Advised operating procedure of acquisition with Fullwavers

## I. Preparing a survey (out of the field)

Work made by the geophysicist

1) Before anything else, choose the spacing of the V-Fullwavers, the measurement electrodes and the position of the injection depending on the depth you want to investigate and the number of V-Fullwaver that you have.
2) Based on this spacing, locate a regular grid on Google Earth trying to avoid blocks, boulders, or submerged areas.
3) Once the location of V-Fullwavers and the injection are chosen, make a list to associate a coordinate to each electrode (P1, P2 and P3) of a specific V-Fullwaver designated by its serial number. We advise to establish conventions such as P1: North, P2: Center and P3: East. We recommend to make a knot on the P1 cable. All regular positioning and setup will reduce the risk of mistake and make the manual processing necessary for some measurements easier.
4) Prepare scrupulously each V-Fullwaver:
   - Erasing the memory
   - Entering P1, P2 and P3 GPS positions in each Fullwavers
   - Preparing a 12h measurement
   - With a 1A current injection
   - Indicating the good injection period (generally 2s)
   - Selecting the 5V or 15V range of measurement
   - Checking the battery level
   - Starting the GPS before being on the field. If you are in the same area than the measurement site, a first search of the GPS signal can drastically reduce the search time once you will be on the field.
5) Check the unpolarizable electrodes that will be used (no leaks)

II. Setup of the V-Fullwavers (on the field)

Work made by the operator

1) Position the 3 electrodes and the V-Fullwaver according to the list previously created in I.3. Do not let the V-Fullwaver in the shade or under a stone, it may lose the GPS PPS Signal.
2) Respect scrupulously the eventual convention (e.g. as P1: North, P2: Center and P3: East)
3) Check the battery
4) Perform a RS Check and control that the ground resistance is ideally below 2 kΩ
5) Check once again the unpolarizable electrodes (no leaks)
6) Press START to start measurement
7) Before the measurement is really started, check all the previously entered parameters (electrode position, current, time of acquisition, period of injection, range of measurement)
8) Check that the measurement has started and wait to check the noise level without injection. If the signal is rather smooth,
9) Close the housing cover

