

MEMORANDUM

Date: 21 June 2019

To:

From: Keith Martin

CC:

Subject: Celina, Minnesota USA, Tromino Passive Seismic

Summary

- While wind noise dominates most observation points, sufficient data has been collected to sufficiently validate the technique.
- Passive seismic data should only be acquired during periods with no wind
- The instrument should always be buried and a weighted bucket used to cover the instrument during acquisition.
- Acquired data quality should be inspected using Tromino Grilla software prior to moving observation stations.
- An updated text document recording all survey conditions, instrument and personnel used should be completed for each observation point as this assists future modelling and interpretation.

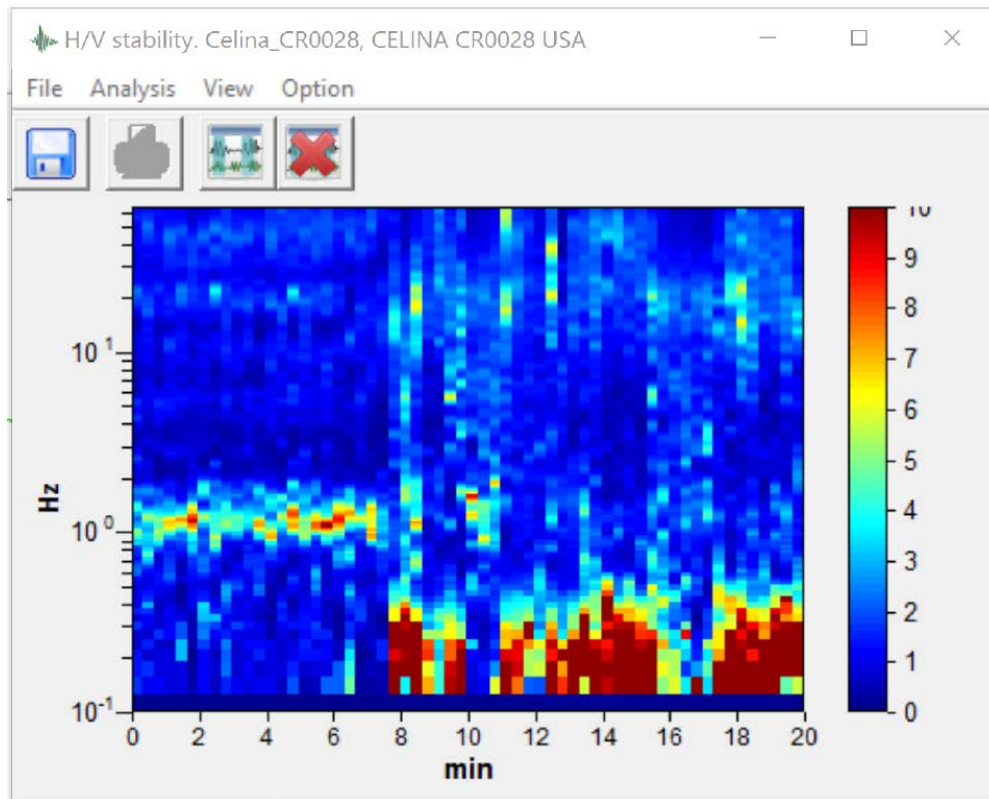
Location 487000mE 5309000mN WGS84NUTM15 (approx.. 093°05.5340 W, 47°56.2440 N (399.0 m))

