

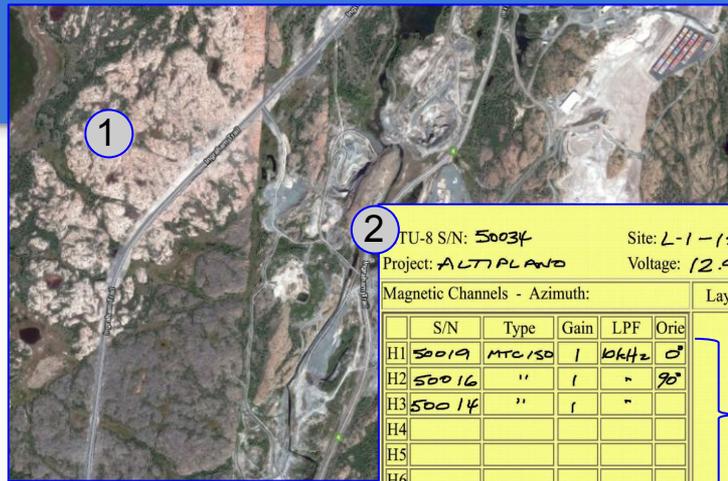
Guide For Field Operations



- 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 Setup
 - Magnetic Channels
 - Connecting the GPS / Battery
 - Connection Sequence
- Testing
 - Pre-Recording Checklist
 - Test Recording
- Best practices

Choose the sites

1. Choose the **Site(s)**
2. **Configuration Layout Sheet**
 - Magnetic Channels North
 - E-lines orientation
 - True North
 - Azimuth
3. Identify the magnetic declination
4. Define how the electric channels will be set up on the site
5. Record how the equipment will be set up on the site
6. Create the configuration file(config.json) on the SD Card



2 TU-8 S/N: 50034 Site: L-1-15 Date: 2015-11-6 Operator: SR
Project: ALTIPLANO Voltage: 12.9V Battery #: 6 Assistant: SS

Magnetic Channels - Azimuth: Layout Geometry: Orthogonal: Parallel: Other: Cal:

	S/N	Type	Gain	LPF	Orie
H1	50019	MTC/50	1	10kHz	0°
H2	50016	"	1	"	90°
H3	50014	"	1	"	
H4					
H5					
H6					

3

5

Notes: Very windy - lots of shrubs nearby

4

E Lines - Azimuth: 0°

	Electrodes		Dipoles			Channel Configuration		
	kΩ to GND	Dist to GND	kΩ	AC	DC	Gain	LPF	Pre
E1	+N 2.5	50 m	4.4	1.0 mV	57 mV	1	10kHz	Y
	-S 2.0	50						
E2	+E 2.1	50	4.2	1.0	22	1	10kHz	Y
	-W 2.3	50						

SD Card Status: Configured: Recorded: Imported:



Avoid:

- Hikers
- Industrial or transportation 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 desired **Schedule**
3. Set the **Receiver Settings**
 - Define the **Sampling Mode** and/or **Sampling Rate**
4. Input the **Configuration Layout** information

 This section is used for inputting the parameters and instrument details that will be used for the recording

Configuration Creator - EMpower

File Receiver Schedule Timezone

Schedule Timezone

- Manual Ctrl+Alt+1
- Automatic Start Ctrl+Alt+2
- Single Shot Ctrl+Alt+3
- Daily Ctrl+Alt+4
- Weekly Ctrl+Alt+5
- Add Schedule Ctrl+A

Receiver Settings

Channel ---

Sampling Mode Continuous sampling Sparse high frequency sampling

Sampling Rate 24ksps High View graphic 0.13 GB / Hour

MTU-5C Broadband Receiver

Phoenix Geophysics

Live Tool

MTC-150 Gain: x4 LPF: 10 kHz S/N: 0

MTC-150 Gain: x4 LPF: 10 kHz S/N: 0

MTC-150 Gain: x4 LPF: 10 kHz S/N: 0

Configuration layout

Layout Geometry Orthogonal

Survey Name

Site Name

Operator(s)

