

LITHOSPHERE

Infiltrometer Operating Instructions

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Preparation for Surface Soil Measurements

- 1). Hammer a metal or plastic ring into ground (keeping it as straight as possible) between 2-5 cm depth.
- 2). Measure depth of ring [installation](#)
- 3). if there are gaps around the inside edge of the ring fill them in with fresh soil and poking with a small stick
- 4). Pour small amount of water into rings to check for leaks.
- 5). Attach the surface soil bell to the lower screw thread of the ball valve (you may need to use plumbers tape to ensure an air tight seal).

Preparation for Sub-Surface Soil Measurements

- 1). Use a 40 mm to 70 mm hand auger to dig a hole to about 600 mm depth or within the soil horizon of interest
- 2). Note the calculations work best for longer narrow holes, so avoid digging a shallow hole with a wide auger
- 3). Remove any smearing on the side walls of the hole by gently scraping the sides with a cylindrical brush.

- 4). Measure and record the depth and diameter of the hole.
- 5). Attach the subsoil mini-bell to a 20 mm diameter irrigation riser, the length of which depends on the depth of soil under investigation.
- 6). Attach the mini-bell and riser to the bottom screw thread of the ball valve

Setup the Infiltrometer

- 1). Attach the legs using the 63 mm ball pin
- 2). Adjust the tube clamp height and secure with wing nut to position the surface bell a few cm above the ground.
- 3). Level the device by adjusting the height of the legs with the four leg grub screws.
- 4). Re adjust the surface bell so that its a few mm above the soil surface
- 5). Check the ball valve is closed to prevent water loss from the device.
- 6). push the air breathing tube to the bottom of the bell.
- 7). Remove the topcap and fill to within 3 cm of the top of the tube, a small air gap is required to get the topcap back on.
- 8). Slowly open the ball valve allowing water into the ring.
- 9). The height of the water in the ring will be maintained at the height of the air tube.
- 10). Raise the airtube to adjust the depth of ponding, usually 0.5 to 2 cm is appropriate.
- 11). use a thin ruler to measure the depth of ponding.

Checking if everything is ok

- 1) For the device to work properly the Mariott must be air tight to build up suction.
- 2). To check the device, ensure that the water level in the Mariott only goes down when a bubble is released.

If the water in the Marriott goes down without a corresponding bubble the depth of water in the ring will rise and flood the ring.

- 3). Apply Vaseline or grease to the top-cap O-rings and reseal the top of the tube.
- 4). Apply plumbers thread tape to screw threads to ensure air tight connections.

Manual measurements

- 1). After about 5 minutes infiltration measure the time and height of water (or float) in the Marriott tube using the scale bar.
- 2). In high infiltration soils take at least 5 measurement over the period it requires to empty the Marriott tube
- 3). In low infiltration soils take at least 5 measurements in which the water level differs by at least 5 mm from the previous measurement.
- 4). Note time to true steady state flow differs between soils and different initial soil moisture contents.
- 5). As a rule of thumb measurements should be for at least 20 minutes, although reaching the steady state can take up to an hour.

Startup Mode

The laser sensor works in 3 different modes depending on if you depress a button while turning the device on.

- 1) Surface Soil Measurements: (default setting) if no button is held while switching the device on (do not hold down any button)
- 3) Subsurface measurements - hold down the middle button and turn the device on
- 4) Data transfer (WiFi) - hold down the left button and turn the device on