Introduction

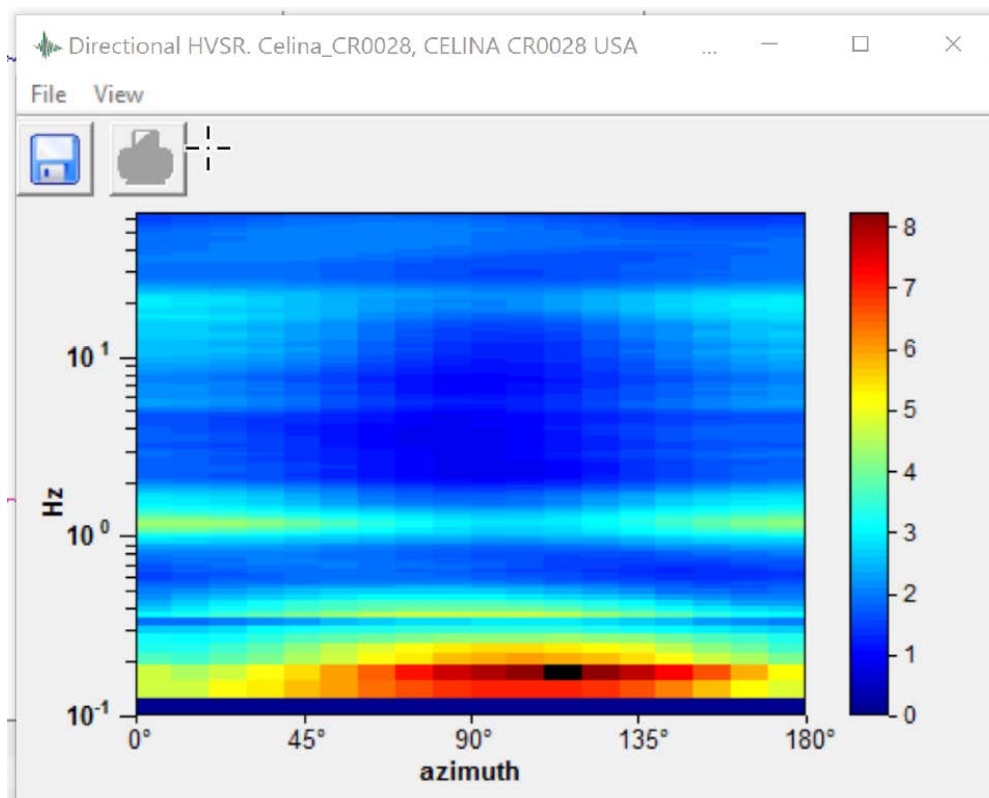
The following note summarises thoughts on recently acquired passive seismic over the Celina project in NW Minnesota. The objective of the survey is to determine depth of the till cover sequence over the basement lithology.

Discussion

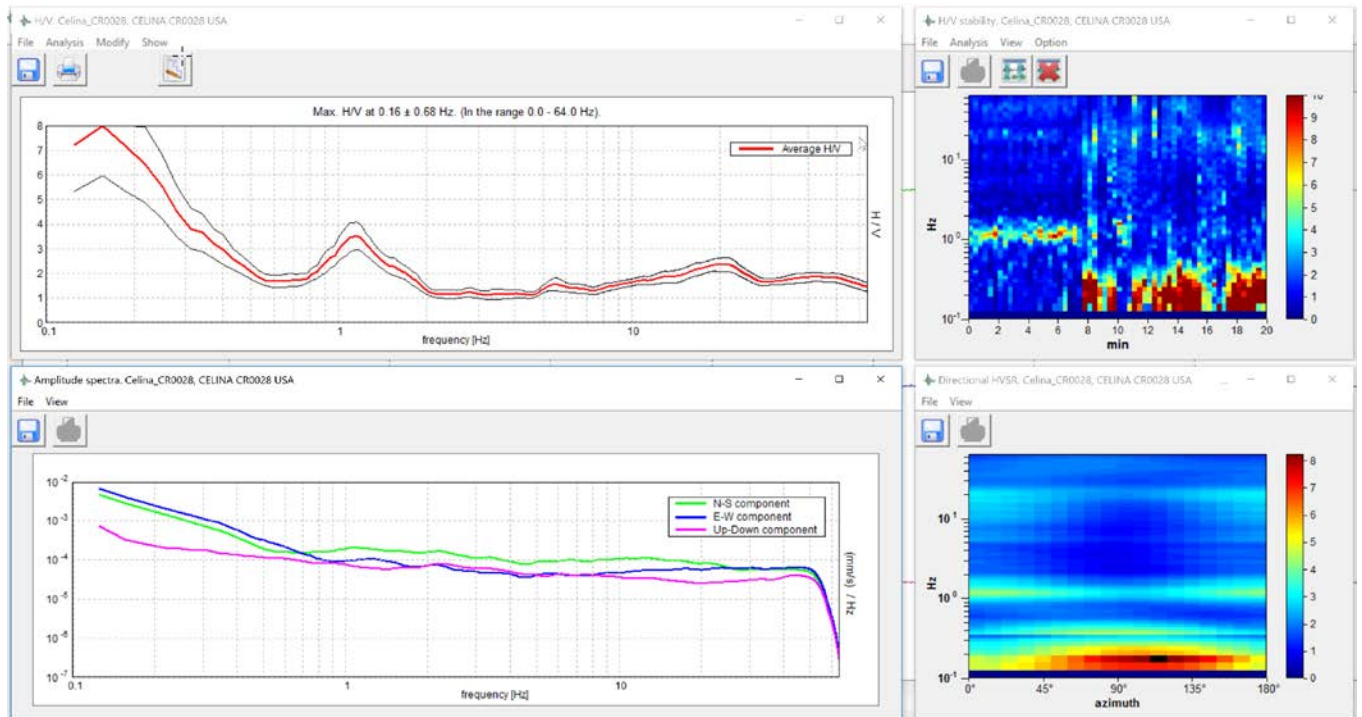
Low frequency wind noise appears to dominate signal at most observation points. Within the Tromino Grilla software it is possible to determine wind direction. Despite considerable wind noise there is sufficient signal to obtain valid data and valid depths to basement.