Configuration Notes

The Notes is useful for documenting any additional information

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



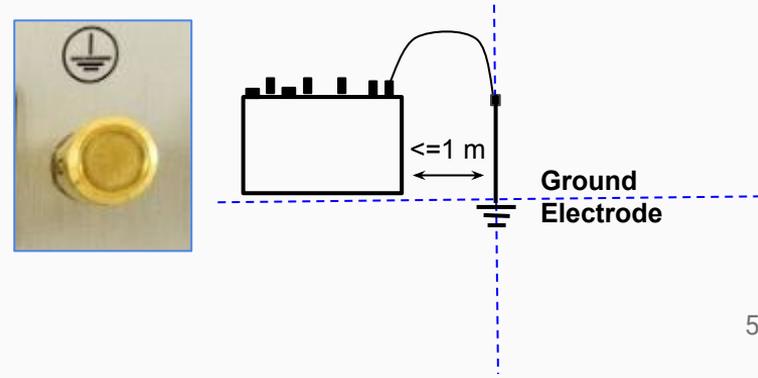
Tools & Supplies

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

Setting up the layout

1. Ensure that you are at the correct location as defined on the map
2. Use a Handheld GPS compass to locate the centre site
 - 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

**The receiver should be at least 1 meter away from the E-Lines, to avoid electromagnetic interference.*



Setting up a survey site

- Document the site details on the **Configuration Layout Sheet**, use a compass to orient the electrodes placing them in the North, South, East, and West cardinal directions
 - Measure and mark the half the E-line cables using adhesive tape
 - Use a marker to label the cables
 - **N**orth - **S**outh
 - **E**ast - **W**est
- With reference to the position of the electrodes, place the Hx (North facing) sensor in the North-East quadrant and the Hy (East facing) sensor in the South-East quadrant.
 - Assign the magnetic sensor with the lower serial number to be the Hx (North-facing) sensor

**The longer the dipole, the better signal-to-noise ratio but at the expense of a greater AC voltage induced by the local power grid*

MTU-8 S/N: 50034 Site: L-1-15 Date: 2015-11-6 Operator: SR
 Project: ALTIPLANO Voltage: 12.9 V Battery #: 6 Assistant: SS

Magnetic Channels - Azimuth: Layout Geometry: Orthogonal: Parallel: Other: Cal:

	S/N	Type	Gain	LPF	Orie
H1	50019	MTG/150	1	10kHz	0°
H2	50016	"	1	"	90°
H3	50014	"	1	"	
H4					
H5					
H6					

Notes: E Lines - Azimuth: 0°

Very windy - lots of shrubs nearby

	Electrodes		Dipoles			Channel Configuration		
	kΩ to GND	Dist to GND	kΩ	AC	DC	Gain	LPF	Pre
E1	+N	2.5	4.4	1.0 mV	57 mV	1	10kHz	Y
	-S	2.0						
E2	+E	2.1	4.2	1.0	22	1	10kHz	Y
	-W	2.3						

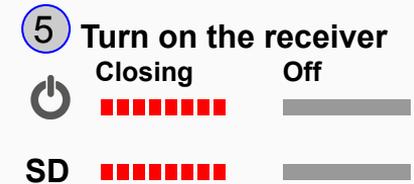
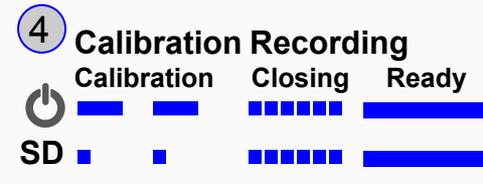
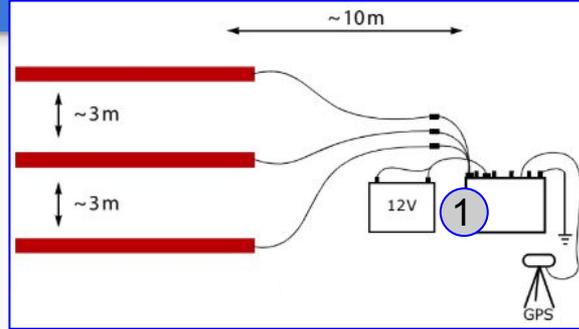
SD Card Status: Configured: Recorded: Imported:



To adjust to the E-line or Sensor installation (See slide 14)

