Guide For Field Operations

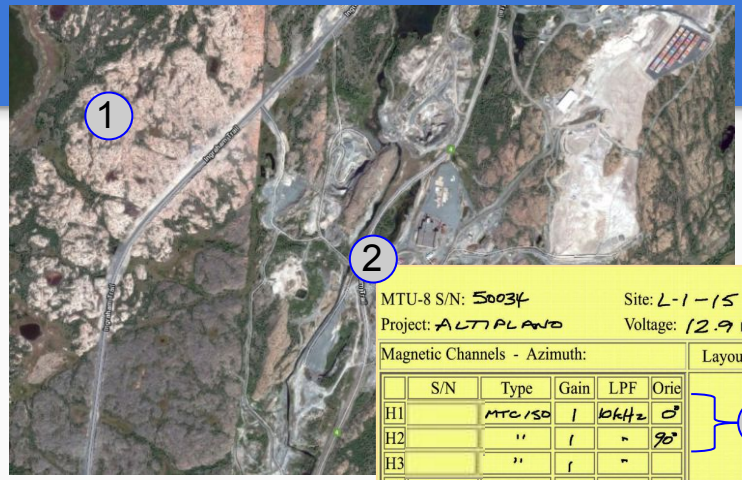
- Planning
  - Choosing the sites
  - Creating the configuration file
- Layout on site
  - Equipment and Tools
  - Setting up the layout
  - Calibrating the equipment
  - Setting up a survey site
  - Electric Channels
  - Magnetic Channels
  - Connecting GPS / Battery
  - Connection Sequence
- Testing
  - Checklist
  - Test Recording
- Best practices

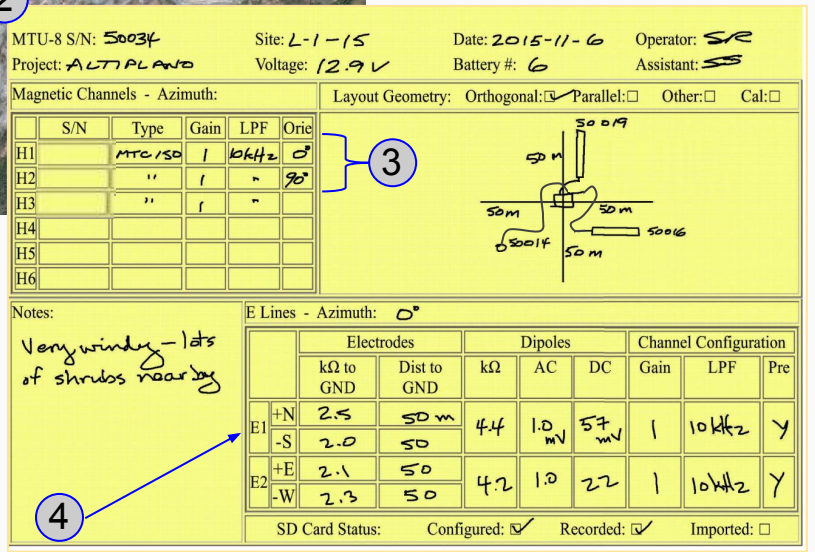
Choose the sites

1. Choose the **Site(s)**
2. **Configuration Layout Sheet**
   E-lines orientation
   - True North
   - Magnetic North
   - Azimuth
3. Identify the magnetic declination
4. Define how your equipment will be allocated
5. Create the file configuration (config.json) SD Card

Avoid:
- Hikers
- Industrial or transport activity
- Power lines or electric fences
- Protect the equipment from animals, the elements, livestock, and even from vegetation (under windy conditions, can induce micro-vibrations that will add noise to the recording)

**Obtain permission to conduct the work on the site*





Configuration Creator

Complete the information:

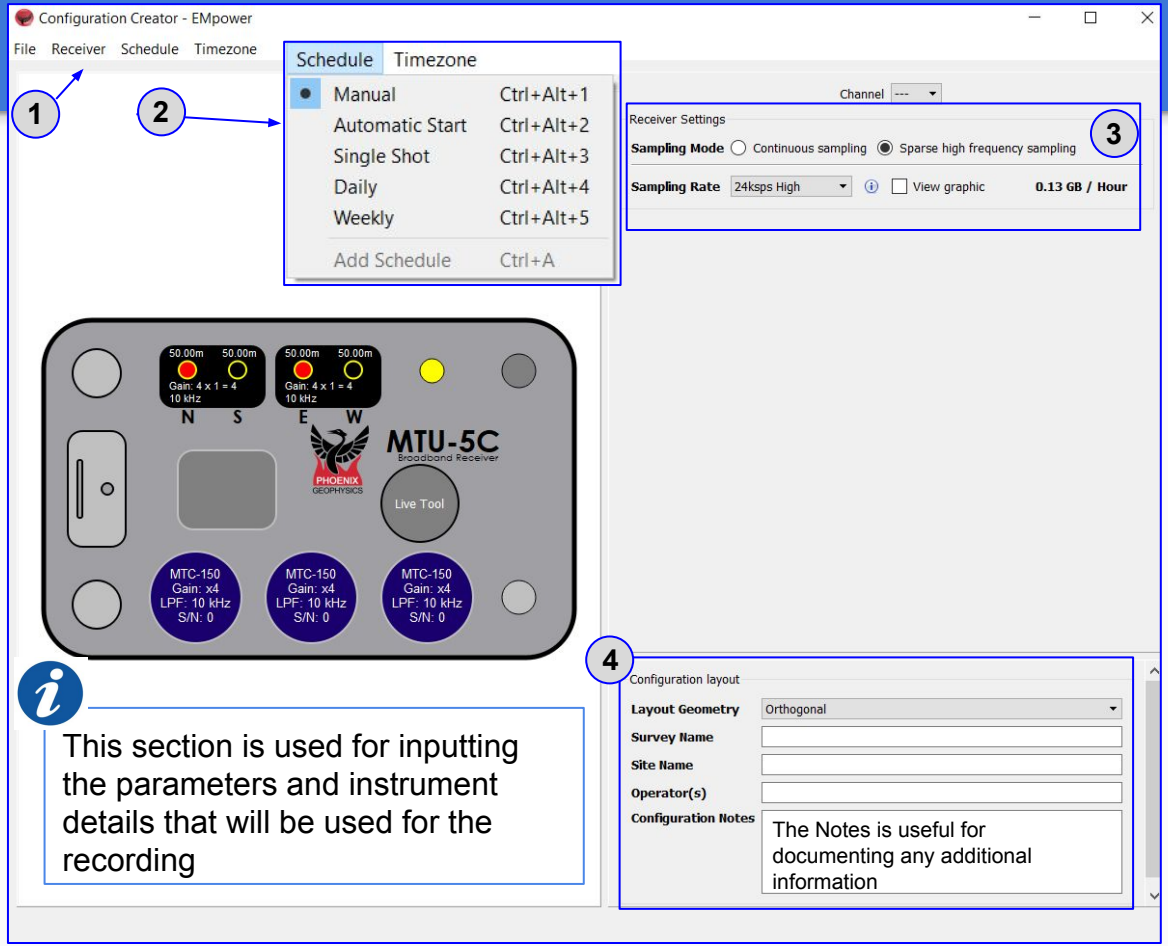
1. Check that the **Receiver** type is **MTU-5C**

2. Select the **Schedule**

3. **Receiver Settings**
   - Define the **Sampling Mode and Rate**

4. **Configuration Layout**

   **This information will be displayed on each channel*



Equipment and Tools

Equipment

1. Configuration Layout Sheet
2. Laptop
3. EMpower + License
4. SD Card + SD Card reader
5. Receiver
6. 12 V Battery
7. Power Cable and GPS Cable
8. Antenna
9. Magnetic Sensors and cables
10. Electrodes
11. E-line cable

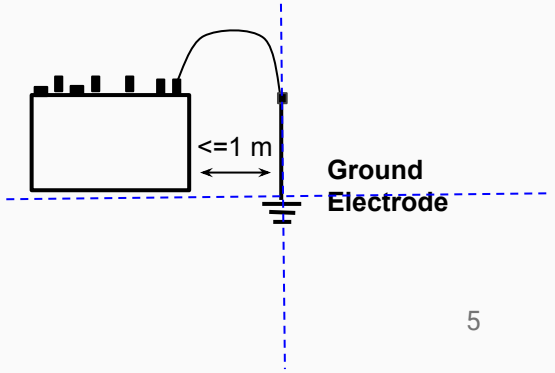
Tools & Supplies

1. Shovel
2. Container of salt water (50 g/L)
3. Handheld compass
4. Measuring tape
5. Multimeters (Analogical and digital)
6. Pencil and permanent marker
7. Level
8. Wire cutters
9. Electrical tape / Flagging Tape
10. Tarp

