SCRIPT TO DOWNLOAD ALL FILES IN A MAT LOGGER

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Subject: How to download MAT loggers under Linux

This document explains how to communicate and download MAT data loggers from a Bluetooth-enabled Linux computer. MAT loggers from Lowell Instruments LLC are capable of measuring Temperature (-5 to 30 C) and Pressure (0-300 psia or 200m depth).

The software is composed of one low-level source code library, so-called MAT library, and one high-level script folder, which contains the application code to automatically collect data from the hardware loggers. The software part is entirely written in python3. Along this report, `source code is formatted in this slightly different font.`

HARDWARE

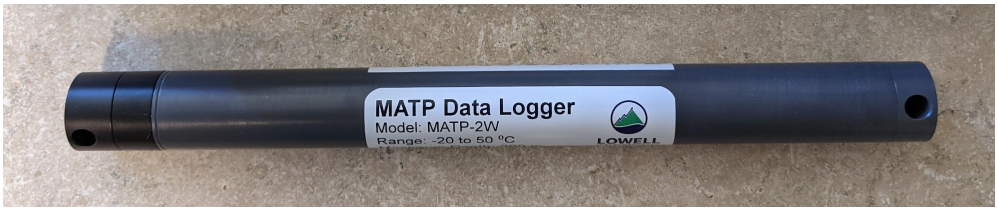

Figure 1: MATP-2W Loger. The pressure sensor is under the black cap on the left. The temperature sensor is internal to the logger approximately in the middle. The USB port and microSD card is accessible under the cap on the right.

The MATP-2W logger (Figure 1, above) contains a pressure sensor (under black cap on left), temperature sensor (approximately in the middle of the logger) and a microUSB port under the grey cap on right). The microUSB port is used for recharging the logger's battery and for direct wired communication including downloading data (in the event of a dead battery).

The logger is rated to 250 m maximum depth. Depths above this limit may burst the pressure sensor and may cause the logger to flood and the logger's electronics and battery getting destroyed.

The logger should be protected from rough handling. When used with commercial fishing operations, it must be protected from impacts from the fishing gear and from the boat itself (when being brought on deck etc.). When used with fixed fishing gear, the logger should be mounted inside the traps and secured with plastic zip ties. When used with trawlers, it is recommended that the logger be mounted to the trawl doors using a protective housing (Figure 2, below). Contact Lowell Instruments when using the logger with other types of fishing gear.

Figure 2: Mounting bracket for use with trawl doors. The two clamps should be welded to the trawler door 8-11 inches apart (center to center). The logger itself is inserted into the pipe with two spacers (not shown) and secured with two bolts.

The MATP-2W data loggers feature a USB port and a microSD memory card. The memory card contains, in its most basic configuration, a setup file (MAT.cfg). The SD card may also contain one or more data files (extension .lid).

The logger setup file (MAT.cfg) is an ASCII text file that is stored on the microSD card prior to the start of the deployment by the user. The setup file contains information used by the logger to determine how it should operate in the next deployment. The existing MAT.cfg file in the delivered loggers has been configured to record Temperature and Pressure every minute, on the minute. In the event the file is modified, the file must be labeled MAT.cfg and it must reside in the root directory of the microSD card. The logger will interpret the file after receipt of the "RUN" command and begin recording until it receives a stop command. If the file is invalid (for example, the "end time" has expired) the logger will return the ERR response. For further knowledge about loggers' commands, see delivered source code.

Once the logger has been started, it will write a new data file (.lid file) that contains the history of the deployment and the raw data to be converted to calibrated engineering units. The data file name is determined by the DFN tag in the MAT.cfg file. For the meaning of the rest of the tags in the MAT.cfg file, please contact Lowell Instruments.

SOFTWARE CONFIGURATION: LINUX

If your linux box is missing some components for Bluetooth app development, these commands may help you:

```
$ pip install wheel

$ apt-get update

$ apt-get install bluez

$ apt-get install libatlas3-base libglib2.0-dev libhdf5-dev python3-dev libgdal-dev libproj-dev proj-data proj-bin python3-venv pkg-config libhdf5-hl-100
```

SOFTWARE CONFIGURATION: BLUETOOTH

Unlike most Bluetooth developments, the project features a nice way to run the application without needing root permissions. Also, it runs enclosed inside a python virtual environment. The following steps were performed in order to configure the environment.

```
$ python3 -m venv venv

$ source venv/bin/activate

$ (venv) pip install pyyaml

$ (venv) pip install git+https://github.com/lowellinstruments/lowell-mat.git
```

Find the location of the file “bluepy-helper” in your python virtual environment:

```
$ find . -name bluepy-helper
```

Probably the answer will be something like (may vay a little regarding the python version) the following line, notice the leading ‘.’ indicating current folder:

```
./venv/lib/python3.9/site-packages/bluepy/bluepy-helper
```

Next give it user-level permissions so there is no need to do stuff as root:

```
$ sudo setcap 'cap_net_raw,cap_net_admin+eip' <absolute-location-bluepy-helper>
```

“Lowell-mat” is the lowell instruments library abstracting all Bluetooth communications. It is based on a custom version of “bluepy”.

SOFTWARE: RUNNING THE USER APPLICATION

Clone the lowell-mat_example repository.

```
$ git clone https://github.com/lowellinstruments/lowell-mat_examples.git
```

Enter the folder ble/bluepy/rn4020/ and run:

```
$ (venv) python recipe_get_all_files.py
```

The code is both commented and self-descriptive. The downloaded LID files can be found in the user home folder.

Figure 3 shows an execution of this script. The only thing needed to be remembered for a successful execution is, obviously, setting the correct MAC addresses of the loggers we want to download. This list, depending on the system, may be case sensitive. The addresses are hardcoded in the code. We also included a way to detect BLE devices around by using the function `ble_scan_for_loggers()`.

```
This script downloads Lowell Instruments MAT loggers

logger download 00:1e:c0:6c:76:13 started
pre: R linux BLE pars ('6', '11', '0')
post: R linux BLE pars ('6', '11', '0')
downloading file 2011605_TP_1m_(0).lid, size 326492
logger 00:1e:c0:6c:76:13 downloaded OK
converted OK: li_dl/dl_files/2011605_TP_1m_(0)_1632322921_Temperature.csv
converted OK: li_dl/dl_files/2011605_TP_1m_(0)_1632322921_Pressure.csv
```

Figure 3. Demo trace of the software downloading a logger

Downloaded files can be removed from the logger to not overpopulate the file system to prevent the logger slowing down. Remember to re-run the logger, if so. Feel free to contact Lowell Instruments for any help, if required, about your modifications.