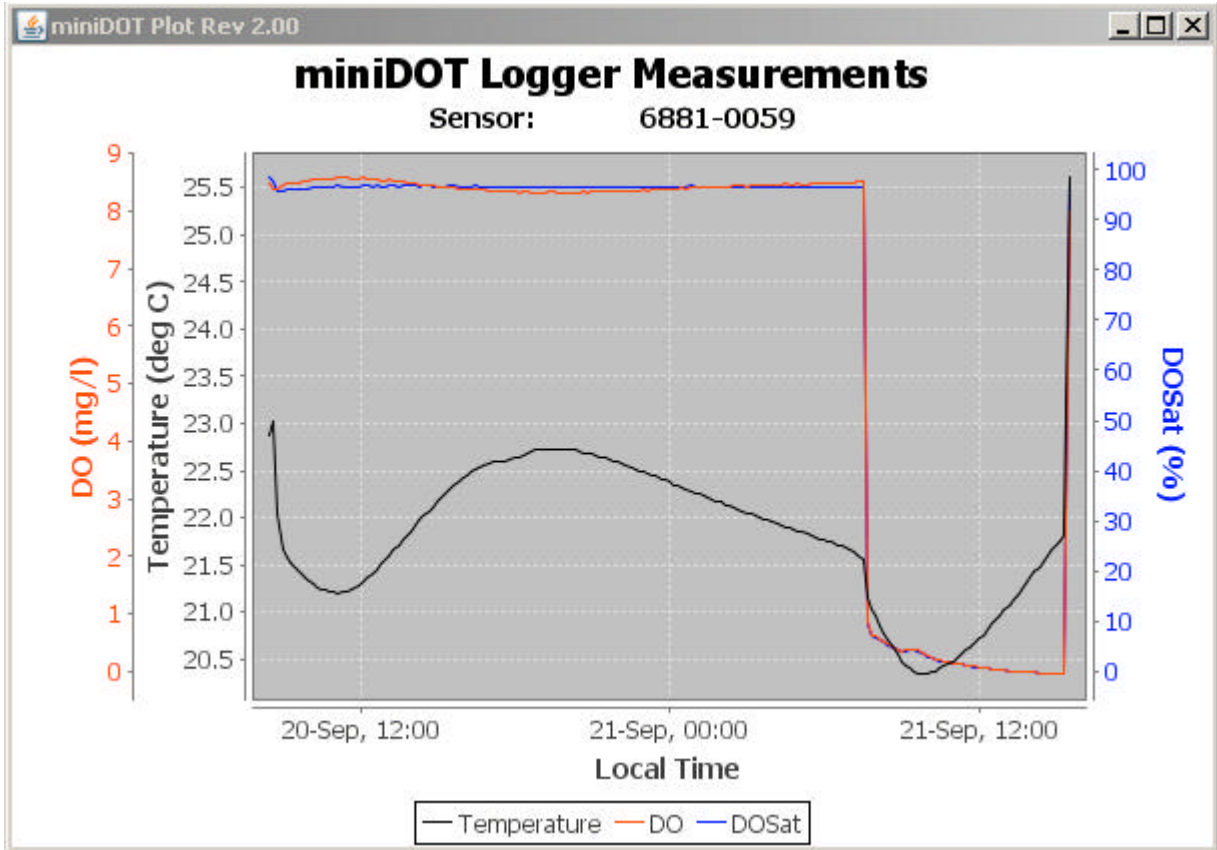


Your miniDOT Logger is supplied with time set to UTC. Enter the time zone of your locale in the Time Zone Offset box. The software will read the miniDOT Logger time and compute local time based on this time zone.

The software will also compute oxygen saturation from the miniDOT Logger measurements. To do this it must know the air pressure and salinity. It calculates air pressure based on elevation of the water surface above sea level. No compensation for weather-induced barometric pressure variation is made. Enter elevation. Enter water salinity.

