



Precision Measurement Engineering, Inc. • www.pme.com

User's Manual 2019



Warranty

1-YEAR LIMITED WARRANTY ON miniPAR HARDWARE

Precision Measurement Engineering, Inc. (PME) warrant that the miniPAR 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 miniPAR 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 a pressure sensor, USB cable, and specifically the LI192 PAR sensor used in miniPAR) 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 miniPAR 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 miniPAR 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 miniPAR 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 miniPAR Logger with extreme caution.

Revision History

Date	Revision Description
2014JUN09	Initial Document, revised from 7392 - PRELIMINARY, NEEDS PICTURES
2017MAY17	Placed new photos in the document
2017MAY20	Added annotations to Controls section pictures. Fixed miniDOT on plot picture
2018APR09	Removed all references to miniDOT and changed to miniPAR
2018APR26	Replaced "dissolved oxygen" with PAR in statements of what is measured.
2019JAN31	Implemented 5 second average, revised battery replacement to insure valid accelerometer reset.
2019APR03	Expanded instructions on o-ring cleaning and maintenance

CONTENTS

Chapter 1 Quick Start

- 1.1 The Quickest Start Possible
- 1.2 A Few Details

Chapter 2 Software

- 2.1 Overview and Software Installation
- 2.2 miniPARControl
- 2.3 miniPARPlot
- 2.4 miniPARConcatenate

Chapter 3 miniPAR Logger

- 3.1 Overview
- 3.2 Opening and Closing the miniPAR Logger
- 3.3 Electrical Connections and Controls
- 3.4 Battery Replacement
- 3.5 Installing Copper Mesh or Plate

Chapter 1: Quick Start

1.1 The Quickest Start Possible

Your miniPAR Logger has arrived completely ready to go. It is set to measure and record PAR, temperature, time, battery voltage, and XYZ acceleration, once every 10 minutes and write one file of measurements daily. Open the miniPAR Logger and move the Logger Control Switch to the “Record” position. In this condition, the miniPAR Logger will record measurements for a year before the internal batteries are expended. You must re-close the miniPAR Logger prior to deploying it. Be sure to make sure the o-ring seal is free of debris before installing the outer case.

At the end of the deployment period, open the miniPAR Logger and connect it to a HOST computer via the USB connection. The miniPAR Logger will appear as a ‘thumb drive’. Your temperature, XYZ acceleration and PAR 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 miniPAR Logger. These files can be copied onto any Windows or Mac HOST computer.

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

- **miniPARControl** program allows you to see the state of the miniPAR Logger as well as set the recording interval.
- **miniPARPlot** program allows you to see the plots of the recorded measurements.
- **miniPARConcatenate** program gathers all the daily files into one CSV (comma-separated values) CAT.txt file.

Your miniPAR 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 PAR, T, and XYZ acceleration once each 10 minutes:

- 1) Open the miniPAR Logger by unscrewing the white pressure housing from the black end cap. It opens like a flashlight. Remove the white 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 miniPAR Logger will now record a measurement of time, battery voltage, temperature, PAR, and 3 axis acceleration every 10 minutes (or at some other interval you may have set using the miniPARControl program). The logger will start recording measurements at the start of the next minute.
- 3) Inspect the o-ring seal for debris.
- 4) Close the miniPAR Logger by screwing the white pressure housing back onto the black end cap.
- 5) Deploy the miniPAR Logger.

