

Oregon Skyglow Measurement Network SQM-LU-DL Configuration and Installation

Ver. 2.0

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Introduction

This is a guideline for SQM-DL-LU configuration and installation practices throughout the Oregon Skyglow Measurement Network. This document describes typical SQM-LU-DL configuration and installation, using configuration and installation details of SQM-LU-DL sn 5333 at Cottonwood Canyon State Park, Wasco, OR.

The primary motivation for this update is to change the document format, placing figures and corresponding text on the same page, hopefully making the instructions easier to follow. Some instructions have been modified where there have been changes in recommended practice.

SQM Configuration - Download UDM

Download and install the Unihedron Device Manager (UDM) version for your computer's operating system (Windows, Mac or Linux) from:

<http://www.unihedron.com/projects/darksky/cd/>

Download the latest version (highest version number). Often the previous and latest versions will be listed.






Updates to UDM are frequent. If it has been a few months, check for a more recent update, download and install to take advantage of recent bug fixes and new features.

| Unihedron Sky Quality Meter (SQM) products disk contents | |
|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Live Contact | <p>Software and information for Unihedron products:</p> <ul style="list-style-type: none">• SQM-LE• SQM-LU• SQM-LU-DL• SQM-LU-DL-V• SQM-LR <p>Unihedron Device manager (UDM):</p> <ul style="list-style-type: none">• Windows• Mac• Linux• Source <p>Reference material:</p> <ul style="list-style-type: none">• Report on SQM by Pierantonio Cinzano sqmreport_v1p4.pdf• Light sensor data sheet TSL237-E32.pdf• IR Filter Hoya HCM500 Spectral response curves hcm500.htm |

SQM Configuration –Download UDM

The following illustrations are screen shots from Mac OS UDM ver. 1.0.0.249. Your display may differ in some details depending on operating system, user interface display preferences, and the UDM version. The current version at the time of this document update is 1.0.0.344, issued 21 Dec 2023.

Index of /projects/darksky/cd/Mac

| <u>Name</u> | <u>Last modified</u> | <u>Size</u> | <u>Description</u> |
|------------------------------------------------------------------------------------------------------------------------|----------------------|-------------|--------------------|
|  Parent Directory | | - | |
|  INSTALL.TXT | 13-Feb-2022 13:47 | 350 | |
|  archive/ | 21-Dec-2023 12:24 | - | |
|  sqmlu-mac.pl | 30-Jul-2013 14:18 | 2.6K | |
|  udm_1.0.0.344.pkg | 21-Dec-2023 12:23 | 8.3M | |

Apache/2.2.14 (Ubuntu) Server at www.unihedron.com Port 80

SQM Configuration – UDM opening screen

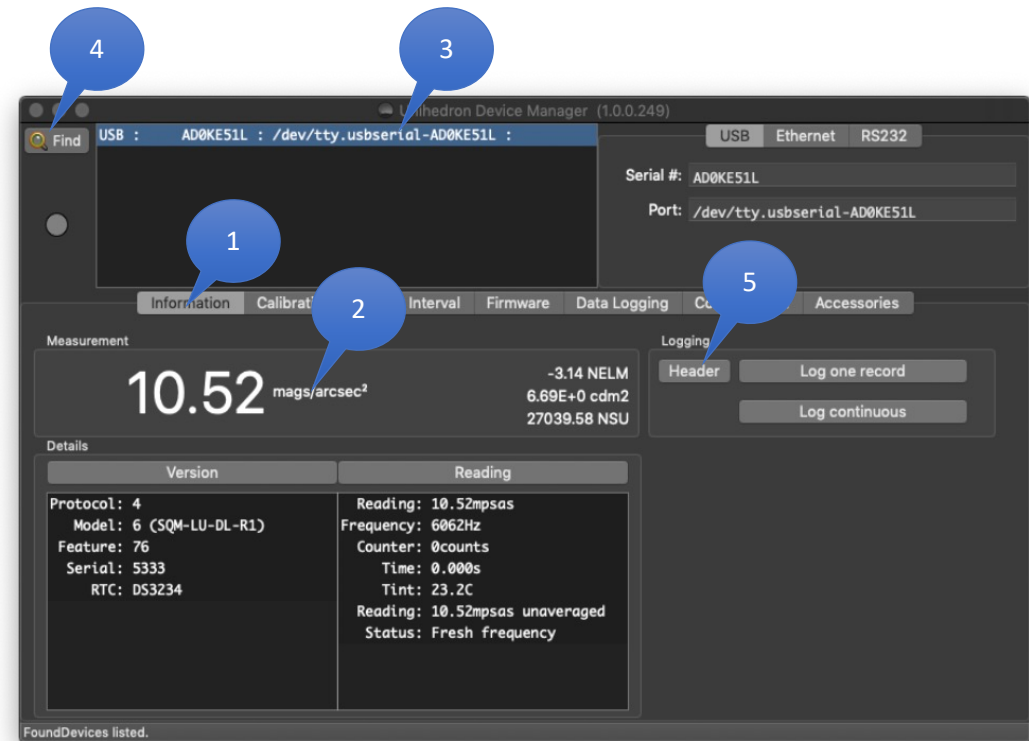
After connecting the SQM to your computer via the provided USB cable and launching UDM the SQM should be recognized, and the opening screen will be displayed.

