User Guide for the GER1500 - Stand Alone Mode

Version 3.0 (2005), by Fran Fogwill
PC version: Panasonic Toughbook
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This User Guide provides reminders of the key processes involved in the setting up and use of the GER1500 spectrometer in stand-alone mode. This mode is where the on-board memory of the spectrometer is used to save scans, which are then downloaded later using the computer. It is recommended that this mode only be used if it is not possible to use the computer controlled mode (single or dual beam).

1. Power

Ensure all batteries (12V and 6V smartpack cells) are fully charged before departing into field. Ideally we recommend that you take a Voltmeter with you to check the charge of the 12V batteries, which should bear a charge of ~13V when fully charged.

2. Spectrometer Warmup

It is recommended that you "warm up" the GER1500 prior to use for spectral measurement collection. Ideally, we recommend at least 15 minutes. This means that you should attach the 12V battery/6V smartpack cell and switch the spectrometer on, so that the red light appears at least 15 minutes before use. This will minimise errors caused by warming of the spectrometer array inside.

3. Setup

3.1 Connect a power supply to the spectrometer. Use a power converter insert or 6V smartpack battery. If using the power converter connect a 12V gel cell using the white cables provided. Switch the spectrometer on using the Power switch.

3.2 Use the menu button on the spectrometer's front panel to navigate through the various options. There are five options, repeatedly pressing the menu button will take you through all five options.

3.3 The first menu you come to will be called "MEM". This needs to be reset to a value of 1 before each day's data collection. Do this by pressing the EDIT key, followed by the downwards pointing arrow key, to the right hand side of the menu key. When you have reset the memory to 1, press EDIT again to toggle out of edit mode. BEWARE that resetting this to 1 will wipe all previous data from the on-board memory, so only do this if you have already downloaded your data from the previous day.

3.4 Press the MENU key again. The second menu that you will come to is called "AVG" and sets the spectrum averaging for each scan. Increasing the averaging improves the signal:noise ratio of your spectra, but be aware that more averaging means longer scan times. Remember that the averaging is actually 2^{x-1} where x is the averaging setting selected. So a setting of 5 here is actually averaging 16, and 6 is actually averaging 32 scans. It is recommended that you use an averaging of 5 or 6 under field conditions. Change the setting by pressing EDIT, followed by the up or down arrow key, followed by EDIT to set the desired averaging. A conversion table for converting the averaging settings is provided below.

Computer averaging setting	Actual number of scans averaged
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128
9	256

3.5 Press the MENU key again. You will now be on a menu called INTSP. This sets the integration speed for the spectrometer head, which is comparable to the shutter speed on a camera. The darker the surface, the longer integration speed should be used. We recommend that you leave this set to AUTOMATIC. This will enable the spectrometer to adjust the integration speed according to the surface being measured without you having to adjust it every time yourself. If an "A" is displayed on the LCD screen, then it is set to automatic. Ignore the number displayed next to the "A", this is the integration speed used at the last scan and is not relevant at this stage. If an "A" is not displayed, you will need to set this. To do so, press the EDIT key followed by the MENU key. This should cause the "A" to be displayed on the screen. When this happens, press the EDIT key again to set this parameter.

3.6 Press the MENU key again. You will now see a menu called "TRG". This sets the functioning for the red trigger button on the front of the spectrometer head. You can set this to "Laser", "Scan" or "Both". This is set using the EDIT key followed by the up or down arrow keys, followed by EDIT to set the trigger function. For stand-alone use, it is recommended that you use "Both", as this will enable you to position the spectrometer head accurately using the laser pointer before collecting a scan.

3.7 Finally, press the MENU key again. This will take you to the last menu option called "OPTIC". This refers to the format you wish to save your data in. Here, we require an option known as "Unity Function", which means that we wish to save the data as raw Digital Numbers (DN). This setting corresponds to optic number 5 in the GER software. Therefore press the EDIT key followed by the up or down arrow keys to set the optic to option 5.

3.8 The spectrometer is now set up ready for data collection.

3.9 Note that on the top line of the LCD display you will see a "TAR" or "REF" display, followed by a number. This number represents the voltage in the spectrometer power supply. If this drops below 6V, you are in a critical battery status situation. Turn the spectrometer off and replace the power supply with a fully charged one. NOTE that switching the spectrometer off will not cause your scans to be lost from the memory.

4. Data collection

To collect a scan with the GER1500 head, you must position the head over the target of interest. The head can be stabilised on a tripod, or hand held. Use the arrow keys on the front of the spectrometer panel to switch between the "REF" and "TAR" modes. Use "REF" mode for Spectralon reference measurements, and "TAR" mode for measurements of your target surface (i.e. rocks, soil, leaves). It is essential that you remember to change the mode of measurement between "REF" and "TAR" accordingly each time, as mistakes are difficult to rectify afterwards.