III. Injection (on the field)

1) In the case where you are using pole-dipole configuration, position the remote electrode according to the list previously created in I.3.
2) Unroll the cable to the I-Fullwaver which is located near the V-Fullwaver area.
3) Find the correct way of plugging the I-Fullwaver on the IRIS Instruments transmitter.
   In order to do so, connect the I-Fullwaver on the transmitter as shown on the picture below. Turn on the transmitter and inject a low current. A + and – signs will be displayed on the LCD screen (see transmitter on the picture below).
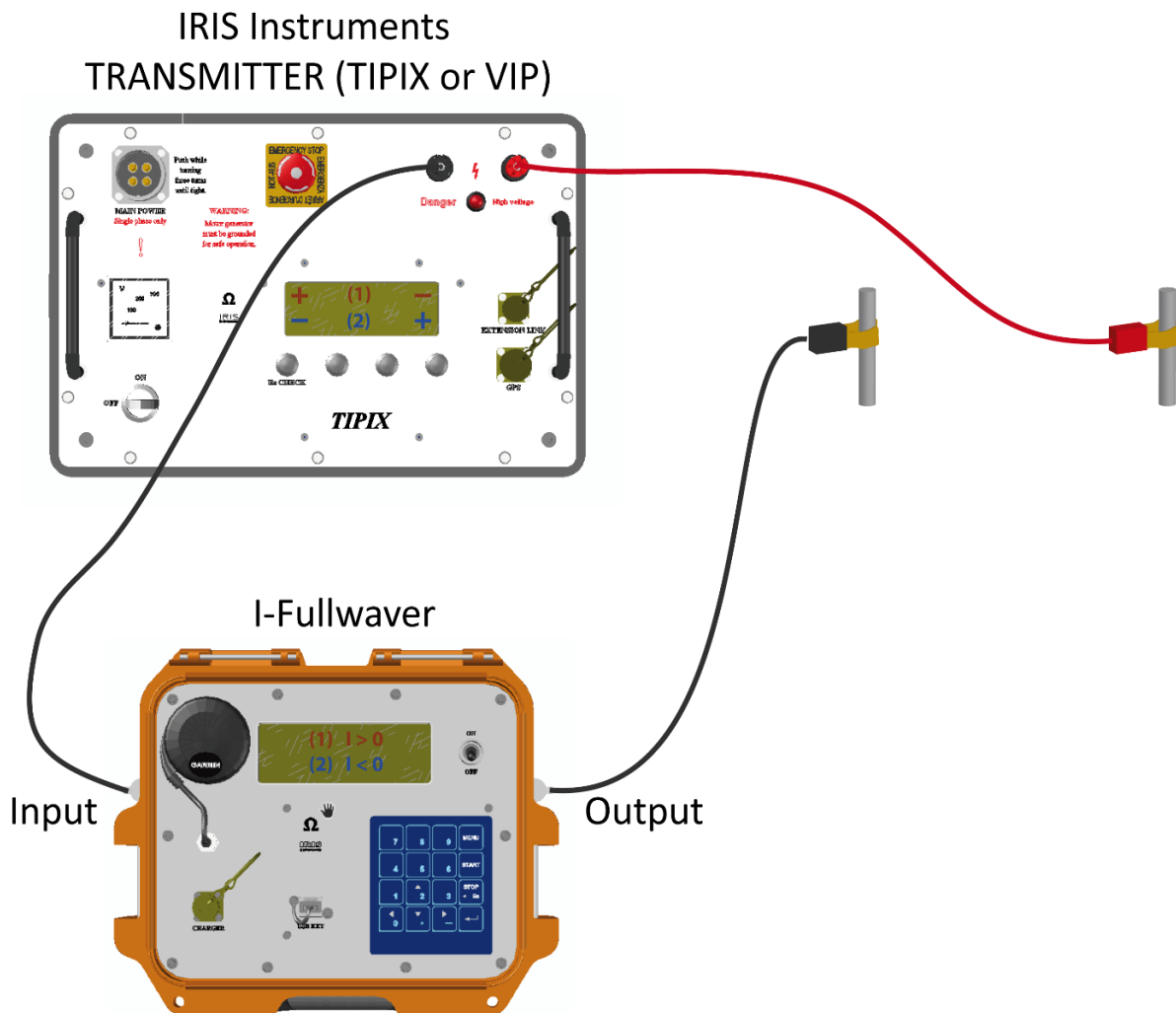
The I-Fullwaver is measuring the correct polarity when the current displayed on the I-Fullwaver is positive when a + sign is displayed on the LCD screen of the transmitter on the side where the I-Fullwaver is connected (*left side on the picture above*). If it is not the case, reverse the plugging of the I-Fullwaver (*e.g. plugging the electrode to the input plug and the transmitter to the output plug*). Check again that the I-Fullwaver is measuring a positive current when the + sign is displayed on the LCD screen of the transmitter on the side where the I-Fullwaver is connected.

4) Take a note of the correct way of plugging the I-Fullwaver and use a marker if necessary (e.g. different colors of cable) to be able to properly plug the I-Fullwaver every day.
5) Position the second electrode called "mobile electrode" on the field according to the list previously created in I.3.

6) Connect the second pole of the transmitter to the mobile electrode.
7) On the I-Fullwaver, enter the position of A and B electrode. For an export on RES3DINV, set the remote electrode coordinate on the electrode B in the I-Fullwaver.
8) Start the injection before starting the I-Fullwaver. Try to find the best range of injection and wait for 3 to 5 periods to see if the injected current is stable. If yes,
9) Start the acquisition on the I-Fullwaver.
10) Write on a paper field book the information for each injection (current, power injected, voltage, contact resistance, duration of the reading, starting time of the reading, ending time, UTM positions of both injection electrodes. All this information may be useful later in case of doubt or error of electrodes positions stored in the files).
11) After 400 seconds, stop the acquisition of the I-Fullwaver and then, stop the transmitter to ensure a perfect current waveform from the beginning to the end.
12) At the end of the day, take off the V-Fullwaver from the measurement and bring it back with you.
13) Before disconnecting, check and note the contact resistance for QC purpose.

