TreeHugger User Guide

GLOBAL CHANGE SOLUTIONS

WARNINGS

USE PROPER SAFETY EQUIPMENT

STAINLESS STEEL BANDING IS SHARP – This product contains stainless steel banding that has sharp edges. Use appropriate protective equipment when handling the band.
RIVETING CAN CAUSE FLYING DEBRIS – Installation of the TreeHugger dendrometer requires the use of a riveter. During the process flying debris may occur. Use appropriate eye protection.

USE PROPER ACCESSORIES

Use only Global Change Solution cables and antennas; the use of non-Global Change Solution cables and antennas may severely degrade performance or damage the TreeHugger, and will void the warranty.

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TreeHugger Logger Manual

SECTION 1 – INTRODUCTION

Congratulations on your purchase of the TreeHugger dendrometer installation package. The TreeHugger installation package is a complete kit for measuring and recording tree growth from Global Change Solutions LLC. It is designed for quick and easy installation for users to start measuring tree growth effortlessly. The TreeHugger is a stand-alone unit for automated measuring and recording of tree growth and stem temperature.

1.1 – DEVICE FEATURES

- Adjustable Measurement Intervals from 1 minute and longer
- Indicator LED when Logging
- Accurate Real-Time Clock
- High resolution ADC for high precision readings
    - 18 bit Analog-to-Digital Converter
    - Accuracy for readings +/- 2um
- Barrel Jack (2.5x5.5mm) for external power
    - Optional D Cell packs for extended battery life
- On-board MicroSD storage
    - Over 1,000,000 lines of data possible
    - General microSD adapter fits into most laptops, computers, and tablets
- Low power consumption

1.2 -- OPTIONAL UPGRADE

- **Non-invasive Hanger Strap** – Duct strap and spring for hanging logger from tree. Eliminates the need to mount the screw hook in the tree, preventing any damage to the tree.

1.3 – TREEHUGGER BILL OF MATERIALS

A. TreeHugger Dendrometer
    1. Sensor Band
    2. Tail
    3. Spring
    4. Clip
B. Data Logger
    1. Data Logger board (TreeHugger)
    2. MicroSD card
    3. 2 x AA Batteries (Not included)
C. Exterior Casing for Data Logger
    1. Hanger Cap
    2. PVC Casing
    3. End Cap w/ Cable Gland
    4. Screw Hook (Not pictured)
    5. Non-Invasive Hanger (Not pictured)

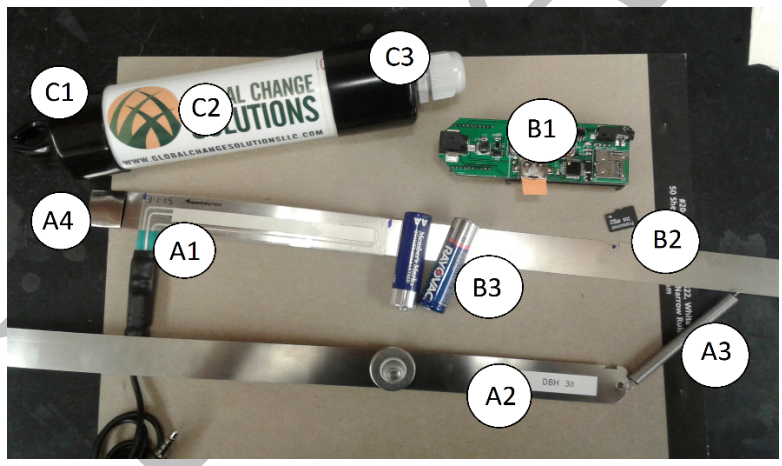


Figure 1.1 – TreeHugger Materials

2.1 – INSTALLING THE TREEHUGGER DENDROMETER

For an instructional video, visit this helpful step-by-step video:
http://www.youtube.com/watch?v=cPBlLMFRDeE

1) Assemble the TreeHugger dendrometer
    a. Place the clip on the left side of the SoftPot sensor under the folded end to secure the clip.
    b. Slide the long side of the TAIL through the right side of the clip and out the left side.
    c. Attach the spring to the terminal clip and end of the tail band.
2) Hanging the TreeHugger dendrometer
    a. Take the ends of the bands and wrap around desired tree. *Note: Minimum tree diameter is at least 10 cm.*
    b. Place tail band on the underside and pull until spring has tension AND plunger is on SoftPot active sensor area in the first 10%.

