

# Electrode Pre-Amplifier

## APS01-System Manual of Operation



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# System Description

The pre-amplification system provides a high input impedance, allowing to perform recordings in places where the contact resistance is really high (in the order of megaohms). Equipped with a high voltage arrester to prevent damage due to static discharges or other high voltage transients.

The system is designed to couple with electrodes that, due to the environment, can only provide high contact impedance. Due to this high contact impedance, electrodes and electric lines act as ultra-broadband sensors of undesired external noise.

For this reason, the system contains integrated low pass filters at each pre-amplification box, preventing the noise caused by high contact resistance, from saturating the inputs of the receiver.



# Electrode Preamp

The Electrode Pre-amplifier is designed to connect the electrodes to the Receiver through a Pre-Amplified, electrically protected interface.

1. Electrode connector
2. Ex / Ey, **Hub** connector (8-pin cable)



# Electrode Preamp Hub

The Electrode Preamp Hub concentrates the signals from the pre-amplifiers and interconnects them to the Receiver

1. Ex / Ey **Receiver** connector
2. Ground Electrode connector
3. 12 VDC power input
4. E1 (Ex) **North** and **South** Pre-amplifier connectors (8-pin cables)
5. E2 (Ey) **East** and **West** Pre-amplifier connectors (8-pin cables)



<b>Model</b>	<b>APS01- System</b>
Dimensions	23.1 cm x 17.3 cm x 24.9 cm
Pre-amplifier weight	1 kg
Hub weight	1 kg
Input impedance	500 M $\Omega$
Suggested operating frequency range	1000 Hz - 1000s
Suggested contact resistance range	10 $\Omega$ - 5 M $\Omega$
Signal voltage range	+/- 10 V
Power voltage range (centralized, 4 electrodes powered from the hub)	10.5 - 13.8 V
Operating temperature range	-25 °C to +70 °C
Approximate cut off frequency of the low pass filter (factory calibrated)	12.5 kHz (2-pole)
Pre-amplifier System consumption (Maximum)	2 W

# System Components

The system is a complement of a geophysical receiver system, and includes the following items:

1. 1x Electrode Preamp Hub (blue box)
2. 4x Electrode Preamp (red boxes)
3. 1x Battery cable
4. 5x interconnect wires (Hub-Receiver)
5. 4x Telluric preamp cables (8-pin, Hub-Preamp)



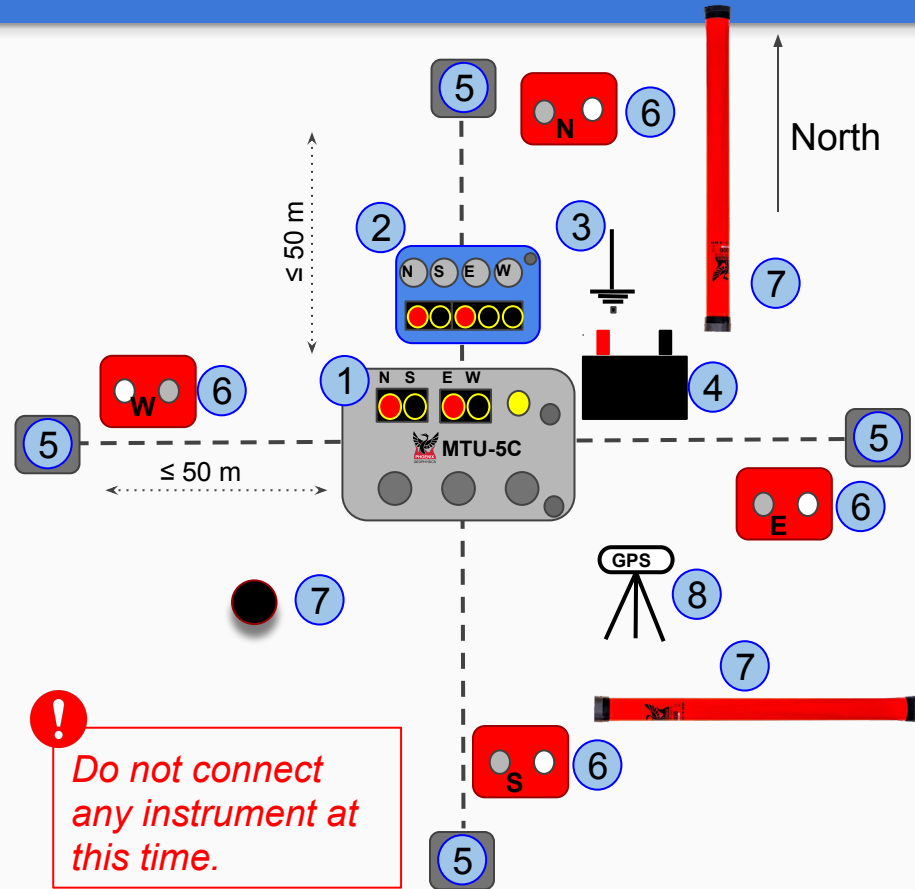
Keep note of the pre-amplifier serial numbers used for each recording in the Layout sheet and in the 'Notes' field in the configuration file.



