



SURFACE OPTICS
CORPORATION

**410 SERIES
REFLECTOMETERS
& EMISSOMETERS**

FAST ACCURATE ASTM COMPLIANCE TESTING

Surface Optics Corporation is an engineering and manufacturing firm specializing in optical property characterization and associated technologies. Headquartered in San Diego, CA, company capabilities include coatings and pigments for thermal and signature control, precision optical measurement services, reflectometers, spectral imaging systems and custom engineering services.

ASTM STANDARD COMPLIANCE

C1549

Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

E903

Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres.

E408

Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Technique.

E1980

Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

SOC410 Series Reflectometers are portable measurement tools for rapid solar reflectance, absorptance, and thermal emittance characterization. Designed for quality control and research and development applications, the SOC410 Series Reflectometers produce precision measurements comparable to complex benchtop instrumentation in an easy-to-use handheld package. A touchscreen interface provides guided calibration, sample identification, and measurement data display.

The SOC410 product line was developed as a collaboration between U.S. Naval Air Systems Command and Surface Optics Corporation, with vital input from the Naval Research Lab (NRL) and National Institute of Standards and Technology (NIST).

- **Portable**
Battery powered cordless design.
- **ASTM compliant**
Compliant with ASTM standards for reflectance and emittance measurements.
- **Easy to use**
Simply press port against sample and pull trigger.
- **Fast data collection**
Measurements in 10 seconds or less.
- **Immediate data**
Touch screen display for data review and management.
- **Easy calibration**
One minute calibration at start of measurement session.



410-VIS-IR REFLECTOMETER

Solar reflectance and thermal emittance measurements

The 410-Vis-IR joins the ET100 and 410-Solar or 410 Solar-i measurement heads in a single package for measuring solar reflectance/absorptance and thermal emittance. The ET100 measurement head collects directional reflectance from 1.5 to 21 μm to determine directional and total hemispherical emissivity. The 410-Solar models measure reflectance at near-normal incidence from 335-2500 nm. Easily switch between reflectance and emittance data collection with a single handle for data display and measurement controls.



BENEFITS

- **Complete spectral range**
Reflectance, absorptance and emittance from 350 nm – 21 μm .
- **ASTM compliant**
Compliant with ASTM E903, E408, C1549 & E1980.
- **No waiting**
90 sec warm up, no equilibration between measurements.
- **Easy to use**
Simply press port against sample and pull trigger.
- **Fast calibration**
One minute calibration at start of measurement session.
- **Room temperature samples**
Calculate emissivity without heating sample.

APPLICATIONS

- **Space Coatings**
Thermal control | α/ϵ | Thermo-optical properties
- **Defense | Aerospace**
IR Signature | Low observable paint & coatings
- **Cool Building Materials**
TSR | SRI | ASTM | LEED | CRRC
- **Concentrated Solar**
Mirror evaluation | Selective absorber coatings
- **Radiative Heat Transfer**
Absorptance for thermal modeling
- **Semiconductors**
Wafer fab hardware emissivity
- **Astronomy**
Mirror evaluation

ORDERING

Standard components	0410-0011	410-Vis-IR Measurement Heads
410-Solar	0410-0001	Handheld Command Module - 120VAC
	0410-0100	Specular Gold Calibration Coupon (Non-NIST Traceable)
	0410-0102	Diffuse Calibration Coupon (Non-NIST Traceable)
	0410-0103	Specular Calibration Coupon (Non-NIST Traceable)
Standard components	0410-0013	410-Vis-IR (Model i) Measurement Heads
410-Solar-i	0410-0001	Handheld Command Module - 120VAC
	0410-0100	Specular Gold Calibration Coupon (Non-NIST Traceable)
	0410-0107	Glazed Ceramic Calibration Coupon (Non-NIST Traceable)
Options	0410-0002	Benchtop Remote Control Unit - 120VAC
	0410-0101	Specular Gold Calibration Coupon (NIST Traceable)
	0410-0106	Diffuse Calibration Coupon (NIST Traceable)
	0410-0104	Specular Calibration Coupon (NIST Traceable)
	0410-0123	Glazed Ceramic Calibration Coupon (NIST Traceable)
	0410-1015	410-Vis-IR Reflectometer Maintenance and Calibration Plan (Non-NIST)
	0410-1014	410-Vis-IR Reflectometer Maintenance and Calibration Plan (NIST)
	0410-1007	410-Vis-IR Extended Warranty
	0410-1012	410-Vis-IR (Model i) Extended Warranty
	0410-0200	Handheld Command Module - 220VAC
	0410-0019	Benchtop Remote Control Unit - 220VAC

EXAMPLE MENU SCREENS

Measurement screen. Results are displayed on the liquid crystal display touchscreen, and stored on a SecureDigital (SD) card.