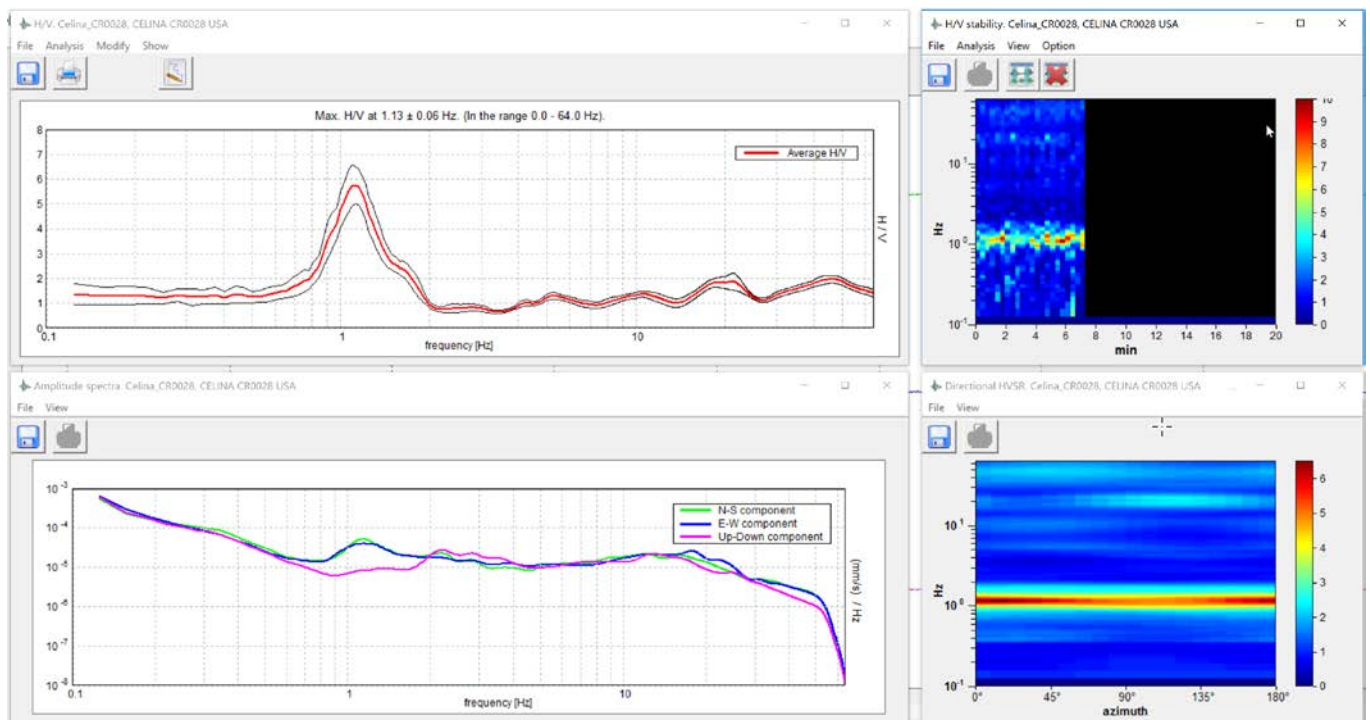
Low frequency wind noise commencing at 8 minutes during the recording at CR0028, after 8 minutes no more signal is observed from the till-bedrock interface.



Directional HVSR at CR0028, wind direction of noise observed 120' (ESE).



Data recorded at CR0028 noise influences the low frequency data and peak is not well defined.



Noise removal defines a good peak for modelling.



Recommendations

- Protect the instrument from wind through burying at least twice its height in depth. After a GPS position is obtained and data collection commenced cover the instrument with a weighted bucket for the 20 minutes of acquisition.
- It's important to avoid acquiring data during any wind activity
- If possible acquire data at a reasonable distance from "noise sources", at least 5 times the height of tree and signage wind noise sources.

Passive seismic instrument – acquiring data and default settings

It's important to not use rechargeable batteries, only use alkaline AA batteries.

Don't move the instrument while switched on, sensors are sensitive and measure micro movements.

Use a compass to orientate the Tromino "north".

Try burying the unit such that it is well below ground level (at least twice its height below surface) and coupled well to the ground surface.