IV. At the end of the day (on the field)

1) At the end of the day, collect all files from V-Fullwavers and I-Fullwavers with an empty USB key to avoid any data confusion.
2) Copy this data on the laptop. Make sure, you have saved all data on one or 2 laptops, just in case one would crash.
3) Check that you have all data of all units and be sure that no data from any V-Fullwaver has been forgotten (this may happen at the end of the day).
4) Copy all data of the day on one single directory in order to make operations easier without changing the name of the file.

V. Starting a new day (on the field)

1) If at each end of the day you remove the V-Fullwaver, each new day, replace each V-Fullwaver at the same location.
2) Be sure that each wire is connected to the proper electrode P1, P2 and P3.
3) Repeat the procedure in II.
4) Continue the acquisition.

VI. Processing

Process data on FullwaveViewer

1) Run FullwaveViewer
2) Check the settings of the program
   a. Process / Type of process / synchronize on Iab
   b. Process / Filter / off
   c. Process / Chargeability windows / Arithmetic
   d. Option/ Compute time auto on Iab wave
   e. Option / Apply Ca and Cb spacing from I-Fullwaver
3) Perform an automatic processing of all the data of the day:
   a. Click on "Batch"

b. Select all the Iab files and click on "ADD IAB FILE TO THE LIST"
c. Select all the Vmn files and click on "ADD VMN FILE TO THE LIST"
d. Click on "COMPUTE LIST TO PROSYS FILE "and enter a filename where all results will be stored in a "bin file "to be read with PROSYS.

Specific operations on FullwaveViewer:

- Checking positions of Fullwavers:
  Open one current file (IAB extension), clicking on File / View positions. You can check the positions of the electrodes and the GPS position of the unit.
  Open one reception VMN file (VMN extension), clicking on File / View positions
  You can check the positions of the electrodes and the GPS position of the unit

- In case, you change the positions of the electrodes, because they were wrongly introduced on the keypad of the FullWaver, you can store this new file with the correct position in another file having a different extension "IRW or VRW ", menu FILE / SAVE

- Reverse polarity, in case most of resistivities are negative because current was logged as Iba instead of Iab: Process / Reverse polarity of the transmitter

- Reprocess a data set because of PPS GPS lost synchronization:
  Open the Iab and the Vmn files
  Select the option:
  Process / Type of Process / Synchronize on Vmn
  With the left button of the mouse, select the common time period for I and V files
  Click on "GET Time "button, click on "COMPUTE" button, then you can store this data set in a "bin" file for PROSYS by clicking on "ADD TO PROSYS FILE "button.

Process data on Prosys

1) for UTM coordinates, please click on File / Long spacing (UTM)
2) Open the "bin" file coming from FullwaveViewer
3) select "View / View IP Window"
4) select "View / View node positions"
5) Keep these 2 windows open and check all data, all lines, one by one. This way you will see the quality of the decay curves and also if the positions of the electrodes are correct.
6) When finished, you can export the data for inversion selecting "File / Export and save / Your inversion program".

Specific operations on Prosys:

- Checking positions of the Fullwavers on Google Earth: View / View waypoint on Google Earth

- Enter topography manually: Processing / Insert topography

- Changing the positions of a given electrode: Processing / Advanced / Replace Node Spacing

- Reverse polarity, in case most of resistivities are negative because current was logged as IBA instead of IAB: Processing / Reverse Transmitter Polarity

- Merging several files in one file: File / Add