Follow these steps to end the deployment

- 1) Recover the miniPAR Logger
- 2) Clean and dry all accessible surfaces. Be careful of the white “dot” on the PAR sensor.
- 3) Open the miniPAR Logger by unscrewing the white pressure housing from the black end cap. Remove the white pressure housing completely, taking care that water does not drip onto interior surfaces of circuits or other items inside the miniPAR Logger.
- 4) Connect to a Windows HOST computer via the USB connection. The miniPAR Logger will appear as a ‘thumb drive’.
- 5) Copy the folder having the same serial number as the miniPAR Logger (example 7530-1234) to the HOST computer.
- 6) (Suggested, but optional) Delete the measurement folder, but NOT the miniPARControl program or the other .jar programs.
- 7) (Optional) Run the miniPARControl program to see the state of the miniPAR Logger such as battery voltage or to select a different recording interval. MiniPARControl will also update the time if the logger has drifted in time.
- 8) (Optional) Run the miniPARPlot program to see a plot of measurements.
- 9) (Optional) Run the miniPARConcatenate program to gather together 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 miniPAR Logger from the USB connection.
- 12) Inspect the o-ring seal for debris.
- 13) Close the miniPAR Logger by screwing the white pressure housing back onto the black end cap.

Remove the batteries if storing the miniPAR 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 miniPAR Logger.

Recording Interval – The miniPAR Logger measures and records time, battery voltage, temperature, PAR and 3-axis acceleration at equal time intervals. The default time interval is

10 minutes. However, it is also possible to instruct the miniPAR Logger to record at different intervals. This is accomplished by running the miniPARControl.jar program supplied with the miniPAR 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 miniPARControl program. (Contact PME for other recording intervals.)

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

Average – Beginning with operating system Rev 1.05 miniPAR Loggers implement averaging of the sensed PAR. This averaging is implemented to reduce the noise that light flicker nearby the surface can generate in the recorded measurements. Each recorded PAR value results from the average of 30 readings of PAR, taken over a 5 second period. This averaging consumes additional battery energy. However the 10 minute sampling interval for a year is still possible. The amount of averaging can be changed. miniPAR Loggers having operating systems prior to Rev 1.05 can be upgraded. Contact PME.

Time – All miniPAR Logger times are UTC (formerly known as Greenwich meantime (GMT)). The miniPAR 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 miniPARControl program will automatically set time based on an Internet time server.

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

File Information – The miniPAR Logger software creates 1 file daily on the miniPAR 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 miniPAR 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 miniPAR Logger by connecting it to a HOST computer. Use the HOST computer's copy/paste functions to move the files from the miniPAR 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 miniPARConcatenate 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 miniPARConcatenate program.

The miniPAR 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 miniPAR 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 miniPAR Logger's SD card. Also, do not use miniPAR Logger to store files unrelated to the miniPAR Logger's operation.

Cleaning the Sensor – Contact Li-Cor for instructions to clean the PAR sensor. The white pressure housing and black end cap can be gently scrubbed.

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 miniPAR Logger consumes battery power mostly from the measurement of PAR and temperature, but also slightly from simply keeping track of time, writing files, sleeping, and other activities. The following table shows the approximate endurance of the miniPAR Logger when powered by the Energizer L91 AA lithium / ferrous disulfide batteries:

SAMPLE INTERVAL (minutes)	Main AA Battery Life (months)	Number of Samples
1	1	50K (approx)
10	>12	50K (approx)
60	>12	25K (approx)

Keep a general record of the miniPAR 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 current demanded from batteries. The 1 month 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 miniPAR Logger. PME suggests you replace the batteries often, especially before any long (months) measurement deployments.

Monitor battery terminal voltage. 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. Your measured voltage will be 2X what is shown below since there are two batteries in series within the miniPAR Logger. You can operate batteries down to about 2.4 Volts (for two in

series, 1.2 Volts on the graph below). Your batteries are dead if the measurement of each battery adds to less than 2.4 Volts.

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. Alkaline batteries may leak if severely discharged.