Select the DATA folder. This is the folder that contains your miniDOT Logger measurement files. This folder MUST NOT contain any other files. This folder can be on the SD card from the miniDOT.

Press 'Process' to begin program operation. The software reads all miniDOT Logger data files in the import folder, writes a CAT.TXT file in the same folder, and finally presents a plot of the measurements similar to the plot shown below.



You may zoom this plot by drawing a square from upper left to lower right (click and hold left mouse button) that defines the zoom region. To zoom completely out, attempt to draw a square from lower right to upper left. Right click on the plot for options such as copy and print. The plot can be scrolled with the mouse while the Control key is held depressed.

Different DATA Folders can be selected during one session of the program. In this case the software produces multiple plots. Presently the plots are presented exactly on top of each other and so when a new plot appears it is not obvious that the old plot is still there. It is. Just move the new plot to see it.

The software can be re-run at any time. If an already processed DATA Folder is selected the software simply reads the miniDOT Logger measurement files again and, after asking permission, overwrites the CAT.TXT file.

2.2 miniDOTControl

The miniDOT Accessory Kit includes software to set the miniDOT Logger sample interval and internal clock. This is a Java program, miniDOTControl.jar. The Java Run Time Engine (JRE) 1.6 or later is required. The JRE is commonly used and likely to already be installed on your computer. If not, then download the current JRE from:

<http://www.oracle.com/technetwork/java/javase/downloads/index.html>

Note that, although this is a Java program, it requires a Windows-specific .dll (mentioned below) and will therefore only run on a computer having a Windows operating system.

This miniDOTControl software supports firmware revision 2.10 and later. This firmware revision begins at about serial number 150 onward. Please obtain a prior version of this manual that describes control of earlier firmware.

Install miniDOTControl by creating a folder and then unzipping the miniDOTControl.zip file into this directory. Two files will appear:

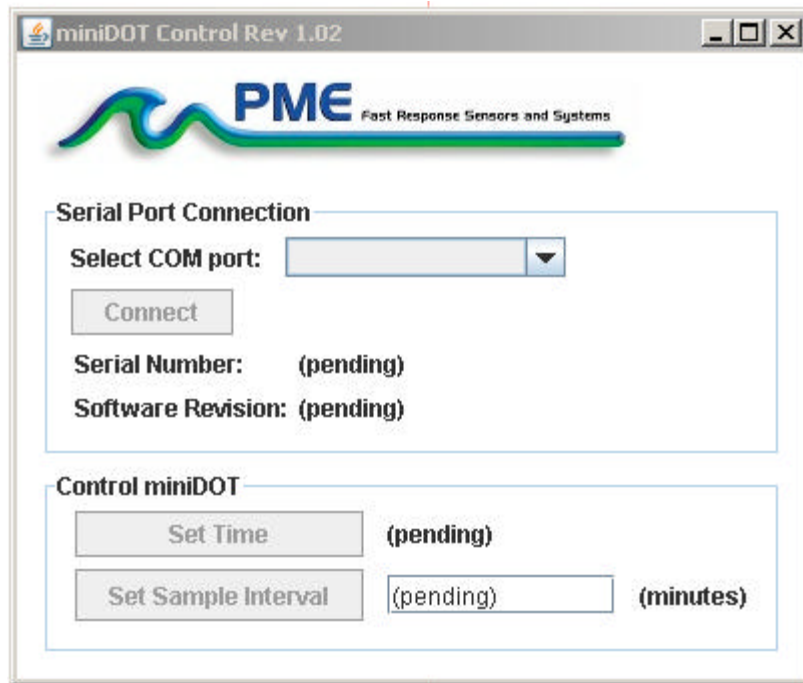
- ? miniDOTControl.jar
- ? libSerialPort.dll

Both files must be present in the directory for program operation.

You must prepare the miniDOT prior to setting it's time. Open the miniDOT Logger. Plug the serial port cable supplied by PME into the logger connector and into the host computer's COM port connector. See Chapter 3 for the location of the connector.