Calibrating the Equipment

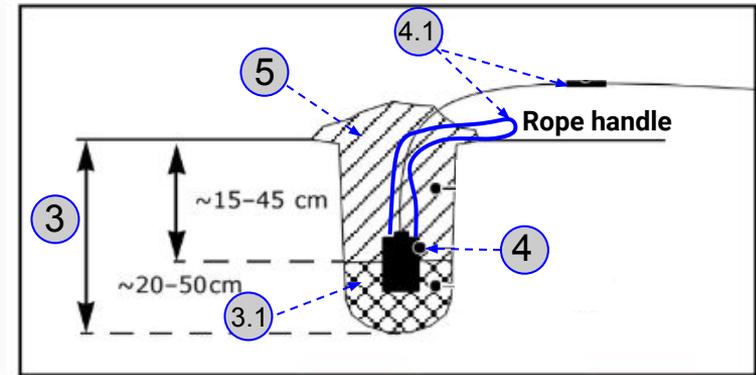
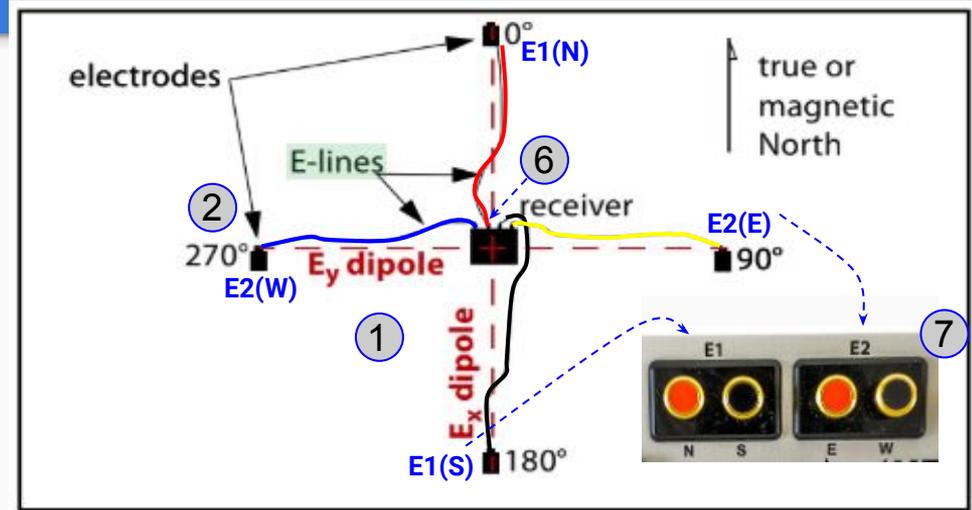
1. Connect the Magnetic Sensors to the receiver
2. Insert the SD Card
3. Turn on the Receiver, wait until both buttons are solid blue.
4. Start the Calibration by pressing the Power button briefly and releasing it
 - At the end of the calibration process, both buttons will be solid blue
5. Turn off the receiver
 - Press the Power button for >3sec and release
 - Pull the SD card of the receiver
 - Review the calibration recording using the EMpower Manage section to view and quality control the calibration
 - If the calibration results are not correct review the cable connections and repeat the recording
 - If this receiver and sensors combination produces incorrect results often, please 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 Setup

1. Write down the electrode number and /or cable number on the **Configuration Layout Sheet**
2. Connect the E-lines to the Electrodes
3. Dig a small hole about 20-50 cm deep removing any sizeable rocks
 - 3.1. 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.
 - 4.1. Leave the electrode end cable and rope handle extended outside the hole
5. Bury 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. Write down on the **Configuration Layout Sheet** the Magnetic Sensor serial numbers before burying the Sensor

2. **Horizontal (Hx, Hy)**

- The free end of **Hx** points North (*the connector end of Hx points south*)
- The free end of **Hy** points East (*the connector end of Hy points west*)
- Dig a trench which is 40 cm deep x 15 cm longer than the Magnetic Sensor on each end, and 10-15 cm wider than the Magnetic Sensor
- Use a bubble level to level the Magnetic Sensor Sensors out of the level can compromise the measurement accuracy
- Label the receiver side of the Sensor orientations (Hx or Hy)

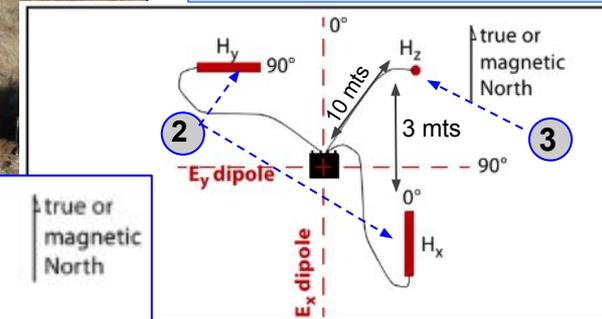
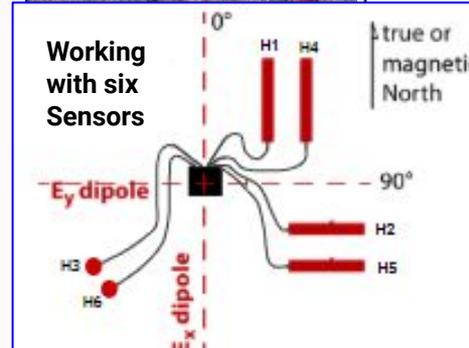
3. **Vertical (Hz)**