410-Solar			
F:1		S:1	
Ready			
nm	Specular	Total	
335-380	.925±.001	.926±.001	
400-540	.940±.002	.942±.002	
480-600	.947±.001	.950±.001	
590-720	.948±.001	.953±.001	
700-1100	.950±.002	.955±.002	
1000-1700	.951±.001	.956±.002	
1700-2500	.953±.001	.958±.001	

Solar absorptance calculation for the selected solar irradiance function.

410-Solar	
Solar Irradiance:	
Air Mass 0	▼
Solar Absorptance:	
$\alpha_t = .116 \pm .001$	
$\alpha_s = .114 \pm .001$	

Directional and hemispherical emittance measurement data screen.

Thermal Emittance	
F:1	S:1
T:300 K	Dielectrics
$\epsilon_{20^\circ} : 0.612 \pm 0.001$	
$\epsilon_{60^\circ} : 0.778 \pm 0.001$	
$\epsilon_H : 0.604 \pm 0.001$	

Set temperature and material type for Hemispherical Thermal Emittance calculation.

Thermal Emittance	
engmeas1/sample1	▼
Temperature [K]:	300.0
HTE table:	dielectrics ▼
DTE at 20 deg: 0.612	
DTE at 60 deg: 0.778	
HTE: 0.604	

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.

410-SOLAR HANDHELD REFLECTOMETER

Measure specular, diffuse and total solar reflectance

The 410-Solar Reflectometer conforms to ASTM E903 and C1549, the standard test methods for solar reflectance measurements. Measures reflectance at near-normal incidence for seven spectral bands. The 410-Solar specifies the specular and diffuse components of the total reflectance. Choose from eight solar irradiance functions, including air mass 0, 1, 1.5, and 2.0, to calculate total solar reflectance/absorptance.



BENEFITS

■ ASTM compliant

Compliant with ASTM E903, C1549 & E1980.

■ 7 discrete bands

335-380, 400-540, 480-600, 590-720, 700-1100, 1000-1700, 1700-2500.

■ Multiple solar irradiance functions

New or custom functions can be added to the default options including AM 0, 1.5.

■ Analysis of total reflectance

Identify specular and diffuse components of total reflectance.

■ Fast calibration

One minute calibration at start of measurement session.

■ Immediate data

Touch screen display for data review and management.

APPLICATIONS

■ Space Coatings

Thermal control | α/ϵ | Thermo-optical properties

■ Concentrated Solar

Mirror evaluation | Selective absorber coatings

■ Defense | Aerospace

IR Signature | Low observable paint & coatings

■ Radiative Heat Transfer

Absorptance for thermal modeling

■ Semiconductors

Wafer fab hardware emissivity

■ Astronomy

Mirror evaluation

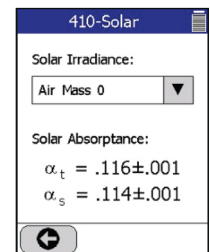
■ Cool Building Materials

TSR | SRI | ASTM | LEED | CRRC

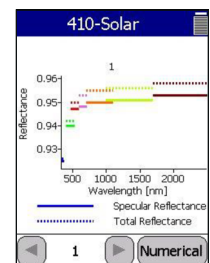
EXAMPLE MENU SCREENS



Measurement screen. Results are displayed on the liquid crystal display touchscreen, and stored on a SecureDigital (SD) card.



Solar absorptance calculation for the selected solar irradiance function.



Graphical representation of the measured reflectance values.

