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# miniDOT Clear

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## USER'S MANUAL

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# TABLE OF CONTENTS

WARRANTY.....	3
Limited Warranty .....	3
SAFETY INFORMATION .....	5
Bursting Hazard .....	5
CHAPTER 1: QUICK START .....	6
1.1 The Quickest Start Possible .....	6
1.2 A Few Details .....	8
1.3 Overview & General Maintenance .....	9
CHAPTER 2: SOFTWARE .....	15
2.1 Overview and Software Installation .....	15
2.2 miniDOT Control .....	16
2.3 miniDOT Plot.....	16
2.4 miniDOT Concatenate .....	19
CHAPTER 3: MINIDOT CLEAR LOGGER.....	21
3.1 Overview .....	21
3.2 Opening and Closing the miniDOT Clear Logger .....	21
3.3 Electrical Connections and Controls.....	22
3.4 Battery Replacement .....	23
3.5 Installing Copper Mesh or Plate.....	24
3.6 Final Mounting Instructions.....	25



# WARRANTY

## Limited Warranty

Precision Measurement Engineering, Inc. (“PME”) warrants the following products to be, as of the time of shipment, free from defects in materials or workmanship under normal use and conditions for the period indicated below corresponding to the product. The warranty period commences on the original date of purchase of the product.

Product	Warranty Period
Aquasend Beacon	1 year
miniDOT Logger	1 year
miniDOT Clear Logger	1 year
miniWIPER	1 year
miniPAR Logger (Logger only)	1 year
Cyclops-7 Logger (Logger only)	1 year
C-FLUOR Logger (Logger only)	1 year
T-Chain	1 year
MSCTI (excludes CT/C-sensors)	1 year
C-Sense Logger (Logger only)	1 year

For valid warranty claims made and covered defects existing during the applicable warranty period, PME will, at PME’s option, repair, replace (with the same or then most similar product) or repurchase (at purchaser’s original purchase price), the defective product. This warranty extends solely to the original end-user purchaser of the product. PME’s entire liability and the sole and exclusive remedy for product defects is limited to such repair, replacement or repurchase in accordance with this warranty. **This warranty is provided in lieu of all other warranties express or implied, including, but not limited to warranties of fitness for a particular purpose and warranties of merchantability.** No agent, representative, or other third party has any authority to waive or alter this warranty in any way on behalf of PME.

## WARRANTY EXCLUSIONS

The warranty does not apply in any of the following circumstances:



- I) The product has been altered or modified without PME's written authorization,
- II) the product has not been installed, operated, repaired, or maintained in accordance with PME's instructions, including, where applicable, use of proper grounding to an earth ground source,
- III) the product has been subjected to abnormal physical, thermal, electrical, or other stress, internal liquid contact, or misuse, neglect, or accident,
- IV) the product failure occurs as a result of any cause not attributable to PME,
- V) the product is installed with ancillary devices such as flow sensors, rain switches, or solar panels that are not listed as compatible with the product,
- VI) the product is installed in a non-PME specified enclosure or with other incompatible equipment,
- VII) to address cosmetic issues such as scratches or surface discoloration,
- VIII) operation of the product in conditions other than that for which the product was designed,
- IX) the product has been damaged due to events or conditions such as caused by lightning strikes, power surges, unconditioned power supplies, floods, earthquakes, hurricane, tornados, vermin such as ants or slugs or intentional damage, or
- X) products provided by PME, but manufactured by a third-party company, which products are subject to the applicable warranty extended by their manufacturer, if any.

**There are no warranties that extend beyond the above limited warranty. In no event is PME responsible or liable to purchaser or otherwise for any indirect, incidental, special, exemplary, or consequential damages, including, but not limited to, lost profits, loss of data, loss of use, business interruption, loss of good will, or cost of procuring substitute products, arising out of or in relation to the product, even if advised of the possibility of such damages or losses. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.**

#### **WARRANTY CLAIM PROCEDURES**

A warranty claim must be initiated within the applicable warranty period by first contacting PME at [info@pme.com](mailto:info@pme.com) to obtain an RMA number. The purchaser is responsible for proper packaging and return shipment of the product to PME (including shipping expense and any related duties or other costs). The issued RMA number and purchaser's contact information must be included with the returned product. PME is NOT liable for loss or damage of the product in return transit and recommends that the product be insured for its full replacement value.

All warranty claims are subject to PME's testing and examination of the product to determine if the warranty claim is valid. PME may also require additional documentation or information from the purchaser to evaluate the warranty claim. Products repaired or replaced under a valid warranty claim will be shipped back to the original purchaser (or its designated distributor) at PME's expense. If the warranty claim is found to be not valid for any reason, as determined by PME in its sole discretion, PME will notify the purchaser at the contact information provided by the purchaser.



## SAFETY INFORMATION

### Bursting Hazard

Should water enter the miniDOT Clear Logger and come into contact with the enclosed batteries, then 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 Clear Logger is designed to release internal pressure, as the black end cap is unscrewed, prior to the disengagement of the black end cap threads. If internal pressure is suspected, then treat the miniDOT Clear Logger with extreme caution.



# CHAPTER 1: QUICK START

## 1.1 The Quickest Start Possible

Your miniDOT Clear Logger has arrived completely ready to go. It is set to measure and record time, battery voltage, temperature, oxygen concentration, and measurement quality once every 10 minutes and write one file of measurements daily. Open the miniDOT Clear Logger and move the Logger Control Switch to the “Record” position. In this condition, the miniDOT Clear Logger will record measurements for a year before the internal batteries are expended. You must re-close the miniDOT Clear Logger prior to deploying it.