Begin program operation by clicking on miniDOTControl.jar and follow the on-screen instructions.

When miniDOTControl runs it presents the screen shown below.



The host computer's serial ports will appear in the Select COM port drop-down list. You must identify the serial port connector on the host computer that corresponds to the list entry. Most lap-top computers will not have a serial port. If this is the case a serial port can be added by purchasing an inexpensive serial-to-usb converter. See manufacturers instructions for this device. PME sells a kit containing this converter.

Click on the Connect button. The software will contact the logger. If the connection is successful the button will turn green and display "Connected". The Serial Number and other parameters will be filled in from information taken from the miniDOT.

The current difference between the host computer's clock and the miniDOT Logger internal clock will be displayed next to the Set Time button. If this difference is acceptable the clock need not be set.

To set the clock, press the Set Time button. Software will set UTC time based upon your host computer's clock. Time set will replace the time error displayed.

The current miniDOT Logger sample interval will be displayed next to the Set Sample Interval button. If this interval is acceptable the interval need not be set.

To set the interval, enter a interval not less than 1 minute and not greater than 60 minutes. Press the Set Sample Interval button.

Switch the miniDOT Logger off and disconnect the serial cable. Close the miniDOT Logger, close the miniDOTControl program.

Your miniDOT Logger's internal clock and sample interval are now set to UTC and the interval you entered.

Chapter 3: miniDOT Logger

3.1 Overview

All of the miniDOT Logger measurements pass from the sensors onto the SD card it contains. Measurements may flow from the logger to host computer by removing the SD card and copying the contents. Customers will be required to open the logger each time measurements are obtained. This chapter describes the logger internal features.

