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GUIDE to SYSTEM CONFIGURATION

UDT Instruments offers a wide range of solutions to meet your light-measurement needs. Our extensive selection of photosensors, optometers, and accessories, supported by state-of-the-art calibration facilities, allows our applications engineers to assemble and configure a tremendous variety of photometric and radiometric systems.

To simplify the selection of options available, we have defined a set of standard bundles, which represent a sample of the photometric solutions available from UDTi. Our most popular bundled solutions are listed by application on our website:

Applications

- Display Measurement
- LED Test & Measurement
- Laser Power Measurement
- Fiber-Optic Testing
- General Photometry
- General Radiometry

A still wider variety of systems may be configured by combining system components from the UDTi catalog, according to specific application requirements. Our technical sales team is always available to help you to specify an appropriate solution. For those who prefer to define their own solution, the following guide is intended to help identify the optimum system configuration to meet your needs.

Beyond the range of options achievable using standard components, our engineering staff stands ready, if needed, to design and build a custom system to meet your exact needs.
CONFIGURING YOUR PHOTOMETER or RADIOMETER SYSTEM

Figure 1 - Block Diagram, Optometer System: A Photometer or Radiometer system consists of a calibrated sensor head combined with an optometer. The sensor head in turn consists of a basic sensor combined with an optical adaptor. The optometer is programmed with the sensor head calibration data, so that the system can display light measurement results in the appropriate units.

BACKGROUND: RADIOMETRY & PHOTOMETRY

Radiometry is a broad discipline, involving the measurement of electromagnetic radiation in terms of its physical power. Radiometric quantities include radiant flux, radiant intensity, irradiance, and radiance. Further information about radiometric concepts, and their practical application, can be found in our Radiometry Tutorial.

Photometry involves the measurement of electromagnetic radiation in terms of its luminous power - that is, its capacity to stimulate the human visual system, and to be perceived as light. Photometric quantities include: luminous flux, luminous intensity, illuminance, and luminance. Further information can be found in our Photometry Tutorial.

CONFIGURING AN OPTOMETER SYSTEM:

1) Choose a SENSOR HEAD Configuration
   a. Select a complete, preconfigured SENSOR HEAD, or...
   b. Assemble a sensor head from components:
      i. Choose a BASIC SENSOR - based on spectral requirements
      ii. Choose an OPTICAL ADAPTOR - based on geometric requirements

2) Choose an OPTOMETER - taking into account the following factors:
   a. Total number of sensors to be monitored
   b. Pulse Integration requirements
   c. Portability requirements/Available bench space

3) Specify a CALIBRATION - usually indicated by choice of sensor head

4) Add MECHANICAL FIXTURES (if needed)
An optometer measures the photocurrent produced by a photometric or radiometric sensor, applies a predefined electro-optical calibration factor, and displays the result in optical units. A photometer system is built by coupling an optometer to a photometric sensor; a radiometer system is built by coupling an optometer to a radiometric sensor.

### OPTOMETER SELECTION TABLE

<table>
<thead>
<tr>
<th>Optometer Model #:</th>
<th>S470</th>
<th>S480</th>
<th>S490</th>
<th>S450</th>
<th>S471</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchtop</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handheld</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number of Sensors</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Flux Mode</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Energy Mode (Pulse Integration)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>PC Interface: USB</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>PC Interface: RS-232</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PC Interface: RS-485</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The S450 and S471 can be operated via an optional USB/RS-232 converter

### Photometric Sensors:

- Models s470, s480, s490: flexOptometers
- Model s471: Portable Optometer
- Model s450: Portable Power/Energy Optometer
The UDT Instruments flexOptometer is a high-performance radiometer/photometer designed to operate as either a stand-alone instrument or a computer-controlled, full-function photometric, radiometric or fiber optic measurement tool. Gamma's new model is available with a single head or with up to four interchangeable sensor heads for optimal flexibility. The 4-channel, flexOptometer includes a new touch-screen backlit LCD interface that offers the end user immediate readout results. Highly configurable via the USB, RS-232, RS-485, and IEEE-488.2 computer interfaces, it is easy to integrate into existing lab instrument architectures. The new light-measuring instrument offers faster, more accurate measurements than any previously available optometric system.

The electronic design is based on Gamma Scientific's advanced performance, highly reliable, TIA-3000 measurement systems, which have become the primary working standards of several National Standards Labs. The transimpedance amplifier design gives very stable DC measurements down to the femptowatt (10\(^{-15}\) Watt) level. It also includes a pulse-integrator for pulsed energy measurements. The instrument is designed as a laboratory grade optometer, with the robustness to operate flawlessly on even the most rigorous production lines. The optometer can be configured with UDTi’s extensive collection of optical sensors making it suitable for a wide variety of light measurement applications. Simply put, the flexOptometer is the ideal instrument for measurement applications such as display, LED, laser power, fiber optics, strobe or signal measurements and more.