At the end of the deployment period, open the miniDOT Clear Logger and connect it to a HOST computer via the USB connection. The miniDOT Clear Logger will appear as a ‘thumb drive’. Your temperature and oxygen concentration measurements, together with a time stamp indicating the time the measurements were made, are recorded in text files in the folder having the serial number of your miniDOT Clear Logger. These files can be copied onto any Windows or Mac HOST computer.

This Manual and other software programs are also recorded on the miniDOT Clear Logger.

- **MINIDOT CONTROL PROGRAM:** Allows you to see the state of the miniDOT Clear Logger as well as set the recording interval.
- **MINIDOT PLOT PROGRAM:** Allows you to see the plots of the recorded measurements.
- **MINIDOT CONCATENATE PROGRAM:** Gathers all the daily files into one CAT.txt file.

Your miniDOT Clear Logger will return to recording measurements after you disconnect the USB connection. If you wish to stop recording, then move the Logger Control Switch to the “Halt” position.

You may move the Logger Control Switch at any time.

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

1. Open the miniDOT Clear Logger by unscrewing the clear pressure housing from the black end cap. It opens like a flashlight. Remove the clear pressure housing completely. Inside you will see the circuit pictured below:





2. Move the Logger Control Switch to the “Record” position. The LED will flash green 5 times. The miniDOT Clear Logger will now record a measurement of time, battery voltage, temperature, and dissolved oxygen every 10 minutes (or at some other interval you may have set using the miniDOT Control program).
3. Inspect the o-ring seal for debris.
4. Close the miniDOT Clear Logger by screwing the clear pressure housing back onto the black end cap.
5. Deploy the miniDOT Clear Logger.

**Follow these steps to end the deployment:**

1. Recover the miniDOT Clear Logger
2. Clean and dry all accessible surfaces except the ‘sensing foil’.
3. Open the miniDOT Clear Logger by unscrewing the clear pressure housing from the black end cap. Remove the clear pressure housing completely, taking care that water does not drip onto interior surfaces of circuits or other items inside the miniDOT Clear Logger.
4. Connect to a Windows HOST computer via the USB connection. The miniDOT Clear Logger will appear as a ‘thumb drive’.
5. Copy the folder having the same serial number as the miniDOT Clear Logger (example 7450-0001) to the HOST computer.
6. (Suggested, but optional) Delete the measurement folder, but NOT the miniDOT Control program or the other .jar programs.
7. (Optional) Run the miniDOT Control program to see the state of the miniDOT Clear Logger such as battery voltage or to select a different recording interval.



8. (Optional) Run the miniDOT PLOT program to see a plot of measurements.
9. (Optional) Run the miniDOT Concatenate program to gather all the daily files of measurements into one CAT.txt file.
10. If no more recording is desired, then move the Logger Control Switch to “Halt”, otherwise leave it set to “Record” to continue recording measurements.
11. Disconnect the miniDOT Clear Logger from the USB connection.
12. Inspect the o-ring seal for debris.
13. Close the miniDOT Clear Logger by screwing the clear pressure housing back onto the black end cap.
14. Remove the batteries if storing the miniDOT Clear 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 Clear Logger.

### RECORDING INTERVAL

The miniDOT Clear Logger measures and records time, battery voltage, temperature, dissolved oxygen concentration and measurement quality at equal time intervals. The default time interval is 10 minutes. However, it is also possible to instruct the miniDOT Clear Logger to record at different intervals. This is accomplished by running the miniDOTControl.jar program supplied with the miniDOT Clear Logger. Recording intervals must be 1 or more minutes and must be less than or equal to 60 minutes. Intervals outside this range will be rejected by the miniDOT Control program. (Contact PME for other recording intervals.)

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

### TIME

All miniDOT Clear Logger times are UTC (formerly known as Greenwich mean time (GMT)). The miniDOT Clear Logger internal clock will drift in the <10 ppm range (< about 30 seconds/month) so you should plan to connect it occasionally to a HOST computer having an Internet connection. The miniDOT Control program will automatically set time based on an Internet time server. If the logger has an issue correcting its time, please contact PME.

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

### FILE INFORMATION





The miniDOT Clear Logger software creates 1 file daily on the miniDOT Clear Logger's internal SD card. The number of measurements in each file will depend upon the sample interval. Files are named by the time of the first measurement within the file based on the miniDOT Clear Logger's internal clock and expressed in YYYY-MM-DD HHMMSSZ.txt format. For example, a file having the first measurement on September 9, 2014 at 17:39:00 UTC will be named:

2014-09-09 173900Z.txt.

Files can be uploaded from the miniDOT Clear Logger by connecting it to a HOST computer. Use the HOST computer's copy/paste functions to move the files from the miniDOT Clear Logger to the HOST computer.

Each measurement within the files has a time stamp. The time stamp format is Unix Epoch 1970, the number of seconds that have passed since the first moment of 1970. This may be inconvenient in some cases. If so, then the miniDOT Concatenate program not only concatenates all the measurement files, but also adds more readable statements of the time stamp.

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

The miniDOT Clear Logger requires time and battery energy to work through the file directory on the SD card to allocate new file space. A few hundred files on the SD card is not a problem, but as the number of files grows large into the thousands then the miniDOT Clear Logger may suffer decreased battery life or other performance problems. Please, at the earliest convenient time, copy the recorded files to a HOST computer and delete them from miniDOT Clear Logger's SD card. Also, do not use miniDOT Clear Logger to store files unrelated to the miniDOT Clear Logger's operation.