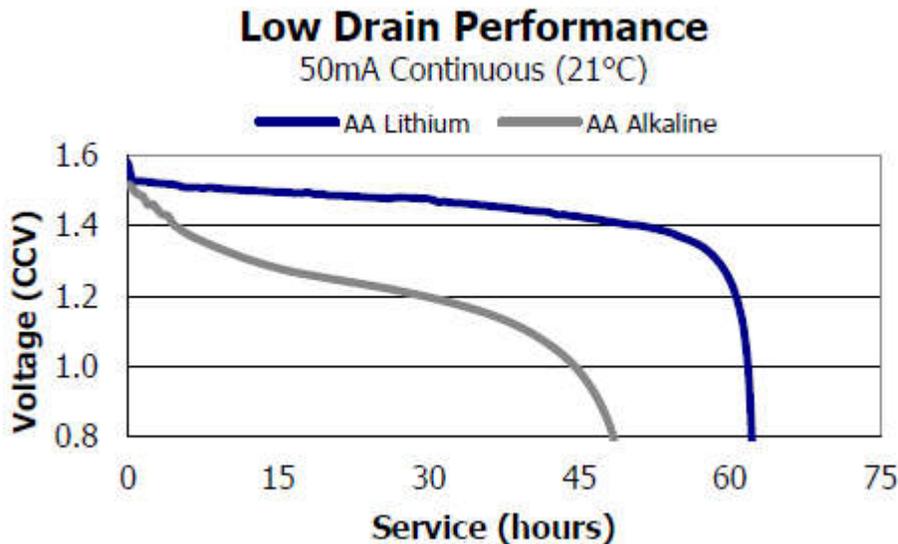
When replacing batteries use only fresh batteries. Don't mix battery types. If one battery differs in type or charge level from the other and the miniPAR Logger runs them to full discharge, then one battery may leak.

Err 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 below gives a general idea of terminal voltage vs. lifetime. Service life in hours is incorrect since miniPAR 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. Double the voltages shown to give the terminal voltage as measured in the picture above. The miniPAR Logger halts operation at a total of 2.4 Volts.



Coin Cell Battery Life – The miniPAR Logger uses a coin cell battery for backup of the clock when the AA batteries are removed. 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.

Re-calibration – The miniPAR Logger will maintain its calibration without the necessity of adjustment by the user. The miniPAR Logger should be returned to PME for recalibration. We suggest that this be done yearly. We do not calibrate miniPAR but rather we disassemble it and send the PAR sensor to Li-Cor for re-calibration. Follow Li-Cor’s suggestion on how often their sensors need to be calibrated.

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

LED Indications – The miniPAR 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 miniPAR 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 miniPAR Logger is ending recording of measurements. This indication appears in response to switching the Logger Control Switch to “Halt.”
Continuously Green	Normal. Indicates the miniPAR 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 – Compare miniPAR recordings to a light standard if available. The sensor can be covered with aluminum foil to get a zero point.

Closing and Opening – Close and open the miniPAR Logger like you would a flashlight; open by unscrewing the white pressure housing from the black end cap. Close by screwing the white pressuring housing on to the black end cap. When closing, do not tighten the white pressure housing. Just screw it on until it makes contact with the black end cap. See Chapter 3 for more instructions.

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 – miniPAR programs depend on Java and require Java 1.7 or higher. Update Java at

<https://java.com/en/download/index.jsp>

Chapter 2: Software

2.1 Overview and Software Installation

The miniPAR Logger arrives with these files on the SD card:

- **miniPARControl.jar** program allows you to see the state of the miniPAR Logger as well as set the recording interval.
- **miniPARPlot.jar** program allows you to see the plots of the recorded measurements.
- **miniPARConcatenate.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 miniPAR Logger.

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

miniPARControl, miniPARPlot, and miniPARConcatenate 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 miniPARPlot 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/download/windows_xpi.jsp

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

2.2 miniPARControl

Begin program operation by clicking "miniPARControl.jar". The program presents the screen shown below:



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

Click the "Connect" button. The program will contact the miniPAR 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 miniPAR Logger.

If the HOST computer is connected to the Internet, then the current difference between an Internet time server's time and the miniPAR Logger's internal clock will be displayed. If more than a week has passed since time was last set, then the miniPAR Logger's clock will be set and the checkmark icon will appear. If the HOST computer is not connected to the Internet, then no time services will occur.