With the Information tab selected (1), the current SQM reading will be displayed (2), and the SQM USB connection details (3).

If the SQM reading and USB connection details are not displayed, press Find (4) to establish the USB connection.

If UDM still fails to connect to the SQM, close UDM, verify proper USB cable connection between SQM and PC, reboot the PC, and launch UDM again.

Once successfully connected to the SQM, click Header (5) in the Logging box to display the Datalogging header window (next page).



SQM Configuration – Datalogging header

The header values appear at the top of each data file. Some header values affect the behavior of software used to process and display the data. It is important that key header entries are completed:

Serial Number: auto-populated

Instrument ID: optional text

Data supplier: name of SQM owner or host

Location name: name of SQM installation site

Position (lat, lon, elev(m)): click Edit (1) to open Set Location screen (detailed on next page)

Other entries as shown in the figure

Comments: optional, shown in figure is details of installation circumstance.

Once entries are complete, including Position, click Close (2)

Datalogging header

Definitions: PDF <http://www.darksky.org/measurements>

Serial Number: 6333

Instrument ID:

Data supplier: IDA Oregon

Location name: Cottonwood Canyon State Park, Wasco, OR

Position (lat, lon, elev(m)): Edit

Local timezone region: northamerica

Local timezone name: PST8PDT

Time Synchronization:

Moving / Stationary position: STATIONARY

Moving / Fixed look direction: FIXED

Number of channels: 1

Cover Offset: -0.11

Filters per channel:

Measurement direction per channel: zenith

Field of view (degrees): 20

Comments: Mounted on fence post along Pinnacles Trial north of the campground.

Close

SQM Configuration – Set Location

Clicking on the map will populate the Latitude and Longitude fields in the Cursor row (1), but this is far too inaccurate to be useful.

Determine the latitude, longitude and elevation (meters) of the SQM location by suitable means, such as a hand-held GPS unit, a navigation app on your phone, or a map application such as Google Earth on your computer.

Enter the SQM site latitude, longitude and elevation values in the corresponding fields in the Desired row (2). Note that latitude and longitude values must be entered in decimal degrees, not in degrees, minutes and seconds. Also note that west latitude must be entered as a negative number (include minus sign). Additionally, note that elevation must be entered in meters (not feet). If you must convert from feet to meters the conversion is $1 \text{ ft} = 0.3048 \text{ m}$ (multiply the elevation in ft by 0.3048).

Click Apply (3) and the values entered in the Desired row will be copied to the Actual row.

Click Close (4) to close the window.

The entered values will now appear in the Position field of the Datalogging Header window (next page).