When you are positioned over the surface that you wish to measure, press the red trigger button on the front of the spectrometer. If you set the trigger function (TRG) to "both" then pressing the red button will result in the laser pointer being activated. Use this to position the radiometer over your desired surface for measurement. Once you release the trigger, the laser pointer will switch off, and the spectrometer shutter will open. You will hear two clicks of the shutter. Between these two clicks, the radiometer must remain in a static position over the surface to be measured. After the second click, it is safe to move the radiometer.

In the field, you should always collect one reference scan of spectralon for every target scan of your field spectra. The reference scan and target scan should be as close together in time as possible. This is essential in order to minimise the effects of the changing atmosphere on the resultant spectra. Therefore your data should resemble:

RTRTRTRTRTRTRTRTRTRTRTRTRT etc.

And not…

RTTTT RTTTT RTTTT RTTTT RTTTT etc.

4.1   Spectralon Panel care
Handle the spectralon panel carefully - do not touch the surface. Mount the spectralon on a tripod using the panel mounting clamp. If insects or dirt land on the surface gently blow them away, preferably using an air duster - do not squash, crush, swipe as this will impair the surface of the panel. Pay particular attention when transfering the panel or putting it back into its case as the surface will dent very easily if it comes into contact with hard surfaces or corners. If the panel becomes dirty, please contact FSF for instructions on how to clean it.

4.2   Weather conditions
It is recommended that you only collect field spectral measurements when the weather is fine and stable. Even hazy conditions can cause significant changes in irradiance which will have an impact on spectra collected using the GER1500 system. If it is necessary to sample in sub-optimal conditions, you must pay extra attention to the method described above, keeping R and T measurements as close together in time as possible. If there are clouds passing overhead, wait for a large enough clear spell before collecting measurements. Do not be surprised if your data are of sub-optimal quality if collected under changeable conditions.

Ideally you should work when the sun is highest in the sky to minimise the effects of shadowing and solar zenith changes. Ideally 2 hours either side of Solar noon are perfect. (Solar noon =1pm BST)

You should not conduct fieldwork with the GER1500 in wet conditions as the electronic equipment is very sensitive to damp and should not be exposed to wet conditions.

4.3   Sampling Strategies
FSF cannot recommend particular sampling strategies as the ideal sampling will vary from project to project, and is under the responsibility of the PI. However, we can recommend that for each point measured, a number of spectra be collected (i.e. a number of Ref-Tar pairs). These can then be averaged to provide a certainty measure of the spectral variability over a fixed point in space. It is up to the PI to determine the most appropriate method for sampling the surfaces of interest with respect to spatial coverage.

4.4   Mounting
The spectroradiometer should be mounted securely during field deployment, and this can be performed using a tripod arrangement. Try to mount the radiometer so that it is viewing from nadir. The levelling device on the radiometer head will allow you to do this. You can also hand-hold the radiometer with the carrying handle, but this is not likely to be so stable.

4.5   Field Of View
It is VERY important to accurately define the Instantaneous field-of-view (IFOV) of the sensor before going into the field. You need to make sure that the size of the area you wish to measure is LARGE relative to the IFOV of the sensor. The FOV is approximately circular and is 3 degrees. A spreadsheet is provided to help you. You should work out the range of heights you intend to use for the radiometer mounting and then work out the diameter of the area to be measured. The reason that this is important is that if you measure an area which is infringed by an area of contrasting reflectance, it can lead to confusing spectra which are very difficult to analyse and correct after the event.

4.6   Log Sheets

It is immensely important to keep accurate log sheets when in the field. Document any changes in solar irradiance and also make a note of every filename and the corresponding surface.

5. Downloading data from the on-board memory to the PC

At the end of the day's data collection, you will need to download the scans from the on-board memory of the spectrometer, and save them to file on the PC provided.