The current miniPAR 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 miniPARControl program by closing the window. Disconnect the miniPAR Logger’s USB cable.

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

2.3 miniPARPlot

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



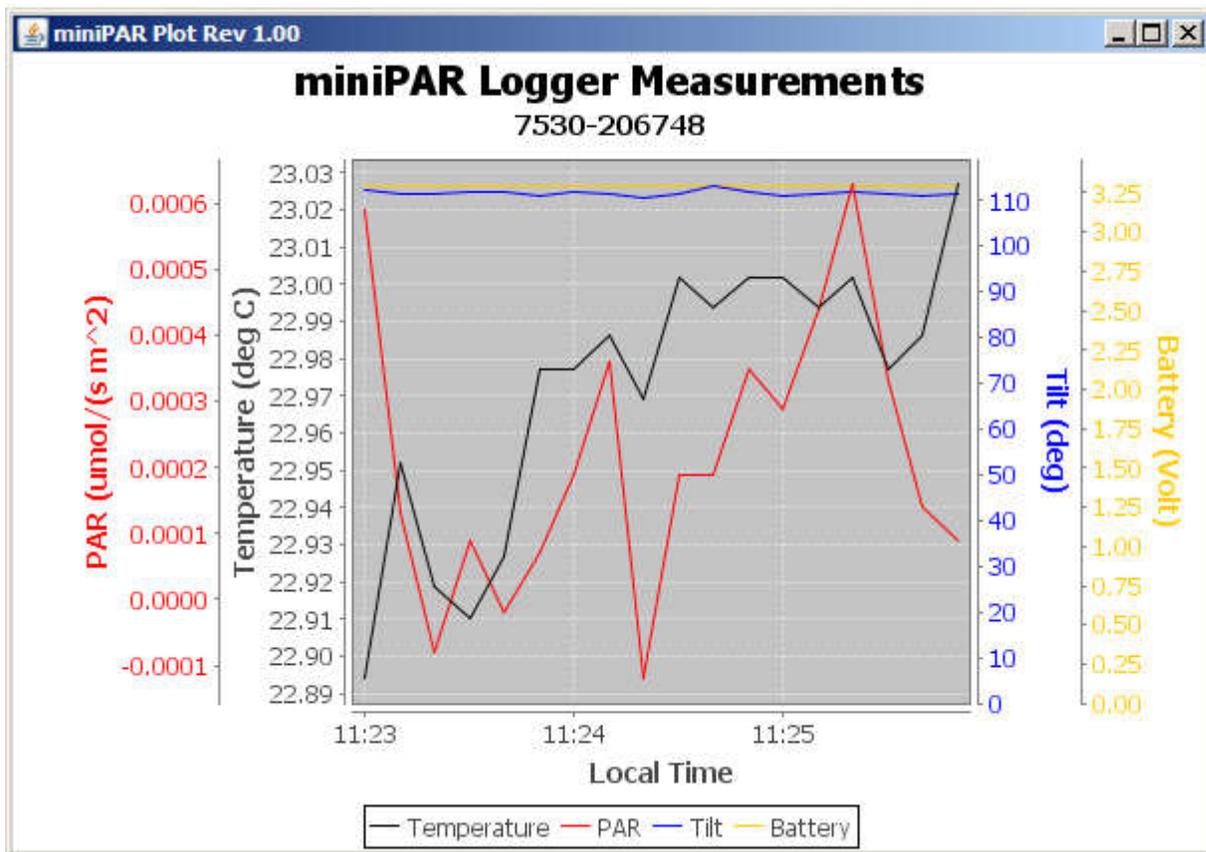
The miniPARPlot program plots the files recorded by the miniPAR Logger. The program reads all the miniPAR Logger files in a folder, except the CAT.txt file.

Select the folder that contains the files recorded by the miniPAR Logger. If the miniPARPlot program is run directly from the miniPAR Logger, then the program will suggest the folder that is located on the miniPAR 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 miniPAR 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 miniPAR Logger is slow.