Setting up the layout

1. Ensure that you are at the right location as defined on the map
   - Use a handheld GPS compass
2. The site centre
   - Choose a dry spot
3. Stay clear of noise sources
4. For the **Ground Electrode,** choose the **center spot** and place the receiver no more than 1 m

**keep the receiver at least 1 m away from the E-Lines, to avoid electromagnetic interference*

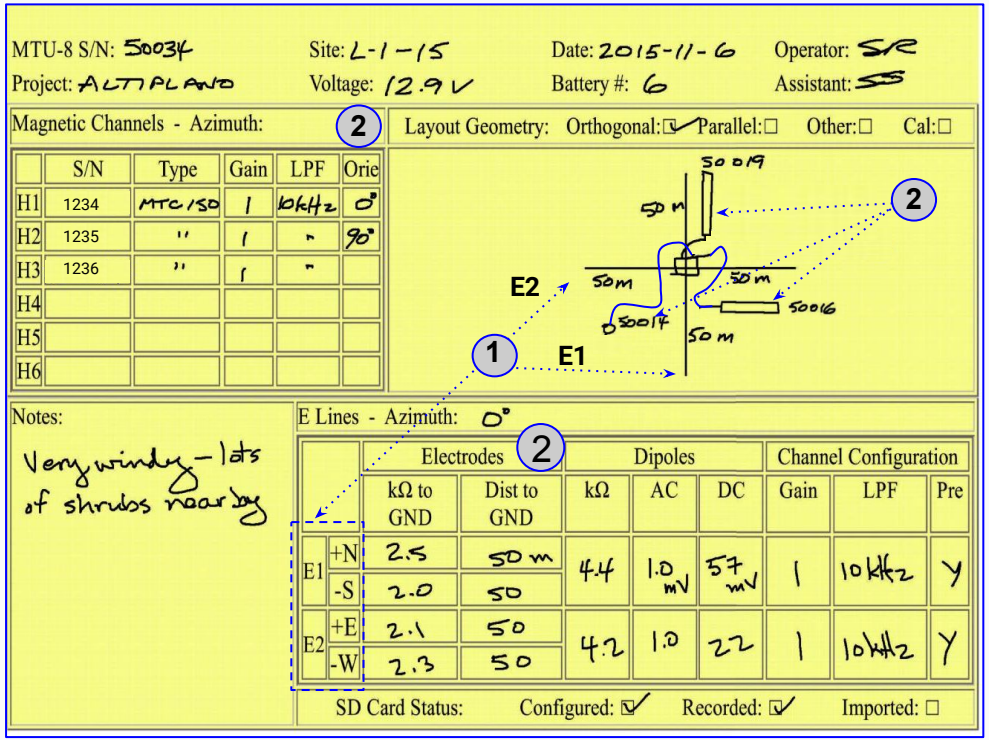


Setting up a survey site

1. Document the site details on the **Configuration Layout Sheet**, use a compass to orient the electrodes placing them the North, South, East, and West
   - Measure and use adhesive tape to mark the length of half the desired dipole on precut E-line cables

     Use a marker to tag the cables
     - **N**orth - **S**outh
     - **E**ast - **W**est
2. Using the position of the electrodes, orient the Sensors place following the Configuration Layout Sheet
   - Try to order by serial number where the minor number is for Hx

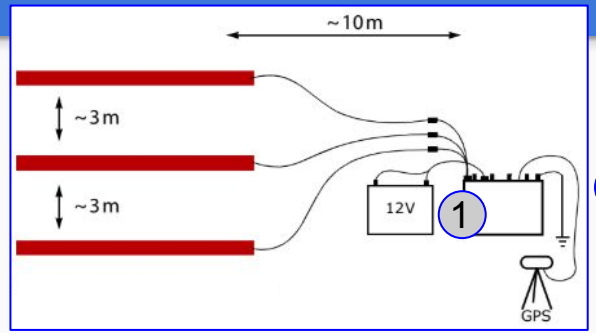
   **The longer the dipole, the better signal-to-noise ratio but the greater the AC the voltage included by the local power grid*

