PSR Series Spectroradiometer
Operator's Manual

Revision Tracking	Changes	Date
1.00	Original Draft	10/5/10
1.01	Added chapter on accessories	10/19/10
1.02	Small additional details on FOV	6/7/11
1.03	Added warnings re: optical slit	8/9/11
1.04	Updated specifications, appendix on reference plate	5/29/12
1.05	Updated address	9/24/12
1.06	PSR-1900 version	10/30/13
1.07	Added description of contact probes, chapter on fan pack, appendices on probe maintenance.	1/21/14
1.08	Updated for PSR+3500	3/31/2015

Table of Contents

1 Introduction

This manual contains data concerning Spectral Evolution's PSR Series field-portable spectroradiometer systems (including PSR+3500, PSR-3000, PSR-2500, PSR-1900). Each instrument in the PSR Series consists of a UV-VIS-NIR range spectrometer coupled with an optional calibrated lens foreoptic or fiber optic cable. The complete system collects and stores spectral data and produces output calibrated to units of spectral radiance (W/m2/nm/sr). Energy enters the spectrometer from an external illumination source by way of the lens or SMA fiber optic cable. The spectroradiometer system operates in the range of 350–2500 nm with two or three detector elements: a 512-element silicon PDA covering the visible range and part of the near infrared (up to 1000nm) and one or two InGaAs arrays that extend detection into the NIR (to 1900 or 2500nm, depending on model).

All electronics controlling system operation are built in to the instrument. Each system incorporates manual controls and on-board storage for self-contained field operation, as well as the capability to connect to a host computer system using the provided application software via USB or Bluetooth communications interface. The instrument is powered by a Li-Ion battery pack (provided with each system)

All PSR Series spectrometer systems contain an internal microprocessor that controls the data acquisition of the detector array, the communication interface to the host PC, and provides data storage. Data stored consists of the calibration data in flash memory, the current dark and reference scan data in RAM as well as the current spectral scan data, also in RAM. The microprocessor also performs mathematical functions on the scan data, such as dark subtraction and automatic integration setting. All PSR Series spectroradiometers have a built in shutter for dark measurements.

2 Hardware and Interface Description

2.1 Part Identification

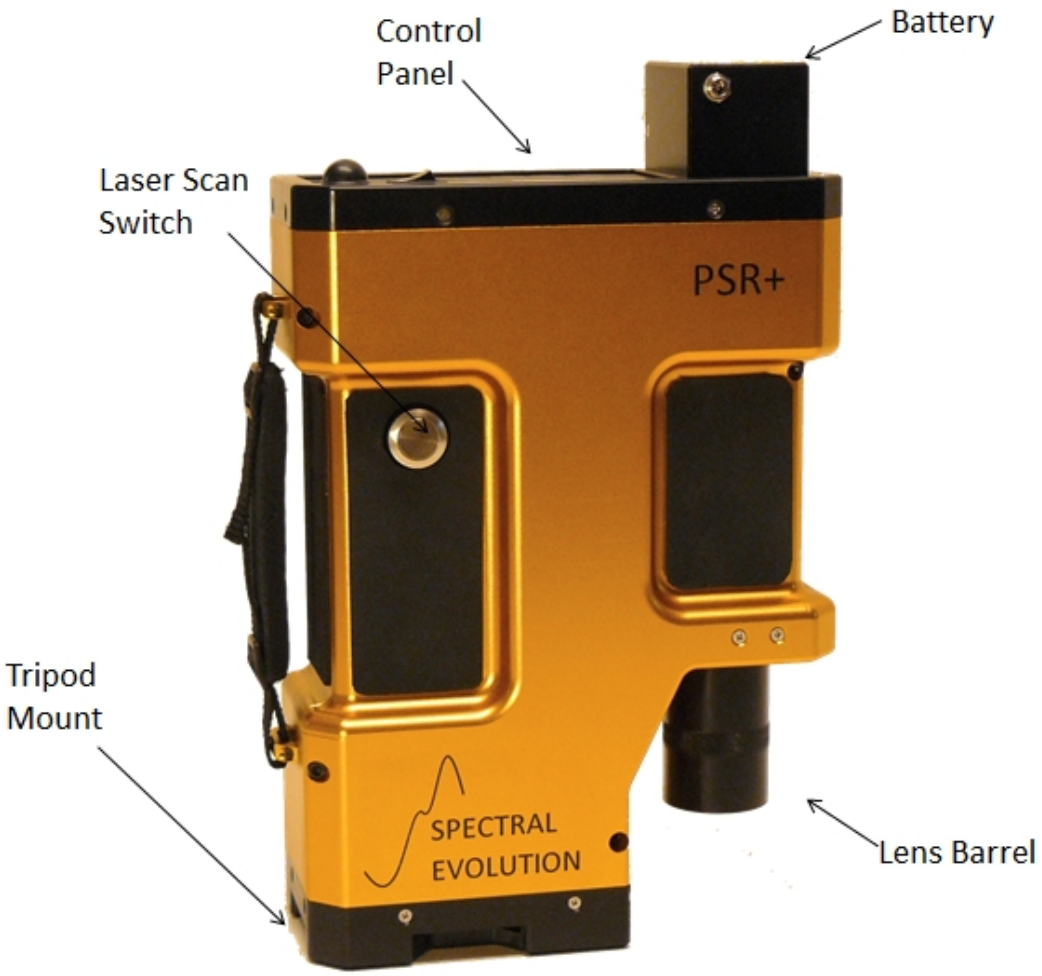

Figure 1: Side View of PSR Series Spectroradiometer

2.1.1 Spectrometer

The spectrometer component in each PSR Series spectroradiometer is a crossed Czerny-Turner configuration using ruled gratings as the dispersive elements. Energy enters the spectrometer and is collimated before being reflected off the gratings and refocused onto the PDA detectors. Depending on the model PSR Series instrument, there are two or three detectors in use. All systems incorporate a 512-element silicon array covering the spectral range from 350–1000 nm. The PSR-1900 and PSR-2500 contain a single 256-element thermoelectrically-cooled InGaAs array that extends

spectral range into the NIR (to 1900 nm and 2500nm, respectively). The PSR-3xxx models use two InGaAs arrays: a 256-element array covering 1000–1900nm and another array (256-elements for the PSR+3500, 128 elements for the PSR-3000) that extend from 1900–2500 with finer spectral resolution.

2.1.2 Battery Pack

All PSR Series spectroradiometers require the use of a Li-Ion battery pack for providing power. Two of these battery packs are supplied with each system. The Li-Ion battery runs at a nominal 7.4V and is designed to provide more than 3 hours operation following a full charge. When the battery is inserted in the recess in the front panel, power can be applied to the PSR Series instrument. When the battery voltage falls too low to power the instrument, it will turn off and go to 0 volts. Remove the battery from the instrument for recharging with the supplied charger. Refer to Section 6: Battery Charger for charging details.

IMPORTANT! DO NOT ATTEMPT TO CHARGE THE BATTERY WHILE IT IS INSERTED IN THE INSTRUMENT!

