Application Note

Measurement of Canopy/Vegetation Reflectance With The *UniSpec-DC*

The UniSpec-DC is a dual channel, field portable instrument capable of unattended, simultaneous measurement of incident and reflected light. It allows sampling under any sky conditions, including clouds. It features an innovative user interface with integral computer and large, full color LCD, dual VIS/NIR detectors and extensive range of accessories for measurement. It is a truly, self-contained system that does not require an external PC for operation.

The purpose of this Application Note is to assist customers by recommending the proper accessories for specific end user applications.

Measurement of Canopy/Vegetation Reflectance

The following hardware is required for simultaneous measurement of incident and reflected light:

- UniSpec-DC Spectral Analysis System
- Reference Standard (Normally a highly reflective, white reference standard)
- Upward looking foreoptics (usually a fiberoptic and cosine receptor)
- Downward looking foreoptics (usually a fiberoptic with FOV lens)

All of these items can be supplied by PP Systems and are generally quoted as a complete system.

A good method for sampling reflectance of vegetation canopies is to connect an upward looking foreoptic (normally a flexible, lightweight fiberoptic cable of a desired length and a cosine receptor) to one of the UniSpec-DC detectors for measurement of incident light. A second downward looking foreoptic (normally a flexible, lightweight fiberoptic cable of a desired length and FOV lens) connects to the other UniSpec-DC detector for measurement of reflected light. For this application, the end user can make simultaneous measurement of incident and reflected light under changing ambient lighting conditions, even on cloudy days.

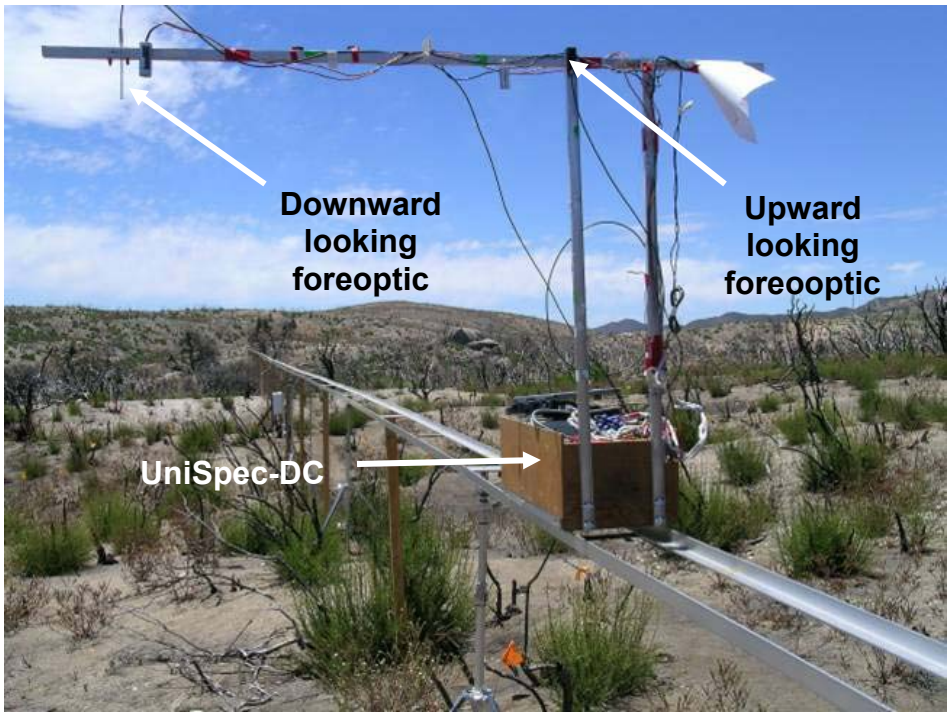


Figure 1. A common “Tram Based” system (photo courtesy of California State University-LA).