ORDERING

Standard components	Options
0410-0004 410-Solar Measurement Head	0410-0002 Benchtop Remote Control Unit - 120VAC
0410-0001 Handheld Command Module - 120VAC	0410-0106 Diffuse Calibration Coupon (NIST Traceable)
0410-0102 Diffuse Calibration Coupon (Non-NIST Traceable)	0410-0104 Specular Calibration Coupon (NIST Traceable)
0410-0103 Specular Calibration Coupon (Non-NIST Traceable)	0410-1016 410-Series Reflectometer Maintenance and Calibration Plan (Non-NIST)
	0410-1009 410-Series Reflectometer Maintenance and Calibration Plan (NIST)
	0410-1002 410-Solar Extended Warranty
	0410-0205 SD Card for Extra Data Storage
	0410-0200 Handheld Command Module - 220VAC
	0410-0019 Benchtop Remote Control Unit - 220VAC

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410-SOLAR-i HANDHELD REFLECTOMETER

Measures total solar reflectance from 335nm to 2500 nm

Designed for increased accuracy when measuring non-uniform or rough materials, the 410-Solar-i retains the original 410-Solar's handheld form factor and in-band spectral resolution. As a result, the 410-Solar-i provides $\pm .02$ measurement accuracy and $\pm .001$ repeatability, a larger beam spot size, and faster measurement and calibration times than the previous 410-Solar model.

BENEFITS

- 410-Solar upgrades**
 Faster measure time, larger spot, single cleanable calibration coupon.
- ASTM compliant**
 Compliant with ASTM E903, C1549 & E1980.
- 7 discrete bands**
 335-380, 400-540, 480-600, 590-720, 700-1100, 1000-1700, 1700-2500.
- Multiple solar irradiance functions**
 New or custom functions can be added to the default options including AM 0, 1.5.
- Cleanable calibration coupon**
 Calibration coupon can be wiped clean.
- Immediate data**
 Touch screen display for data review and management.

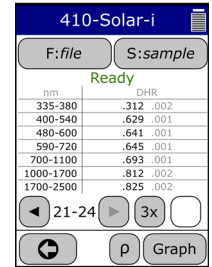
APPLICATIONS

- Cool Building Materials**
 TSR | SRI | ASTM | LEED | CRRC
- Space Coatings**
 Thermal control | α/ϵ | Thermo-optical properties
- Defense | Aerospace**
 IR Signature | Low observable paint & coatings
- Radiative Heat Transfer**
 Absorptance for thermal modeling
- LiDAR**
 Test Target Reflectance

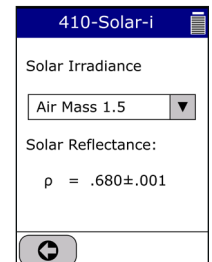


EXAMPLE MENU SCREENS

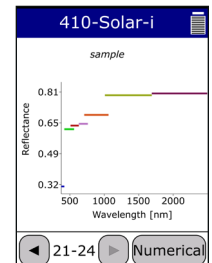
Measurement screen.



Total solar reflectance calculation for the selected solar irradiance function.



Graphical representation of the measured reflectance values.



ORDERING

Standard components	0410-0015 0410-0001 0410-0107	410-Solar-i Measurement Head Handheld Command Module - 120VAC Glazed Ceramic Calibration Coupon (Non-NIST Traceable)
Options	0410-0002 0410-0123 0410-1016 0410-1009 0410-1019 0410-0207 0410-0200 0410-0019	Benchtop Remote Control Unit - 120VAC Glazed Ceramic Calibration Coupon (NIST Traceable) 410-Series Reflectometer Maintenance and Calibration Plan (Non-NIST) 410-Series Reflectometer Maintenance and Calibration Plan (NIST) 410-Solar-i Extended Warranty SD Card for Extra Data Storage Handheld Command Module - 220VAC Benchtop Remote Control Unit - 220VAC
LiDAR Model	0410-0021	410-LiDAR Measurement Head - 850, 905, 940, 1550 nm bands

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SPECIFICATIONS 410-SOLAR, 410-SOLAR-i