2.1.3 Optical Input (Foreoptic)

The PSR+3500 comes with a 4° nominal FOV lens foreoptic. The lens screws into the unit and is easily removed. Additional lenses with different fields of view are available as options. Also, a keyed fiber optic cable with matching adapter may be included with your instrument, as well as additional fiber accessories such as contact probes and leaf clips. **See Section 5, Changing Foreoptic Accessories** for the proper procedure for changing the optical accessories.

For the appropriate accessories (e.g. lenses), the entire spectrometer/foreoptic system is factory-calibrated for radiance using a NIST-traceable source. The calibration coefficients are stored in flash memory by the internal microprocessor. The application software retrieves these coefficients and applies them to acquired scan sample data to convert to radiometric units.

IMPORTANT

1. When optics are changed, it is up to the user to select the proper calibration preset for that specific foreoptic, either from the control panel for standalone scans or, when using DARWin SP software for real-time data collection, from the Foreoptic pull-down menu on the scan toolbar. In both cases the available presets will be intuitive, such as “LENS4” for the 4° lens, “FIBER” for the bare fiber optic, etc.

2. For reflectance measurements (non-calibrated), be sure to select the “PROBE” preset when using either the handheld or bench-top reflectance probe accessories.

If you have installed the fiber optic cable and are planning to use the handheld reflectance probe, bench-top reflectance probe, or triggering pistol grip, attach the supplied power cable to the instrument by locating the connector near the optical input (see figure below).

Figure 2: Detail of Optical Input/Laser/Probe Connector

For more details on using the reflectance probes, see the appropriate appendix sections.

Figure 3: Hand-held Reflectance Probe

Figure 4: Bench-top Reflectance Probe

2.1.4 Tripod Mount

The tripod mounting plate is conveniently located enabling the spectroradiometer to be mounted on a tripod. The mounting plate on the bottom of the instrument has a 1/4-20 NC threaded hole that is compatible with most conventional photographic or video tripods.

2.1.5 Serial Communications

Communications with the PSR Series are conducted using USB or Bluetooth. USB communications require a standard cable with USB-B connector to fit the receptacle on the control panel. The first time the host PC is connected to the instrument, Windows® will need to install drivers for the virtual COM port functionality. These drivers are included on the CD-ROM that was provided with your unit. Once the drivers are loaded, the provided Windows® application software interacts with the spectroradiometer using a virtual COM port in the same fashion as a standard RS-232 serial port (115200 baud, 8 data bits, 1 stop bit, no parity).

All PSR Series instruments are enabled for wireless communications with the application software provided the user has installed a Bluetooth serial port on the host PC. Depending on your Bluetooth adapter's configuration utility, you will need to enter an identifier for your instrument type (typically called its PIN key or pairing code) the first time you use your instrument. This code will be "psr3500", "psr2500" or "psr1900" as appropriate. Your Bluetooth utility will recognize the instrument by a unique name with the syntax "PSR-<Model#> <Serial#>.

2.1.6 Front Panel

The front panel of all PSR Series spectroradiometers contains the on/off switch, Bluetooth antenna, USB connector, battery receptacle and a control panel with membrane switches and LCD display. See **Section 3: Control Panel** for more information.

2.1.7 Laser Scan Switch

The Laser Scan switch is located on the top cover of the PSR Series spectroradiometer. Depressing the switch actuates the sighting laser and can be optionally configured to initiate the start of the spectral scan.

DANGER: DO NOT LOOK INTO THE LASER BEAM AT ANY TIME, INCLUDING INSTRUMENT SETUP OR OPERATION.

For more information see Appendix A: Laser Safety.

2.2 Interface Specification

2.2.1 Battery Pack

Your PSR Series spectroradiometer is supplied with two Li-Ion battery packs that insert into the recess on the front panel.

Important: See **Section 6: Battery Charger** for details on charging the external battery and safe operation.

2.2.2 USB Serial Connector

For communications via USB, the front panel is equipped with a USB Type-B receptacle connector, compatible with all standard USB cables with Type-B plug.

Pin 1: +5V
Pin 2: D-
Pin 3: D+
Pin 4: GND

2.2.3 Serial Communications via USB or Bluetooth Virtual COM Port

Baud Rate: 115200 bps
Parity: none
Data Length: 8
Stop bit: 1
Flow Control: none

2.2.4 ESD protection: +/- 15 KEV human body model, +/- 8KEV contact discharge

3 Control Panel

The control panel of each PSR Series spectroradiometer contains the controls and displays that are required for the stand-alone operation of the instrument.

Figure 5: Control Panel Detail

3.1 Indicators

The Control Panel has 3 LED status indicators.
Power LED The power indicator is illuminated when the power is on.
Laser LED The laser indicator is illuminated when the laser is on.
Connect LED The connect indicator is illuminated when no Bluetooth communication link has been established.

3.2 Switches

3.2.1 Power Switch

The power switch provides on/off control of the unit.

3.2.2 Membrane Switches

The three (3) membrane push button switches provide control of the unit during standalone operation and the capability of modifying the unit's operation. The functions of the switches are detailed below.

3.2.3 Switch Function

Scan Steps through scan options (Reference/Target/Dark Scans)
Menu Steps through the menu options (Memory Scan#/Dark Scan Mode/Scan Timer/Optic/Laser Scanning)

Edit Toggles or cycles through parameter lists for each menu option

3.3 LCD Display

The LCD display is an eight (8) character, two (2) row display that shows the selected scan and status messages.

ROW 1 displays the scan types, status messages, and battery voltage. The SCAN button allows the user to select the type of scan to perform.
ROW 2 displays the parameter menu. The MENU button allows the user to scroll through a set of available parameters, and the EDIT button changes the parameter settings.

3.3.1 Scan Types

The next type of scan to be collected is displayed in row 1 as follows:

REF x.xx - Indicates that a spectral measurement will be stored as a Reference Scan; current battery voltage is x.xx volts, or "LBAT" (Low BATtery) when indicated.

TAR x.xx - Indicates that a spectral measurement will be stored as a Target Scan; current battery voltage is x.xx volts, or "LBAT" (Low BATtery) when indicated.

Pressing the SCAN button cycles through these options. Note that after a REF scan is taken, the instrument automatically switches to collecting TAR scans.

3.3.2 Status Messages:

These messages are also displayed on row 1:

SCANNING - Indicates that a spectral data acquisition is being performed.
BUSY - Indicates that the instrument is performing a lengthy internal operation.

3.3.3 Parameter Menu:

The parameter menu is displayed on row 2. The MENU button allows the user to cycle through the following parameters. The EDIT button changes the parameter values.

MEM# xxx - Displays the memory slot that will hold the next acquired scan. The allowable values are from 1 to 500. The memory slot cannot be adjusted by the keypad, with the exception of completely erasing all memory.

To erase all memory and set MEM# to one (1), the <MENU> and <EDIT> keys must be pressed simultaneously. **IMPORTANT!** This operation permanently erases all internally stored scans taken in standalone operation mode.

