

# 410-LIDAR HANDHELD REFLECTOMETER

## Measures reflectance at 850nm, 905nm, 940nm and 1550nm

The 410-LIDAR measures reflectance simultaneously at four key wavelengths employed by lidar systems. Collect measurements on materials and objects that cannot easily be brought into the lab. Fast calibration and measurement times without sacrificing measurement accuracy and repeatability. Option to customize wavelengths.

### BENEFITS

- **4 discrete wavebands**  
850nm, 905nm, 940nm and 1550nm wavelengths.
- **Fast calibration**  
One minute calibration at start of measurement session.
- **One measurement**  
Collects data at all wavebands in a single 7 sec. measurement.
- **Band customization**  
Add or replace stock bands with custom wavelengths.
- **Cleanable calibration coupon**  
Calibration coupon can be wiped clean.
- **Immediate data**  
Touch screen display for data review and management.

### APPLICATIONS

- **Field Measurements**  
Monitor drift in calibrated reflectance values of outdoor targets
- **Lab Measurements**  
In house calibration and reporting at Lidar wavelengths
- **Product qualification**  
LiDAR sensor characterization
- **Large target measurements**  
Measure multiple spots on large lidar calibration targets



### EXAMPLE MENU SCREENS

Measurement screen.

410-LIDAR	
F:file	S:sample
Ready	
nm	DHR
850	.312 .002
905	.629 .001
940	.641 .001
1550	.645 .001
◀ 21-24 ▶ 3x	
⏪ ρ Graph	

### ORDERING

Standard components	0410-0021	410-LiDAR Measurement Head
	0410-0053	Handheld Command Module - 120VAC
	0410-0107	Glazed Ceramic Calibration Coupon (Non-NIST Traceable)
Options	0410-0002	Benchtop Remote Control Unit - 120VAC
	0410-0123	Glazed Ceramic Calibration Coupon (NIST Traceable)
	0410-1016	410-Series Reflectometer Maintenance and Calibration Plan (Non-NIST)
	0410-1009	410-Series Reflectometer Maintenance and Calibration Plan (NIST)
	0410-1019	410-LiDAR Extended Warranty
	0410-0207	SD Card for Extra Data Storage
	0410-0054	Handheld Command Module - 220VAC
	0410-0019	Benchtop Remote Control Unit - 220VAC



CE Equipment described herein is subject to US export regulations and may require a license prior to export. Diversion contrary to US law is prohibited.

# SPECIFICATIONS 410-LIDAR

410-LIDAR	
<b>MEASURED DATA</b>	
<i>Measured Parameter</i>	Directional hemispherical reflectance (DHR)
<i>Method</i>	Integrated total reflectance in a band for a given angle of incidence
<i>Measured Value</i>	Absolute reflectance (0-1)
<i>Calculated Value</i>	Total reflectance, absorptance
<i>Wavelength Bands (nm)</i>	850nm, 905nm, 940nm and 1550nm
<i>Angle of Incidence</i>	20° from normal incidence
<i>Calibration Coupon</i>	Glazed Ceramic
<b>PERFORMANCE</b>	
<i>Accuracy</i>	+/- .02
<i>Repeatability</i>	±.005 units
<i>Beam Spot Size</i>	0.50 inches
<i>Measurement Time</i>	7 seconds
<i>Sample Size and Geometry</i>	Flat: ≥ 0.5 in. diameter Curved: 6 in. convex; 12 in. concave
<i>Warm Up Time</i>	90 seconds
<i>Time Between Measurements</i>	2 seconds
<i>Sample temperature</i>	Ambient or heated/cooled to 0 - 100° C
<i>Operating Temperature</i>	0° to 40° C
<b>POWER</b>	
<i>Run Time</i>	2 hours on one battery. Battery easily replaced with continuous operation after battery replacement.
<i>Power Source</i>	Rechargeable battery (standard environmentally friendly NiMH)
<i>Battery Recharge Time</i>	1 hour
<i>VIS-NIR Source</i>	Tungsten filament, temperature controlled by user
<b>DIMENSIONS</b>	
<i>Weight</i>	4.7 lbs. (2.13 kg)
<i>Form Factor/Size</i>	H 11.54 in., L 9.04 in., W 3.27 in. (29.31 cm x 22.96 cm x 9.44 cm)
<b>INTERFACE</b>	
<i>Operator Interface</i>	LCD graphics screen, 1/4 VGA, touch screen, software buttons; trigger switch in handle
<i>Diagnostics</i>	On screen status and signals monitor. Signal values stored with data. Raw data collection and display.
<b>MISCELLANEOUS</b>	
<i>Format</i>	Data files can be opened and post processed with Excel or a text processor
<i>Storage</i>	Removable SanDisk (SD) card
<i>Export control</i>	ECCN #3A999.F