410 Solar or 410 Solar-i included in 410 Vis-IR Package.

	410-SOLAR	410-SOLAR-i
MEASURED DATA		
<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), Diffuse Reflectance	Absolute reflectance (0-1)
<i>Calculated Value</i>	Total Solar reflectance, Solar absorptance, specular reflectance	Total Solar reflectance, Solar absorptance
<i>Wavelength Bands (nm)</i>	335-380, 400-540, 480-600, 590-720, 700-1100, 1000-1700, 1700-2500	
<i>ASTM Standards</i>	C1549 E1980 E903	
<i>Angle of Incidence</i>	20° from normal incidence	
<i>Calibration Coupon</i>	Specular, Diffuse	Glazed Ceramic
PERFORMANCE		
<i>Accuracy</i>	+/- .02	
<i>Repeatability</i>	±.005 units	
<i>Beam Spot Size</i>	0.25 inches	0.50 inches
<i>Beam Angle</i>	3° half cone angle	N/A
<i>Measurement Time</i>	10 seconds	7 seconds
<i>Solar Irradiance Functions</i>	Air Mass 0 (AM) Extraterrestrial irradiance (ASTM E490-00) Hazy sky AM1.5 beam-normal irradiance (ASTM E891-87) Clear sky AM1 global horizontal irradiance (SMARTS 2.9.5) Clear sky AM1.5 global irradiance surface tilted 37° (ASTM G173-03) Clear sky AM1.5 global irradiance surface tilted 20° (ASTM G197-14) Clear sky AM1.5 global irradiance surface tilted 90° (ASTM G197-14) Clear sky AM1.5 global horizontal irradiance (SMARTS 2.9.5) Clear sky AM2.0 global horizontal irradiance (SMARTS 2.9.5)	
<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	
POWER		
<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	
DIMENSIONS		
<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)	
INTERFACE		
<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.	
MISCELLANEOUS		
<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	

ET-100 HANDHELD THERMAL EMISSOMETER

Total hemispherical emittance measurements

The ET-100 measures directional reflectance from 1.5 to 21 μm and, based on those values, calculates directional and total hemispherical emissivity. The ET100 Emissometer conforms to ASTM E408, the standard test method for the determination of emittance using a portable instrument. In-band reflectance data for six discrete bands.



BENEFITS

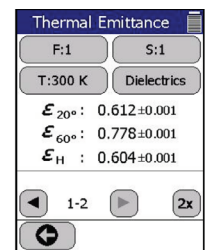
- **ASTM compliant**
Use for ASTM E408 and E1980.
- **6 discrete bands**
1.5-2.0, 2.0-3.5, 3.0-4.0, 4.0-5.0, 5.0-10.5, 10.5-21.
- **Immediate warm up**
90 sec warm up, no equilibration between measurements.
- **Room temperature samples**
Calculate emissivity without heating sample.
- **Two incident angles**
Data for 20° and 60° angles of incidence.
- **Emittance for multiple materials**
Metals & dielectrics.
- **Elevated temperature model**
Calculate emittance at any temperature Kelvin.
- **In-Band spectral resolution**
Increased accuracy over broadband for selective radiating materials.
- **Gier Dunkle DB-100**
Replacement for discontinued DB-100.

APPLICATIONS

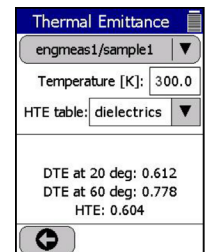
- **Space Coatings**
Thermal control | α/ϵ | Thermo-optical properties
- **Defense | Aerospace**
IR Signature | Low observable paint & coatings
- **Radiative Heat Transfer**
Absorptance for thermal modeling
- **Semiconductors**
Wafer fab hardware emissivity
- **Cool Building Materials**
SRI | ASTM | LEED
- **Energy**
Nuclear | Concentrated Solar

EXAMPLE MENU SCREENS

Directional and hemispherical emittance measurement data screen.



Set temperature and material type for Hemispherical Thermal Emittance calculation.