# Equipment distribution

To the extent possible, configure the station using the following Layout diagram. (see [Guide for Field Operation](#))

1. Place the **Receiver**
2. Place the **Hub** close to the **Receiver** considering the length of the interconnect wires
3. Set up the **Ground Electrode** next to the Hub
4. Place the **Battery** between the receiver and the **Hub** (both instruments will use the same battery)
5. Install the **Electrodes** (or titanium plates) in four cardinal points, at a distance no longer than 50 m from the **Ground Electrode**
6. Place an **Electrode Preamp** close to each **Electrode** (other than the ground electrode)
7. Install the magnetic **Sensors** (see *Layout guidelines*)
8. Setup the **GPS** antenna close to the **Receiver**

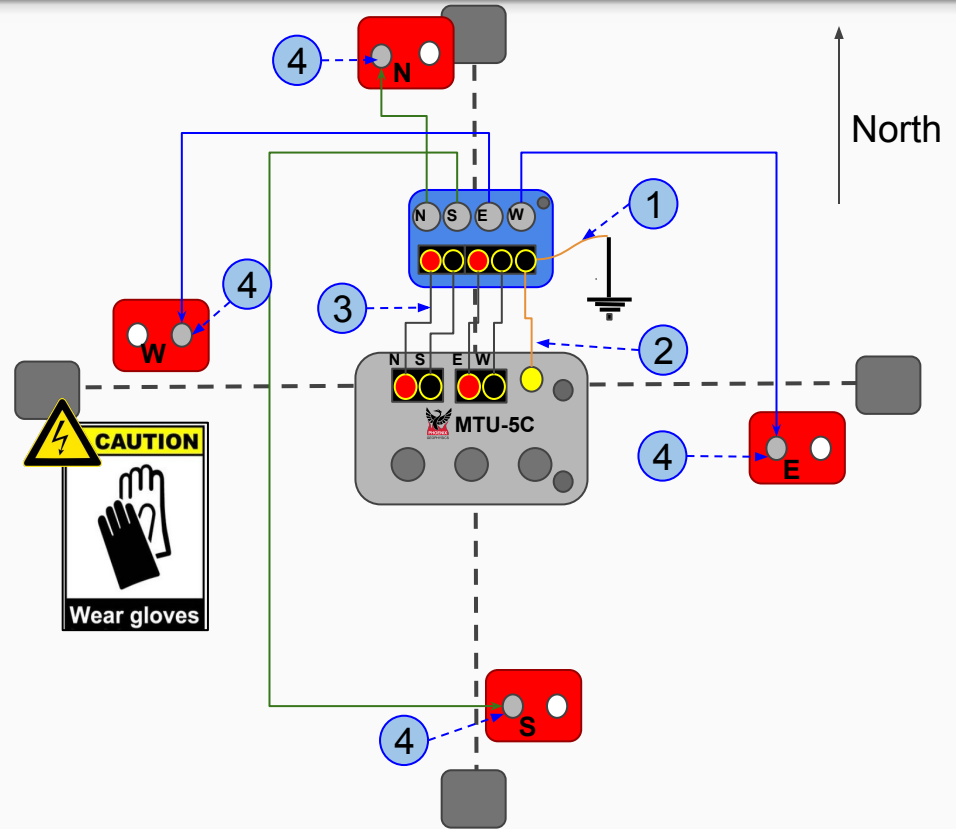


# Connection Sequence

In order to avoid risk of shock or equipment damage, use the following connection sequence:

1. Connect the **Ground Electrode** to the **Hub**
2. Connect the Ground interconnect wire from the **Hub** to the **Receiver**
3. Connect the other 4 interconnect wires between the **Hub** and the **Receiver**
4. Use **8-pin cables** to connect the **Hub** with each **Electrode Preamp**

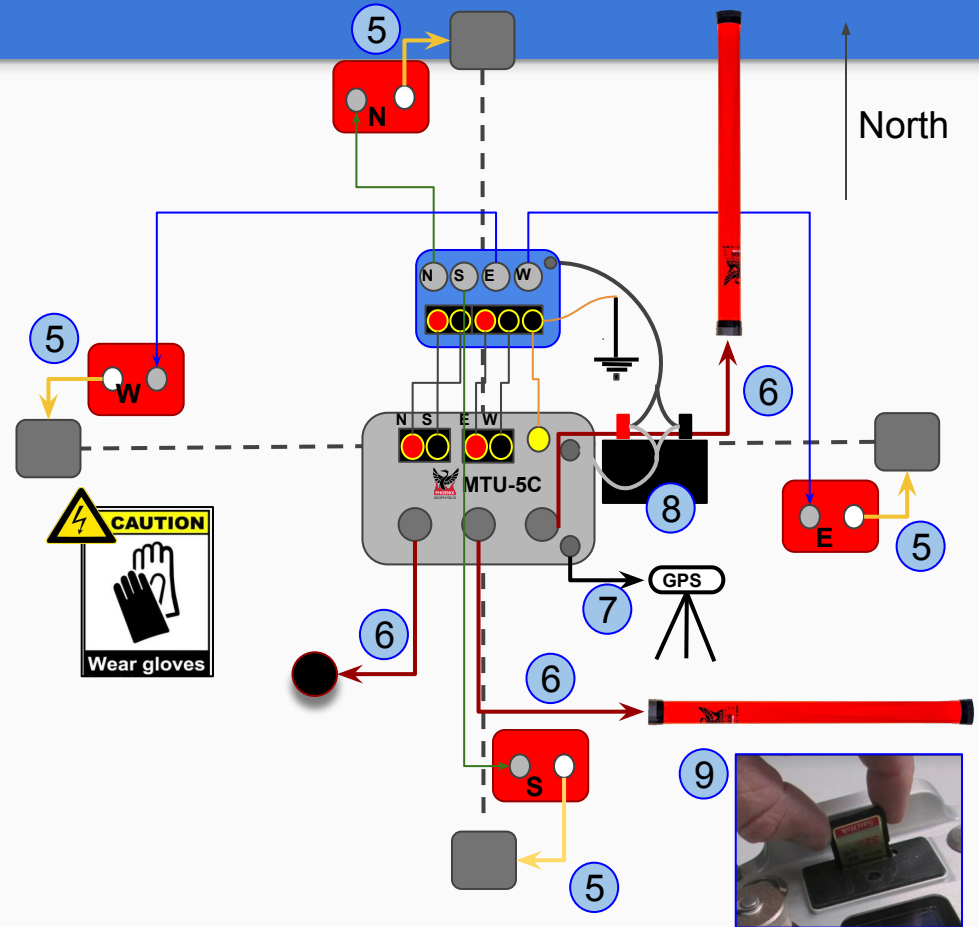
**Note:** The devices are designed for permafrost environments, so they are resistant to splashes of water. Take precautions if you suspect that any of the red or blue enclosures may end up submerged in water, for example, due to heavy rain or melting ice.