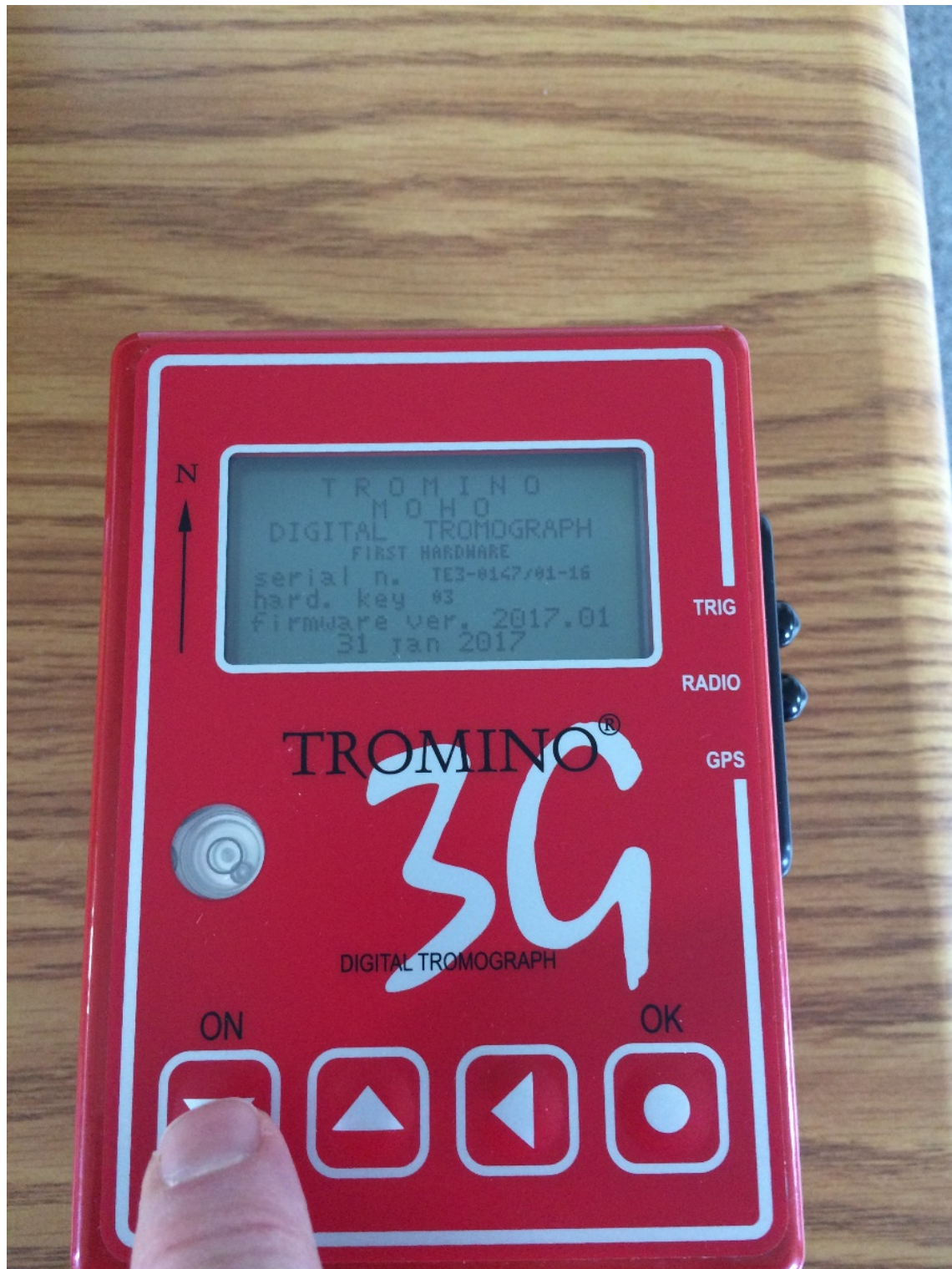
Avoid locating the instrument near "trees" and "street signs" try and locate the unit a distance equivalent to at least five times the height of the tree/sign away from the noise source.

Recording parameters used at Celina are summarised in the .TXT file stored within the trace directories and shown below.

```
"Celina_CR0002, CELINA CR0002 USA"
"Trace length: 0h20'00""
"Analysis performed on the entire trace."
"Start recording: 20/06/17 14:14:49"
"End recording: 20/06/17 14:34:49"
"Smoothing type: Triangular window"
"Sampling rate: 128 Hz"
"Window size: 20 s"
"Smoothing: 10%"
"GPS location: 093°05.5340 W, 47°56.2440 N (399.0 m)"
"(UTC time synchronized to the first recording sample): not available in this acquisition mode + 0 + 0 samples"
"Satellite no.: 06"
"Max. H/V at 0.16 ± 0.03 Hz (in the range 0.0 - 64.0 Hz)."
"Channel labels: NORTH SOUTH; EAST WEST; UP DOWN "
"Instrument: TE3-0147/01-16 "
"Data format: 32 byte"
"Full scale [mV]: 51"
```