ORDERING

Standard components	0410-0007	ET100 Emissometer Measurement Head
	0410-0001	Handheld Command Module - 120VAC
	0410-0100	Specular Gold Calibration Coupon (Non-NIST Traceable)
Options	0410-0002	Benchtop Remote Control Unit - 120VAC
	0410-0101	Specular Gold 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)
	0410-1003	ET100 Extended Warranty
	0410-0204	SD Card for Extra Data Storage
	0410-0200	Handheld Command Module - 220VAC
	0410-0019	Benchtop Remote Control Unit - 220VAC

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ET-10 HANDHELD THERMAL EMISSOMETER

Emittance at 3-5 and 8-12 microns

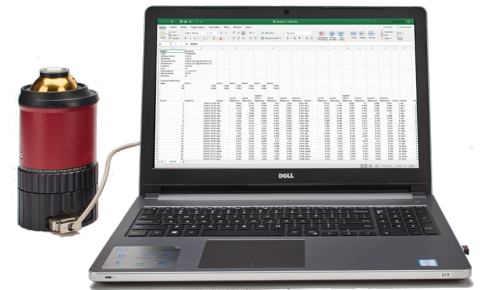
The ET10 answers the long-standing need for measuring emissivity as an entry parameter for calibrating infrared thermography devices. The ET10 measures total reflectance and directional emissivity at 20 degrees angle of incidence for 3-5 and 8-12 microns. View results immediately on the touch screen display.

BENEFITS

- **MWIR/LWIR sensors**
3-5 and 8-12 μm bands.
- **Room temperature samples**
Calculate emissivity without heating sample.
- **Fast warm up**
90 sec warm up, no equilibration between measurements.
- **Portable**
Battery powered cordless design.
- **Rapid measurements**
Measure total solar reflectance in 7 seconds.
- **Immediate data**
Touch screen display for data review and management.
- **Fast calibration**
One minute calibration at start of measurement session.

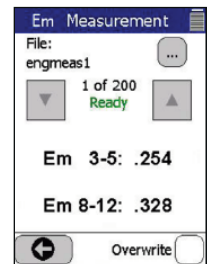
APPLICATIONS

- **Defense | Aerospace**
IR Signature | Low observable paint & coatings
- **Radiative Heat Transfer**
Emissivity for thermal modeling | Thermal camera calibration
- **Semiconductors**
Wafer fab hardware emissivity
- **Cool Building Materials**
Energy performance | Thermal modeling



EXAMPLE MENU SCREENS

Measurement screen. Results are displayed on the liquid crystal display touchscreen, and stored on a SecureDigital (SD) card.



ORDERING

Standard components	0410-0008 0410-0001 0410-0100	ET10 Emissometer Measurement Head Handheld Command Module - 120VAC Specular Gold Calibration Coupon (Non-NIST Traceable)
Options	0410-0002 0410-0101 0410-1016 0410-1009 0410-1004 0410-0209 0410-0200 0410-0019	Benchtop Remote Control Unit - 120VAC Specular Gold Calibration Coupon (NIST Traceable) 410-Series Reflectometer Maintenance and Calibration Plan (Non-NIST) 410-Series Reflectometer Maintenance and Calibration Plan (NIST) ET10 Extended Warranty SD Card for Extra Data Storage Handheld Command Module - 220VAC Benchtop Remote Control Unit - 220VAC

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410-DHR HANDHELD REFLECTOMETER

Infrared reflectance measurements

The 410-DHR is a product of collaboration between U.S. Naval Air Systems Command and Surface Optics, with vital input from the Naval Research Lab (NRL) and National Institute of Standards and Technology (NIST).

It was developed to answer a broad need for a portable device for verification of optical properties of large objects in the field. The 410-DHR measures the integrated surface reflectance of a surface at two angles of incidence (20° and 60°) and for six discreet wavelength bands in the .9 to 12 μm spectral range.



BENEFITS

■ In-band reflectance & emittance

9-1.1, 1.9-2.4, 3.0-4.0, 3.0-5.0, 4.0-5.0, 8.0-12.0.

■ Measures curved & large objects

Measurements can be taken without special jigs or fixtures.

■ Dual angles of incidence

Near normal 20° and near grazing 60° incident angles.

■ Grazing angle

80° incident angle optional model.

■ Easy to use

Simply press port against sample and pull trigger.

■ Fast data collection

Measurements in 10 seconds or less.

■ Fast calibration

One minute calibration at start of measurement session.

