Appendix C

Parallel and White Noise Testing

This appendix explains how to set up the folowing tests in the field or labratory:

- parallel noise test
- white noise test
- parallel white noise test

About noise tests

Three types of tests can be performed, using either natural or artificial signals. Artificial signals are provided by the Phoenix Dual Random Noise Generator.

About the Phoenix Dual Random Noise Generator

Phoenix manufactures a Dual Random Noise Generator (WN-2) specifically for testing System 2000 and System 2000.*net* receivers. Two separate noise generators are contained within the case, with outputs marked as E_x and H_y for one generator and as E_y and H_x for the other generator.

Specially configured cables are provided to connect the WN-2 to the receiver and to connect input terminals in parallel. The cable that connects the H_y terminal on the WN-2 to the MAG INPUT or AUXILIARY terminal of the receiver is wired to provide the same signal to both the H_y and H_z channels.

Controls. A rotary control on the WN-2 selects high frequency output (10kHz–1Hz), low frequency output (500Hz–0.002Hz or 500s), or turns the unit off. Use the HI setting for testing the AMT data type. Use the LO setting for testing the MT data type. Turn the unit OFF when not in use.

Fig. C-1: WN-2 Dual Random Noise Generator.

Power. The generator is powered by a 9V battery. A fresh battery will last for about 24h of use.

Check the battery voltage before each noise test. Turn the output to either HI or LO and probe the built-in battery test terminals with a voltmeter. If the voltage is not at least 7V, replace the battery before continuing.

To replace the battery:

1. Remove the four screws from the top of the WN-2 enclosure and remove the cover.
2. Replace the spent battery with a fresh 9V battery.
3. Replace the cover and the four screws.

Cables. Three cables are supplied with the WN-2. The two-way mag input cable is internally wired so that the H_y signal is duplicated on the H_z input. The E_x and E_y cables have red and black wires ending with two and three lugs, respectively. This configuration allows flexibility in setting up the different tests.

Note 
The instructions for setting up the tests sometimes specify that more than one lug be connected to a terminal. The purpose is to prevent dangling wires from touching and causing short circuits.

Purposes of noise tests

Sensor noise floor. To test the noise floor of sensors (telluric or magnetic), conduct a parallel noise test in the field using the natural MT signal.

Transfer function of receiver. To test the transfer function of an instrument, conduct a white noise test in the laboratory or field, using a Phoenix WN-2 Dual Random Noise Generator.

Input amplifiers. To test the noise floor of the instrument's front-end board amplifiers, conduct a parallel white noise test in the laboratory or field, using a Phoenix WN-2 Dual Random Noise Generator.

Duration of tests

All tests should acquire data for at least two hours. The longer the test, the lower the frequency for which results are valid. A two hour test is long enough to give results down to 0.002Hz (500s).

Calibration

Calibrate the instrument before conducting any noise tests. Before conducting a parallel noise test, also calibrate the sensors. The calibration files are essential for data processing.

Setting up a parallel noise test

Parallel noise tests to check the noise floor of sensors should be conducted in the field, under normal survey conditions.

The physical setup is similar to a normal site setup except for the placement of electrodes and/or sensors. You can test just the E-channels, just the H-channels, or both.

Warning 

If you test only the H-channels, connect all of the E-line terminals to the instrument ground. The terminals are connected directly to amplifier inputs, and open circuits produce steady-state saturation.
Failure to ground the E-line terminals may damage the receiver and void your warranty.

Preparing a Startup.Tbl file

Before you begin the test, prepare a Startup.Tbl file on the CompactFlash card that will be used. For a parallel noise test, the settings for filters, gains, etc. should be the same as for data acquisition at the same site.

To set up a parallel noise test:

1. Set up the calibrated receiver and sensors as for a regular data acquisition, but place the electrodes on two parallel lines about 10cm apart, and place the coil sensors about 1.5m apart, at right angles to

the E-lines. (See Fig. C-2.) The electrodes can be buried in two large holes or in four separate holes.

2. Make sure the instrument is properly grounded, and if you are testing only magnetic sensors, ground all the E-line terminals.
3. Acquire data for at least two hours.
4. Process the data as instructed in the *Data Processing User Guide*.

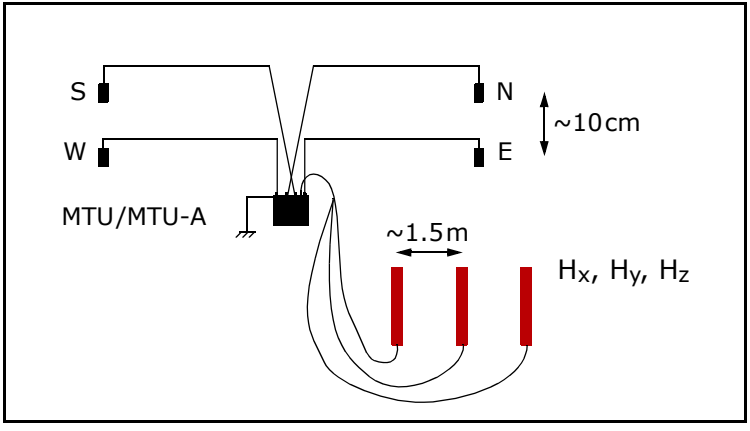

Fig. C-2: Setup for parallel noise test. (Battery and GPS antenna omitted for clarity.)

Setting up a white noise test

White noise tests to check the transfer function of an instrument can be set up in the field or indoors in a laboratory, as long as GPS signals can be aquired.

Preparing a Startup.Tbl file

Before you begin the test, prepare a Startup.Tbl file on the CompactFlash card that will be used.