STIM xxx - STIM xxx is the scan averaging time. The allowable values are from 1 to 30. The length of time for a scan is xxx seconds, for each light and dark scan.

O:xxxxxx - Entrance optic option. **This must be set to the entrance optic in use for correct calibration factors to be applied**. There can be up to eight (8) optic calibration options stored in a single instrument. Some possibilities are listed below:
(1) LENS 4 – 4 degree FOV lens
(2) FIBER1 – standard 25 degree FOV fiber optic
(3) LENS14 – 14 degree FOV lens
(4) RAW DN – no calibration applied

LSCN xxx - Laser Scan Switch function. This can be set to ON or OFF. When the Laser Switch is depressed, the sighting laser is (always) turned on. When LSCN is set to ON, a stand alone scan will be acquired when the switch is released. When LSCN is set to OFF, no scan will be acquired.

3.3.4 Modifying a parameter

(1) Depress the MENU button to locate the parameter you wish to edit.
(2) Modify the parameter by depressing the EDIT button. The push button switches are programmed to scroll the menu of available options.
(3) Depress the MENU button again to save the selected parameter setting.

4 Operational/Functional Description

The PSR Series spectroradiometers operate as portable field instruments with onboard data storage and an easy-to-use manual control panel for standalone operation. Combined with a host PC, the PSR can also be controlled for acquisition in real time and for retrieval and display of the stored scan data.

4.1 Setup

Battery Pack

To use the PSR Series spectroradiometer install a fully charged battery pack by inserting it into the battery slot located on the instrument's operating panel. When inserting the battery into the battery slot, the four copper tabs on the battery should be oriented towards the outboard side of the instrument.

IMPORTANT: Never attempt to recharge the battery while it is inserted in the instrument!

Instrument Power-on Time

Switch the power switch to the ON position. When initially switched on, the PSR Series disables its membrane switches and displays the message "SEI" on Row 1 of the LCD display. During this initial power-on period the spectroradiometer is waiting for the thermoelectric coolers to reach operating temperature before data collection can begin. This initial power-on period lasts less than a minute; when complete, the message "REF x.xx" is displayed on the LCD readout.

IMPORTANT: each PSR Series spectroradiometer contains a heat sink built into the instrument base plate that requires unobstructed air flow for proper operation. Never rest the instrument on its heat sink while the unit is powered!

Figure 6: View of the underside of the instrument with heat sink.

Instrument Warm-up Time

For optimal performance, the PSR Series instrument should initially be powered on for a period of approximately 15 minutes prior to use. During this period, the instrument should be placed in the environment where scanning will take place. This period allows the detector temperatures and other electronics to stabilize before taking spectral data.

Instrument Orientation

The PSR should be setup with its black external heat sink fins oriented as close as possible to vertical. Also, outdoors the heat sink (bottom cover) should be oriented away from the sun in order to maximize internal heat dissipation.

Laser (Tripod or Hand-held)

A sighting laser is used to aid in aligning the instrument to the target to be measured. The sighting laser can be actuated by pressing the laser scan switch on the top cover of the instrument.

CAUTION: Do NOT look into the sighting laser window or laser beam.
For more information see Appendix A: Laser Safety.

Field of View

A field of view diagram is provided with each instrument and shows the relative position of the sighting laser spot and the active field of view for the instrument at the

distance specified on the diagram. The reference or sample (target) should be large enough and positioned such that the target area of interest completely fills the field of view of the instrument.

If optional entrance optics are included, the corresponding FOV diagrams will also be supplied. (Refer to the document included on the CD supplied with your instrument).

4.2 Standalone Operation

Dark Measurement Overview

Important Note (Spring 2015): The PSR+3500 incorporates new fast dark compensation and no longer supports Scaled Dark processing as performed in earlier models.

A dark measurement is automatically taken immediately prior to taking reference or target measurements. There is no need to manually perform a dark measurement. The dark measurement is stored temporarily in RAM and overwritten with each new scan.

Reflectance Measurement Overview

A reflectance measurement takes the scan of a reference (white plate) and calculates the ratio of the target scan to that reference. Unless the instrument is set to AutoDark Mode (where it takes a new dark reading with every scan) - if any of the below conditions exist, a new dark measurement should be taken:

· After instrument power-up and warm-up, but before acquiring any reference/target scans.
· Every 3-5 minutes thereafter; more often if time and conditions allow, or if lighting or environmental conditions are changing.

If any of the below conditions exist, a new reference measurement should be taken before a series of target measurements:
· Beginning of a new set of scans.
· Any change in the collection optics.
· The instrument has been idle for an extended period, or has been turned off.
· Lighting conditions have changed or are variable.

When in doubt, take a reference measurement!

Taking a REFERENCE Measurement
1. Check that the LED Power Indicator is illuminated, indicating that the power is enabled.
2. Press the Menu membrane switch unit the LSCN menu item appears; press the Edit membrane switch so that ON appears.
3. Press the Scan membrane switch until the REF x.xx scan message on the LCD. (x.xx indicates battery voltage) Check to see if battery is adequately charged.
4. Place a reference at the point of measurement making sure to completely fill the field of view of the instrument. This reference measurement is associated with all succeeding measurements until a new reference measurement is established.
5. Press and hold the Laser Scan button to activate the sighting laser and verify the placement of the reference plate relative to the laser spot as required to fill the field of view.
6. Release the Laser Scan button to record the measurement. The LCD counter increments to display the next available memory location.

Taking a TARGET Measurement
1. Check that the LED Power Indicator is illuminated indicating that the power is enabled.
2. Press the Menu membrane switch until the LSCN menu item appears; press the Edit membrane switch so that ON appears.
3. Press the Scan membrane switch until the TAR x.xx scan message on the LCD. (x.xx indicates battery voltage) Check to see if battery is properly charged.
4. Place a reference at the point of measurement making sure to completely fill the field of view of the instrument. This reference measurement is associated with all succeeding measurements until a new reference measurement is established.
5. Press and hold the Laser Scan button to activate the sighting laser and verify the placement of the target to be measured relative to the laser spot as required to fill the field of view.
6. Release the Laser Scan button to record the measurement. The LCD counter increments to display the next available memory location. **Additional target measurements may be made by pressing and releasing the Laser Scan switch.**

4.3 Operation with a Host PC

The PSR Series spectroradiometer interacts with the DARWin SP software running on the host PC using USB or Bluetooth communications interface. The primary tasks that can be performed by running DARWin SP while connected to your spectroradiometer are:

1. Controlling the instrument remotely and collecting and displaying scan data in real time, with expanded control options, and

2. Retrieving and displaying scan data collected and stored during standalone operation.

Be sure to install the software (and any USB/Bluetooth communications drivers as needed) prior to the first time you connect to the instrument.

When running DARWin SP make sure your instrument has a charged battery and that it is powered and that the proper communications interface has been enabled. As with standalone operation, the instrument requires approximately one minute to stabilize before it will respond to communications from the software. Once communications have been established, a brief initialization sequence follows and then your system is ready for use.

For detailed information on how to use DARWin SP with your PSR Series spectroradiometer, see the DARWin SP User Manual included with your instrument.