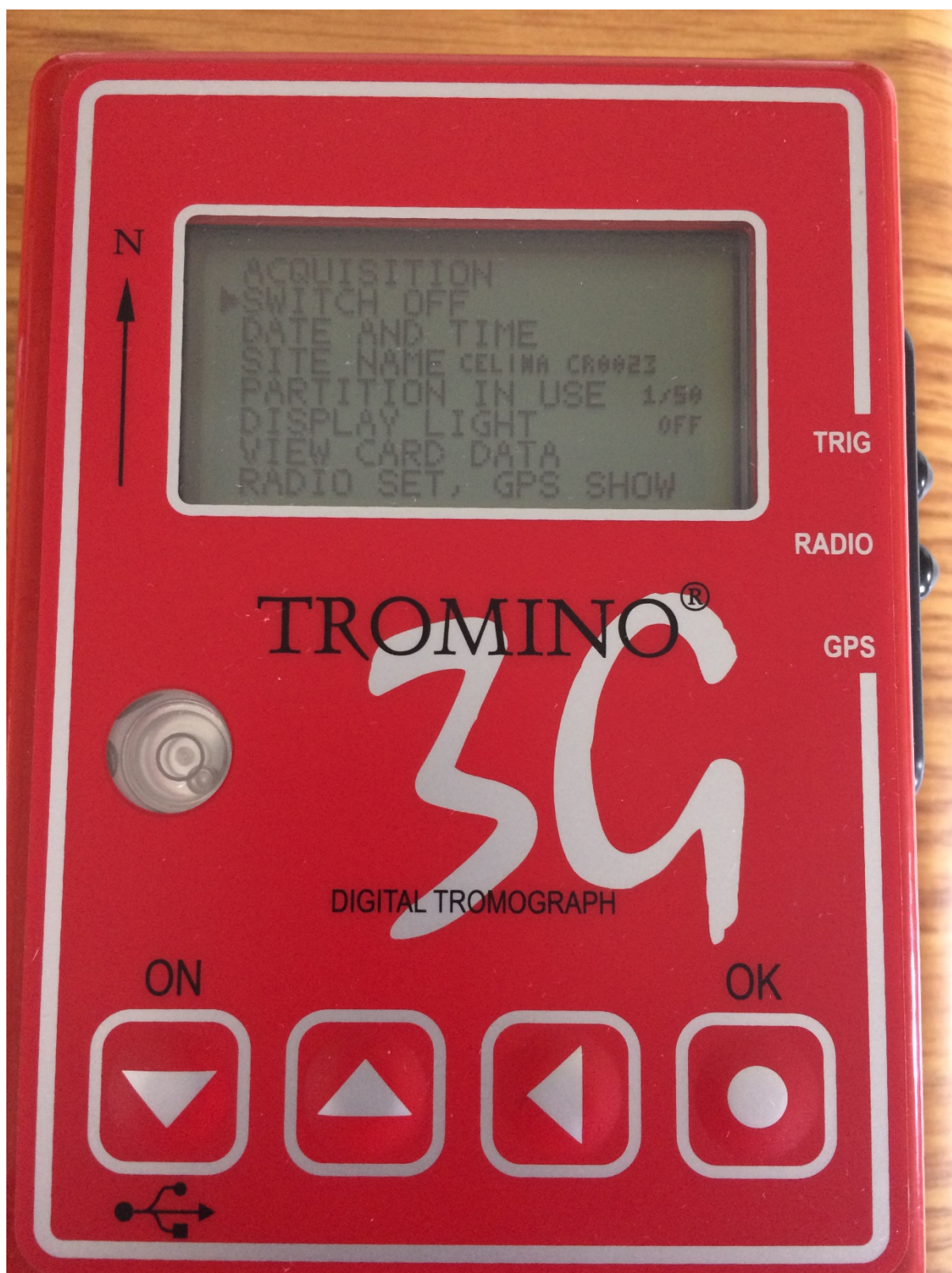

The following pictures capture the settings which are best for general acquisition of data.



Tromino – first screen which passes too quick to review, unless you hold the “on” key!



Tromino – first screen which appears, battery, date and time check.