## 1.3 Overview & General Maintenance

### CLEANING THE SENSING FOIL

The sensing foil can be cleaned at regular intervals depending on the fouling condition at the site. The cleaning procedure of the sensing foil should be done with caution so that the protective coating is not removed. If the fouling is calcareous it can normally be dissolved with household vinegar.

If the marine growth remains, then use Q-tips to gently wipe the sensing foil after it has been softened by soaking in vinegar or perhaps diluted HCl. After cleaning the sensing foil, then it should be rinsed well in clean tap water before storing or reuse. Do not use other organic solvents such as acetone, chloroform, and toluene since these and others will damage the sensing foil.

*Never peel away untreated organisms from the oxygen sensing foil. Doing so will likely damage it.*

The sensing foil can also be cleaned using a 3% H<sub>2</sub>O<sub>2</sub> solution or rinsing it with ethanol.

The clear pressure housing and black end cap can be gently scrubbed however the clear pressure housing can easily scratch if an abrasive material is used. [Contact PME](#) for replace clear pressure housing.



Keep the sensing foil out of direct sunlight for extended periods of time.

### AA ALKALINE BATTERY LIFE

Alkaline batteries will give somewhat less performance than lithium, especially at low temperatures. Alkaline batteries are superior to lithium in one way: you can determine how much battery life remains by measuring the battery terminal voltage. For short deployments of a month or two, then alkaline batteries will provide adequate performance. For longer deployments, or for deployments in cold environments, then substitute lithium batteries.

### AA LITHIUM BATTERY LIFE

The miniDOT Clear 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 shows the approximate endurance of the miniDOT Clear Logger when powered by the Energizer L91 AA lithium / ferrous disulfide batteries:

Sample Interval (Minutes)	Main AA Battery Life (Months)	Number of Samples
1	12	500K
10	>12	>52,000
60	>12	>8,000

Keep a general record of the miniDOT Clear Logger's number of samples. It is not possible to accurately tell the charge state of a lithium battery by measuring 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.

The numbers in the table above are, at the time of this writing, based upon extrapolations of testing of 500K samples acquired at a 5-second interval. The 1-year performance at 1 minute is very likely. Performance at longer sample intervals will be much longer, but how long is difficult to predict. In any event, these AA batteries are easily available and relatively inexpensive compared to the cost of the miniDOT Clear Logger. PME suggests you replace the batteries often, especially before any long (months) measurement deployments.

Monitor battery voltage in the miniDOT Control program. You cannot tell from terminal voltage of a lithium battery how long the battery will last, but you can tell if it will die soon. The Low Drain Performance plot below gives an estimate of terminal voltage for both lithium and alkaline batteries.



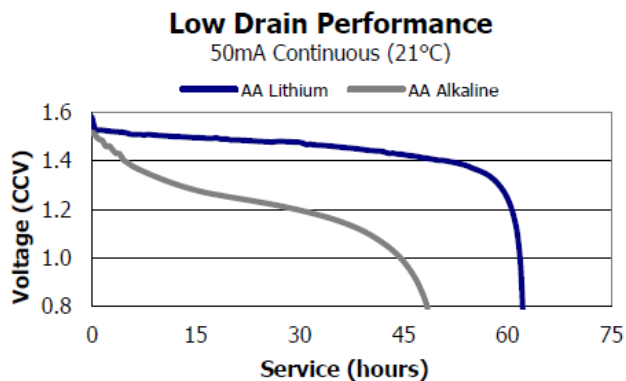
You can operate batteries down to about 2.4 Volts (for two in series, 1.2 Volts on the graph below). Remove the batteries and measure each of them. If your combined battery voltage is less than 2.4 Volts, replace the batteries.

You may also use alkaline AA batteries such as Duracell Coppertop. They will not last nearly as long, especially at low temperatures, but will likely be adequate for several weeks at 10-minute interval.

When replacing batteries use only fresh batteries. Do not mix battery types. If one battery differs in type or charge level from the other and the miniDOT Clear Logger runs them to full discharge, then one battery may leak. SEE SECTION 3.4 FOR CAUTION ON BATTERY PLACEMENT.

*Error on the side of caution when planning your deployment.*

The recommended battery is the Energizer L91 lithium battery. For more information including the performance at low temperatures, then click the link: <http://data.energizer.com/PDFs/l91.pdf>



The figure to the left gives a general idea of terminal voltage vs. lifetime. Service life in hours is incorrect since miniDOT Clear Logger draws far less than 50 mA continuously, but the general shape of the voltage vs. time gives an estimate of life remaining. This plot is taken from the manufacturer's specification. The plot is for a single battery. The miniDOT Clear Logger halts operation at a total of 2.4 Volts.

### COIN CELL BATTERY LIFE

The miniDOT Clear Logger uses a coin cell battery for backup of the clock when the power is switched off. This coin cell battery will supply many years of clock operation. Should the coin cell battery discharge, then it must be replaced by PME. Contact PME.



## RECALIBRATION

The miniDOT Clear Logger will maintain its calibration without the necessity of adjustment by the user. The miniDOT Clear Logger should be returned to PME for re-calibration. We suggest that this be done yearly.