5 Changing Foreoptic Accessories

Your PSR Series instrument comes with a standard lens foreoptic installed. If you have purchased additional foreoptic accessories such as fiber optic cable and 180° diffuser, this section describes their installation.

Important:
Removing the factory-installed lens exposes the optical slit (see Figure 9). The slit is extremely fragile; therefore it is important to take extra care when removing and installing foreoptic accessories to avoid damaging it. Always keep a lens or other foreoptic installed to protect the slit from dust, fingerprints, etc.

To install the fiber adapter, first, remove the battery from the instrument and place it on a sturdy surface. Protect the lens by covering it with the supplied plastic cap. Unscrew the lens foreoptic from the PSR by turning it counterclockwise. Remove from the PSR and cover the opposite end of the lens barrel with a second plastic cap and store the lens in a secure place.

Figure 7: Lens barrel after removal

Next, turn the PSR so the optical mounting area is facing upwards. Secure the instrument so it is sturdy and locate the fiber alignment plug (Figure 8).

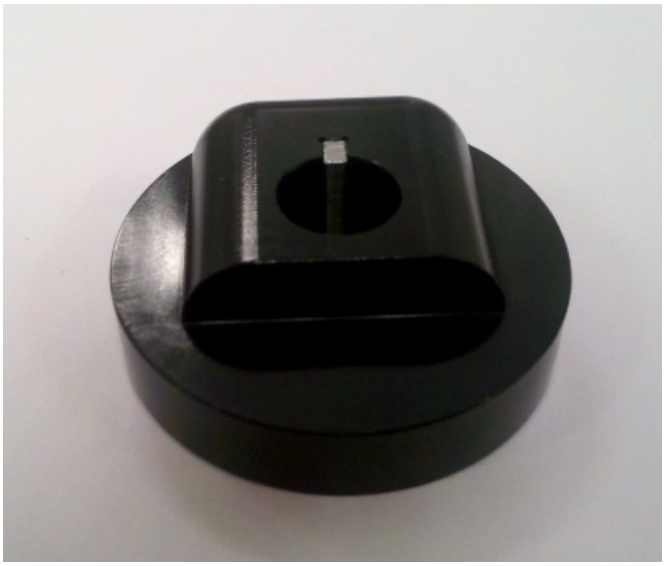

Figure 8: Fiber Alignment Plug

Install the Fiber Alignment Plug as shown in Figure 9. The plug has a rectangular tab on its underside that fits into the matching slot in the bottom of the circular recess in the instrument. Make sure that the plug is oriented so the rounded corners and the shiny metallic key are facing towards the center of the instrument and that the optical slit shows through the hole in the plug. Be careful not to touch the slit when moving the plug.

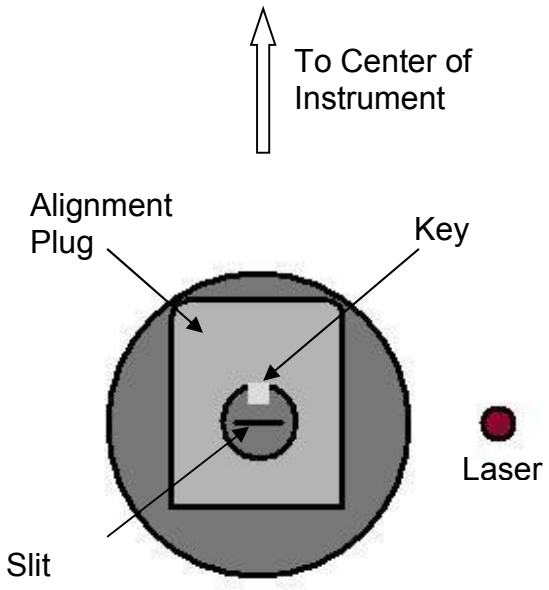

Figure 9: Detail of Fiber Alignment Plug Installation

Next, locate the threaded Fiber Adapter (Figure 10). Screw the knurled thumbscrew all the way in to make sure there is sufficient clearance, and then install the adapter onto the instrument by threading it clockwise onto the mounting area. *Do not tighten the adapter just yet - maintaining some slack will make it easier to install the fiber optic cable in the next step.*

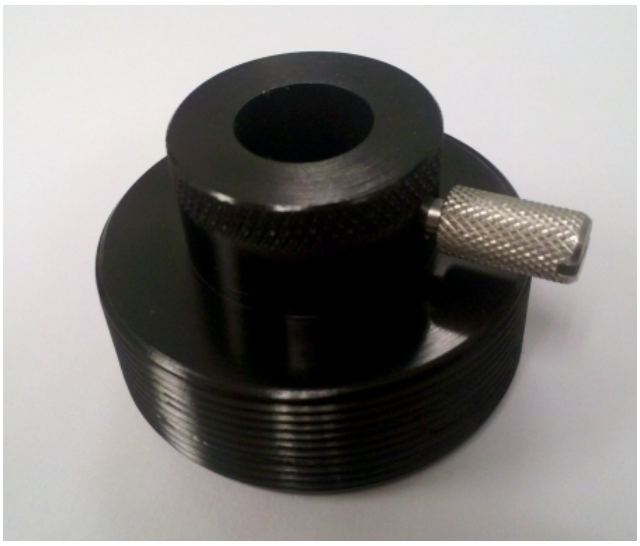

Figure 10: Fiber Adapter

Next, loosen the thumbscrew and insert the *keyed* end of the fiber optic cable (Figure 11) through the hole in the Fiber Adapter and make sure the keyway on the cable aligns properly with the key on the Fiber Alignment Plug. Do not force the cable.

Important: Verify that the keyed end of the cable goes into the adapter to ensure proper alignment of the optical fibers and to avoid slit damage.

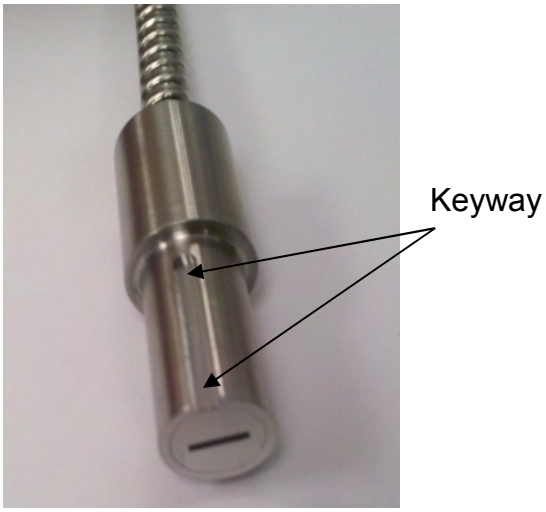

Figure 11: Fiber Optic Interface

When properly seated, the cylindrical barrel portion of the cable will protrude about ¼" from the top of the Fiber Adapter. Once the fiber is seated within the adapter, tighten the thumbscrew to hold it in place and then finish tightening the Fiber Adapter to the instrument.

At the opposite end of the fiber optic cable is a threaded SMA-type connector that simply screws into the Diffuser (Figure 12).