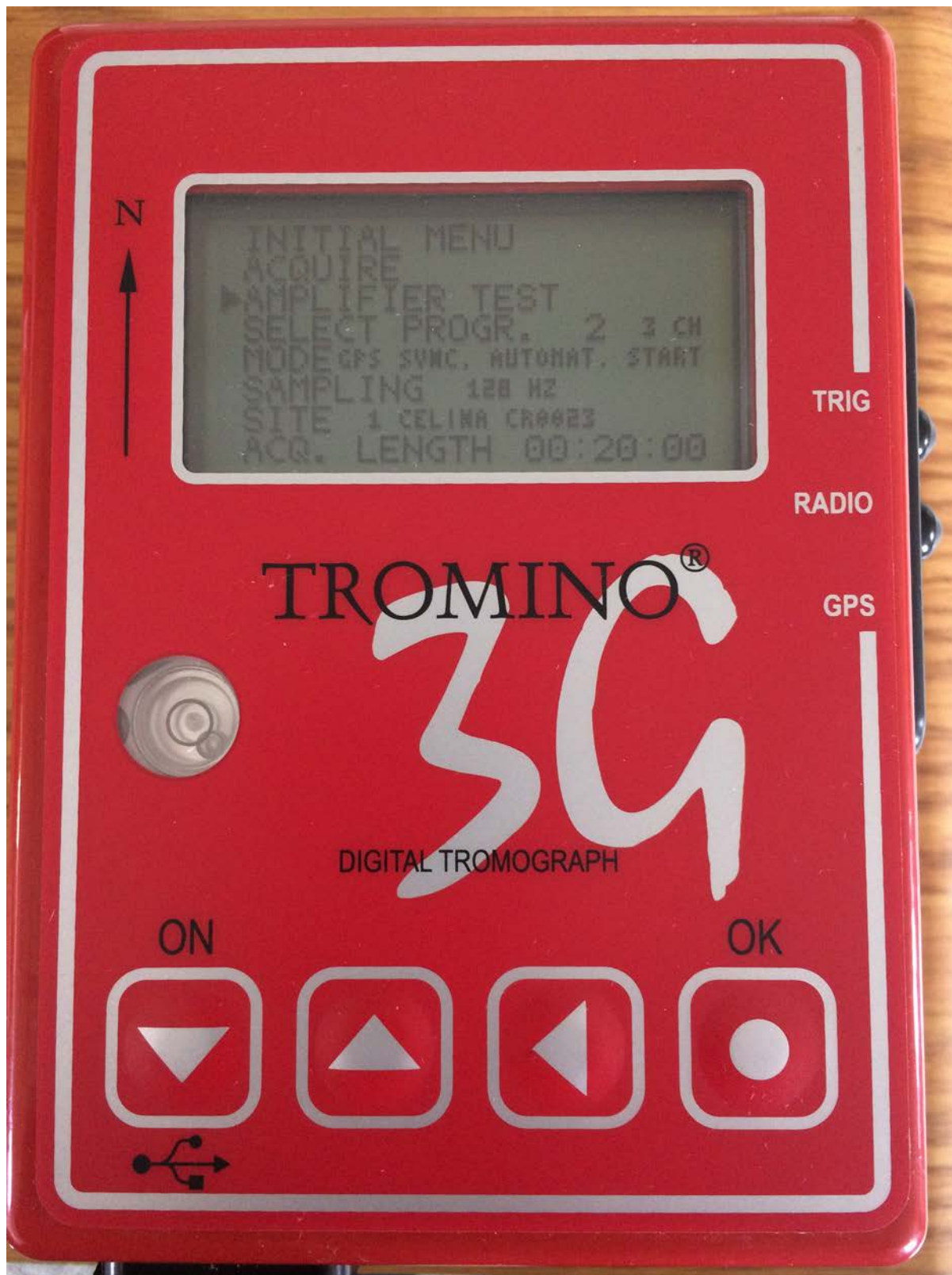
Initial setup menu, if necessary adjust time and date, edit site name and country, reset first partition to "1" at the beginning of day (allowing it to increment with each observation).



Adjusting site name (either drill hole ID or line easting/northing and country).