The miniPAR Logger’s measurement folders must NOT contain any files besides those the miniPAR Logger recorded and the CAT.txt file.

Click “Plot” to begin plotting.

The program reads all the miniPAR 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.

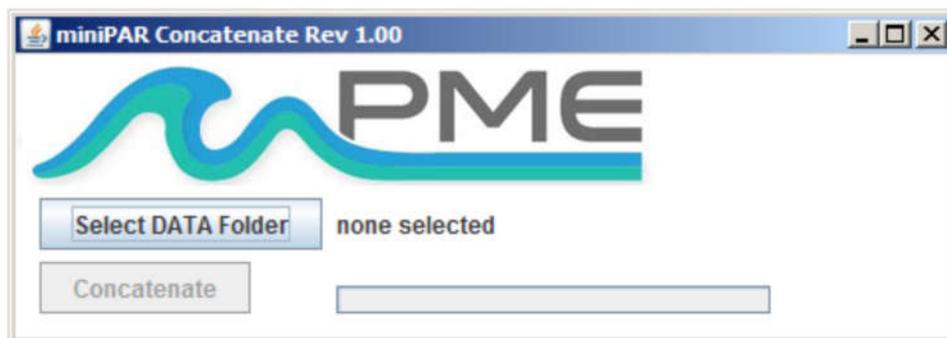
The program can be re-run at any time. If an already processed DATA Folder is selected, then the program simply reads the miniPAR Logger's measurement files again.

End the miniPARPlot 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 miniPARPlot 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 miniPARPlot that sub-samples can be provided by PME. Please contact PME in this case.

2.4 miniPARConcatenate

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



The miniPARConcatenate program reads and concatenates the files recorded by the miniPAR 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. CAT.txt is CSV (comma-separated values) file and can easily be imported into Excel and other database files.

Select the folder that contains the files recorded by the miniPAR Logger. If the miniPARPlot program is run directly from the miniPAR Logger, then the program will suggest the folder located on the miniPAR 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 miniPAR 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 miniPAR Logger is slow.

The miniPAR Logger measurement folders must NOT contain any files besides those the miniPAR 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:

```
MiniDOT Logger Concatenated Data File
Sensor: 7530-795336
Concatenation Date: 2017May22 13:34:28 PDT
```