APPLICATIONS

■ Defense | Aerospace

IR Signature | Low observable paint & coatings

■ Radiative Heat Transfer

Emissivity for thermal modeling | Thermal camera calibration

■ Semiconductors

Wafer fab hardware emissivity

■ Stealth Coatings

Bands tailored for low-observable spectral signatures

EXAMPLE MENU SCREENS

Measurement screen. Results are displayed on the liquid crystal display touchscreen, and stored on a SecureDigital (SD) card.

um	R 20°	R 60°
0.9-1.1	.123	.223
1.9-2.6	.120	.320
3.0-4.0	.127	.122
3.0-5.0	.254	.109
4.0-5.0	.131	.121
8.0-12.0	.389	.222

Data file selection screen.

Measurement Files
meas1
meas2

ORDERING

Standard components	0410-0003	410-DHR Emissometer Measurement Head
	0410-0001	Handheld Command Module - 120VAC
	0410-0100	Specular Gold Calibration Coupon (Non-NIST Traceable)
Options	0410-0002	Benchtop Remote Control Unit - 120VAC
	0410-0101	Specular Gold 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)
	0410-1001	SOC 410 DHR Extended Warranty
	0410-0206	SD Card for Extra Data Storage
	0410-0200	Handheld Command Module - 220VAC
0410-0019	Benchtop Remote Control Unit - 220VAC	
80 Degree Grazing Angle Model	0410-0005	SOC-410-DHR Grazing Angle Reflectance Measurement Head
	0410-0105	Grazing Angle Calibration Coupon (Non-NIST Traceable)
	0410-1006	SOC-410-DHR Grazing Angle Extended Warranty

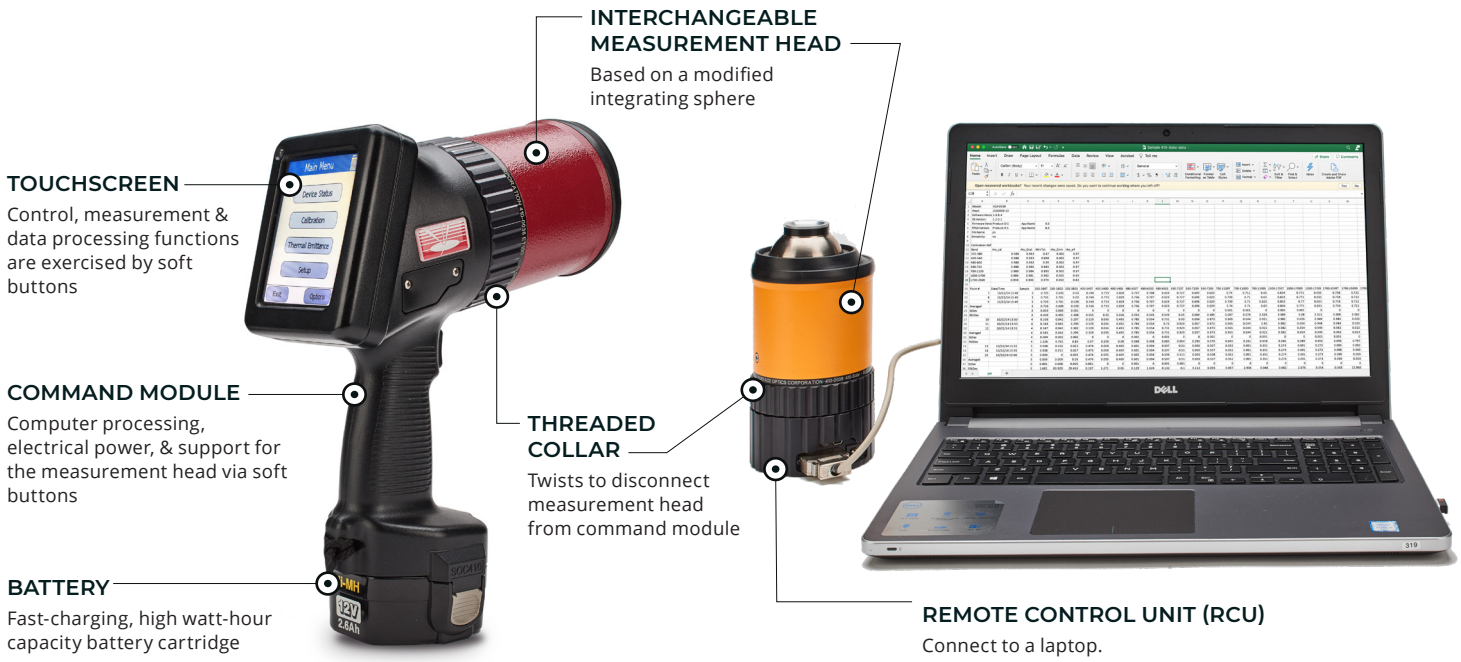
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SPECIFICATIONS ET-100, ET-10, 410-DHR

ET-100 included in 410 Vis-IR Package.