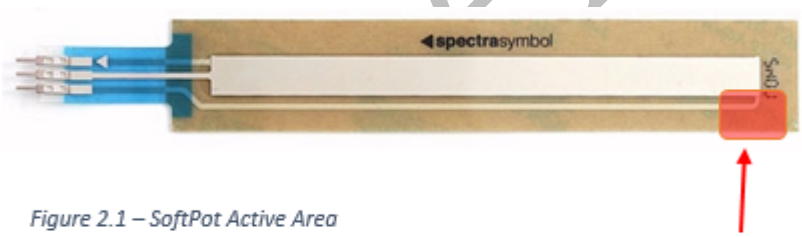


Figure 2.1 – SoftPot Active Area

SoftPot Active Area- First 10%

    c. Mark tail band through the hole on the end of the sensor band.
    d. Remove band from tree and trim off excess banding from tail.
    e. Punch a 1/8” hole at designated marking.
    f. Disconnect spring from terminal clip.
    g. Wrap band around tree and insert 1/8” rivet from backside of banding.
    h. Re-attach spring to terminal clip
3) Align the banding
    a. Check that banding is securely wrapped around the tree.
    b. Center plunger over the SoftPot sensor and check that plunger makes contact with the active area of the sensor and is firmly pressing against the SoftPot. *(See Figure 2.1, 2.2, & 2.3)*

c. Use Loctite or similar thread lock to secure plunger in position.

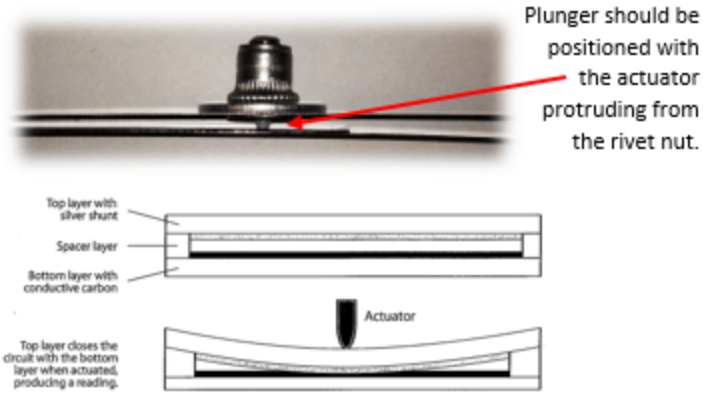


Figure 2.2 (TOP) – Plunger position in rivet nut
Figure 2.3 (BOTTOM) – SoftPot Cross Section

2.2 – INSTALLING THE DATA LOGGER

1) Remove the end cap with cable and from logger casing.
2) Remove cap from cable gland
3) Insert cord through cable gland cap and through cable gland.
4) Re-assemble cable gland.
5) Insert cord into data logger. Ensure connector is pushed in firmly.
6) Insert batteries into data logger.
7) Press the reset button on the data logger.

Figure 2.4 – Installed TreeHugger

If successful, a short flash (miniSD and hardware initialized) followed by a longer flash (logging data point) should occur. The initial set-up should be finished and is ready to be inserted into the casing.