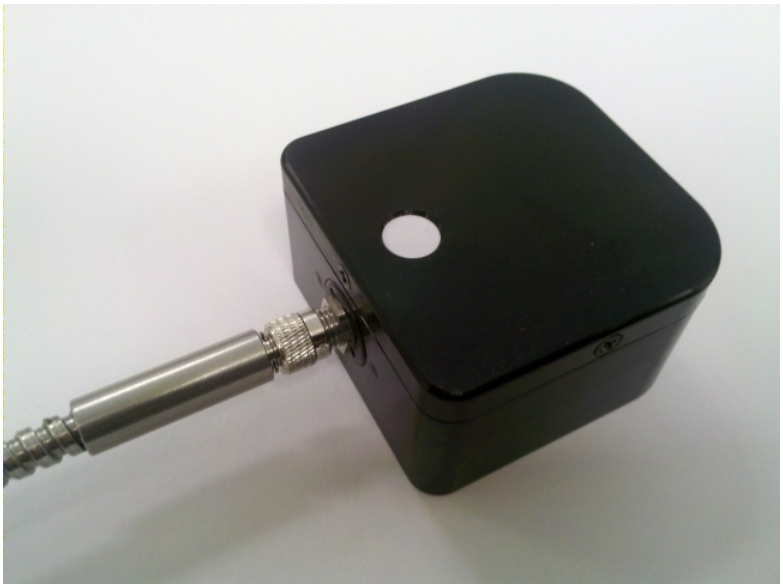

Figure 12: Diffuser with Fiber Optic Cable

6 Battery Charger

6.1 Introduction

The provided battery charger is used to charge one lithium-ion battery. The charger operates from 110/240 volt AC line supply. Follow all directions for proper, safe operations. Only charge batteries indoors in a cool place.

6.2 Operation

To charge the external battery pack:

1. IMPORTANT! Make sure to remove the battery pack from the instrument before charging!
2. Plug the charger's round male plug into the battery pack's female jack.
3. Plug the charger into an AC outlet.

The charger's *RED* LED will be illuminated during charging; when charging is complete the charger's *GREEN* LED will be illuminated.

Charging a battery from empty to full capacity will take approximately 6-7 hours.

6.3 Specifications

Input: 100–240 VAC, 0.3A (Max), 50/60 Hz
Output: 8.4 VDC, 1.3A (Max)

6.4 Information and Warnings

Cells: 18650 Li-ION cells with IC protection are used inside the battery pack

Protection: 4A max polyswitch is installed in the battery pack for double over-discharging protection.

The battery will be automatically cut off to zero (0) volts when its voltage falls too low for PSR operation.

WARNINGS:

- Avoid heavy impact to the battery pack; this may cause the battery pack to malfunction.
- Do not expose the battery pack to fire or extreme heat; this may cause the battery pack to malfunction.
- Do not use any DC power supply or charger other than the dedicated battery charger supplied with your instrument; this may cause the battery pack to malfunction.

Also, always power the PSR Series instrument with its battery only. *NEVER* use the dedicated battery charger to provide power to the instrument.

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Appendix A: Laser Safety

The PSR Series Spectroradiometers use a Class 3R laser beam that complies with IEC 60825-1, Ed. 1.2. The source of laser energy in the PSR is a nominal 3 mw, continuous, 635 nm diode laser. No maintenance or adjustments are required in order to keep this product in compliance with the above specifications.

DANGER:

Do not look into the laser beam at any time including instrument setup or operation.

The laser is operated by pressing the Laser Scan Switch located on the top surface of the instrument. See Section 2: Hardware and Interface Description, for the location of this control.

CAUTION - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

There are no user serviceable components within this device. The unit should be returned to the manufacturer in case of malfunction.

LABELING:

The following labels are required for the PSR Series instrument. Each label is described below. If the instrument does not have the appropriate labels, contact the manufacturer to ensure that your unit is in compliance.

(1) Explanatory Label

Location – Bottom (black heat-sink side) of instrument.

(2) Supplementary Explanatory Label

```
Laser Power: 3 mW, Laser Wavelength 635 nm.
Laser conforms to IEC 60825-1, Ed 1.2.
```

Location – Bottom of instrument, on the product information label.

(3) Warning Label

Location – Bottom of instrument.

(4) Aperture Label

Location - Next to the laser aperture.

Appendix B: Bluetooth Information

Bluetooth Versions Supported: V1.1
Bluetooth Class: Class I
Bluetooth Connection Type: Virtual COM Port
Bluetooth Connection Pin Key/Pairing Code: psr3500

Appendix C: PSR+3500 Specifications

Performance Specifications

Spectral Range	350–2500 nm
Spectral Resolution nominal	3.0 nm (350–1000 nm) 8nm @ 1500nm 6nm @ 2100nm
Sampling Interval	Data output in 1nm increments; 2151 channels reported
Detectors	512 element Si PDA (350-1000nm) 256 element InGaAs (970-1900nm) 256 element InGaAs (1900-2500nm)
Noise Equivalence Radiance (4* Lens)	$<0.5x10^{-9}$ W/cm^2/nm/sr@400nm $<0.8x10^{-9}$ W/cm^2/nm/sr@1400nm $<1.0x10^{-9}$ W/cm^2/nm/sr@2100nm
A/D Converter	16 bit
Wavelength Accuracy	.5 nm
Wavelength Reproducibility	.1 nm
Integration Time	8.4 ms minimum