## O-RING AND SEAL

When the clear pressure housing is screwed on to the black end cap, then it passes along the o-ring located in the black end cap several revolutions. Keep this o-ring lightly lubricated with silicone grease or an oil compatible with buna-N o-ring material.

It is important to keep the o-ring free of debris. Failure to do so can lead to a breaching of the seal and water entry into the logger housing. Wipe off debris with a lint free clean cloth. PME recommends Kimtech Kimwipes for this application. Next, re-lubricate the o-ring.

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

## LED INDICATIONS

The miniDOT Clear Logger indicates its operation with its LED. The table below presents LED indications:

LED	Reason
1 Green Flash	Normal. Presented immediately after new batteries are installed. Indicates that the CPU has started its program.
1 Green Flash	Occurs at the time of sampling for sample intervals of 1 minute or less.
5 Green Flashes	Normal. Indicates that miniDOT Logger is beginning to record measurements. This indication appears in response to switching the Logger Control Switch to "Record."
5 Red Flashes	Normal. Indicates the miniDOT Logger is ending recording of measurements. This indication appears in response to switching the Logger Control Switch to "Halt."
Continuously Green	Normal. Indicates the miniDOT Logger is connected to a HOST computer via the USB connection.
Continuously Flashing Red	SD card write error. Try removing/reinstalling batteries. Contact PME.



## VERIFYING CALIBRATION

You may from time to time want to verify the calibration of your miniDOT Clear Logger. Do this by placing the miniDOT Clear Logger in a black 5-gallon bucket containing 4 gallons of fresh water. (The picture below shows a white bucket so that the miniDOT Clear Loggers are more easily seen.) The miniDOT Clear Logger's black end cap is heavy and the miniDOT Clear Logger will tend to flip so that this end is down. Prevent this somehow. The miniDOT Clear Logger must be placed in the bucket with the black end cap upwards. Otherwise bubbles will accumulate in the black end cap area and miniDOT Clear Logger will not sense the DO in the water correctly. Use an aquarium pump and air stone in the water to provide a bubble stream. Cover the bucket with a black lid. The idea is to prevent light from enabling algal growth.



Record measurements for several hours or a day, but in any event long enough for the miniDOT Clear Logger's temperature to come to equilibrium with the water. During the experiment, find the local air pressure, either from measurements or from a local weather station. Watch out... weather stations often report barometric pressure referenced to sea level. You must determine the absolute barometric pressure at your elevation.

A more comprehensive experiment is to additionally place ice in the bucket and mix until the water temperature is close to zero degrees. Next, remove the ice. Place the bucket on a towel or piece of cardboard and cover the top of the bucket with a towel. Record for 24 hours as the bucket temperature gradually returns to room temperature.

After recording the bubbled water, you may also remove the air stone and gently mix a packet of baker's yeast into the bucket together with a tablespoon of sugar. The water must be only slightly warm to the touch but not more than 30 deg C. These organisms will deplete all the dissolved oxygen in the water. Cut a disc of thin plastic film just large enough to lay on top of the water. Place this on top of the water. Do not stir or bubble after placing the film. Record measurements for at least an hour or more.

Use the miniDOT Clear Logger's miniDOT Plot program to examine the measurements. Saturation values should be very close to 100%, depending upon the accuracy that you have determined barometric pressure. If you placed ice in the bucket, then saturation values will still be 100%. You will see the DO concentration and temperature change greatly as the bucket warms.

The recorded data, when using yeast should show 0% saturation and 0 mg/l dissolved oxygen concentration. In practice the miniDOT Clear Logger often reports slightly positive values of about 0.1 mg/l, but within the accuracy of the miniDOT Clear Logger.



## CLOSING AND OPENING

Close and open the miniDOT Clear Logger like you would a flashlight; open by unscrewing the clear pressure housing from the black end cap. Close by screwing the clear pressuring housing on to the black end cap. When closing, do not tighten the clear pressure housing. Just screw it on until it contacts the black end cap. See Chapter 3 for more instructions.

*Caution: DO NOT remove the stainless-steel screws in the black end cap. There are no user serviceable parts here. If the screws are removed, then you will damage the miniDOT Clear Logger and it will have to be returned for repair.*

## STORAGE WHEN NOT IN USE

Remove the batteries. Keep the black end covered with the cap supplied by PME. If the cap is lost, then cover the black end cap with aluminum foil. There may be a calibration effect of ambient lighting so attempt to keep ambient light from reaching the sensing foil as much as possible.

## JAVA

miniDOT Clear programs depend on Java and require Java 1.7 or higher. Update Java at <https://java.com/en/>.

## ENVIRONMENTAL USE AND STORAGE CONDITIONS

miniDOT Clear is useful over the range of 0 to 150% saturation of dissolved oxygen, over the range of 0 to 35 deg C temperature and may be continuously immersed in fresh or salt water to a maximum depth of 100 meters. miniDOT Clear may be stored in environments ranging from 0 to 100% humidity and temperatures ranging from -20 deg C to +40 deg C.

## ELECTRICAL POWER SPECIFICATIONS

miniDOT Clear is battery powered and requires 2 AA size expendable or rechargeable batteries. Voltage requirement is 3.6 VDC. Maximum current demand is 30 mA.



## CHAPTER 2: SOFTWARE

### 2.1 Overview and Software Installation

The miniDOT Clear Logger arrives with these files on the SD card:

- miniDOTControl.jar program allows you to see the state of the miniDOT Clear Logger as well as set the recording interval.
- miniDOTPlot.jar program allows you to see the plots of the recorded measurements.
- miniDOTConcatenate.jar program gathers all the daily files into one CAT.txt file.
- Manual.pdf is the manual.