5.1   To Download:

1. Connect the spectrometer to a power supply and switch on
2. Take a serial cable and connect this to the spectrometers COM2 port
3. Attach the other end of the serial cable to COM1 on the Panasonic Toughbook PC
4. Power up the Panasonic, ensuring that it is connected to an external power supply (Mains/12V).
5. Open Windows Explorer. Create a directory for yourself in the "My Computer, C-drive:\FSF\Users" folder
6. Launch the GER1500.exe software
7. Check that the opening prompt box which appears on launch of the software, displays the correct serial numbers for your spectrometer configuration. As an example, a pop-up box will appear which will display the following:

   The serial number should appear below the version number of the software (e.g. 2038); as demonstrated above. If this is not the case, you will need to edit the program's initialisation file (ger.ini). Before doing this, you should contact FSF for instructions. At your training session, FSF staff will make sure that the ger.ini file is set to the correct configuration, so there should be no need to change this.
8. Assuming that the software has launched correctly, click the **OK** button on the prompt box, and then proceed to select the **FILE** menu and then **New.**
9. Choose the folder in which to save your data (i.e. the folder you just created in Windows Explorer) and give a root name for your spectra - click OK
10. Click on the drop down menu called **CONTROL** and choose the option labelled **Read Memory**
11. The computer will now communicate with the spectrometer and determine the number of scans in the on-board memory of the GER1500.
12. A box will appear which states the number of scans held on the memory, and the starting filename as specified in step 5.
13. If you are completely happy that you collected all of your scans with the correct Ref/Tar attribute (set on the spectrometer head, just prior to data collection), then proceed with the download and press **OK**. Your data will now be written to a GER sig file. The target scans will be written to a file with the immediately previous reference scan, and given an incrementally increasing filename and a .sig extension, e.g. grass**_000.sig**, grass**_001.sig**, grass**_002.sig** etc.
14. If you know that at some point during data collection, you saved a scan with the incorrect Ref/Tar attribute, (i.e. a Ref scan was saved as Tar), then you should check the box labelled **EDIT SCAN TYPES** before proceeding to download. The computer will now download each scan at a time, one by one, and ask you to check the Ref/Tar

attribute. Where necessary you can prompt the software to change it from Ref to Tar or vice versa. This process is very lengthy if you have collected a lot of scans.

TIP - IF THE SETUP BOX DOES NOT APPEAR SOON AFTER SELECTING *Control, Read Memory,* THEN THERE IS LIKELY TO BE A CONNECTION PROBLEM. AN ERROR MESSAGE WILL APPEAR SAYING "**COULD NOT OPEN PORT**" CHECK THE SERIAL CABLE CONNECTION, AND CHECK THAT THE RADIOMETER IS SWITCHED ON. YOU WILL ALSO NEED TO CHECK THAT COM1 IS SELECTED AS THE COMPUTER PORT IN THE *Setup* WINDOW.

5.2   Processing

If you are out in the field for more than 1 day, it is recommended that you process a couple of spectra of each measurement sequence in the evening (FSF Post Processing templates can be downloaded from http://fsf.nerc.ac.uk/resources/post-processing). At least if you spot problems which might indicate a problem in data collection you will have a chance to rectify these on succeeding days. If you don't understand something, please contact FSF to discuss the problem, so that mistakes can be rectified quickly and easily.

It is always easier to resolve problems before you collect spectra, rather than trying to make sense of spectra collected using incorrect methods.

6. General notes on the Panasonic Toughbook PC

1. Always charge the internal battery from the mains overnight before use
2. Always connect a 12V battery to the computer using the car adapter and 12V converter, as the computer's internal batteries are not sufficient for a full day in the field
3. Take care if using the pen, as it takes a while to get used to the way that it operates. Watch out when using it within Windows Explorer as it is very easy to move files around that are critical to the operating system, which may cause major problems with the computer.
4. DO NOT INSTALL ANY EXTRA DEVICES ONTO THE PC. This has been known to confuse the serial port settings and prevent communication with the spectrometer.
5. In case of a major technical difficulty with the Panasonic, you should always phone FSF to ask advice.

7. SUMMARY of key points to remember in field

1. Always connect 12V battery to computer using the car adapter and 12V converter, as the computer's internal batteries are not sufficient for a day in the field
2. Only work when solar conditions are optimal - 2/3 hours either side of Solar noon and when it is sunny and clear. Be extra careful about working in sub-optimal conditions.
3. Warm up the instrument prior to use (15 mins is ideal)
4. Take a reference scan of Spectralon for every target measurement
5. Keep accurate log sheets
6. Accurately determine the size of the IFOV at a given height before going into field.
7. Make sure that the IFOV is completely filled with the target of interest.
8. Collect more than 1 spectrum over each target to get an idea of the spectral variability of each surface.
9. Process and examine a few spectra each evening to check that they are correct and of good quality
10. Lack of power is actually one of the most common problems so….

MOST IMPORTANTLY - CHARGE YOUR BATTERIES EVERY NIGHT

FSF staff have experienced most technicalities with this system and will normally be able to offer advice over the telephone. So remember, if you are not sure about anything, ring FSF.

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