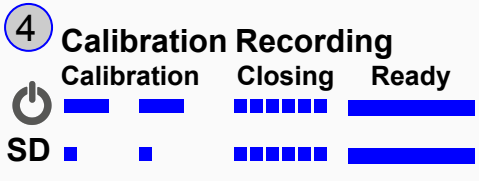


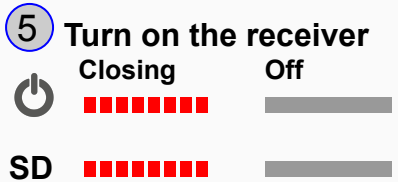
For any adjust to the E-line or Sensor installation *(See slide 14)*

Calibrating Equipment

1. Connect the sensors (Sensors should only be calibrated outdoors and away from noise)
2. Insert the SD Card
3. Turn on the Receiver, wait until both buttons are solid blue.
4. Start the Calibration by pressing the Power button briefly and release
   - At the end of the calibration process, both buttons will be solid blue.
5. Turn off the receiver
   - Press the Power button for >3sec and release
   - Pull the SD card of the receiver
   - Review the recordings using the EMpower Manage module to view and quality control the calibration
   - If the results are not correct review the connections and repeat the recording
   - If the receiver / sensors repeat this often, they should contact Phoenix geophysics for support (see the last page)



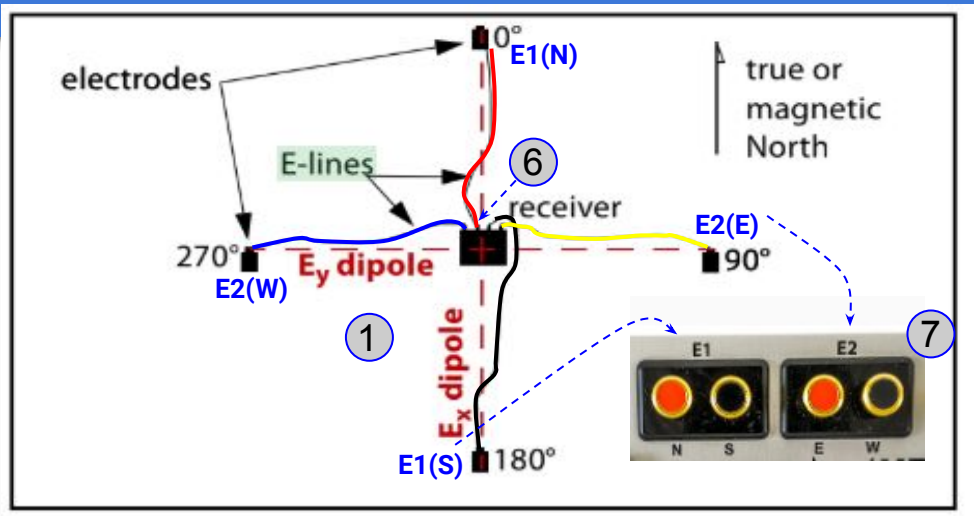


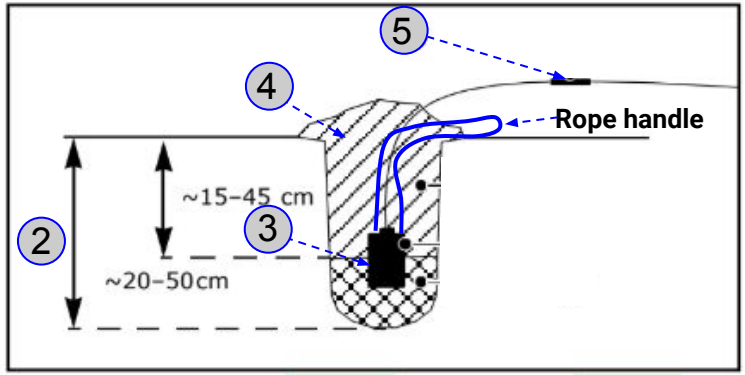


The calibration process should take place at the beginning of every survey (do not have to be buried to be calibrated)

Electric Channel

1. Register the electrode number and /or cable number on the **Configuration Layout Sheet**
2. Connect E-lines to the Electrode
3. Dig a small hole about 20-50 cm deep removing any sizeable rocks
   - Loosen the dirt at the bottom of the hole
     Pour in at least 1 liter of salt water and mix it with the dirt to form a uniform mud
4. Place the electrode upright in the hole
   Rotating it back and forth to position it solidly in the mud, leave the end electrode cable and rope handle extended outside the hole (5)
5. Cover the electrode completely with the loose dirt
6. Mark the end cable (receiver side) with N,S, E and W
7. Connect E-lines to the receiver