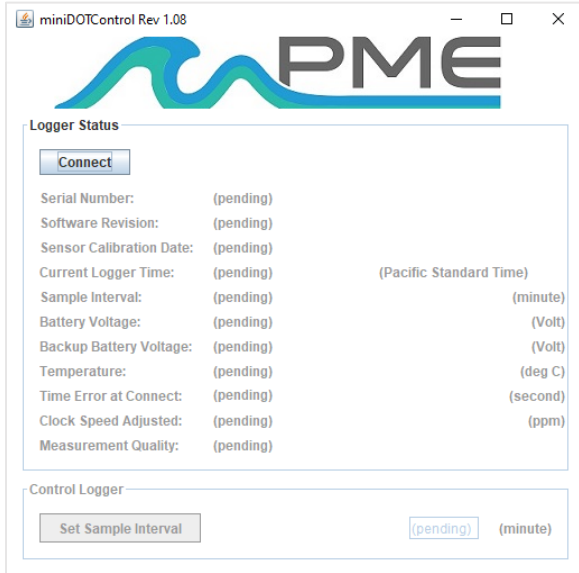
These files are located on the root directory of the miniDOT Clear Logger.

PME suggests you leave these programs where they are on the miniDOT Clear Logger, but you may copy them to any folder on your HOST computer's hard drive.

miniDOT Control, miniDOT Plot, and miniDOT Concatenate programs are Java language programs that require the HOST computer to have the Java Runtime Engine V1.7 (JRE) or later versions installed. This engine is commonly required for Internet applications and will likely already be installed on the HOST computer. You can test this by running the miniDOT Plot program. If this program displays its graphical user interface, then the JRE is installed. If not, then the JRE can be downloaded via the Internet from <http://www.java.com/en/>.

At this time, the miniDOT Clear Logger is supported on the Windows operating systems but may also operate on Macintosh and perhaps Linux.





## 2.2 miniDOT Control

Begin program operation by clicking “miniDOTControl.jar”. The program presents the screen shown below:

The miniDOT Clear Logger must be connected to the HOST computer via the USB connection at this time. When correctly connected, the miniDOT Clear Logger’s LED will display a constant green light.

Click the “Connect” button. The program will contact the miniDOT Clear Logger. If the connection is successful, then the button will turn green and display “Connected”. The Serial Number and other parameters will be filled in from the information taken from the miniDOT Clear Logger.

If the HOST computer is connected to the Internet, then the current difference between an Internet time server’s time and the miniDOT Clear Logger’s internal clock will be displayed. If more than a week has passed since time was last set, then the miniDOT Clear Logger’s clock will be set and the check mark icon will appear. If the HOST computer is not connected to the Internet, then no time services will occur. If the miniDOT Clear is unable to automatically set time and there is a large time error at connect, please contact PME about correcting this.

The current miniDOT Clear Logger’s sample interval will be displayed next to the “Set Sample Interval” button.

To set the interval, enter an interval not less than 1 minute and not greater than 60 minutes. Click the “Set Sample Interval” button. Shorter and faster intervals are available. Contact PME.

If this interval is acceptable, then the interval need not be set.

End the miniDOT Control program by closing the window. Disconnect the miniDOT Clear Logger’s USB cable.

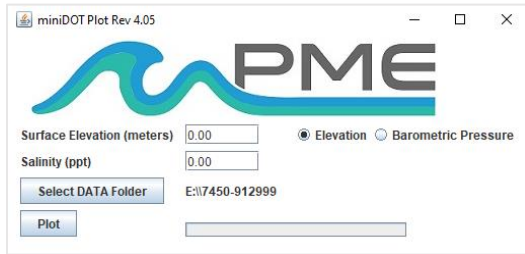
Upon disconnection of the USB cable, the miniDOT Clear Logger will begin logging or remain halted as indicated by the position of the Logger Control Switch.

## 2.3 miniDOT Plot

Begin the program operation by clicking “miniDOTPlot.jar”. The program presents the screen shown below.







The miniDOT Plot program plots the files recorded by the miniDOT Clear Logger. The program reads all the miniDOT Clear Logger files in a folder, except the CAT.txt file. The program will also compute air saturation from the dissolved oxygen measurements. To do this, the program must know the air pressure and salinity. It calculates air pressure based on elevation of the water surface above sea level or uses the

barometric pressure you enter if Barometric Pressure is selected. If the Surface Elevation is entered, then no compensation for weather-induced barometric pressure variation is made. Enter elevation or barometric pressure. Enter water salinity.