To prepare a Startup.Tbl file:

1. Start WinHost.
2. Set the E_x and E_y dipole lengths to 1m.
3. Set the Low Pass Filter to 0 (Weak or Weakest).
4. For MT data, set all of the H sensor serial numbers to COIL0000.
5. For AMT data, set all of the H sensor serial numbers to AMTC0000.
6. Set appropriate acquisition times.
7. Save the file and load the card in the receiver.

To set up a white noise test:

1. Connect the calibrated receiver to a GPS antenna and a 12V power supply, but do not turn it on yet.
2. Using the special cable supplied with the WN-2, connect the E_X terminal of the WN-2 to the N and S terminals of the receiver: Connect all three lugs on the black wire to the S terminal and both lugs on the red wire to the N terminal. (See Fig. C-3.)

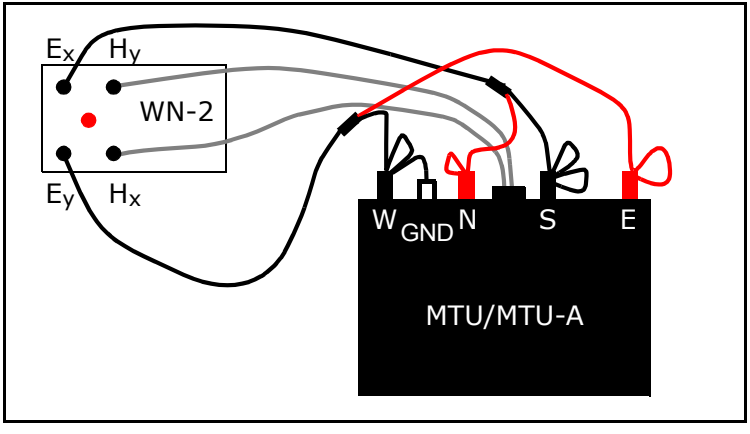

Fig. C-3: Setup for white noise test. (Battery and GPS antenna omitted for clarity.)

3. Connect the E_Y terminal of the WN-2 to the GND, E and W terminals of the receiver: Connect the lug at the end of the black wire to the GND terminal and the other two lugs to the W terminal. Connect both lugs on the red wire to the E terminal. (See Fig. C-3.)
4. Connect the H_X and H_Y terminals of the WN-2 to the MAG INPUT terminal of the receiver. (The cable wiring supplies the H_Y signal to the H_Z input as well.)
5. Turn on the receiver and set the WN-2 to LO for MT data or to HI for AMT data.
6. Acquire data for at least two hours.
7. Process the data as instructed in the *Data Processing User Guide*.

Setting up a parallel white noise test

Parallel white noise tests to check the noise floor of an instrument's input amplifiers can be set up in the field or indoors in a laboratory, as long as GPS signals can be aquired.

The instructions that follow ensure that both E channels receive an identical signal and that all three H channels receive an identical signal. (The H_z channel is connected in parallel with the H_y channel by the internal wiring of the MAG INPUT cable.)

Preparing a Startup.Tbl file

Before you begin the test, prepare a Startup.Tbl file on the CompactFlash card that will be used.

To prepare a Startup.Tbl file:

1. Start WinHost.
2. Set the E_x and E_y dipole lengths to 1m.
3. Set the Low Pass Filter to 0 (Weak or Weakest).
4. For MT data, set all of the H sensor serial numbers to COIL0000.
5. For AMT data, set all of the H sensor serial numbers to AMTC0000.
6. Set appropriate acquisition times.
7. Save the file and load the card in the receiver.

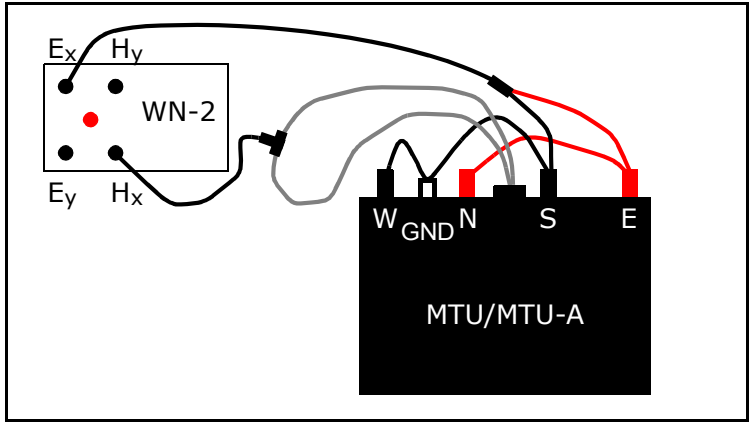

Fig. C-4: Setup for parallel white noise test. (Battery and GPS antenna omitted for clarity.)

To set up a parallel white noise test:

1. Connect the calibrated receiver to a GPS antenna and a 12V power supply, but do not turn it on yet.
2. Connect a cable to the E_X terminal of the WN-2.
3. Connect the lugs on the red wire of the cable to the red terminals of the receiver. (See Fig. C-4.)
4. Connect the lugs on the black wire of the cable to the GND and black terminals of the receiver.
5. Connect the two-way cable to the MAG INPUT terminal of the receiver and join the free ends of the cable with a T-connector.
6. Connect the H_X terminal of the WN-2 to the T-connector. (The cable wiring supplies the H_Y signal to the H_Z input as well, so all H channels receive the same signal.)
7. Turn on the receiver and set the WN-2 to LO for MT data or to HI for AMT data.
8. Acquire data for at least two hours.
9. Process the data as instructed in the *Data Processing User Guide*.