Early Flow

- Early infiltration tends to be faster than the later true 'steady state' infiltration rate.
- The period of early flow tends to be longer for dryer soils, but can last between 1 to 20 minutes.
- My advice is to setup the device and allow water to pond in the ring/auger hole for at least 5 minutes before commencing measurements
- During this soaking period measure the diameter of the ring and depth of water ponded in the ring for the surface mode, or for the subsurface mode, the auger hole diameter and the depth of water in the auger hole.
- You will need these measurement for the next step
- **Setting up the laser sensor for surface soil measurements.**
- For surface soil infiltration and hydraulic conductivity do not hold down any button whilst turning on the sensor.
- The device has 3 setup screens which you need to adjust the parameters in order to calculate infiltration rate and hydraulic conductivity.
- To adjust preset values for all screens use the left button to scroll down, the middle button to scroll up and the right button to move to the next screen or wait 5 seconds.
- 1). Ring Diameter. Enter the diameter of the ring in mm
- 2). Ring Insertion: enter the depth to which the metal ring has been pushed into the ground. Subtract the height of the ring above the soil surface from 70 mm.
- 3). Soil Type: You need to enter the most appropriate soil type from the table below. In most cases this will be 0.012 for structured soil
- 4). Water Depth: Measure the depth of ponding in the ring once infiltration has started
- 5). IR Time Gap: The time over which measurements are averaged. In fast infiltrating soils this should be 1-3 minutes, in slow infiltrating soils this should be 3-10 minutes. If this value is too small the data will appear to go up and down a little between time increments due to when bubbles are released. If this is set to fast it risks running out of water or measurements taking a painfully long time to complete.
- 6). Allow infiltration to proceed for at least 10 -15 minutes or until the infiltration rate has slowed to a consistent value.
- 7). Record your results.

Setting up for subsoil measurements

- 1) Unscrew the bottom bell from the base of the stop cock valve.
- 2). Select an appropriate length of tube (riser) for the depth of soil being investigated.

- 3) Attach the bottom bell to the base of the riser and the rise to the base of the stopcock. Use thread tape for all screw attachments.
- 4). Auger a hole to the correct depth. Auger holes should be narrow rather than wide, and deep rather than short. Ideally the depth should be **twice** the diameter. The depth of the auger hole should extend $\frac{2}{3}$ of the way into the target soil layer as flow is predominantly downward.
- 5). If possible scrape away any soil smearing with a large bottle brush on a post from the inside of the hole.
- 6). Gently pour some water into the hole to **commence** infiltration.
- 7). Lower the infiltrometer into the hole to check the base of tube is near the top of the soil layer being investigated.
- 8). Measure the depth of the hole.
- 9). Fill the infiltrometer with water and place the topplug.
- 10). lower the device into the hole and commence infiltration by turning on the stopcock.
- 11). The depth of ponding in the hole can now be adjusted by loosening the butterfly nut on the tube clamp and sliding the tube up (preferred) or down
- 12). wait for regular bubbling to commence to indicate the depth of ponding in the hole has stabilised.
- 13). measure the depth of ponding by subtracting the depth to the water surface from the depth of the hole

Setting up the laser for subsoil measurements.

- 1). Hold down the middle button and turn on the device. You should see it display blw grd 'below ground' then skip to the next screen.
- 2). Enter the hole diameter and on the next screen depth of water in mm
- 3). Adjust values down with the left button and up with the middle button.
- 4). Set an appropriate infiltration measurement duration, usually 3-10 minutes as infiltration into subsoils tends to be slower than topsoils.

5). Measure for at least 15-20 minutes or until the infiltration rate has decreased to a constant value.

Charging and downloading the laser sensor.

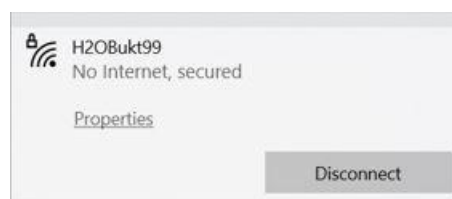
- To download data from the topcap, hold down the left button and turn on the device.
- The screen will say starting in wifi mode
- If you have **insufficient** power to use the wifi the screen will display 'looks like your out of power'.
- To charge the device connect a USB micro cable and wait. Normal battery power is about 4.3 vt. The device can either be on or off during recharge.
- If you have **sufficient** battery power you will will see displayed wifi on
- SSID H2OBukt99 connect and open <http://192.168.4.1/> in browser.
- Go to wifi devices and turn on or connect H2OBUKT99. This will turn off your internet and connect to the device.
- If you are asked for a password enter: 123456789

H2OBukt99

Download

File Size: 129.885 KB

Delete



- Enter <http://192.168.4.1/> in a browser. Push the **Download** button a .txt file will appear in the download folder.
- Enter <http://192.168.4.1/> in a browser. Push the **Download** button a .txt file will appear in the download folder, with a name like data(23).txt

```
RUN 2 [ 160,30,2,10,60000,100,100,100 ]
```

```
26, 223, 377, 0.00, 0.00, 0  
29, 223, 377, 0.00, 0.00, 0  
32, 226, 377, 0.00, 0.00, 0  
35, 228, 376, 0.00, 0.00, 0  
38, 228, 374, 0.00, 0.00, 0  
41, 228, 375, 0.00, 0.00, 0  
44, 228, 374, 0.00, 0.00, 0  
-- -- -- -- -- -- --
```