SQM Configuration – completed header

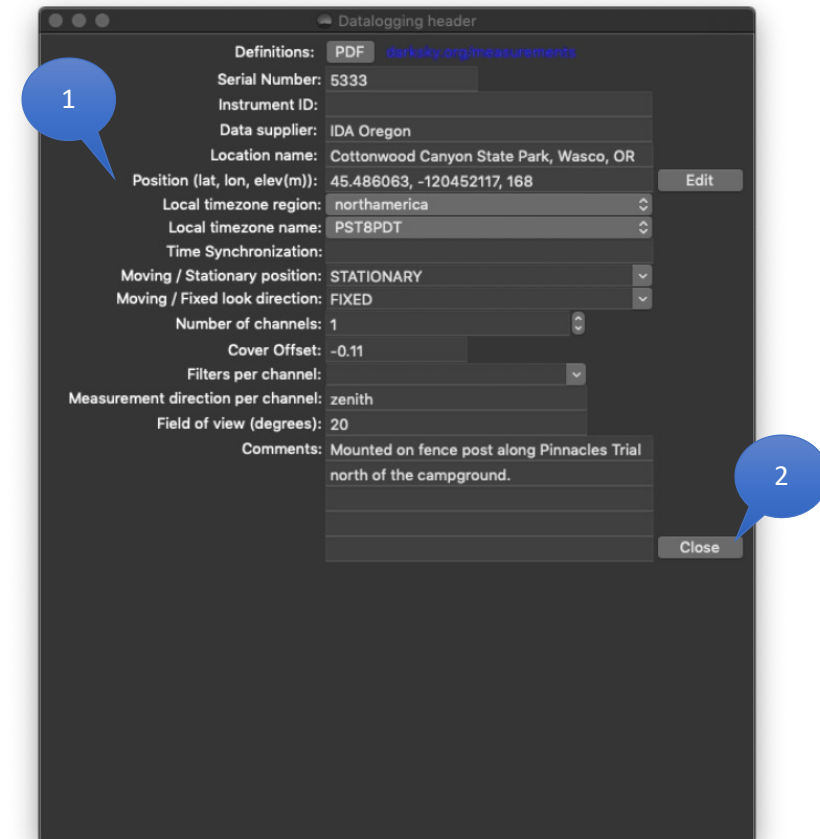
The completed header, with position field (1) now populated, is shown at right.

Clicking Close (2) closes the Datalogging header window and saved the header information.

Note:

The header information is saved to a small file on the PC used to configure the SQM. When the SQM is subsequently connected to the **same PC** the SQM will be recognized by its serial number and the header will be populated with the header information saved on **that PC** for that SQM.

If a **different PC** is used the header information will have to be manually reentered before downloading and saving data from the SQM, otherwise the header in the downloaded and saved data file will be blank, and the data file will not be useable for subsequent data processing.



SQM Configuration – Data Logging setup

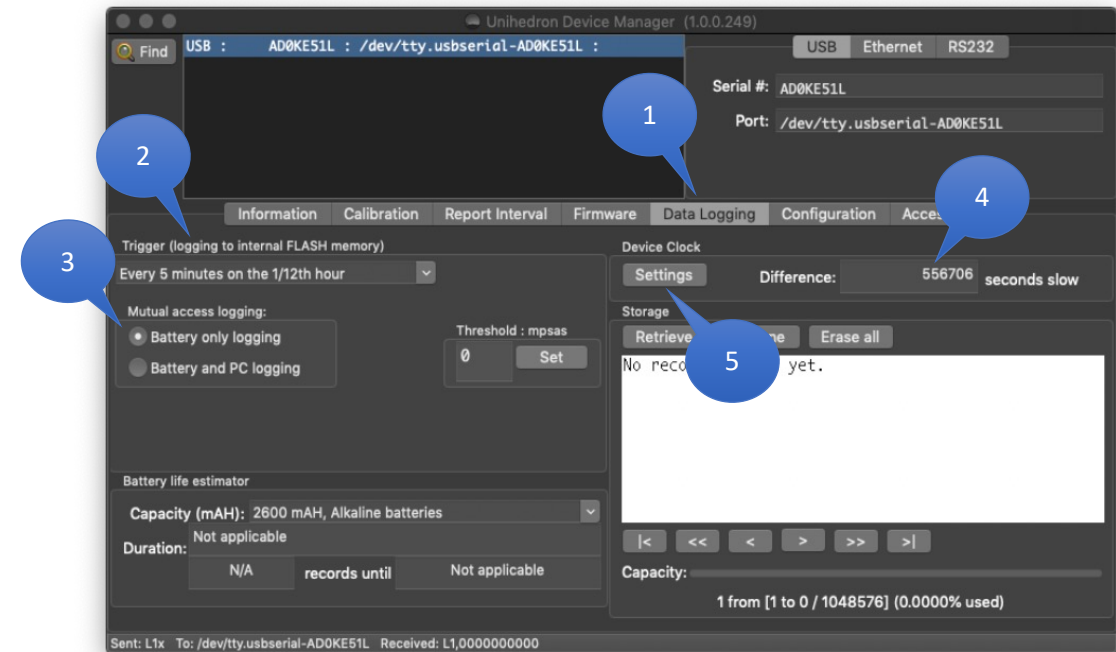
Upon returning to the Data Logging window, select the Data Logging tab (1).

