

# Field Guide for the GER1500 - Single Beam Mode Radiance/irradiance measurements

Version 1.0 (2006), by Alasdair Mac Arthur

PC version: Panasonic Toughbook CF18

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These tips provide reminders of the key processes involved in the setting up and use of the GER1500 spectrometer in single-beam mode for measuring spectral radiance or irradiance. This mode is where the computer is used to control the scans collected by the spectrometer head. Operating the spectrometer in this mode offers advantages over stand-alone mode, since it is possible to view the (raw) spectra as they are collected, thus allowing for real-time visualisation of the data.

## 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. Computer

Charge the Panasonic CF18 Toughbook on the mains computer prior to use in the field. This is best done overnight on mains power supply. When in use in the field, always use the Panasonic car charger with 12V battery converter to provide power to the computer, as the internal battery is only likely to last between 2 and 4 hours without an external source plugged into it. A fully charged 12V battery providing power to a fully charged computer should provide a full day's power.

## 3. 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.

## 4. Setup

To provide power to the spectrometers, use a power converter insert or 6V smartpack battery. If using the power converter connect a 12V gel cell using the cables provided. Switch the spectrometer on using the Power switch. The red power light will now switch on.

### Optical input accessories

- ◆ Spectral radiance measurements – The GER1500 is calibrated for spectral radiance measurement with standard and wide angle field of view lenses. Carefully fit the appropriate lens to the input port of the spectrometer. The software will be configured to collect the raw data (DN) with the corresponding system response calibration file applied post processing.
- ◆ Spectral irradiance measurements. The GER1500 is calibrated for spectral irradiance measurement with a waterproof fibre optic light guide fitted with a cosine corrected diffuser assembly. Carefully screw the threaded end of the fibre optic light guide to the

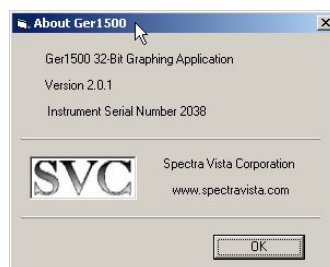
threaded input port of the spectrometer, located at the centre of the lens mount. It may be best to rotate the spectrometer while holding the fibre optic light guide. **Take care not to twist the fibre optic light guide or the fibres will break.** Ensure the cosine diffuser is fully screwed on to the fibre optic light guide. The software will be configured to collect the raw data (DN) with the corresponding system response calibration file applied post processing.

### Configuring the Spectrometer head:

- ◆ Use the MENU button on the spectrometer's front panel to navigate through the various menu options. There are five options, repeatedly pressing the menu button will take you through all five options. For use in single-beam mode, you only need to adjust one of these options, the others will be set in the collection software.
- ◆ Press the MENU key until you reach a menu option 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.

### The Panasonic Toughbook Computer - Setup Procedure

1. Connect the spectrometer to a power supply and switch on.
2. Take a serial cable and connect this to the spectrometer's **COM2** port
3. Attach the other end of the serial cable to the COM port at the back of the Panasonic Toughbook at rear left.
4. Power up the computer ( front left of PC marked "power"). See the Panasonic Toughbook General Instructions at the end of this document for more details.
5. Log on as "FSF User" or as "GER 1500 User" depending on laptop supplied
6. Open Windows Explorer. Using the touchpad or touchscreen pen, go to 'c:\Program Files\Spectra Vista\GER1500\Data' (the default directory) and create a directory for yourself in the "USERS" folder.
7. From desktop icon launch the GER1500 software.
8. Check that the opening prompt box which appears on launch of the software displays the correct serial number 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.

9. 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**

10. 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** . For example 'Plot1' as the root name. The software automatically appends an underscore and a sequential number e.g \_001.sig to each file giving it the complete file name as Plot1\_001.sig for example
11. Check **FILE, Data Options** - check that there is a tick next to the **Autosave** option.
12. On the same menu bar, check that **Format** is set to **Sig File**.
13. Click on the drop down menu called **CONTROL** and choose the option labelled **Setup**.
14. The computer will now communicate with the spectrometer and establish connection with the GER1500.

**TIP** - IF THE SETUP BOX DOES NOT APPEAR SOON AFTER SELECTING **Control, Setup** 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 SPECTRORADIOMETER IS SWITCHED ON. YOU WILL ALSO NEED TO CHECK THAT COM1 IS SELECTED AS THE COMPUTER PORT IN THE **SETUP** WINDOW.