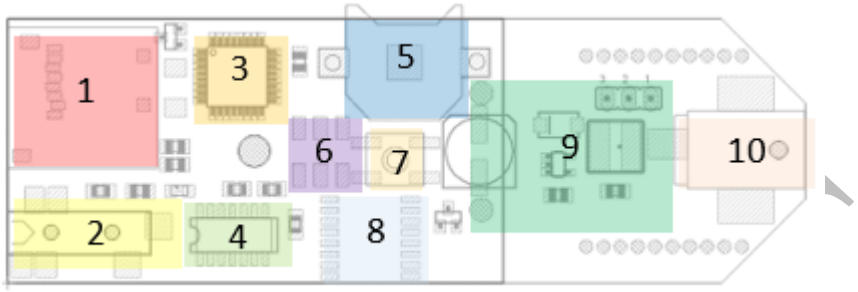
   a. If this does not happen, and a long flash is first, there is an initialization problem or the microSD card is missing.

   *Note: Every time you remove the SD card, etc. you **must** press the reset button again and watch for the flash pattern.*

8) Re-assemble the casing (Inserting a silicon desiccant pack in the casing and sealing the lower cap with a silicon calk are recommended for humid locations)
9) Insert screw hook into tree or use optional strap to hang the data logger.

SECTION 3 – TREEHUGGER HARDWARE DETAILS

3.1 – BOARD LAYOUT



1) MicroSD slot
2) 3.5mm 4 CH Jack
3) Microcontroller
4) High Resolution ADC
5) 3V 3023 coin cell battery
6) ISP Programming Header
7) Reset Switch – Push-Button
8) Clock
9) Power Management
10) 5.5/2.5mm Barrel Jack

3.2 – MICROSD REQUIREMENTS

1) MicroSD should be a standard card. ***No SDHC***.
2) Stand-by current should be as low as possible. (>200uA)
3) Moisture ratings should be 95% RH or greater.

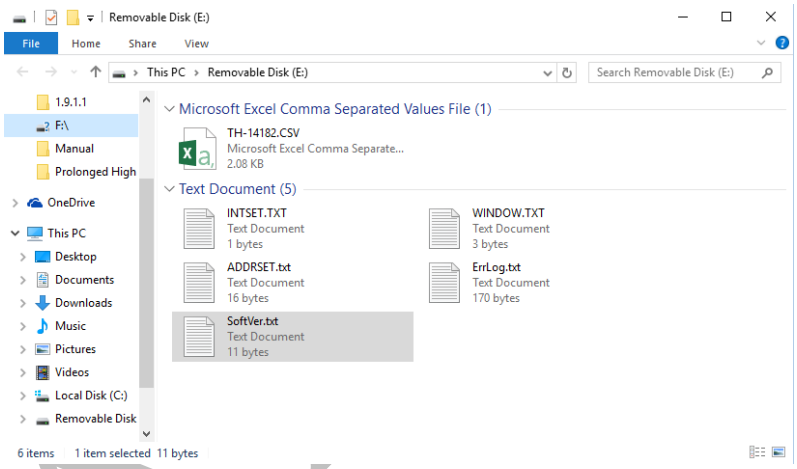
3.3 – BATTERY/POWER SPECIFICATIONS

1) Rated 1.5V for standard “AA” or “D” Cells.
2) Rated 1.2V-1.5V for rechargeable batteries.
3) Batteries should be changed under 2.0V.
4) 5.5mm O.D. / 2.5mm I.D. Barrel Jack Input should be between 1.8V and 3.3V.