Verify that Trigger is set to “Every 5 minutes on the 1/12th hour (2).

Verify that battery only logging is selected (3).

In the Device Clock section, note the Difference displayed in seconds between the device clock and the internal clock of the connected PC (4).

If this difference is not close to zero, click Settings (5) to open the Device Real Time Clock setting window (next page).



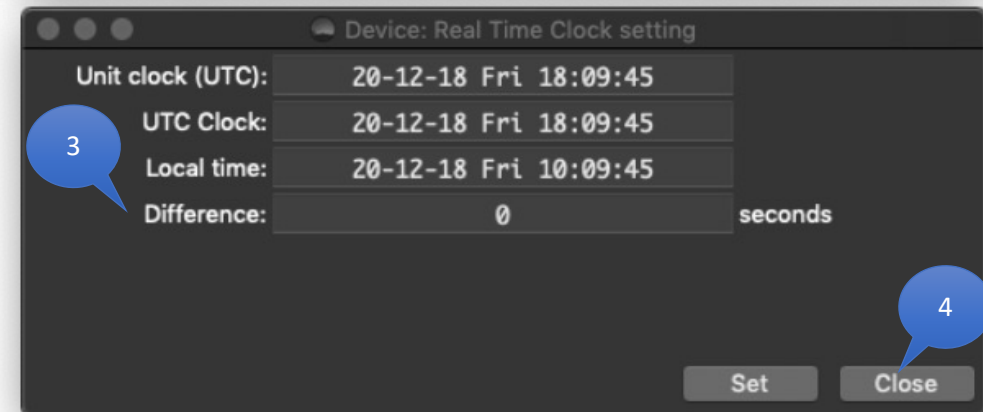
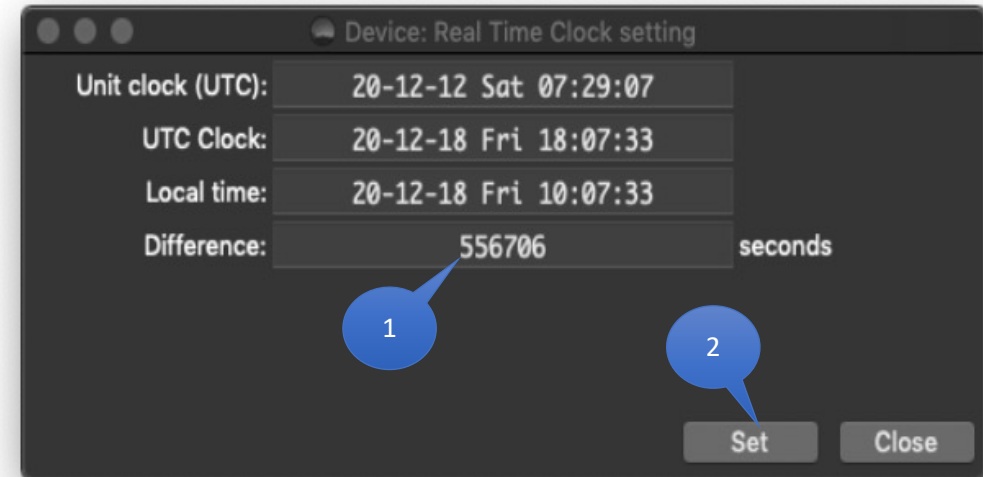
SQM Configuration - Device Real Time Clock synchronization