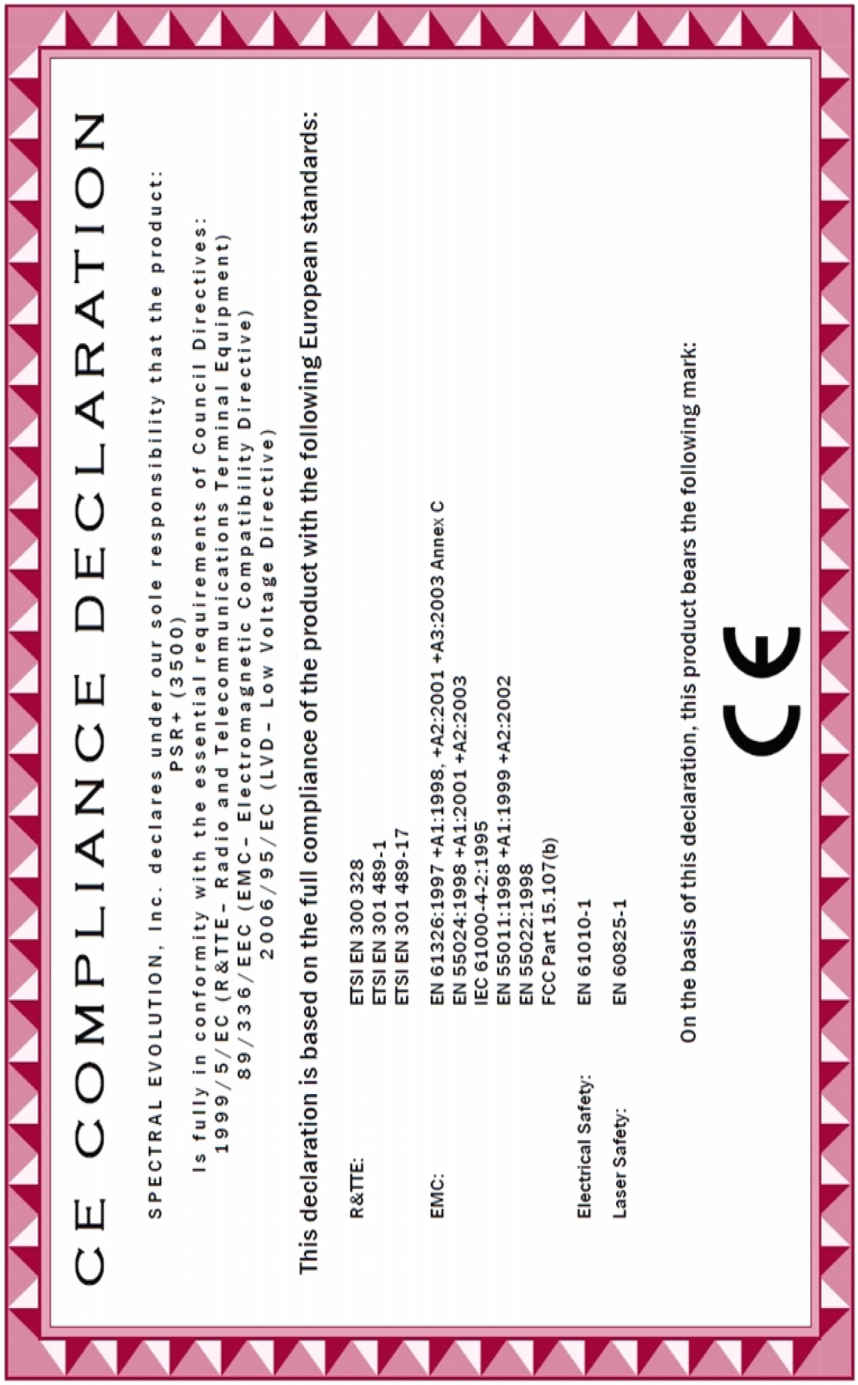
Physical Specifications

Power	Supplied (2) Li-Ion battery packs, 7.4V nominal
Size	8.5” x 11.5” x 3.25”
Weight	< 8 lbs
Communications Interface	USB and Bluetooth virtual COM ports
Foreoptics	4° lens provided (other options available)
Onboard Storage	500 spectra
Tripod Mount	Two ¼-20 mounting holes

Environmental Specifications

Operation	
Temperature	-10–40°C
Humidity	15–90 % non-condensing
Storage	
Temperature	-20–70°C
Humidity	15–90 % non-condensing

Appendix D: CE Compliance Declaration



CE COMPLIANCE DECLARATION

SPECTRAL EVOLUTION, Inc. declares under our sole responsibility that the product:
PSR+ (3500)
Is fully in conformity with the essential requirements of Council Directives:
1999/5/EC (R&TTE- Radio and Telecommunications Terminal Equipment)
89/336/EEC (EMC- Electromagnetic Compatibility Directive)
2006/95/EC (LVD- Low Voltage Directive)

This declaration is based on the full compliance of the product with the following European standards:

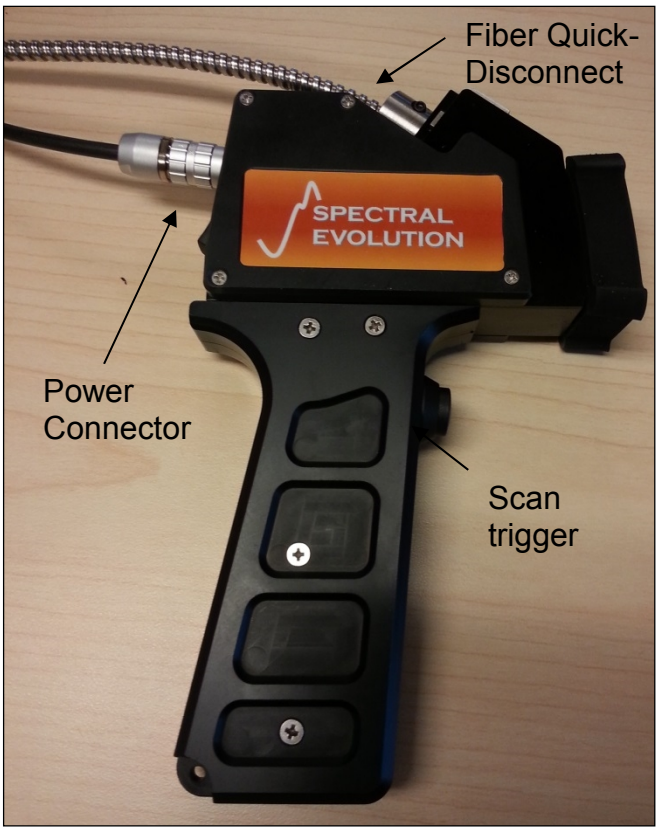
R&TTE:	ETSI EN 300 328 ETSI EN 301 489-1 ETSI EN 301 489-17
EMC:	EN 61326:1997 +A1:1998, +A2:2001 +A3:2003 Annex C EN 55024:1998 +A1:2001 +A2:2003 IEC 61000-4-2:1995 EN 55011:1998 +A1:1999 +A2:2002 EN 55022:1998 FCC Part 15.107(b)
Electrical Safety:	EN 61010-1
Laser Safety:	EN 60825-1

On the basis of this declaration, this product bears the following mark:

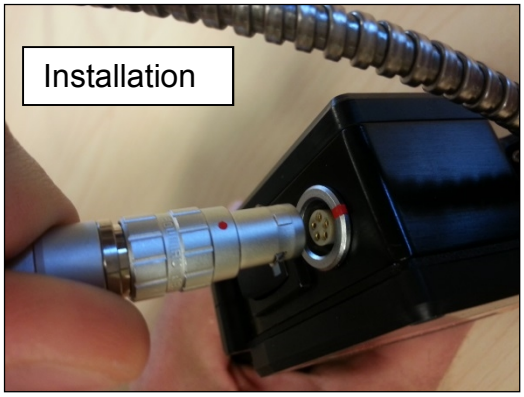
CE

Appendix E: Handheld Contact Probe

Operation



1) Connect one side of the supplied power/triggering cable to the handheld contact probe power connector as shown above. The red dot on the cable connector must align with the red dot on the contact probe body connector. In order to remove the cable from the contact probe, grasp the connector by the knurled or ribbed collar and pull directly away from the contact probe. Pulling the collar, and only the collar, will disengage a latch in the connector and remove the connector from the probe in one motion.