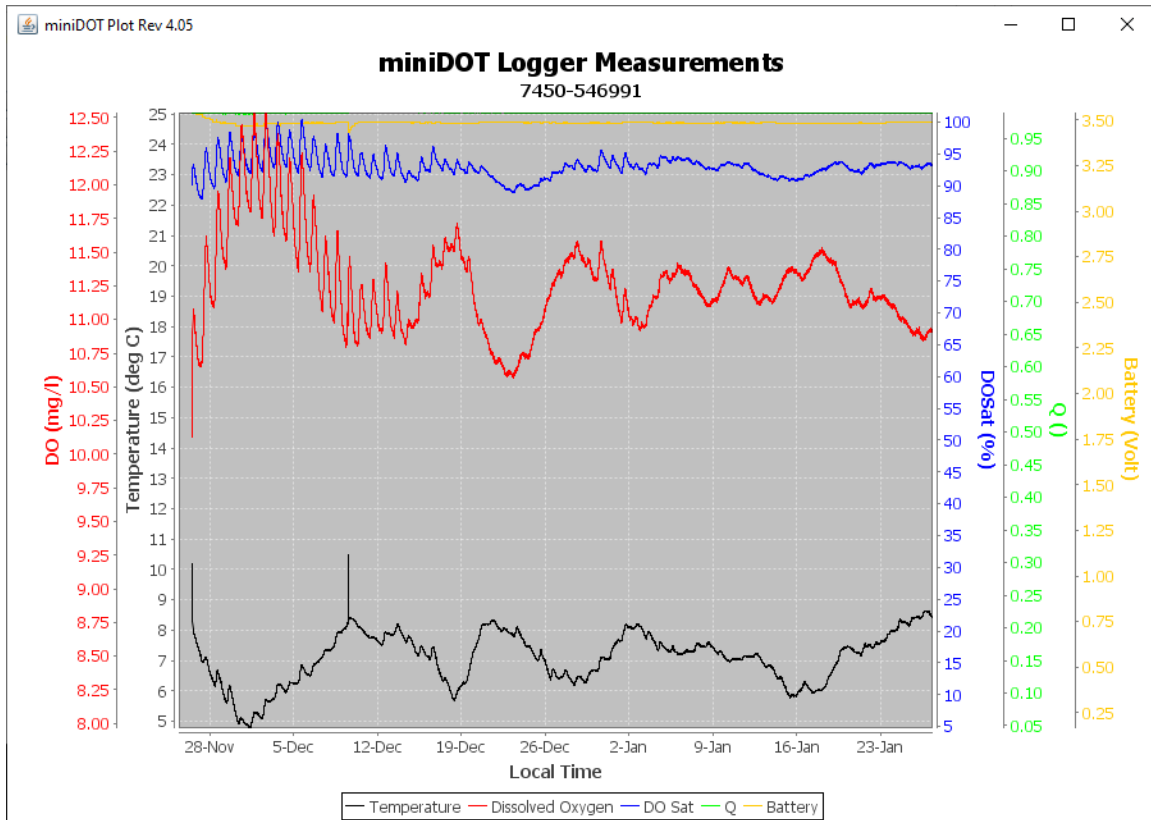
Select the folder that contains the files recorded by the miniDOT Clear Logger. If the miniDOT Plot program is run directly from the miniDOT Clear Logger, then the program will suggest the folder that is located on the miniDOT Clear Logger's SD card. You may accept this by clicking "Plot", or you may click "Select DATA Folder" to browse to your HOST computer's hard drive. If the number of measurements recorded is small, for example a few thousand, then these can conveniently be plotted directly from the miniDOT Clear Logger's storage. However, it is best to copy large measurement sets to the HOST computer and select them there. The file access to the miniDOT Clear Logger is slow.

The miniDOT Clear Logger's measurement folders must NOT contain any files besides those the miniDOT Clear Logger recorded and the CAT.txt file.

Click "Plot" to begin plotting.

The program reads all the miniDOT Clear Logger's data files in the selected folder. It concatenates these and presents 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. Copies of the plot can be obtained by right clicking on the plot and selecting Copy from the pop-up menu.

Different DATA Folders can be selected during one session of the program. In this case the software produces multiple plots. Unfortunately, the plots are presented exactly on top of one 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 previous plots.

The program can be re-run at any time. If an already processed DATA Folder is selected, then the program simply reads the miniDOT Clear Logger's measurement files again.

End the miniDOT Plot program by closing the window.

Special note: plotting of sample sets of more than 200K samples may consume all the memory available to the JRE. The miniDOT Plot program will present a partial plot and freeze in this case. A simple solution is to separate the files into multiple folders and plot each folder individually. A special miniDOT Plot that sub-samples can be provided by PME. Please [contact PME](#) in this case.

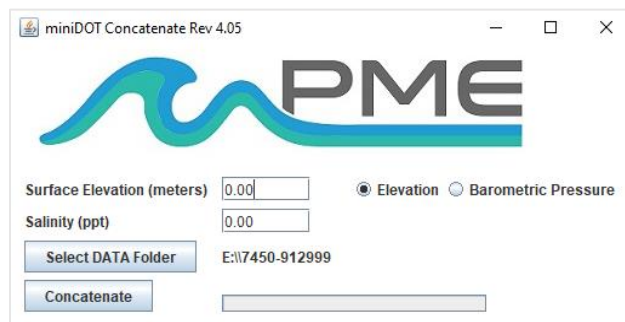


## 2.4 miniDOT Concatenate

Begin the program operation by clicking “miniDOTConcatenate.jar”. The program presents the screen shown below.

The miniDOT Concatenate program reads and concatenates the files recorded by the miniDOT Clear Logger. This program produces a CAT.txt file in the same folder as selected for the data. The CAT.txt file contains all the original measurements and contains two additional statements of time and air saturation. To compute saturation, the program must know the air pressure and salinity. It calculates air pressure based on elevation of the water surface above sea level or uses the barometric pressure you entered if the Barometric Pressure was selected. If Surface Elevation is entered, then no compensation for weather-induced barometric pressure variation is made. Enter elevation or barometric pressure. Enter water salinity.