Initially there may be a large difference between the SQM unit clock and the computer clock (1).

Press the Set button (2) to synchronize the SQM internal real time clock with the connected computer's clock. Needless to say, the computer's clock must be in synch with an Internet time standard service, which is usually the case if your computer is currently or was recently connected to the Internet.

After synchronizing the device real time clock with the PC's clock the difference will be zero, or 1 second at most (3).

Press Close (4) to return to the Data Logging window.



SQM Configuration – Data Logging Settings

Note that the Device Clock difference is now displayed as 0 seconds (1).

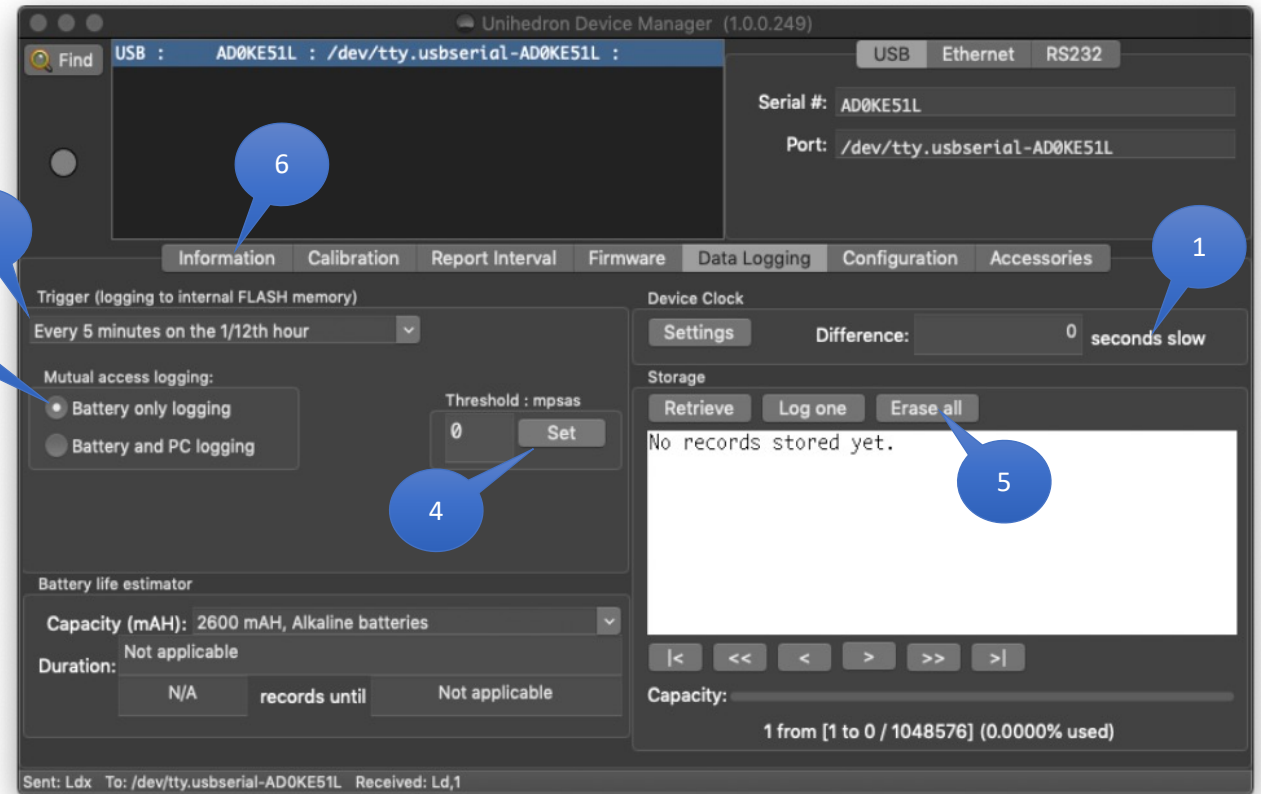
In the Data Logging window (Figure 8), with the Data Logging tab still selected, under “Trigger (logging to internal FLASH memory)” select “Every 5 minutes on the 1/12th hour.” (2).