2) The Fiber Optic Cable connects to the contact probe by means of a quick-disconnect system. In order to attach the FOC, first locate the flat spot on the metal fiber collar. This flat spot should face parallel to the right-hand side of the probe as you look at it from behind. You may also verify that the fiber is oriented correctly by looking through the fiber connection hole in the probe to view the associated flat spot in the contact probe body. Once the fiber is roughly in the right orientation, press the metal collar into the hole in the contact probe until a click is heard. Test the connection by pulling gently on the fiber collar—this should not cause the fiber to release from the probe.

   To remove the fiber from the probe, depress the stainless steel tab on top of the probe by pressing gently on the center of the tab. The fiber should spring free of the probe body.

3) When ready to start taking scans, connect the instrument-side connector of the power/triggering cable into the main unit next to the fiber optic adapter (in the same manner as it was connected to the contact probe) and then, using the on/off switch, turn the probe on.
4) Hold the sample window of the probe flat to the sample, or as perpendicular to the surface as possible if the surface is irregular. Ensure that the contact probe power is on, and the spectrometer unit is set to “external trigger mode” as described in the unit user manual. When the probe is first switched ON, the green LED on the power switch is illuminated.
5) Press the trigger button on the front of the grip until a click is heard, and then immediately release the trigger. The LED on the back of the probe will begin blinking, and will return to its original state of constant illumination once the scan is complete.
6) After completing the needed scans, make sure to switch the probe power off.

Changing the Light Bulb

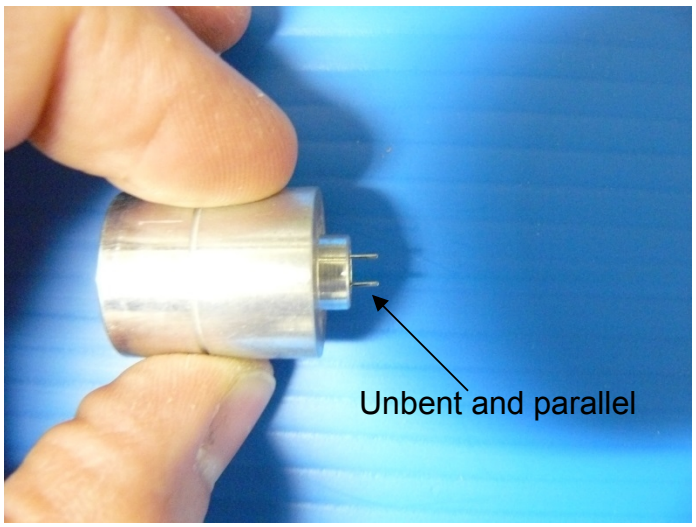
1) Ensure the Probe is off and has had time to cool to room temperature. The bulb may be HOT after prolonged operation.

2) Remove the lid of the probe by using a Phillips head screw driver to remove the 5 #2-56 screws as shown.

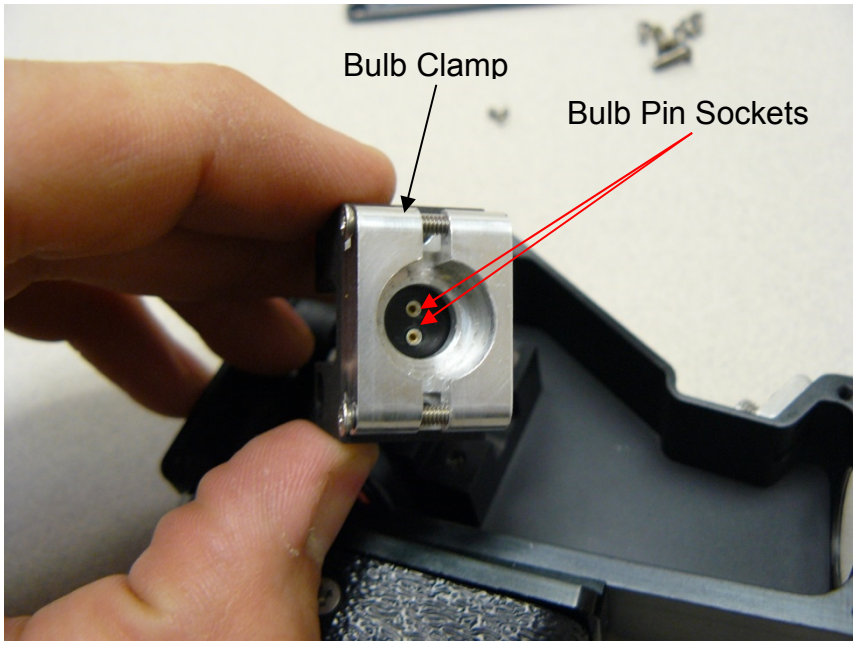
3) Undo the two #4-40 screws on the light bulb housing and remove the assembly from the contact probe, as shown below.

4) Loosen, but do not remove, the bulb clamping screws. The light bulb may now be freely removed from its clamp. Do this by pulling the bulb straight out of the clamp.

5) Inspect the replacement bulb pins to ensure that they are straight and parallel to each other see image below. If the pins are not aligned properly lightly bend them into the correct position. Correctly aligned pins will make installing the bulb much easier.



6) While wearing a powder-free latex glove grab the new bulb and place it into the contact probe clamp while moving the bulb pins to align them with the pins sockets, shown in the picture below. *CAUTION:* even with latex gloves on be careful not to touch the inside of the bulb's reflector. The oils from your finger or dust from the gloves can stick to the reflector and can alter its output characteristics including service life.



7) Lightly press the bulb into the receptacle after the pins and sockets are aligned. There should be a slight click to indicate the bulb is properly seated in the receptacle.

8) Using a Phillips head screw driver lightly tighten the bulb clamp screws. Try and spin the bulb a little after tighten. If there is no movement then move on to the next step. However if the bulb moves tighten the clamp screw until the bulb is not free to move.

9) Re-install the bulb housing and tighten down the #4-40 housing screw so they are hand tight.

10) Replace the probe cover by reinstalling the 6 #2-56 screws.

Gasket

The handheld contact probe is shipped with a thick rubber gasket which surrounds the sapphire window and prevents cracking of the window and damage to the surrounding aluminum. The gasket presses on to the front of the contact probe, and may be removed by pulling gently on one of the tabs on the gasket.

Specifications

Input: 5.5-9 *V, 2A minimum*
Bulb: *Halogen*, 4.25 *V*, 1.06*A*, ~650 life hours, Color Temp 3,000°*K*

Information and Warnings

WARNINGS:

The contact probe will become hot after extended use, to avoid this turn off the probe when not taking scans with it. Turning off the bulb while not in use also extends both battery charge and the overall life of the bulb.

Do not place any combustible materials in the contact probe sampling area for a long period of time.

Appendix F: Desktop Reflectance Probe

Operation

Desktop contact probe. On/Off switch is facing away from the camera.
Note that this photo does not show the updated locking power connector.