Magnetic Sensors

1. Register on the **Configuration Layout Sheet** the serial numbers before burying the Sensor

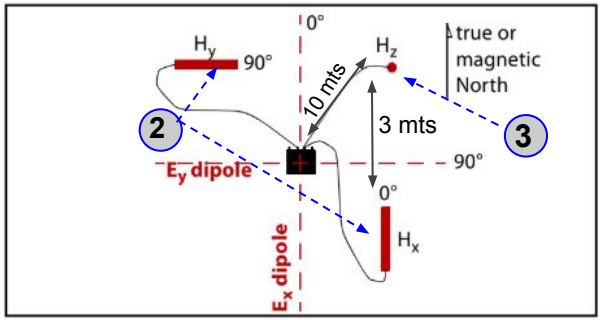
2. **Horizontal (Hx, Hy)**
   - The free end of **Hx** points North *(connector points south)*
   - The free end of **Hy** points East *(connector points west)*
   - 40 cm deep x 15 cm from each end
   - 10-15 cm from each side
   - Level the sensors *(any inclination could affect the data)*
   - Mark the receiver side of the E-line *(Hx, Hy)*

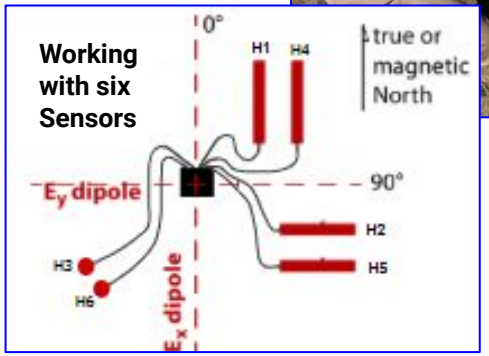
3. **Vertical (Hz)**
   - Dig a hole deep enough to completely bury the sensor
   - Mark the receiver side of the E-line *(Hz)*

1

Magnetic Channels - Azimuth:

	S/N	Type	Gain	LPF	Orie
H1	12345	MTC-150	1	10kHz	0°
H2	67891	"	1	"	90°
H3	78912	"	1	"	
H4					
H5					
H6					





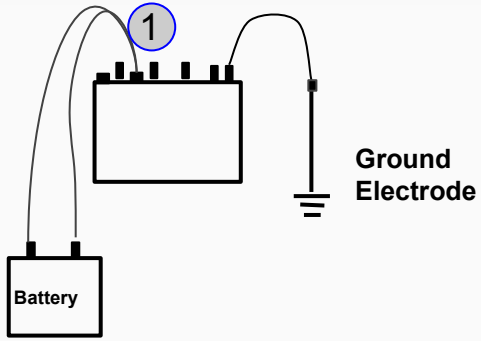
The Sensors should be 10 meters away from the receiver and 3 meters between each sensor

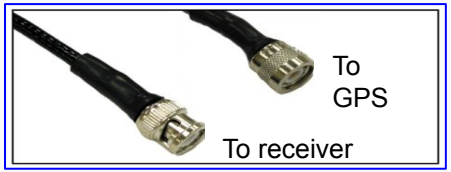
Avoid to walking over the sensor once installed

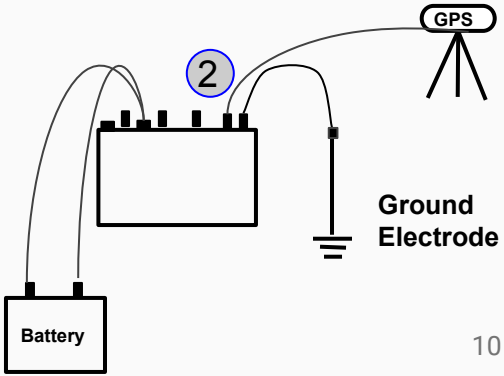
Connecting GPS / Battery

1. **Battery**
   - Connect the battery,
     - Black (-) negative
     - Red (+) positive
   - Fit the slotted connector (to the receiver's connector)

2. **GPS**
   - Connect the cables on the GPS antenna and Receiver
   - Open the antenna tripod, if necessary tape the antenna tripod to a stake, post or large tripod