Under “Mutual access logging,” select “Battery only logging” (3).

Under “Threshold: mpsas,” enter 0 and press Set (4).

To clear device memory of any data stored prior to installation at the new location, in the Storage box, click “Erase all” to clear device memory of all previously stored data (5).

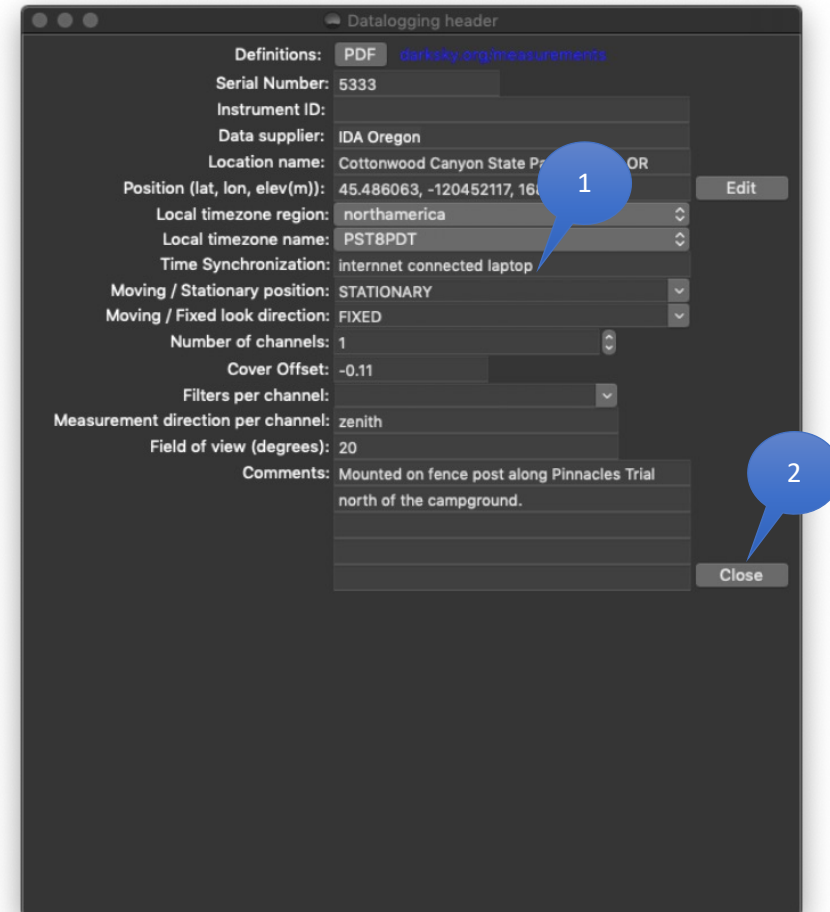
Select the “Information” tab (6) to return to the opening screen, then Header to reopen the Datalogging Header window.



SQM Configuration – Specify Time Synch Method

In the Time Synchronization field note the time synchronization method used (1), e.g. “internet connected laptop”.

Click Close (2) to close the Datalogging Header window.