### **SETUP Menu**

15. Check that the computer port setting is **com 1** (this is the default)
16. The first option that you need to select is labelled as **Entrance Optic**. This does not refer to the optic that you have attached to the front of the spectrometer, as one might suggest. It is actually asking the user to set the format in which you wish to save your data. Here, we require an option known as "**Unity Function**", which means that we wish to save the data as raw Digital Numbers (DN). Choose this option from the drop down menu. The reason for using a DN save option is because all of the FSF post-processing software is designed to work on raw DN GER Sig files.
17. The second option that you will need to set is called **Averaging** and this 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 choosing an option from the drop down menu. A conversion table for converting the averaging settings is provided below.

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

18. In the same menu box, you can set the date and time of the GER1500 internal clock. This information appears in the header file of the data you collect. You can view the date and time settings on the instrument itself, but only for a few seconds when you switch the instrument on. There is no way to alter the time or date in stand alone mode. Note that the date and time settings will not necessarily be the same as those on the computer clock as there is no communication between the two. If you want them to say the same time you will have to set this manually. However, all data files that are created will automatically receive the date and time of the computer clock, so to avoid confusion it is recommended that the instrument and computer are both set to the same time and date.
19. Finally go to the **OPTIONS** menu and turn off **single graph**, leave only a tick next to **multiple graph**. For further instructions on graph display please refer to the GER1500 user manual.

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

## 5. Data collection

### 5.1 Spectral radiance measurements

To collect a scan with the GER1500 head, you must point the head at the radiating target of interest. The head can be stabilised on a tripod, or hand held.

To assist in aligning the spectrometer with the target, the red trigger button on the front of the spectrometer can be pressed to activate the internal laser. Refer to GER1500 user manual for detailed instructions on the trigger options.

Each of the GER1500 data files contains three columns of data- the wavelength scale, the target spectral data and the reference spectral data. When acquiring spectral radiance measurements the software appends by default the last available reference scan, however this is ignored when post processing the spectral radiance measurements. It is recommended that a reference scan be taken once at the start of each measurement sequence solely to fulfil the GER software requirements.

- ◆ In the GER1500 collection software, press the button marked **REFERENCE** on the left hand side of the screen to acquire one nominal reference scan at the start of the measurement sequence. Wait until second 'click' is heard before acquiring target data.
- ◆ In the GER1500 collection software, press the button marked **TARGET** on the left hand side of the screen. The spectrometer shutter will open. You will hear two clicks of the shutter. Between these two clicks, the spectrometer must remain in a static position relative to the target being measured. After the second click, it is safe to move the spectrometer.
- ◆ Ensure the target radio button to the bottom left of the graph is selected. The Y-axis scale does not represent the spectra radiance values at this stage as the data displayed is not spectrally calibrated.
- ◆ The details included in the file header (including file name) are displayed below the graph.
- ◆ Record file name and target details into the log sheets supplied by FSF.

### 5.2 Spectral irradiance measurements

To collect a scan with the GER1500 head, the cosine diffuser at the end of the fibre optic light guide must be rigidly mounted such the white diffuser top surface is horizontal and clear of any shadows. The spectrometer must be safely placed below or beside the cosine diffuser.

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### **5.3 Weather conditions**

It is recommended that you only collect field spectral measurements when the weather is stable. Even hazy conditions can cause significant changes in irradiance which will have an impact on spectra collected. Always record the ambient light conditions and cloud levels in your log sheet.

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.

### **5.4 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. It is recommended that multiple measurement be taken and 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 targets of interest with respect to spatial coverage.

### **5.5 Mounting**

The spectroradiometer should be mounted securely during field deployment, and this can be performed using a tripod arrangement. You can also hand-hold the spectrometer with the carrying handle, but this is not likely to be so stable.

### **5.6 Field Of View**

It is VERY important to be aware of the field of view to ensure you are only measuring the desired target area. The FOV for the standard lens is approximately circular and is 4 degrees.

### **5.7 Log Sheets**

It is hugely 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.

### **5.8 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 surface in the evening using the FSF Excel post processing template (GER 1500 Radiometric Calculator\_Ver 01.XLT) and User Guide (Guidelines for GER 1500 Templates\_v1.doc)

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**

1. Always charge the internal battery from the mains overnight before use.
2. Take care when 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.
3. DO NOT INSTALL ANY SOFTWARE OR EXTRA DEVICES ONTO THE PC.
4. Perform all data post-processing on your own PC not on the FSF notebook.
5. In case of a major technical difficulty with the Panasonic Toughbook, 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. Be extra careful about working in sub-optimal conditions.
3. Warm up the instrument prior to use (15 mins is ideal)
4. Keep accurate log sheets
5. Determine the size of the FOV at a given distance before going into field.
6. Make sure that the FOV is completely filled with the target of interest.
7. Collect more than 1 spectrum over each target to get an idea of the spectral variability.
8. Process and examine a few spectra each evening to check that they are correct and of good quality
9. 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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