- Dig a hole deep enough to completely bury the Magnetic Sensor
- Use a bubble level to level the Magnetic Sensor
- Mark the receiver side of the Magnetic Sensor(Hz)



1	S/N	Type	Gain	LPF	Oric
H1	12345	MTC/50	1	10kHz	♂
H2	67891	"	1	"	90°
H3	78912	"	1	"	
H4					
H5					
H6					

i The Sensors should be at least 10 meters away from the receiver and at least 3 meters away from each other

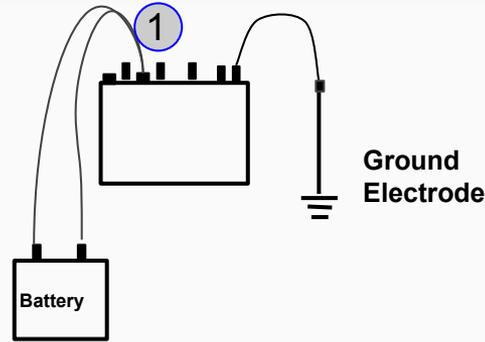


! Avoid to walking over the sensor once installed

Connecting GPS / Battery

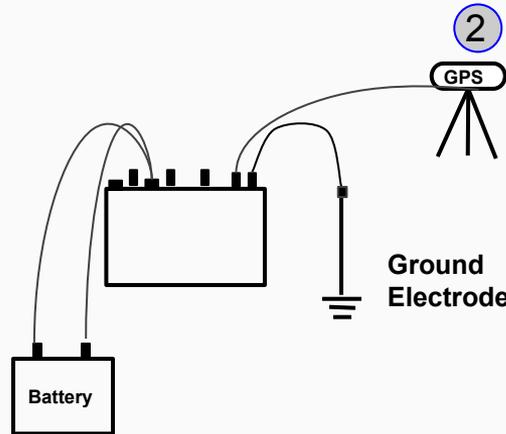
1. Connect the battery cable

- 1.1. Black (-) negative
- 1.2. Red (+) positive
- 1.3. Connect the battery cable to the receiver "12V" connector



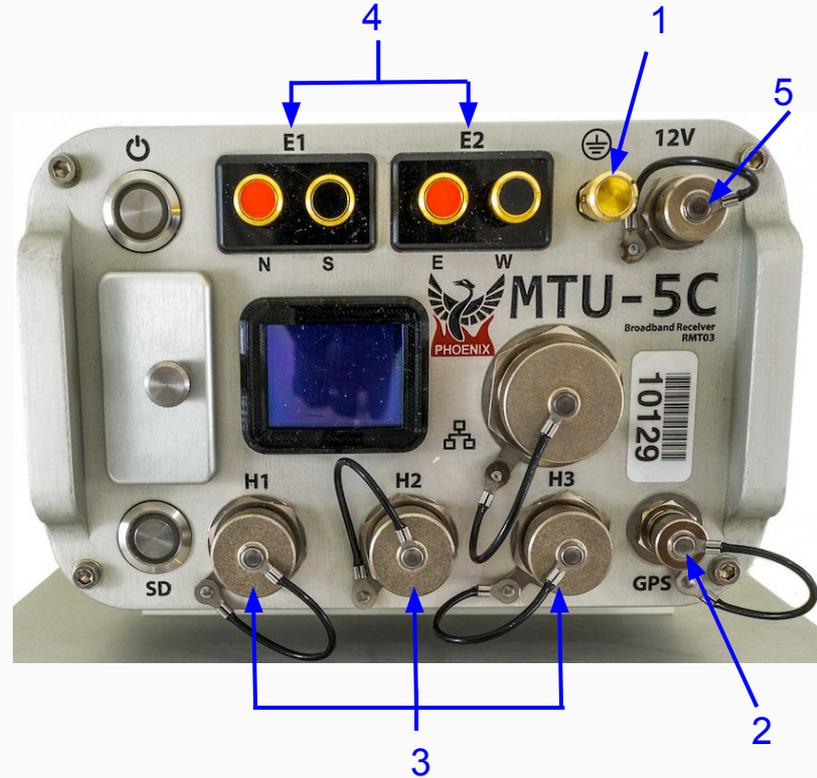
2. Connect the GPS antenna to the Receiver

- 2.1. Under normal conditions the GPS antenna can be left in the side pocket of the receiver bag
- 2.2. In case of poor sky visibility, it might be necessary to relocate the antenna using the supplied tripod or other means.