# Connection Sequence

5. Connect each **Electrode Preamp** to the corresponding **Electrode** (or titanium plate)
  - To avoid electric shock or static discharges, touch the wire of the electrode to the binding post of the pre-amplifier, without touching the wire or the binding post with hands.
6. Connect the **Receiver** to the Magnetic Sensors
7. Connect the **GPS** antenna to the **Receiver**
8. Connect the **Battery** to both the **Receiver** and the **Hub**
9. Insert the SD card and turn on the receiver



The SD card must be inserted at the end of the connection sequence to prevent damage to the card

# Special Steps For Processing Data With Preamps

Once the recording is imported into a project ([see the DAA15 Data Management manual](#)), it is possible to apply a calibration to compensate for the filter effect of the pre-amplifiers

1. Select the Recording
2. Start the **Process** data wizard
3. When selecting the electric channels, click **Edit** to open the dialog that allows applying a special calibration
  - Type the Calibration serial for **Ex** and for **Ey** (*These calibrations should already be imported*)
  - EMpower will show a green check mark if the calibration is found

The screenshot displays the EMpower software interface. At the top, a recording titled 'Remote (15 h 36 m 50 s)' is selected, indicated by a blue circle '1' and an arrow. Below this, the 'Status' section shows 'Approved' with a green checkmark. The 'Tools' section has three buttons: 'Time Series', 'Spectra', and 'Process (Orthogonal)', with the 'Process (Orthogonal)' button highlighted by a blue circle '2'. The 'Recording Information' section shows details such as 'Recording ID: 10125\_2017-08-23-234742', 'Start time: Aug 23 2017 17:47:43 (Local) America/Edmonton (GMT-06:00)', 'Duration: 15 h 36 m 50 s', 'Survey name: Kimberly, BC : Aug 2017', and 'Station name: Remote'. Below this, a dialog box titled 'Select a recording to use for the electric components' is open. This dialog has a dropdown menu showing 'S-5 5C - 10125 - Dec 01 15:07:12 - Dec 02 09:34:58'. Under 'E-Channel details', there are two sections: 'Ex' and 'Ey'. The 'Ex' section has a dropdown for 'Ex Calibration Serial' set to '10996' with a green checkmark next to it. The 'Ey' section has a dropdown for 'Ey Calibration Serial' set to '0' with a red 'X' next to it. A blue dashed box highlights these two sections, with an arrow pointing to the 'Edit' button in the bottom right corner of the dialog, which is also highlighted by a blue circle '3'. The 'Save' and 'Cancel' buttons are visible at the bottom of the dialog.



*Calibration files and a table of serial numbers will be provided by Phoenix Geophysics.*

# Usage Recommendations

1. Always ensure that the hub is connected to the battery
2. When pre-amplifiers are connected, note that the contact resistance measured by the receiver at start, is invalid (the receiver measures the resistance of the pre-amplifier instead)
3. To measure the contact resistance of your four high impedance electrodes (*or Titanium plates*), connect a wire between the ground electrode and one of the four electrodes, and measure the contact resistance with an analog multimeter. Repeat the process for each electrode.
  - Remove the temporary wire when recording, to prevent it from acting as an external noise source



*Please check out the [FAQs](#)*

*<https://phoenixgeophysics.freshdesk.com/>*

*Or email us at: [support@phoenix-geophysics.com](mailto:support@phoenix-geophysics.com)*