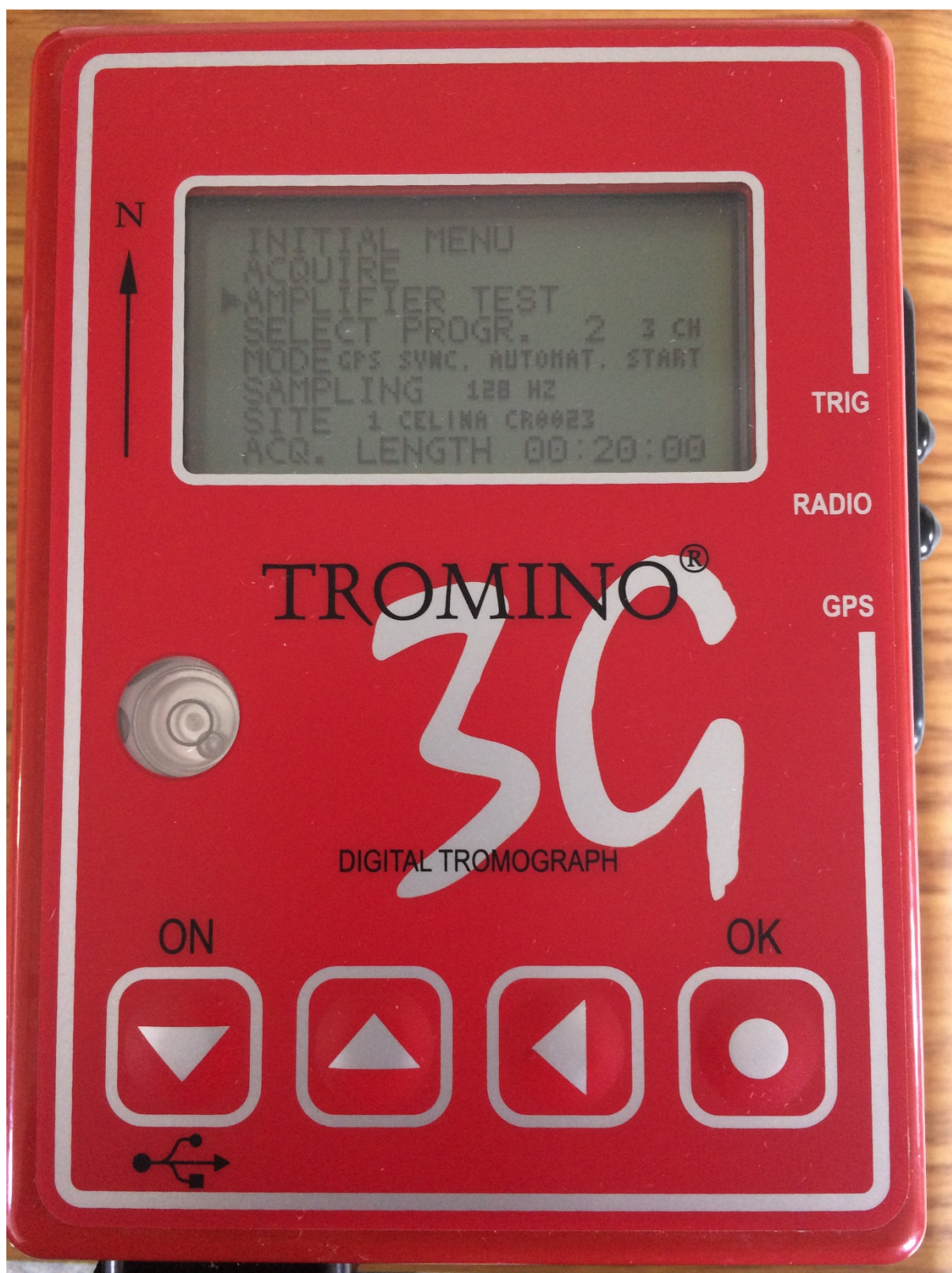


Resetting partition at the beginning of each day, adjust selected to “1” at start of day. This will increment by one with each observation. “Must maintain note book record of reading, GPS position, partition record number and any notes which will assist editing at end of day and interpretation of the data at a future date.



Sample frequency can be changed though usually set to 128 Hz. Confirm Program selected to 2 and 3 CH is selected, if acquisition length is incorrect change by editing "ACQ. LENGTH".





Select "Amplifier Test" check for system functionality and noise check.