- The top of the text file will have a series of number like this... RUN 2 [160,30,2,10,60000,100,100,100]. Run is the unique run number that incrementally increases each time the device is turned on. Remember this number to link site and time to data (its on the LCD screen). The numbers in the bracket refer to the numbers you selected for that run, i.e. (in order L to R) The Ring Diameter, Ring Insertion depth , Soil Type, Depth of Water, Infiltration time step, Hole diameter, Depth of_ Water in bore hole, Hole Depth.
- The data from left to right is: time (seconds), distance to float (mm), battery power (divide by 100 to get volts), Infiltration Rate (mm/hr), Hydraulic conductivity (mm/hr), 0 for surface soil or 3 for subsoil mode.

If for some reason you were unable to download over wiFi there is a backup procedure for downloading the data via USB.

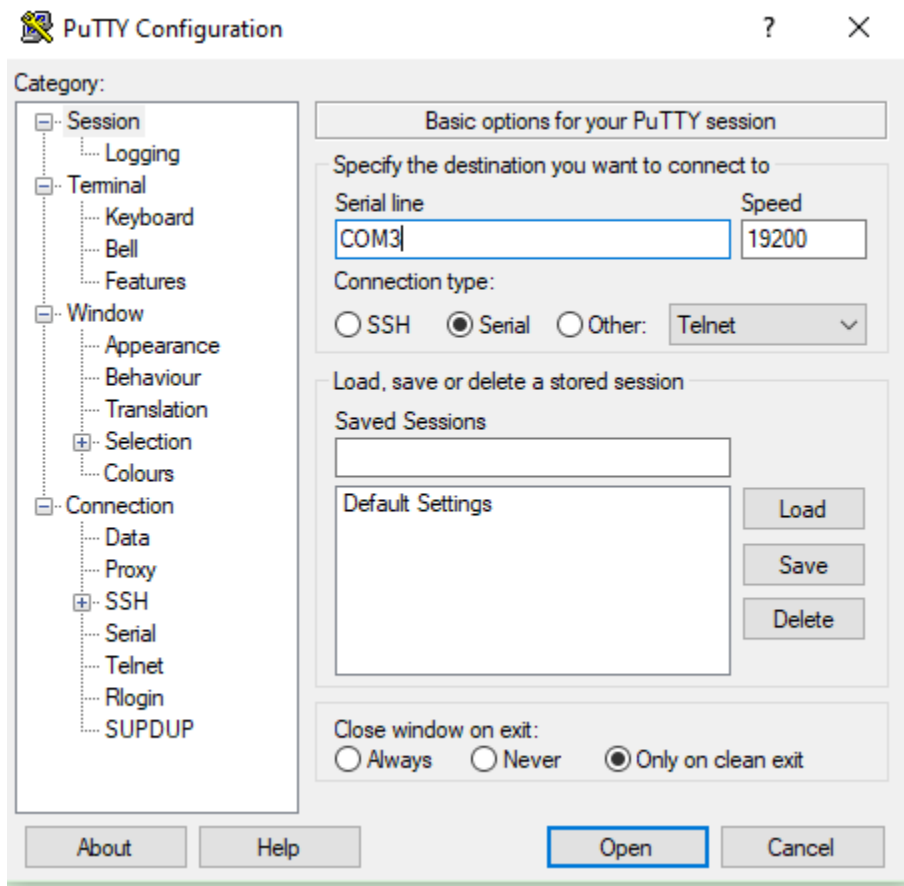
- 1) Download PUTTY <https://www.putty.org/>