SECTION 4 – PROGRAMMING TREEHUGGER

4.1 – MICROSD FILES

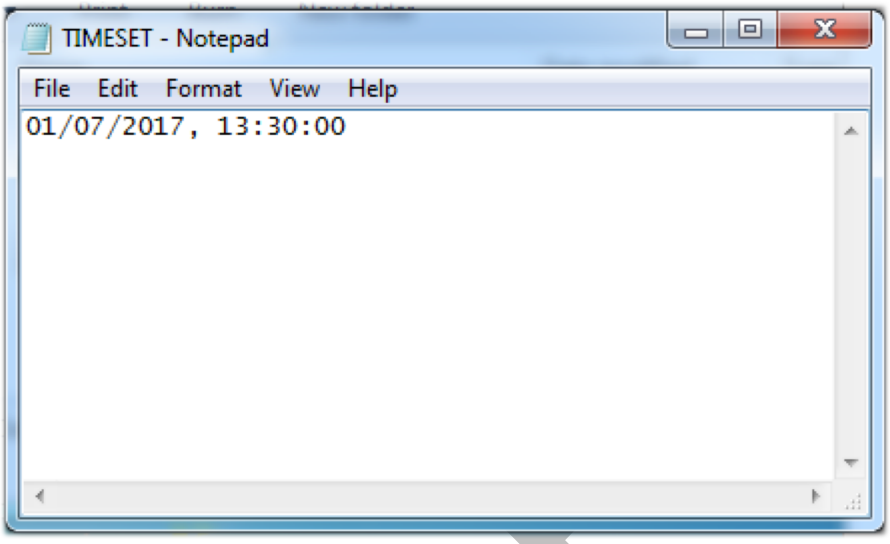
- Programming the data logger involves creating two text files (TXT) on your computer and copying them onto a proper microSD card.
- INTSET.txt – Instructs the data logger the interval between measurements in minutes.
- TH-xxxxx.CSV – Data from logging is recorded in this file
- TIMESET.txt – Sets the time and date in American format. *Once these files have been used by the microprocessor on the logger, they are removed after being used and will not be on the data logger after changing the settings.*



4.2 – SETTING THE DATE / TIME

1) Remove the microSD card from data logger.
2) Insert card into desired device.
3) Create a file named TIMESET *(filename is critical)* with a desired starting timestamp.
    a. Open Notepad on Windows.
    b. Enter desired date followed by a comma.
        (mm/dd/yyyy)
        Ex. 01/07/2017 (January 07th, 2017)
    c. Entered desired time (24-hour clock)
        (**hh:mm:ss)**
        Ex. 13:30:00 (1:30 PM)
    d. Save file as TIMESET
4) Insert card into data logger

5) Press reset button
6) Data logger will reset the clock at next start-up and erase the TIMESET file after the reset is complete.



4.3 – SETTING THE LOGGING INTERVAL

1) Remove the microSD card from data logger.
2) Insert the card into desired device.
3) Create a file named INTSET *(filename is critical)* with desired interval setting.
    a. Open Notepad on Windows
    b. Enter desired interval setting in minutes
    c. Save file as INTSET
4) Insert card into data logger.
5) Data logger will reset the interval at the next start-up.

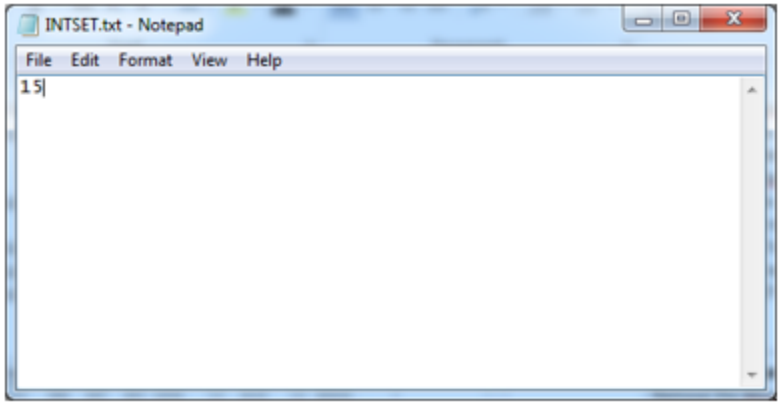


Figure 4.3 – INTSET Example w/o designation

4.5 – RETREVING DATA FROM TREEHUGGER

When you are ready to retrieve data from the loggers, remove the microSD card from the device and insert it into your laptop or computer and copy the CSV file to your device. The format is described as below:

COLUMN A: DATE; (month/day/year)
COLUMN B: TIME; (hh:mm)
COLUMN C: CHANNEL 1; POT READ
COLUMN D: CHANNEL 2; TEMPERATURE
COLUMN E: CHANNEL 3; SPARE
COLUMN F: CHANNEL 4; EXCITE
COLUMN G: BAND TEMP CALCULATION; CELCIUS

$$= \left(\frac{298.15^{-1} + 3974^{-1} * \ln \frac{D * 10000}{F - D})}{10000} \right)^{-1} - 273.15$$

COLUMN H: BOARD TEMP: FROM RTC
COLUMN I: POSITION CALCULATION; MILLIMETER

$$= \frac{C}{F} * 100$$

COLUMN J: BATTERY VOLTAGE

C2532 | 583921

	A	B	C	D	E	F	G	H	I	J
1	Date	Time	Ch1	Ch2	Ch3	Ch4	mm	Band Tem	Board Ten	Bat Volt
2	5/22/2017	13:09	46	40546	6468	2047984	0.002	150.201	26	0.01
3	5/22/2017	13:12	15	182609	1284593	1130078	0.001	67.508	27.5	2.57
4	5/22/2017	13:13	586437	546640	1287656	1124468	52.152	26.259	26.75	2.58
5	5/22/2017	13:14	585812	555921	1287015	1123390	52.147	25.465	25.75	2.57
6	5/22/2017	13:15	584812	560703	1286562	1122437	52.102	25.042	25	2.57
7	5/22/2017	13:16	584765	564187	1286140	1121734	52.13	24.733	24.5	2.57
8	5/22/2017	13:17	584468	566640	1285734	1120562	52.158	24.488	24	2.57
9	5/22/2017	13:18	584359	568281	1285390	1121390	52.11	24.39	24	2.57
10	5/22/2017	13:19	584359	569500	1285062	1121125	52.123	24.281	23.75	2.57
11	5/22/2017	13:20	584421	570437	1284781	1121203	52.124	24.209	23.5	2.57
12	5/22/2017	13:21	584312	570906	1284531	1120765	52.135	24.154	23.5	2.57

SECTION 5

TROUBLESHOOTING GUIDE

Problem	Reason	Solution
Time was reset to: 01/01/2000 00:00:00	3V 3023 coin cell battery is dead.	Replace battery with 3V 3023 coin cell
	3V 3023 coin cell clip is corroded	Clean with electronics cleaner
	3V 3023 coin cell clip is disconnected	Re-Solder contacts or see tech support
Indicator LED does not flash on start up.	AA or D Batteries are dead	Replace batteries with 1.5V rated AA (D if using expansion pack)
	Battery connections are corroded	Clean contacts with electronics cleaner
Data logger does not write to the SD card	SD card does not match required specs	Replace MicroSD card with specifications according to Section 3.3
	Batteries are too low to write to SD but will still run the unit	Replace batteries with specifications according to Section 3.4
	MicroSD card is corrupted and cannot be written too	Replace MicroSD card with specifications according to Section 3.3

Problem	Reason	Solution
Interval does not set to INTSET value	The logger has not been restarted	Reset logger with MicroSD card inserted
	INTSET.txt is improperly named	Rename or recreate INTSET.txt (See Section 4.3)
	INTSET.txt is corrupted	Delete and recreate INTSET.txt (See Section 4.3)
Data Sets show spikes / bad data.	Connector is loose	Secure connections to board by firmly pushing together
	Plunger is not firmly pressing against SoftPot	Tighten the plunger located on tail band.
Temperature Data shows spikes	Sun flecks are heating black shrink wrap near band	Place reflective tape over black shrink wrap

Table 5.1 – Troubleshooting Guide

SECTION 6

TECHNICAL SUPPORT

For further technical support, please contact support@globalchangesolutionsllc.com

When requesting technical support for a TreeHugger unit or set, pleace include the following information:

- TreeHugger Serial Number
- Software Version Number. *(This can be found on the microSD card in the VERSION text file.)*
- Location of deployment
- Species of tree
- Physical details of logger and *band (i.e. Corrosion, buildup, moisture, damage, etc.)*
- A detailed description of the problem