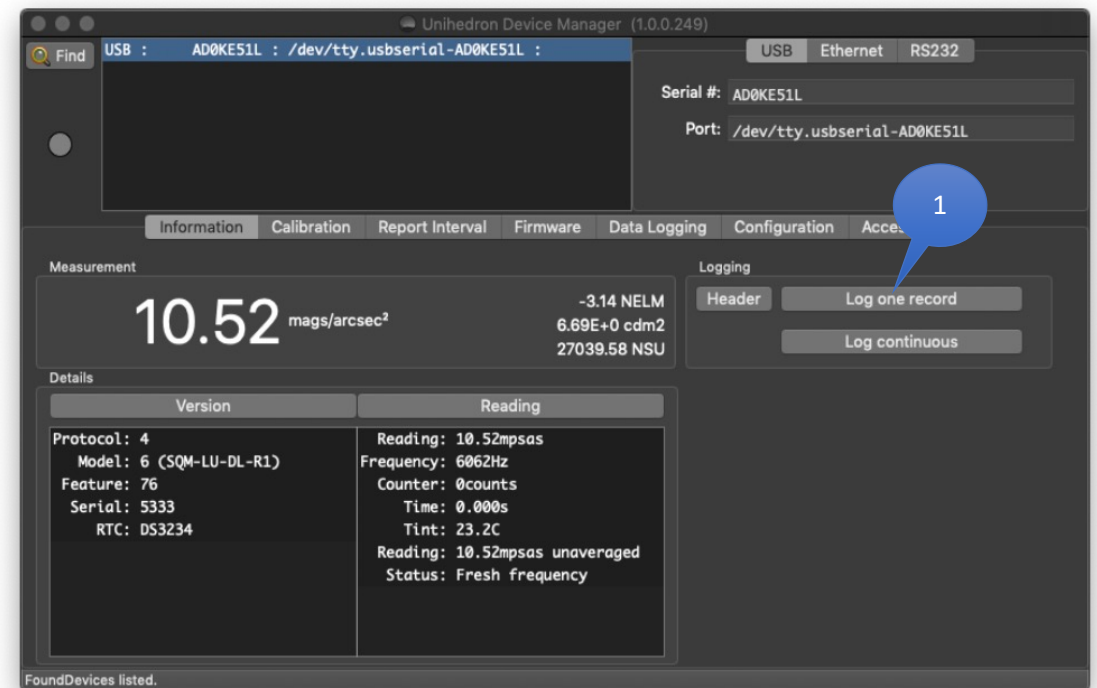


SQM Configuration – Final Test & Install

Under Logging, press “Log one record” to perform one measurement. The value displayed in the Measurement box should update, along with details in the Version and Reading boxes.

Satisfied the SQM is operating properly, close the UDM application, disconnect the SQM from the computer, and connect the battery pack, loaded with 6 new AA batteries. The SQM is now recording measurements at 5-min intervals on the 1/12th hour and will continue to do so unattended until it is time to retrieve the SQM, download data, and replace batteries, typically at 3-month intervals.

Insert the SQM into the weatherproof housing, taking care that the housing window is clean and centered over the SQM lens.



SQM Installation - Examples

Select a secure location where the SQM will not be vulnerable to disturbance, will have an unobstructed view of the overhead sky, and will not be affected by nearby artificial sources at night.

Mount the SQM at the selected location, ensuring that the SQM is aimed at zenith by verifying with a bubble level that the housing cover is horizontal.

Details of the installation will vary with site circumstances. A few examples follow.

Pine Mountain Observatory

The SQM is mounted to a communications antenna mast attached to one of the observatory domes. The SQM is attached to the mast with a pair of pipe straps. A tall stepladder is required to access the SQM.



Mosier

The SQM is mounted at the top of a wood post using the pipe straps and staples supplied with the SQM. The post extends about 7 ft. above ground level. The location is on private property, $\frac{3}{4}$ mile up a gated private road. In a less secure location, a taller post would have been used, placing the SQM well out or reach, requiring a ladder for access. The SQM is mounted at the top of a wood post using the pipe straps and staples supplied with the SQM. The post extends about 7 ft. above ground level. The location is on private property, $\frac{3}{4}$ mile up a gated private road. In a less secure location, a taller post would have been used, placing the SQM well out or reach, requiring a ladder for access.