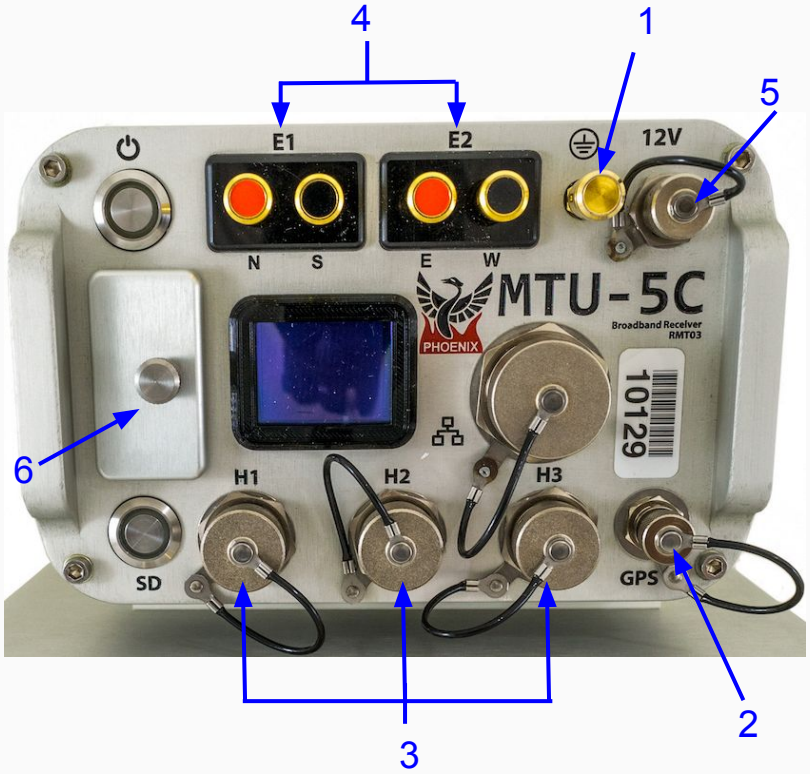






Connection Sequence

1. Ground electrode
2. GPS antenna
3. Electric channels
4. Sensor channels
5. Battery *(always at the end)*



Checklist

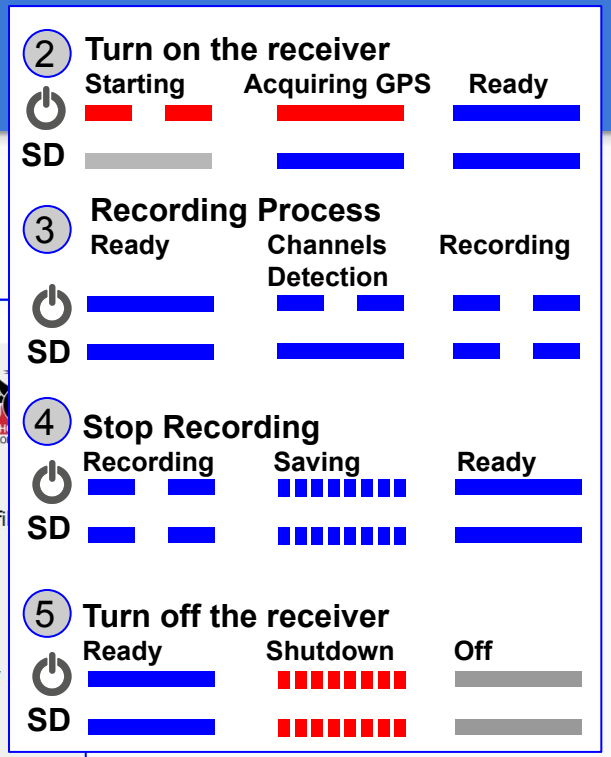
- Battery
- GPS antenna
- Inserting the SD card
- GPS synchronization
- Measure and orient electrode and sensor
- Keep cables flat on the ground, (not draped over plants or obstacles). Bury or weight the cables down if necessary to reduce wind noise
- Ensure clear sight-lines between the GPS antenna and the sky
- Test Recording (see next page)