Unix Timestamp, (Second),	UTC_Date_& Time, (none),	Pacific Standard Time, (none),	Battery, (Volt),	Temperature, (deg C),	PAR, ($\mu\text{mol}/(\text{s m}^2)$),	Acceleration X, (g),	Acceleration Y, (g),	Acceleration Z (g)
1495119720,	2017-05-18 15:02:00,	2017-05-18 08:02:00,	3.380000,	23.211000,	0.362010,	-1.213000,	0.089000,	0.390000
1495119760,	2017-05-18 15:03:00,	2017-05-18 08:03:00,	3.390000,	23.061000,	0.129660,	-1.215000,	0.092000,	0.376000
1495119840,	2017-05-18 15:04:00,	2017-05-18 08:04:00,	3.390000,	22.985000,	0.554630,	-1.204000,	0.087000,	0.376000
1495119900,	2017-05-18 15:05:00,	2017-05-18 08:05:00,	3.400000,	22.818000,	-1.934160,	-1.209000,	0.096000,	0.391000
1495119960,	2017-05-18 15:06:00,	2017-05-18 08:06:00,	3.400000,	22.751000,	0.154100,	-1.201000,	0.103000,	0.385000
1495120020,	2017-05-18 15:07:00,	2017-05-18 08:07:00,	3.410000,	22.735000,	-0.833470,	-1.226000,	0.070000,	0.419000
1495120080,	2017-05-18 15:08:00,	2017-05-18 08:08:00,	3.410000,	22.693000,	0.469020,	-1.204000,	0.104000,	0.383000
1495120140,	2017-05-18 15:09:00,	2017-05-18 08:09:00,	3.410000,	22.626000,	-1.029150,	-1.218000,	0.071000,	0.423000
1495120200,	2017-05-18 15:10:00,	2017-05-18 08:10:00,	3.420000,	22.634000,	-1.230940,	-1.201000,	0.094000,	0.403000
1495120260,	2017-05-18 15:11:00,	2017-05-18 08:11:00,	3.420000,	22.584000,	0.823690,	-1.220000,	0.062000,	0.424000
1495120320,	2017-05-18 15:12:00,	2017-05-18 08:12:00,	3.420000,	22.593000,	-0.436000,	-1.204000,	0.087000,	0.412000
1495120380,	2017-05-18 15:13:00,	2017-05-18 08:13:00,	3.420000,	22.567000,	-1.457200,	-1.224000,	0.071000,	0.422000
1495120440,	2017-05-18 15:14:00,	2017-05-18 08:14:00,	3.420000,	22.542000,	0.441500,	-1.197000,	0.088000,	0.392000
1495120500,	2017-05-18 15:15:00,	2017-05-18 08:15:00,	3.420000,	22.501000,	-0.301470,	-1.215000,	0.088000,	0.391000
1495120560,	2017-05-18 15:16:00,	2017-05-18 08:16:00,	3.430000,	22.459000,	-1.234000,	-1.223000,	0.065000,	0.420000
1495120620,	2017-05-18 15:17:00,	2017-05-18 08:17:00,	3.430000,	22.475000,	-0.952710,	-1.229000,	0.072000,	0.431000
1495120680,	2017-05-18 15:18:00,	2017-05-18 08:18:00,	3.430000,	22.484000,	0.010490,	-1.209000,	0.075000,	0.425000
1495120740,	2017-05-18 15:19:00,	2017-05-18 08:19:00,	3.430000,	22.467000,	-1.007750,	-1.223000,	0.063000,	0.420000
1495120800,	2017-05-18 15:20:00,	2017-05-18 08:20:00,	3.430000,	22.459000,	0.591320,	-1.229000,	0.071000,	0.432000

End the miniPARConcatenate program by closing the window.

Chapter 3: miniPAR Logger

3.1 Overview

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

3.2 Opening and Closing the miniPAR Logger

The miniPAR Logger’s circuitry is contained in a waterproof housing that must be opened. Unscrewing the white pressure housing from the black end cap opens the miniPAR Logger. This is similar to opening a flashlight. Turn the white pressure housing counter clockwise relative to the black end cap. Close the miniPAR 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. Lubricate the o-ring occasionally with silicone oil intended for buna-N o-ring material.

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

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

3.3 Electrical Connections and Controls

Removal of the cover reveals the miniPAR 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 miniPAR Logger's mode:

- Record – When the switch is in this position the miniPAR Logger is recording measurements.
- Halt – When the switch is in this position the miniPAR Logger is not recording and is sleeping at low power.

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

The **Main Batteries** (2 X AA on side opposite to pictured side above) provide main power to the miniPAR 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 miniPAR Logger. PME recommends Energizer L91 AA size lithium batteries or Duracell AA size alkaline batteries.

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

http://ww2.duracell.com/media/en-US/pdf/gtcl/Product_Data_Sheet/NA_DATASHEETS/MN1500_US_CT.pdf

Caution: Improper replacement of the batteries will damage the miniPAR Logger.

Follow these steps:

- 1) Move the miniPAR Logger's Control Switch to the "Halt" position.
- 2) Remove the depleted batteries **noting the position of the (+) terminal**.
- 3) Switch miniPAR to RECORD, then back to HALT. Wait 1 minute.
- 4) Use only new, fully charged batteries, both of the same type.
- 5) Install fresh batteries with the **(+) position the same as the removed batteries**. The (+) position is also marked on the inside of the battery holder.
- 6) The miniPAR 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.

Enjoy your new miniPAR!