	ET-100	ET-10	410-DHR
MEASURED DATA			
<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>	Directional thermal emissivity at 20°, directional thermal emissivity at 60°, hemispherical thermal emissivity	Directional thermal emissivity at 20°	In-band emissivity
<i>Wavelength Bands (microns)</i>	1.5-2.0, 2.0-3.5, 3.0-4.0, 4.0-5.0, 5.0-10.5, 10.5-21	3.0-5.0, 8.0-12.0	9-1.1, 1.9-2.4, 3.0-4.0, 3.0-5.0, 4.0-5.0, 8.0-12.0
<i>Angle of Incidence</i>	20° & 60° from normal incidence	20° from normal incidence	20° & 60° from normal incidence
<i>ASTM Standards</i>	E903		
<i>Calibration Coupon</i>	Specular Gold		
PERFORMANCE			
<i>Accuracy</i>	+/- .03		
<i>Repeatability</i>	±.005 units		
<i>Beam Spot Size</i>	0.50 inches		
<i>Measurement Time</i>	10 sec	7 sec	10 sec
<i>Sample Size & 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 Temp</i>	0° to 40° C		
POWER			
<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>IR Source</i>	Kanthal filament operated at about 1,000°C		
ENVIRONMENT			
<i>Storage</i>	-25° to 70°C		
<i>Operating</i>	0° to 40° C		
DIMENSIONS			
<i>Weight</i>	4.7 lbs		
<i>Form Factor/Size</i>	H 11.54", L 9.04", W 3.27" (29.31 cm x 22.96 cm x 9.44 cm)		
INTERFACE			
<i>Operator Interface</i>	LCD graphics screen, 1/4 VGA, touch screen, software buttons; trigger switch in handle		
<i>Inspection Applications</i>	Pass/fail can be incorporated, user set values		
<i>Diagnostics</i>	On screen status and signals monitor. Signal values stored with data. Raw data collection and display.		
MISCELLANEOUS			
<i>Date Format</i>	Data files can be opened and post processed with Excel or a text processor		
<i>Data Storage</i>	Removable SanDisk (SD) card		
<i>Export control</i>	ECCN #3A999.F		

410 SERIES REFLECTOMETERS & EMISSOMETERS



HANDHELD CONFIGURATION

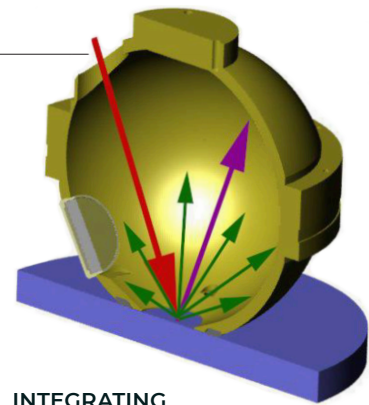
BENCHTOP CONFIGURATION

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° or 60°). 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-VIS-IR	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	Dual measurement head package consisting of a 410-Solar model and ET100 measurement heads with a single command module	1.5 - 2.0 μm 2.0 - 3.5 μm 3.0 - 4.0 μm 4.0 - 5.0 μm 5.0 - 10.5 μm 10.5 - 21.0 μm	3.0-5.0 μm 8.0-12.0 μm	0.9 - 1.1 μm 1.9 - 2.4 μm 3.0 - 4.0 μm 3.0 - 5.0 μm 4.0 - 5.0 μm 8.0 - 12.0 μm
<i>Calculated Properties</i>	Total, diffuse & specular 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° and 60°	20°	20° and 60°
<i>Calibration Coupon(s)</i>	Solar Diffuse Solar Specular	Glazed Ceramic		Specular Gold	Specular Gold	Specular Gold
<i>ASTM Compliance</i>	C1549 E903 E1980	C1549 E903 E1980		E408 E1980		N/A



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