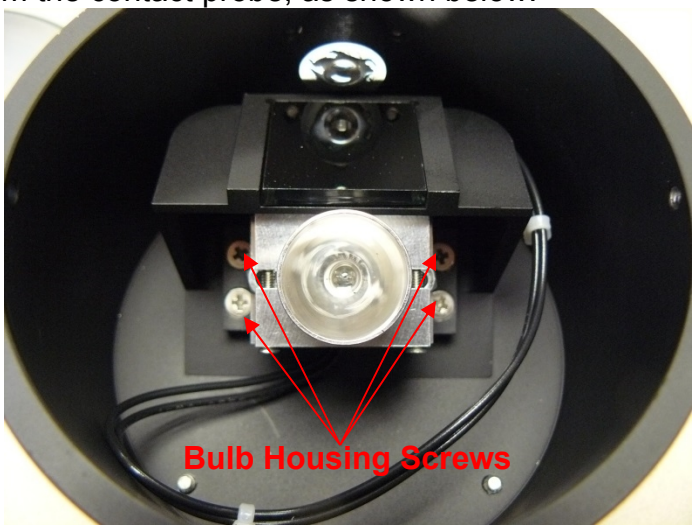
1) Connect the probe-side power connector of the provided power/triggering cable to the contact probe as shown above. Make sure to tighten down the lock nut on the power connector.
2) Connect the fiber optic cable to the SMA905 connector on the contact probe. Tighten down the lock nut on the fiber to make a tight connection.
3) When ready to start taking scans thread the instrument-side connector of the OreXpress cable into the instrument and then, using the on/off switch, turn the probe on.
4) Gently place the sample over the sample window of the probe (presenting as flat a surface as possible) and then follow the procedures detailed in the software manual for taking scans.
5) After completing the needed scans, make sure to turn the probe off.

Changing the Light Bulb

1) Ensure the desktop probe is off and has had time to cool to room temperature

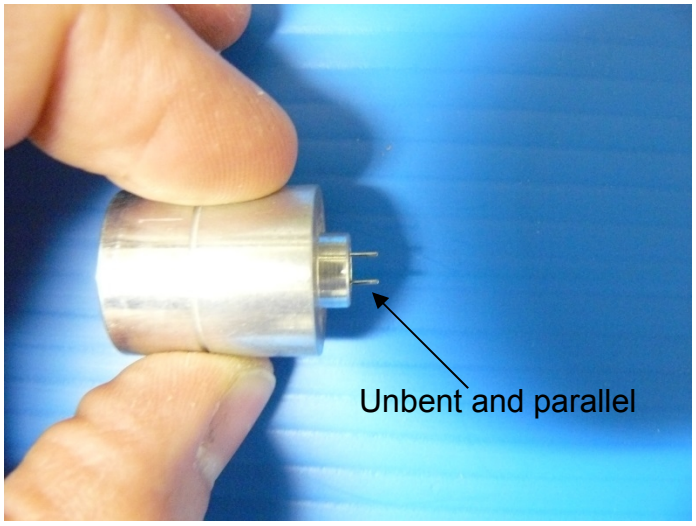
2) Remove the lid of the probe by using a Phillips head screw driver to remove the 4 #4-40 screws, as shown on the next page.

3) Undo the four #4-40 screws on the light bulb housing screws and remove the assembly from the contact probe, as shown below.

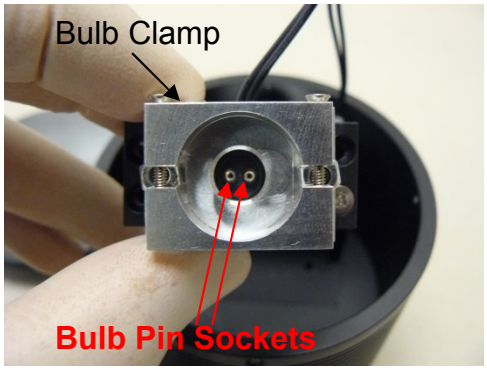


4) Loosen, but do not remove the bulb clamping screws, after the light bulb is free to be removed from its clamp. Do this by pulling the bulb straight out of the clamp.

5) Inspect the new bulb pins to ensure that they are straight and parallel to each other see image below. If the pins are not aligned properly lightly bend them into the correct position. Correctly aligned pins will make installing the bulb much easier.



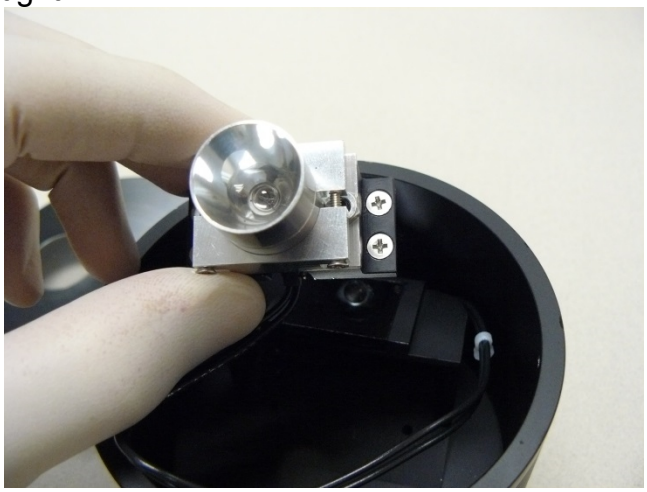
6) While wearing a powered free latex glove grab the new bulb and place it into the contact probe clamp while moving the bulb pins to align them with the pins sockets, shown in the picture below. *CAUTION:* even with latex gloves on be careful not to touch the inside of the bulb's reflector. The oils from your finger or dust from the gloves can stick to the reflector and can alter its output characteristics including life expectancy.



7) Lightly press the bulb into the receptacle after the pins and sockets are aligned. There should be a slight click to indicate the bulb is properly seated in the receptacle.

8) Using a Phillips head screw driver lightly tighten the bulb clamp screws. Try and spin the bulb a little after tighten. If there is no movement then move on to the next step. However if the bulb moves tighten the clamp screw until the bulb is not free to move.

9) Place all 4 screws back in the bulb housing and then install the assembly back into the unit. With the holes lined up tighten down the #4-40 housing screw so they are hand tight.



10) Attach the probe cover by reinstalling the 4 #4-40 screws.

Specifications

Input: 5.5-9 *V, 2A minimum*
Bulb: *Halogen*, 4.25 *V*, 1.06*A*, ~650 life hours, Color Temp 3,000 *°K*

Information and Warnings

WARNINGS:

The contact probe will become hot after extended use, to avoid this turn off the probe when not taking scans with it. Turning off the bulb while not in use also extends both battery charge and the overall life of the bulb.

Do not place any combustible materials in the contact probe sampling area for a long period of time.

Appendix G: Reference Plate

Your instrument may be supplied with a 2”x2” White Reference Plate designed to be used as the reference material for reflectance scans. The plate is made of polytetrafluoroethlyene (PTFE) and has high diffuse reflectance.

Over time the surface of the plate may become dirty or scratched. In order to restore the plate to its original properties, it can be cleaned by sanding the PTFE material under running water with a 220-240 grit waterproof emery cloth until the surface is totally hydrophobic (water beads and runs off immediately). Sanding should be done gently, in a figure-8 motion, rinsing away the sanded off layer as you go. When complete, dry the surface by blowing nitrogen or clean compressed air over the surface.