Select the folder that contains the files recorded by the miniDOT Clear Logger. If the miniDOT Plot



program is run directly from the miniDOT Clear Logger, then the program will suggest the folder located on the miniDOT Clear Logger. You may accept this by clicking “Concatenate”, or you may click “Select DATA Folder” to browse your HOST computer’s hard drive. If the number of measurements recorded is small, for example a few thousand, then these can conveniently be plotted directly from the miniDOT Clear Logger’s storage. However, it is best to copy large measurement sets to the HOST computer and

select them there. The file access to the miniDOT Clear Logger is slow.

The miniDOT Clear Logger measurement folders must NOT contain any files besides those the miniDOT Clear Logger recorded and the CAT.txt file.

Click “Concatenate” to begin concatenating files and create the CAT.txt file.



The CAT.txt file will resemble the following:

```
1 MiniDOT Logger Concatenated Data File
2 Sensor: 7392-0002
3 Concatenation Date: 2014Jun30 10:20:40 PDT
4
5 DO concentration compensated for salinity: 0.0 (ppt)
6 Saturation computed at elevation: 0.0 (meter)
7
8 Unix Timestamp, UTC_Date_&_Time, Pacific Standard Time, Battery,
9 (Second), (none), (none), (Volt),
10 1402942957, 2014-06-16 18:22:37, 2014-06-16 11:22:37, 3.310000,
11 1402942959, 2014-06-16 18:22:39, 2014-06-16 11:22:39, 3.320000,
12 1402942961, 2014-06-16 18:22:41, 2014-06-16 11:22:41, 3.320000,
13 1402942963, 2014-06-16 18:22:43, 2014-06-16 11:22:43, 3.320000,
14 1402942965, 2014-06-16 18:22:45, 2014-06-16 11:22:45, 3.320000
```

End the miniDOT Concatenate program by closing the window



## CHAPTER 3: MINIDOT CLEAR LOGGER

### 3.1 Overview

All miniDOT Clear Logger measurements are saved in files on the SD card inside the miniDOT Clear Logger. The files are transferred to a HOST computer via a USB connection where the miniDOT Clear Logger appears as a “thumb drive”. Measurements may be plotted by the miniDOT Plot program and files concatenated by the miniDOT Concatenate program. The miniDOT Clear Logger itself is controlled by the miniDOT Control program. Customers are required to open the logger each time measurements are transferred to the HOST computer. This chapter describes the miniDOT Clear Logger’s internal features.

### 3.2 Opening and Closing the miniDOT Clear Logger

The miniDOT Clear Logger’s circuitry is contained in a clear waterproof housing that must be opened. Unscrewing the clear pressure housing from the black end cap opens the miniDOT Clear Logger. This is like opening a flashlight. Turn the clear pressure housing counterclockwise relative to the black end cap. Close the miniDOT Clear Logger by reversing this procedure after being sure that the o-ring is free from debris. If debris is found, then wipe it off with a clean lint free cloth. PME recommends Kimtech Kimwipes for this application. Next, re-lubricate the o-ring with silicone grease or oil intended for buna-N o-ring material.

Please attempt to handle the miniDOT Clear Logger by only touching the aluminum chassis. Try not to touch the circuit board.

When closing the miniDOT Clear Logger, inspect the o-ring and the interior of the clear pressure housing for debris. Lubricate the o-ring, and screw the clear pressure housing onto the black end cap until the clear pressure housing just touches the black end cap. Do not tighten! The miniDOT Clear Logger tends to get a little tighter during deployment.

If you cannot open the miniDOT Clear Logger by yourself, then find another person with strong hands. This person should grip the black end cap while the other person turns the clear pressure housing.

*Caution: Do NOT remove the stainless screws in the black end cap. If this is done, then the miniDOT Clear Logger will be permanently damaged and must be returned for repair.*



### 3.3 Electrical Connections and Controls

Removal of the cover reveals the miniDOT Clear Logger's connections and controls, shown below.



The LED Light is a LED that can display either red or green light. This is used to indicate the different features described in Chapter 1 in this manual.

The Logger Control Switch controls the miniDOT Clear Logger's mode:

Record – When the switch is in this position the miniDOT Clear Logger is recording measurements.

Halt – When the switch is in this position the miniDOT Clear Logger is not recording and is sleeping at low power.



The USB Connection allows communication between the miniDOT Clear Logger and an external HOST computer. When connected, the miniDOT Clear Logger is in HALT mode regardless of the Logger Control Switch position. When disconnected, the miniDOT Clear Logger's mode is controlled by the Logger Control Switch position. The switch position may be changed while the USB is connected.





The LCD Screen shows the status of the miniDOT Clear Logger. The screen will display information as long as the AA batteries are installed. When the Logger Control Switch is in HALT, the screen displays the miniDOT serial number, operating system revision, calibration date, and status (“Halted”)



If the miniDOT Clear Logger is connected to a computer via the USB cable, the screen will indicate if a successful computer connection has been made.

When the Logger Control Switch is set to RECORD, the LED light will flash, and the LCD Screen will display the recording interval. The logger will then wait for the next sample interval time to display a reading. If the logger is set to the default 10-minute sample interval, the screen will display a reading 10 minutes after the logger is set to Record mode.

At this time, the logger will display the latest temperature (deg C) and oxygen (mg/L) measurements along with the battery voltage. These readings will remain static until the next sample interval when a new measurement is taken and displayed.

**NOTE:** miniDOT Clear units equipped with a 16GB SD card will take longer to appear as a useable removable disk drive on your computer.