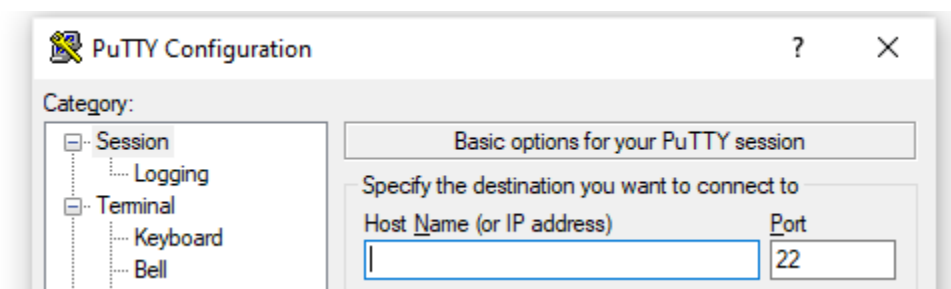
Or go to the app store



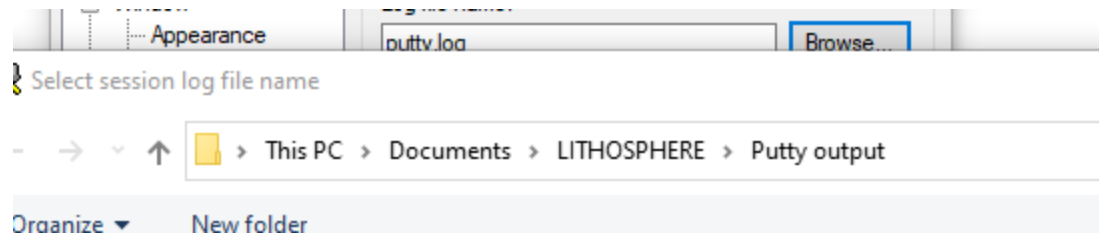
- 2) Turn on your infiltrometer device
- 3) Connect the infiltrometer sensor to your computer via USB cable
- 4) Open Putty
- 5) Enter the correct com port (7,9,11 etc, not 3),
- 6) Set the download speed to 19200,
- 7) Select the serial button (not SSH or Other)



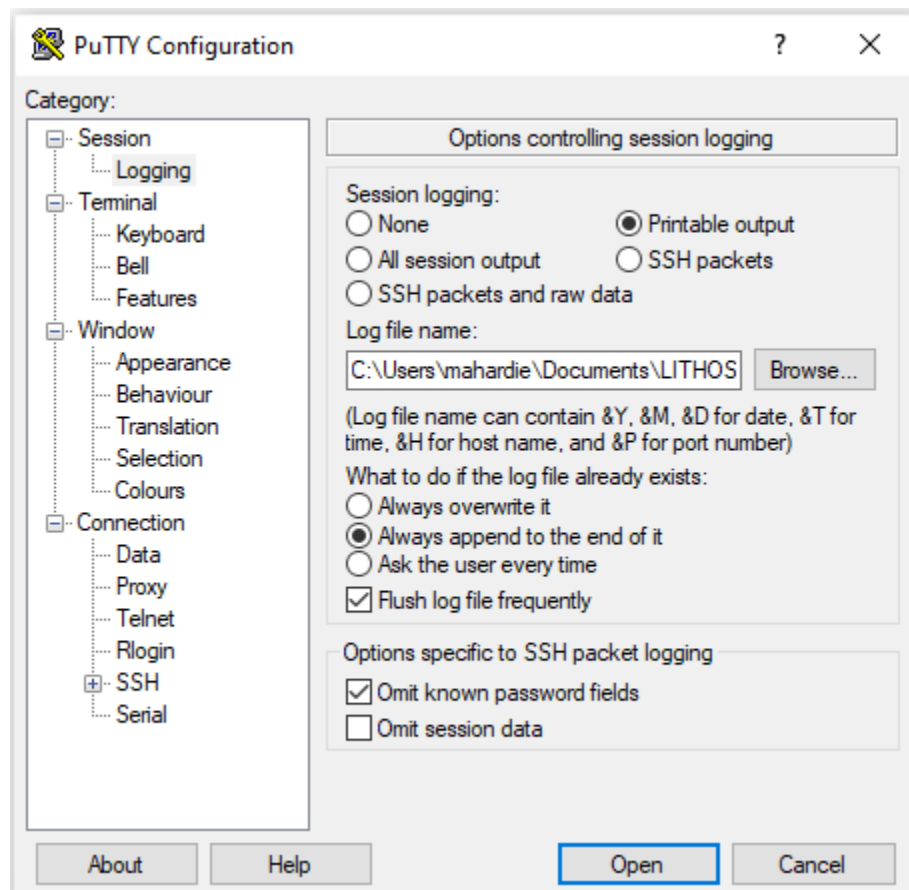
- 8) Go to the logging menu



- 9) Select printable output
- 10) Change the file location to something in documents