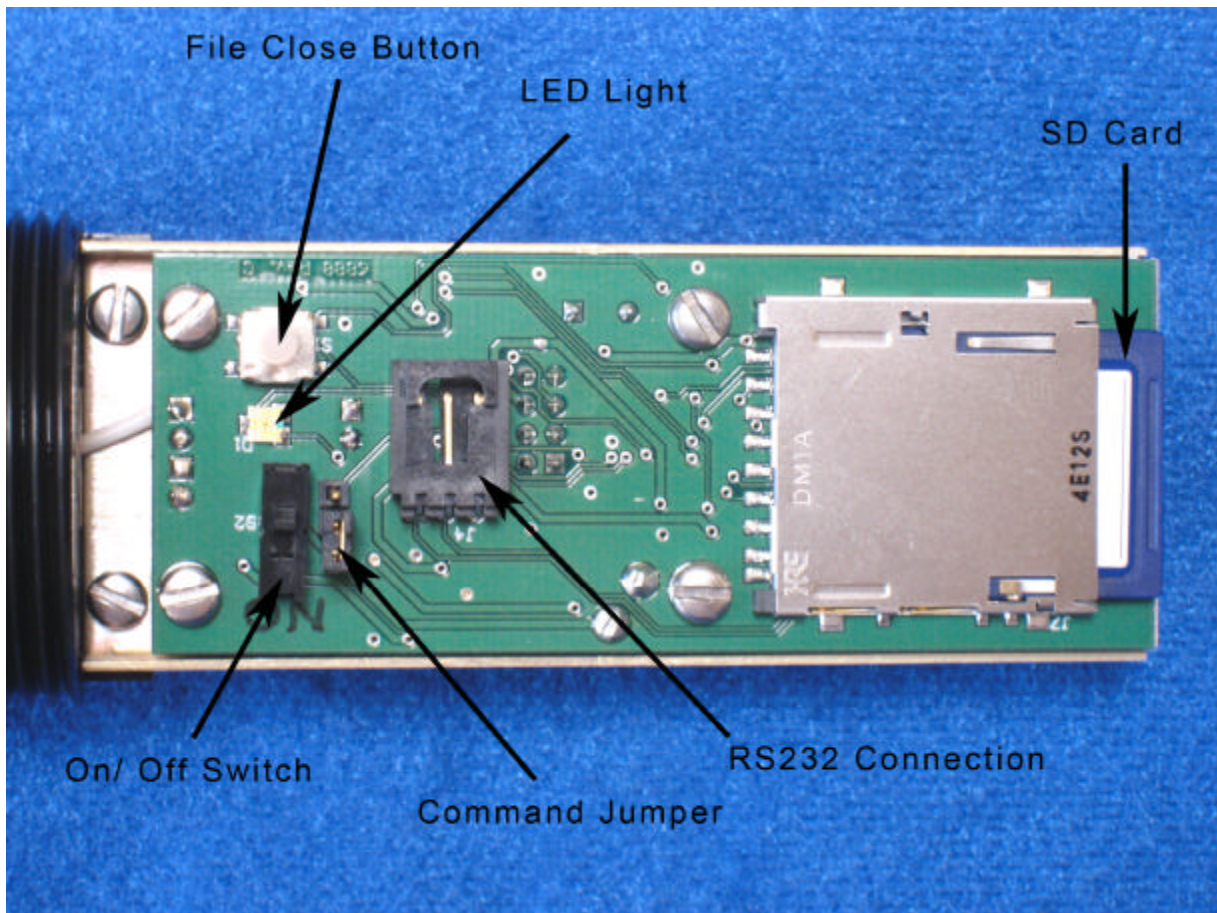
3.2 Opening and Closing the Logger

The logger circuitry is contained in a waterproof housing that must be opened. The housing is opened by unscrewing the white pressure housing from the black end cap. Turn the pressure housing counter clockwise relative to black end cap. Close by reversing this procedure after being sure that the o-ring is free from debris. Lube o-ring occasionally with grease intended for buna-n o-ring material.



3.3 Electrical Connections and Controls

Removal of the cover reveals the logger connections and controls, shown below.



The **SD Card** contains data files and the calibration file. These are described elsewhere in this manual.

The **LED Light** is a yellow or green LED. This is used to indicate different features described elsewhere in this manual.

The **File Close Button** causes the program to save the current file and halt data logging. Press this button prior to switching power off.

The **RS232 Connection** allows communication between the logger and an external computer. Communication parameters are 9600 baud with 8 bits, no parity, and one stop bit. This port is used to connect to PME's miniDOTControl program.

The **On/Off Switch** connects or disconnects battery power to the logger. In the 'Off' position the logger is completely without power except for the clock circuit. Note that 'On' and 'Off' positions are marked in white letters on the circuit board nearby the On/Off Switch.

The **Main Battery** provides main power to the miniDOT Logger. Note the positive (+) terminal. (See picture in Section 3.8).

The **Command Jumper**, Beginning with firmware revision 2.10 (generally about miniDOT serial number 150) the Command Jumper is no longer used.

SD CARD

PME ships a 2 GB SD card with the logger. The miniDOT Logger measurements are recorded on this card.

3.4 File Close Button

The logger records individual measurements to the SD card file when the measurement is made. After each measurement the file remains open. If the power fails or is switched off while the file is open, then the file information is lost. Files are recorded 4 times daily so only as much as 6 hours of measurements are at risk. The user must inform the miniDOT software that the power is about to be switched off by pressing the File Close button. The software will detect this action and close the presently open file. Thereafter the logger will halt its mission and flash its LED repeatedly.

3.5 Battery Replacement

Be sure that the replacement battery is compatible with miniDOT. PME recommends a Tadiran TL-5903/S. This is a AA size, lithium chemistry, 3.6 V battery designed to supply 100 mA continuous current and having a 2.4 Ah capacity. Beware that not every 3.6 V, 2.4 Ah, AA size will operate miniDOT correctly. The battery must also be able to continuously supply 100 mA.

Improper replacement of the battery will damage the miniDOT Logger.