The **Main Batteries** (2 X AA on side opposite to pictured side above) provide main power to the miniDOT Clear Logger. Note the positive (+) terminal. Batteries are described in Chapter 1 of this manual.

### 3.4 Battery Replacement

Be sure that the replacement batteries are compatible with the miniDOT Clear Logger. PME recommends Energizer L91 AA size lithium batteries or Duracell AA size alkaline batteries.

<http://data.energizer.com/PDFs/l91.pdf>

[https://d2ei442zrkqy2u.cloudfront.net/wp-content/uploads/2016/03/MN1500\\_US\\_CT1.pdf](https://d2ei442zrkqy2u.cloudfront.net/wp-content/uploads/2016/03/MN1500_US_CT1.pdf)



*Caution: Improper replacement of the batteries will damage the miniDOT Clear Logger.*

**Follow these steps:**

1. Move the miniDOT Clear Logger's Control Switch to the "Halt" position.
2. Remove the depleted batteries noting the position of the (+) terminal.
3. Use only new, fully charged batteries, both of the same type.
4. Install fresh batteries with the (+) position the same as the removed batteries. The (+) position is also marked on the inside of the battery holder.
5. The miniDOT Clear Logger's LED Light should flash to indicate that the software is beginning operation within a second or two after you complete the battery installation. At this time, the logger will enter the mode selected by the Logger Control Switch (which should initially be "Halt" from Step 1).

*Please be aware that the warranty will become void if the batteries are installed backwards.*

### 3.5 Installing Copper Mesh or Plate

miniDOT Anti-Fouling Copper Kit includes:

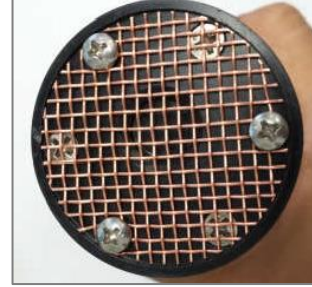
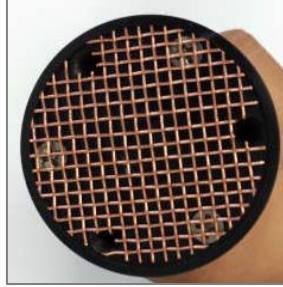
- 1 Cu Wire Mesh Disc 1 Cu Plate
- 1 Nylon Ring
- 3 Phillips Pan Head Screws

#### HOW TO INSTALL THE CU MESH ON A MINIDOT CLEAR LOGGER:

- |   |   |  |
|---|---|--|
| <p>1. Use a Phillips screwdriver to remove 3 of the 6 screws (every other one). Do NOT remove all screws. At least 3 must always remain screwed in.</p> | <p>2. Position the nylon ring under the Cu mesh so that the notches in the nylon ring and Cu mesh align over the screw holes.</p> | <p>3. Install the three pan head screws included in the kit. Gently tighten.</p> |
|---|---|--|







*CAUTION: Environments where debris can get trapped inside the sensing area should be avoided when using this product. PME recommends using the Cu plate in such environments.*

### HOW TO INSTALL THE CU PLATE ON A MINIDOT CLEAR LOGGER:

1. Use a Phillips screwdriver to remove 3 of the 6 screws (every other one). Do NOT remove all screws. At least 3 must always remain screwed in.
2. Position the Copper Plate faced down so that the notches in the Copper Plate perfectly align over sensing foil and over the screw holes.
3. Install the three pan head screws included in the kit. Gently tighten.

*Save the ss316 screws. They will be needed if the Cu mesh is removed.*



### 3.6 Final Mounting Instructions

Appropriate mounting of miniDOT Clear at the deployment site is the customer's responsibility. PME provides the suggestions below.



## EASY METHOD

miniDOT Clear has a broad flange at one end. The easy way to mount miniDOT Clear is by shackling this mounting flange to a bight tied into a rope. Several miniDOT Clear may be mounted on the rope in this way. This is the easy way, but subject to the considerations below.

## ABRASION

miniDOT Clear's oxygen sensing foil is constructed of silicone rubber and other materials. This material can be worn away with resulting loss of calibration. If miniDOT Clear is to be used in moving water transporting sand or other debris some protective housing must be constructed. The goal is to reduce water velocity near miniDOT Clear's sensing foil but at the same time allow water access, without accumulation of debris.

## BUBBLES

In some cases bubbles from sediment decomposition can rise through the water column. If these become trapped against miniDOT Clear's sensing foil, they will bias the miniDOT Clear's measurement. miniDOT Clear's sensing end is heavy compared to the rest of the instrument. miniDOT Clear will therefore tend to hang with the sensing end downwards and may trap bubbles. If bubbles are anticipated the mounting should arrange to position miniDOT Clear horizontally or with the sensing end upwards.

## FOULING

miniDOT Clear senses the oxygen concentration within its sensing foil. Software within miniDOT Clear uses this value to calculate the amount of oxygen that must have been present in the fresh water adjacent to the foil. The assumption that fresh water is in contact with the foil is implicit in this calculation. Fouling organisms that colonize the foil surface can interrupt the water-foil connection. In this case the oxygen concentration in the foil represents whatever oxygen is within the organisms. Living things use or generate oxygen and so their presence will bias miniDOT Clear's measurements. If fouling organisms are present the mounting should be designed to limit their presence or at least be designed so that the miniDOT Clear can be cleaned from time to time.

**Enjoy your new miniDOT Clear Logger!**