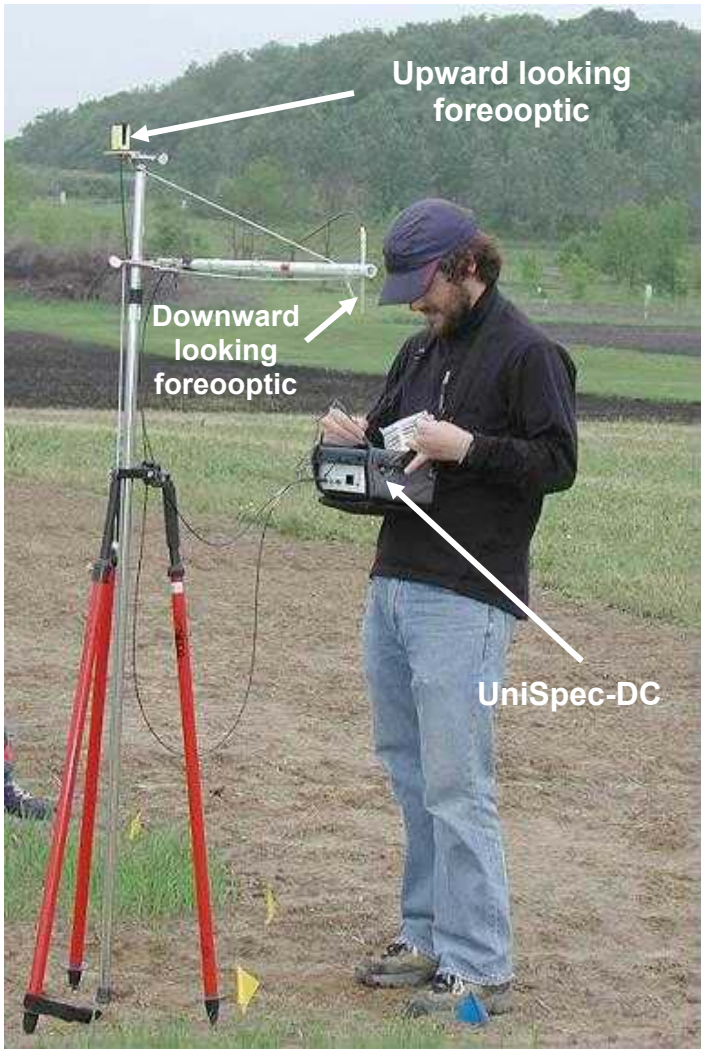
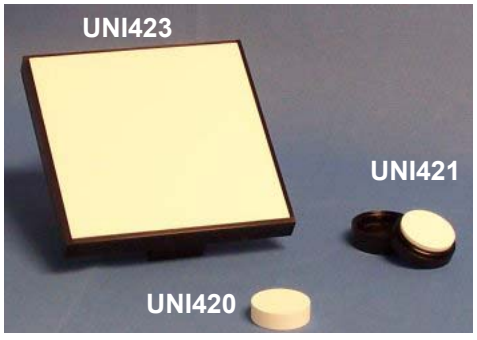


Figure 2. A common ground based system (photo courtesy of Michigan State University).

Reflectance Standards

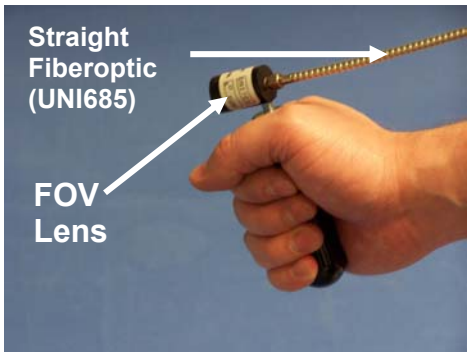
A suitable reference standard is required for accurate measurement of reflectance. PP Systems offers a range of white "reference standards" offering a convenient and simple method of calibrating the internal halogen light source, the optical fibers and spectral detector in the UniSpec-DC.
We recommend the large, 5" square reference standard (with tripod mounting) for field remote sensing applications.