Connection Sequence

1. Ground electrode
2. GPS antenna
3. Electric sensor channels
4. Magnetic Sensor channels
5. Battery *(always connect the battery last)*



Pre-Recording Checklist

1. Battery is connected and fully charged
2. GPS antenna is connected and has good sky visibility
3. SD card is prepared and installed
4. Site layout and orientation are correct and recorded on the layout sheet
5. Ground electrode is installed and connected
6. Magnetic sensor cables and E-line wires are properly connected and lying flat on the ground (not draped over plants or obstacles).
 - Bury or weight the cables down if necessary to reduce wind noise
7. No warnings on the receiver screen
8. GPS is synchronized

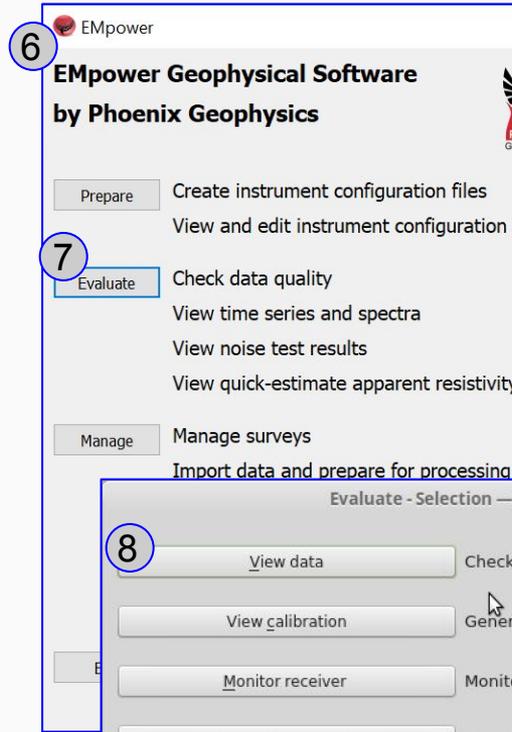
Now the receiver is ready to perform a test recording (see the next page)



Quick verification recording

1. Insert the **SD Card**
2. Turn on the **receiver**
3. Start the recording data for 10-12 minutes
4. Stop the recording
5. Turn off 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 the recdata folder and select the recording file and click Choose
 - Review the recording information

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



2 Press the power button briefly and release

	Starting	Acquiring GPS	Ready
SD			

3 Press the power button briefly and release

	Ready	Channels Detection	Recording
SD			

4 Press the **Power** button briefly and release

	Recording	Saving	Ready
SD			

5 Keep pressing the power button 3 sec and release

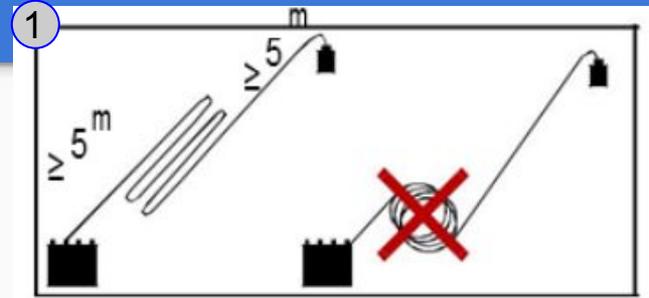
	Ready	Shutdown	Off
SD			

 *Avoid to walking over the sensor once installed*

Best practices

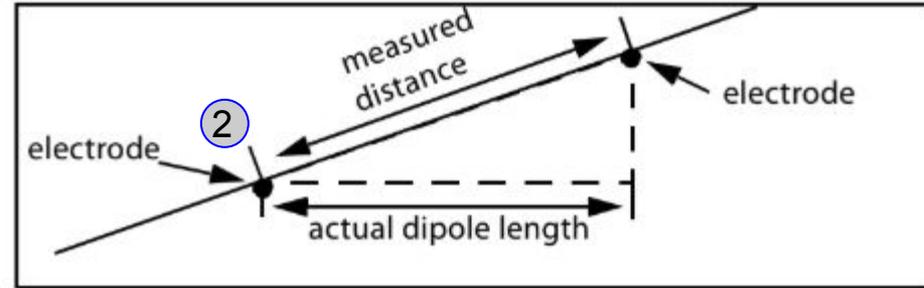
1. Excess E-lines wire:

- Always lay excess wire(s) in elongated S-shapes, no closer than 5 meters from the receiver or the sensor(s). Do not take up excess E-line wire by gathering the E-line wire up into a coil.



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 the encounter inclines, compensate by 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 and use this calculated value when processing the data



To minimize wind-induced noise, ensure that the Electronic sensors wires and Magnetic sensor cables are lying flat on the ground. Place weights on them every meter or so if necessary. Shovel loads of dirt or medium sized rocks make good weights.



Email: support@phoenix-geophysics.com

Phone: + 1 416 491 7340