# 410 SERIES REFLECTOMETERS & EMISSOMETERS

**TOUCHSCREEN**  
Control, measurement & data processing functions are exercised by soft buttons

**COMMAND MODULE**  
Computer processing, electrical power, & support for the measurement head via soft buttons

**BATTERY**  
Fast-charging, high watt-hour capacity battery cartridge

**INTERCHANGEABLE MEASUREMENT HEAD**  
Based on a modified integrating sphere

**THREADED COLLAR**  
Twists to disconnect measurement head from command module

**REMOTE CONTROL UNIT (RCU)**  
Connect to a laptop.

**HANDHELD CONFIGURATION**

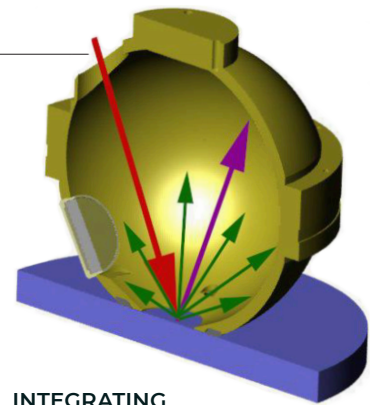
**BENCHTOP CONFIGURATION**

## METHODOLOGY

The basic structure of a measurement head is an internal source, a modified integrating sphere, and detectors. The reflectance measurement is made by collimating the source beam onto the target, the energy is reflected back into the sphere, and eventually detected or dissipated.

The 410 Series Reflectometers measures the integrated surface reflectance of a surface at a given angle of incidence ( $20^\circ$  or  $60^\circ$ ). The integrating sphere captures the reflected light from the target material, integrating reflections in all directions. Wavelength-filtered detectors measure the total light reflected in each wavelength band and converts it to an analog electrical signal.

The 410 Series Reflectometer electronics processes the detector signals for initial amplification (fixed), filtering, offset adjustment, secondary amplification (variable), and analog to digital conversion. The digitized signals are read by the on-board processor, stored in memory, and then used to determine the target sample reflectance at each incident angle and wavelength band. Those reflectances are used to calculate additional properties such as directional thermal emittance or total hemispherical emittance. Results are displayed on the liquid crystal display touchscreen, and stored on a SecureDigital (SD) card.



### INTEGRATING SPHERE SCHEMATIC

Schematic of the integrating sphere in contact with a sample.

Red arrow - illuminating beam

Purple arrow - reflected beam

Green arrows - scattered light

## CALIBRATION COUPON



## CALIBRATION

An easy calibration process is required before each measurement session. The software GUI will walk the user through the process. Calibration is performed using calibration coupon(s) with known reflectance values.

# 410 REFLECTOMETERS MODEL COMPARISON GUIDE

The SOC410 Series Reflectometers are portable contact measurement devices designed to take precise, accurate reflectance and emittance measurements. Made with an ergonomic power-drill design, the SOC410 Series lets you easily take measurements in-the-field or around the lab—no cords or external batteries necessary. The world's largest defense, aerospace, and energy companies rely on SOC410 data.



Model	410-Solar	410-Solar-i	410-LiDAR	ET-100	ET-10	410-DHR
<i>Spectral Bands</i>	335 - 380 nm 400 - 540 nm 480 - 600 nm 590 - 720 nm 700 - 1100 nm 1000 - 1700 nm 1700 - 2500 nm	335 - 380 nm 400 - 540 nm 480 - 600 nm 590 - 720 nm 700 - 1100 nm 1000 - 1700 nm 1700 - 2500 nm	850 nm 905 nm 940 nm 1550 nm	1.5 - 2.0 $\mu\text{m}$ 2.0 - 3.5 $\mu\text{m}$ 3.0 - 4.0 $\mu\text{m}$ 4.0 - 5.0 $\mu\text{m}$ 5.0 - 10.5 $\mu\text{m}$ 10.5 - 21.0 $\mu\text{m}$	3.0-5.0 $\mu\text{m}$ 8.0-12.0 $\mu\text{m}$	0.9 - 1.1 $\mu\text{m}$ 1.9 - 2.4 $\mu\text{m}$ 3.0 - 4.0 $\mu\text{m}$ 3.0 - 5.0 $\mu\text{m}$ 4.0 - 5.0 $\mu\text{m}$ 8.0 - 12.0 $\mu\text{m}$
<i>Calculated Properties</i>	Total, diffuse & specular reflectance absorptance	Total reflectance/absorptance	Total reflectance/absorptance	In-band total reflectance Directional thermal emissivity at 20° Directional thermal emissivity at 60° Hemispherical thermal emissivity	Directional thermal emissivity at 20°	In-band total reflectance In-band emissivity
<i>Angle of Incidence</i>	20°	20°	20°	20° and 60°	20°	20° and 60°
<i>Calibration Coupon(s)</i>	Solar Diffuse Solar Specular	Glazed Ceramic	Glazed Ceramic	Specular Gold	Specular Gold	Specular Gold
<i>ASTM Compliance</i>	C1549 E903 E1980	C1549 E903 E1980		E408 E1980		N/A

Also available is the 410-VIS-IR model, a dual measurement head package consisting of the 410-Solar and ET100 measurement heads with a single command module.