At present, the customer can select from two different UniSpec-DC system configurations. Both options share a common upward looking foroptic that includes a fiberoptic (Part No. UNI686) and cosine receptor (Part No. UNI435). The difference is the downward looking foreoptics based on the determination of the FOV:

Option 1 –Defined FOV

PP Systems can supply FOV lens with a defined FOV. Most customers will require a straight fiberoptic (generally 2m in length) and a specific FOV for the downward looking foreoptic. At present, we offer three different FOV lens accessories (3°, 6° or 12°) along with associated fiberoptics to choose from.



Other FOV lens and straight fiberoptics are available and made to order. If a different FOV or straight fiberoptic is needed, please contact PP Systems and let us know the requirements. The FOV lens has a standard tripod thread built into it to allow it to be used with camera tripods (for stationary use) or it can be used for hand-held applications with a simple hand grip supplied as standard. It is very common for customers to request a 2m length fiberoptic along with one or more FOV lens.

For customers that want to measure reflectance of vegetation canopies using a defined FOV lens, we recommend the following system configuration:

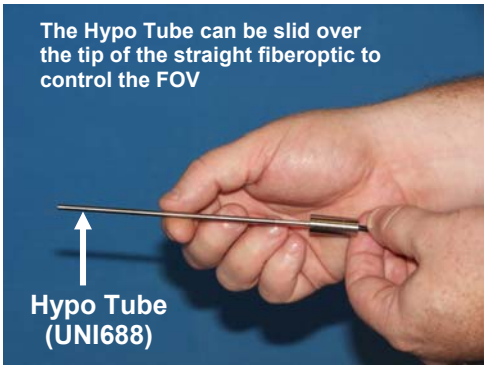
Qty	Cat. No.	Description
1	UNI021	UniSpec-DC Spectral Analysis System Including: System console, user interface, dual detectors (310-1100nm, VIS/NIR), basic spares, software and operation manual.
1	UNI685	Straight Fiberoptic, 2M, SMA-SMA
1	UNI700	3° FOV Lens
1	UNI686	Straight Fiberoptic, 2M, SMA-Custom Ferrule (For use with cosine receptor)
1	UNI435	Cosine Receptor
1	UNI423	Calibrated Reference Standard (5” square with Tripod Mounting)

If a customer requires a 6° or 12° FOV, then recommend the following in addtion to or instead of the Part No. UNI700:

Qty	Cat. No.	Description
1	UNI705	6° FOV Lens
1	UNI710	12° FOV Lens

Option 2 – Manual FOV

For the downward looking foreoptic, PP Systems can supply a straight fiberoptic (Part No. UNI684) with a standard SMA type connector (for connection to the UniSpec-DC detector and a custom ferrule on the other end). The custom ferrule has a 100mm tip constructed out of stainless steel. The ferrule provides a FOV determined by the acceptance angle of the fiberoptic (approximately 25° full angle). A simple way to manually reduce the FOV is to slip over the ferrule a piece of "Hypo Tube" that is slightly longer than the ferrule itself. For example, a piece of "Hypo-tube" that is approximately 10mm longer than the 100mm ferrule will provide a FOV (full angle) of approximately 20°.



For customers that want to measure reflectance of vegetation canopies using a "Manual FOV" approach (as shown in **Figures 1 and 2**), we recommend the following system configuration:

Qty	Cat. No.	Description
1	UNI021	UniSpec-DC Spectral Analysis System Including: System console, user interface, dual detectors (310-1100nm, VIS/NIR), basic spares, software and operation manual.
1	UNI684	Straight Fiberoptic, 2M (for use with the Hypo Tube)
1	UNI688	Hypo Tubing (1/8" Diameter)
1	UNI686	Straight Fiberoptic, 2M, SMA-Custom Ferrule (For use with cosine receptor)
1	UNI435	Cosine Receptor
1	UNI423	Calibrated Reference Standard (5" square with Tripod Mounting)

If a different length straight fiberoptic is needed for the upward or downward looking foreoptic, please contact PP Systems and let us know the requirements.

For further technical support, please contact us at:

PP Systems
110 Haverhill Road, Suite 301
Amesbury, MA 01913 U.S.A.

Tel: +1 978-834-0505
Fax: +1 978-834-0545

Email: support@ppsystems.com
URL: www.ppsystems.com