Application Note

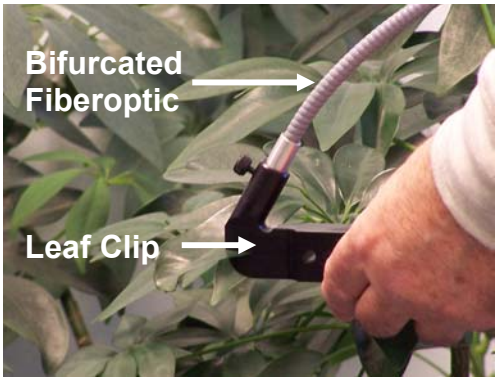
Measurement of Leaf/Canopy Level Reflectance With The *UniSpec-SC*

The UniSpec-SC, commonly referred to as a "Reflectometer", is a single channel, field portable instrument designed for measurement of leaf/canopy reflectance. It features an innovative user interface with integral computer and large, full color LCD, built-in light source and extensive range of accessories for measurement on individual leaves (including needles) and vegetation. 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 on Most Types of Leaves

Most customers are interested in measuring spectral reflectance on a wide variety of flat leaves. For most "Plant Physiological" applications, measurements need to be non-destructive, in-situ, and measured in the VIS/NIR regions (310-1,100nm). It is also imperative that the software is capable of calculating the common "vegetation" indices such as NDVI, mNDVI, PRI, WBI, Summed Green Reflectance and Red/Green Ratio. In addition to the main unit (UniSpec-SC) which must be portable, the system must provide a light source suitable for reflectance measurements in the VIS/NIR, a bifurcated fiberoptic for delivery of light to the sample and for directing reflected light back to the detector, a sample holder (leaf clip) for sealing and holding the leaf in place at a fixed angle (60^{o}) and a reference standard for calibration of the light source and detector. PP Systems offers all of these accessories for use with the UniSpec-SC.



For most customers interested in typical leaf reflectance measurements, we recommend the following system configuration (including optional external battery pack for extended use in the field:

Qty	Cat. No.	Description
1	UNI007	UniSpec-SC Spectral Analysis System Including: System console, user interface, detector (310-1100nm, VIS/NIR), basic spares, software and operation manual.
1	UNI400	Standard Bifurcated Fiberoptic
1	UNI500	Standard Leaf Clip
1	UNI420	Uncalibrated Reference Standard
1	UNI431	External Battery Pack

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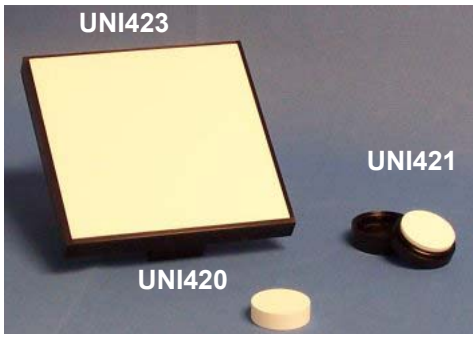
Reference Standards

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-SC.



Measurement on Conifers and Individual Needles

PP Systems is the only company that can supply a system capable of measurement of spectral reflectance on tiny samples (< 1.0 mm) such as individual pine needles. For these customers, we recommend the following system configuration (including optional external battery pack for extended use in the field:

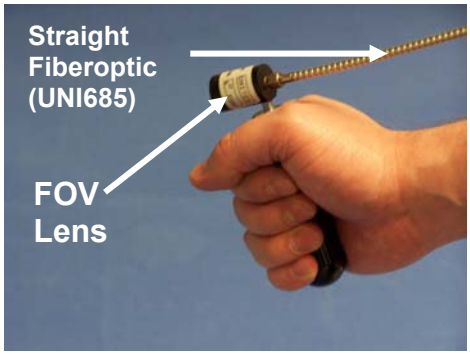
Qty	Cat. No.	Description
1	UNI007	UniSpec-SC Spectral Analysis System Including: System console, user interface, detector (310-1100nm, VIS/NIR), basic spares, software and operation manual.
1	UNI410	Mini Bifurcated Fiberoptic
1	UNI501	Mini Leaf Clip
1	UNI420	Uncalibrated Reference Standard
1	UNI431	External Battery Pack

Measurement of Canopy/Vegetation Reflectance

A good method for sampling reflectance of vegetation canopies is to connect a flexible, lightweight fiberoptic cable of a desired length to the UniSpec-SC detector. For this application, the internal light source is not usedand instead, the end user must rely on ambient light which may require more frequent "reference" scans against a suitable reference standard. This application requires a straight fiberoptic (normally 2m in length) with an SMA type connector at one end (to connect to the detector input) and a foreoptic with a defined field of view (FOV) at the other end (to limit the field of view to a defined region of the target). The customer has two UniSpec-SC system configurations available based on the determination of 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. 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:

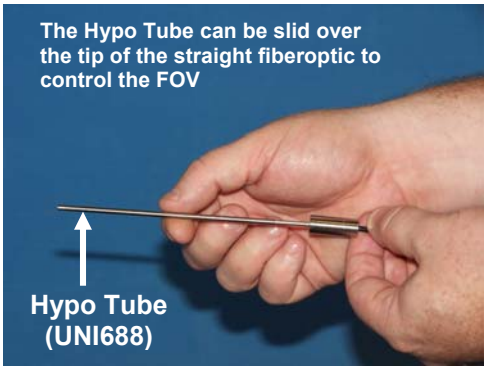
Qty	Cat. No.	Description
1	UNI007	UniSpec-SC Spectral Analysis System Including: System console, user interface, detector (310-1100nm, VIS/NIR), basic spares, software and operation manual.
1	UNI685	Straight Fiberoptic, 2M, SMA-SMA
1	UNI700	3° FOV Lens
1	UNI420	Uncalibrated Reference Standard
1	UNI431	External Battery Pack

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

PP Systems can supply a straight fiberoptic (Part No. UNI684) with a standard SMA type connector (for connection to the UniSpec-SC 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, we recommend the following system configuration:

Qty	Cat. No.	Description
1	UNI007	UniSpec-SC Spectral Analysis System Including: System console, user interface, detector (310-1100nm, VIS/NIR), basic spares, software and operation manual.
1	UNI684	Straight Fiberoptic, 2M (for use with UNI688)
1	UNI688	Hypo Tubing (1/8" Diameter)
1	UNI420	Uncalibrated Reference Standard
1	UNI431	External Battery Pack

If a different length straight fiberoptic is needed, please contact PP Systems and let us know the requirements.

For further technical support, please contact us at:

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