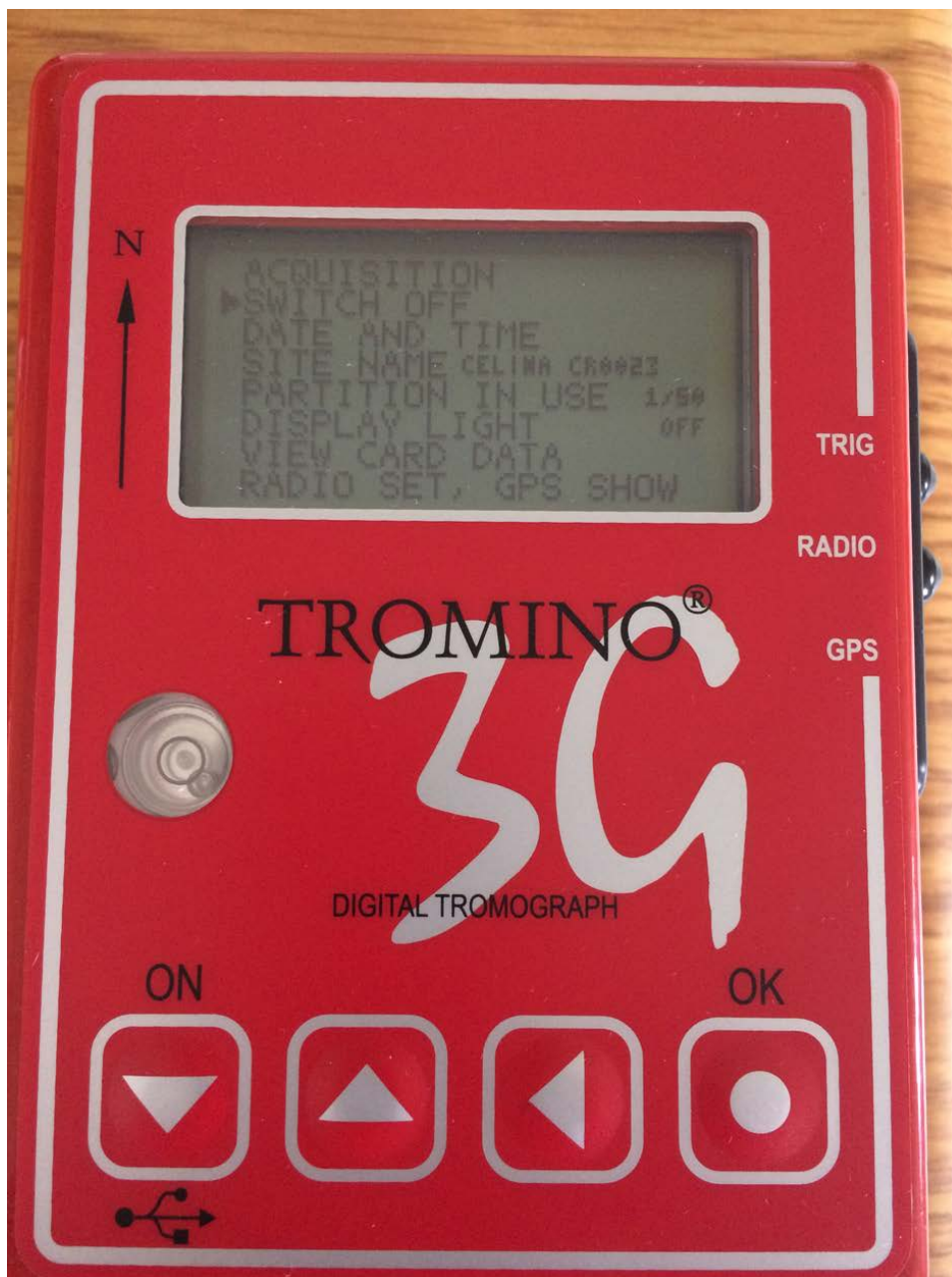
Amplifier Test, showing noise on each of the three channels (north-south, east-west and vertical)





After selecting acquisition, this screen suggests the unit is looking of GPS signal. In tree covered terrains the external antenna may be required. It's important to ensure the correct antenna is annotated on the main menu, otherwise edit to either "INT" for internal or "EXT" for external.

When acquisition is completed the unit will suggest "time is up" and you can then exit to the main screen to select "switch off".





Do's and Don'ts for Tromino Usage

Do not use rechargeable batteries.

Do not drop the instrument.

Do not open the instrument, return instrument if it fails.

Do not move, tilt or shake the instrument while turned on.

Ensure instrument is turned off before moving or transporting it.

Do not scratch or damage the baseplate.

Always use the support legs and make sure they are fully screwed in.

Use appropriate legs - long legs for soil, short (cone) legs for hard surfaces

Place Tromino on natural ground (i.e. avoid pavement, asphalt, etc.)

Avoid getting the instrument wet, especially with saline water.

Cover instrument from strong winds.

Return instrument immediately if it fails.

HANDY TIPS:

Good coupling with the ground is more important than perfect levelling

Align instrument parallel or perpendicular to ridges/scarps/faults/lineaments

Tromino field procedure for overcoming “stuck” sensors

1. Go to a reference site or place where good quality readings have been taken previously. You should then use this site for all future tests.
2. Set your Tromino to PROG 1 (i.e. no GPS), 128Hz sample rate and 20 minute recording time.
3. Take a recording (Record #1) at the known site (i.e. press ACQUIRE and then SAVE).
4. Upon completion of that recording, start a new recording but don't SAVE it (i.e. press ACQUIRE only)
5. Shake the instrument gently for 2-3 seconds in the three orthogonal directions while it's acquiring.
6. Now set the instrument into the ground (as you would normally to take a reading), and press SAVE and wait until the recording is complete. This is Record #2.
7. Repeats steps 4 - 6 for a third recording. This is Record #3.
8. Import the 3 Record traces and verify that the response is the same for each component in each recording.
9. Repeat this procedure on a regular basis.

Resource Potentials

[illegible]