Follow these steps:

- 1) If the logger is logging, press the File Close button.
- 2) Move the On/Off Switch to the Off position.
- 3) Remove the depleted battery **noting the position of the (+) terminal.**
- 4) Install the fresh battery with the **(+) position the same as the removed battery.** The (+) position is also marked on the chassis nearby the proper end of the battery holder.
- 5) Review the battery installation. **Be sure the (+) end of the battery is properly positioned!!**
- 6) Move the power switch to the On position.
- 7) The miniDOT Logger LED Light should flash once to indicate that it is beginning operation.

If you install the battery backwards and turn the power on, then you should plan to purchase a new miniDOT Logger.

3.6 File Management

The miniDOT Logger writes 4 data files daily onto the SD card. These are text files that contain the measured data. These files contain the serial number of the miniDOT Logger that wrote the file and also a time stamp for each measurement. The miniDOT Plot software reads all these files and produces a CAT.TXT file that contains the original data plus extra information.

The recommended method of file management is the following:

- 1) Deploy the miniDOT Logger for a period, and recover it.
- 2) Remove the SD card and place in a card reader on a host Windows computer.
- 3) Run miniDOT Plot, selecting the DATA directory on the SD card. This creates the CAT.TXT file in the SD card DATA directory.
- 4) Create a folder on the host computer for this miniDOT Logger deployment. Copy all files in the SD card DATA directory to this folder. Keep separate miniDOT Logger deployments in separate folders. Keep folders grouped into a folder for the specific miniDOT serial number.
- 5) Delete all files in the SD card DATA directory.
- 6) Replace the SD card in the miniDOT. Tape in place.

File management may be handled in other ways, but in any event be sure that the SD card DATA folder is empty prior to beginning a deployment. If it is not empty nothing bad happens but unpredictable miniDOT Logger operation may occur if the number of files becomes large, roughly over 1000 files.

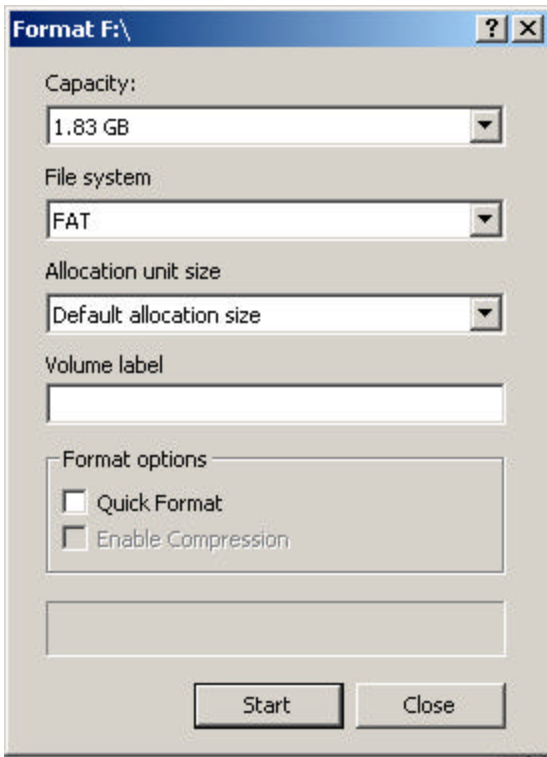
3.7 SD Card

miniDOT is supplied with a 2 GB SD card. Alternates can be purchased and used with miniDOT. Use only SanDisk 2 GB SD cards. Cards manufactured by other manufacturers may work also but PME has tried SanDisk. In any event use only 2 GB capacity cards.

Format every card prior to using with miniDOT.

Format cards only on a PC computer running a Windows operating system. Other computers or operating systems may work but PME has tried only Windows.

When formatting, select FAT, not NTFS or FAT32. Do not provide a volume label nor select Quick Format. Here is the correctly set Windows 2000 Format dialog:



Press Start!