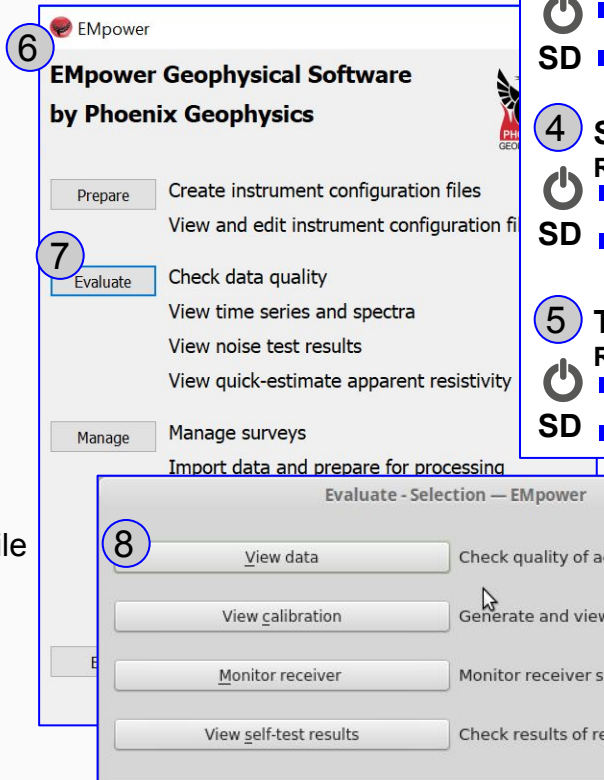
Keep accurate records on a layout sheet.

Test Recording

1. Insert the **SD Card**
2. Turn on the **receiver**
3. Recording data test (10-12 minutes)
4. Stop the recording
5. Turn off the receiver
   - Press button for >3sec and release
   - Pull the SD card of the receiver
6. Open Empower
7. Click the Evaluate button
8. Select View data
   - Select the SD card (The recording process creates two folders, log and recdata)
   - Open recdata folder and select the recording file and click Choose
   - Review the information recording

**Verify that there was not a warning icon on the left of the channels or next to the Recording ID*



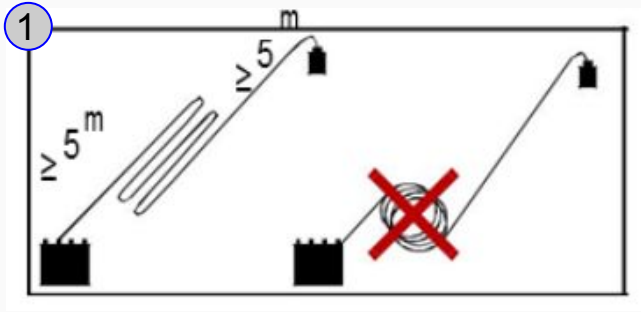


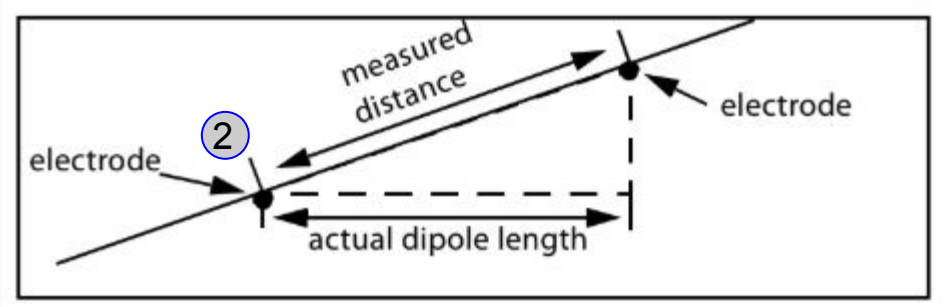
Avoid to walking over the sensor once installed

Best practices

1. **Excess cable:**
   - Always lay excess cable in elongated S-shapes, no closer than 5m from the ends

2. **Slope:**
   - E-lines laid out down a steep slope can also create a problem: the measured distance between the electrodes no longer equals the actual horizontal length of the dipole. Instead, the measured distance is a vector resulting from both horizontal and vertical displacement
     **If you encounter inclines, compensate using trigonometry*
   - One way is to calculate how much to lengthen the E-lines when laying out the site so that the horizontal component of the vector is the desired dipole length
   - Alternatively, can calculate the actual horizontal dipole length before processing the data





To minimize wind-induced noise, ensure that the sensors cables lie flat on the ground
Place weights on them every meter or so if necessary

Technical Support Contact

Email: *support@phoenix-geophysics.com*
Phone: *+ 1 416 491 7340*