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Dry Creek

The SQM is attached to a steel fence post, using the pipe straps supplied with the SQM. This location is on private property, behind a locked gate. This SQM was eventually disturbed by a trespasser who walked in and removed the SQM from its housing out of curiosity, then replaced it, but ignorant of its function, reinserted the SQM aimed downward. The SQM has since been removed for use elsewhere. If an SQM is again installed at this location, it will be mounted on a tall pole, making the SQM inaccessible without a tall stepladder or orchard ladder (a better choice than a stepladder on irregular ground).

A steel fence post is a good mounting solution for installations at secure locations, or for short term installations where security is not an issue. A steel fence post is quickly driven in place using a post driver, and later removed with a post puller.



Camp Hancock

The SQM is mounted to a pressure-treated 2x4 using the pipe straps and staples supplied with the SQM. Prior to driving the pair of staples into the 2x4 block the plumb angle relative to the roof rake is measured and a pencil line marked on the 2x4 block at that angle. The pair of staples were driven on that line, and the SQM was attached to the block, then the block was screwed to the rafter. In this case, the block was necessary to set the SQM out from the metal roofing overhang, but even if that were not the case, this procedure makes installation easier than direct attachment with staples and straps directly to the structure.



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Cottonwood Canyon State Park

This installation, at the top of a tall post, part of an old corral, illustrates the advantage of first mounting the SQM to a wood base, in this case a 1x4 board, before mounting the SQM to the supporting structure. The board was pre-drilled for the four mounting screws, and the centerline of the board was marked. The two staples supplied with the SQM were driven into the board, aligned with the centerline. Pilot holes were drilled for the points of the staples to reduce the risk of splitting the board, and making sure that the staple bodies were indeed properly aligned once driven into the board. The SQM was attached to the board using the supplied pipe straps before mounting to the post. After the first screw was driven, the bubble level of a tri-square was used to align the board plumb before driving the other three screws.



Shooting Star Ranch

This installation is in a remote location on a 3100-acre ranch at the end of a steep and rugged ranch road secured by a locked gate. The SQM was installed on a sturdy fence post. Cows can be present on the far side of the fence, but never on the near side. We thought about disturbance by cows as well as people.



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Shooting Star Ranch

The SQM is mounted via a mounting board. The mounting board was prepared before visiting the site, cut to size, pre-drilled for mounting screws, and pilot holes for the two staples. The mounting staples were already driven into the board and mounting screws started in their holes in the shop. One screw was driven into the post, then the board was rotated level, checked with a bubble level before the opposite corner screw was driven. The front surface of the board was checked for plumb and wood shims set between the board and post and adjusted until the board surface was plumb before driving the remaining screws. The SQM housing was attached to the staples with a pair of pipe straps.



Ensuring SQM zenith alignment

The optical axis of the SQM should be aimed vertically, at zenith. The first assumption we make is that the optical axis is aligned with the body of the SQM. The second assumption is that the body of the SQM, and therefore its optical axis is aligned with the axis of the weatherproof housing. This condition is achieved by making sure two edges of the SQM housing are in contact with the inner wall of the weatherproof housing tube. This is achieved by stuffing a foam piece into the tube as shown below, pressing two corners of the SQM body against the inner wall of the tube



Ensuring SQM zenith alignment

Once the cap of the weatherproof housing is set in place, with the housing cap window centered over the SQM lens, zenith alignment is verified using a bubble level.



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Ensuring SQM zenith alignment

A convenient alternative is using a level or clinometer app on your phone.



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Vent hole

Speaking of foam rubber pieces, one of the foam rubber pieces supplied with the SQM is intended to cover the vent hole in the bottom of the weatherproof housing. This enables pressure equalization yet keeps insects out.

Birds



Birds

In some locations, especially during nesting season, and before the numerous fledglings and their parent migrate, the SQM may become a favored bird perch. You may grow weary of cleaning bird poop off the SQM housing window. Wires taped to the cap deter bird perching.



Birds

This is a seasonal solution, best removed after fall migration. In winter, the spikes trap snow.