- 11) Change the file extension to .txt
- 12) Select always append to the end of it



- 13) Make sure the device is on and recording data normally
- 14) Press the right button on the infiltrometer whilst the device is working normally (taking readings. The infiltrometer screen will show USB/BLUETOOTH DOWNLOAD (its doesn't use Bluetooth ignore). This can take some time to download.
- 15) Data that looks like this is your current readings.

```
Module SW Version : AA 80 00 C 00 01 C 19 B2
Time, Distance 49, 1894, 0.00, 0.00, 0.00, 0
- message appended to file: data.txt
52, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
57, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
61, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
65, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
70, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
74, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
78, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
83, 1894, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
```

16) Data that looks like this is your stored data

```
COM11 - PuTTY
28641, 1913, 439, 0.00, 0.00, 0
28644, 1913, 439, 0.00, 0.00, 0
28647, 1913, 439, 0.00, 0.00, 0
28650, 1913, 439, 0.00, 0.00, 0
28653, 1913, 439, 0.00, 0.00, 0
28656, 1913, 439, 0.00, 0.00, 0
28659, 1913, 439, 0.00, 0.00, 0
28662, 1913, 439, 0.00, 0.00, 0
28665, 1913, 439, 0.00, 0.00, 0
28668, 1913, 439, 0.00, 0.00, 0
28671, 1913, 439, 0.00, 0.00, 0
28674, 1913, 439, 0.00, 0.00, 0
28677, 1913, 439, 0.00, 0.00, 0
28680, 1913, 439, 0.00, 0.00, 0
28683, 1913, 439, 0.00, 0.00, 0
28686, 1913, 439, 0.00, 0.00, 0
28689, 1913, 439, 0.00, 0.00, 0
28692, 1913, 439, 0.00, 0.00, 0
28695, 1913, 439, 0.00, 0.00, 0
28698, 1913, 439, 0.00, 0.00, 0
28701, 1913, 439, 0.00, 0.00, 0
28704, 1913, 439, 0.00, 0.00, 0
28707, 1913, 439, 0.00, 0.00, 0
28710, 1913, 439, 0.00, 0.00, 0
```

17) When its finished downloading it will return to normal measurements which will continue to be recorded individually

18) You will find your data in the file location you specified.

```
Data - Notepad
File Edit Format View Help
27, 1894, 435, 0.00, 0.00, 0
29, 1894, 436, 0.00, 0.00, 0
33, 1894, 436, 0.00, 0.00, 0
36, 1812, 435, 0.00, 0.00, 0
39, 1812, 436, 0.00, 0.00, 0
42, 255, 436, 0.00, 0.00, 0
45, 258, 435, 0.00, 0.00, 0
48, 259, 437, 0.00, 0.00, 0
51, 262, 436, 0.00, 0.00, 0

*****
54, 262, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
57, 1798, 0.00, 0.00, 0.00, 0.00
- message appended to file: data.txt
----- PuTTY log 2023.12.11 10:39:33 -----
a!!(Abrrbrj)
110, 1894, 439, 8250.250.21, 5511.58, 0
119, 1894, 438, 8250.21, 5511.58, 0
122, 1894, 438, 8250.21, 5511.58, 0
125, 1894, 438, 8250.21, 5511.58, 0
128, 1894, 439, 8250.21, 5511.58, 0
131, 1894, 438, 8250.21, 5511.58, 0
Ln 1, Col 1 100% Windows (CRLF) UTF-8
```

Clearing the data

If for whatever reason you wish to clear the data from the device

- 1) Press the middle button whilst the device is running.
- 2) You will see a screen with 2 options (1) C -all, (2) B Only data



- 3). To delete all data and changes to the starting configuration (i.e ring size, water depth etc) and return the device to the default settings press button C (Left), or
- 2) To Delete just delete the data (recommended) press button B (middle)