**FEATURES**

- Available in single and multi-channel models:
  - Model S470  Single-channel
  - Model S480  Dual-channel
  - Model S490  Four-channel

- Touch screen back-lit LCD display
- Configurable from 1 up to 4 measurement Sensor heads
- USB, RS-232-, RS-485, and IEEE-488.2 PC interfaces
- Low-light level measurements down to 10\(^{-15}\) Watts or 10\(^{-8}\) Lux
- Silicon, photomultiplier, germanium and indium-gallium-arsenide (InGaAs) detectors available
- Configurable with World-class photopic detectors (f1’ < 1%)

**APPLICATIONS**

- Display Measurements
- LED Measurements
- Fiber-optic Measurements
- Laser Power Measurements
- Strobe & Signal Measurements
- Lamp Measurements
- Night-Vision Testing
- Customized optics for any application
# Specifications

**Electronic**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight Photometric/Radiometric Ranges</td>
<td></td>
</tr>
<tr>
<td>Range-to-Range Linearity</td>
<td>&lt;0.1% for most ranges (&lt;0.25% for most sensitive range)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>$10^{15}$ to $10^3$ Amps</td>
</tr>
<tr>
<td>Resolution</td>
<td>$1 \times 10^{-15}$ Amps</td>
</tr>
<tr>
<td>Dark Current Suppression</td>
<td>50 nA Max</td>
</tr>
<tr>
<td>Noise</td>
<td>$&lt;5 \times 10^{-15}$ Amps</td>
</tr>
<tr>
<td>Frequency Roll-off</td>
<td>&lt;10 Hz on most sensitive range</td>
</tr>
<tr>
<td>A-to-D converter</td>
<td>24-bit for each decade</td>
</tr>
<tr>
<td>Sensitivity (photometric)</td>
<td>$10^{-15}$ to $10^{-3}$ Amps</td>
</tr>
<tr>
<td>Sensitivity (radiometric)</td>
<td>$10^{-14}$ to $10^{-3}$ coulomb</td>
</tr>
<tr>
<td>Frequency Roll-off</td>
<td>&lt;10 Hz on most sensitive range</td>
</tr>
<tr>
<td>A-to-D converter</td>
<td>24-bit for each decade</td>
</tr>
<tr>
<td>Dark Current Suppression</td>
<td>50 nA Max</td>
</tr>
<tr>
<td>Noise</td>
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<tr>
<td>Frequency Roll-off</td>
<td>&lt;10 Hz on most sensitive range</td>
</tr>
<tr>
<td>A-to-D converter</td>
<td>24-bit for each decade</td>
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<tr>
<td>Sensitivity (photometric)</td>
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<tr>
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<td>$10^{-14}$ to $10^{-3}$ coulomb</td>
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<tr>
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<tr>
<td>A-to-D converter</td>
<td>24-bit for each decade</td>
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<tr>
<td>Dark Current Suppression</td>
<td>50 nA Max</td>
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<tr>
<td>Noise</td>
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<td>Resolution</td>
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<td>&lt;10 Hz on most sensitive range</td>
</tr>
<tr>
<td>A-to-D converter</td>
<td>24-bit for each decade</td>
</tr>
</tbody>
</table>

**Radiometric/Photometric Ranges**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Range</th>
<th>Sensor Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irradiance</td>
<td>$&lt;0.020$ nanoWatts/cm² to $3000$ microWatts/cm²</td>
<td>Model 221</td>
</tr>
<tr>
<td>Irradiant Energy</td>
<td>$&lt;0.04$ nanoJoules/cm² to $1.0$ microJoules/cm² **</td>
<td>Model 221</td>
</tr>
<tr>
<td>Radiant Flux</td>
<td>$&lt;0.020$ nanoWatts to $3000$ microWatts</td>
<td>Model 221</td>
</tr>
<tr>
<td>Luminous Intensity</td>
<td>$&lt;0.0001$ candelas to $10,000$ candelas</td>
<td>Model 424 CIE 127 Condition B Configuration</td>
</tr>
<tr>
<td>Illuminance</td>
<td>$&lt;0.005$ lux to $500,000$ lux</td>
<td>Model 211</td>
</tr>
<tr>
<td>Luminance</td>
<td>$&lt;0.007$ candela/m² to $1,200,000$ candela/m²</td>
<td>Model 2153</td>
</tr>
<tr>
<td>Illuminant Energy</td>
<td>$&lt;0.005$ lux<em>seconds to $10$ lux</em>seconds ***</td>
<td>Model 211</td>
</tr>
</tbody>
</table>

**General**

- Automatic/Manual ranging
- Microprocessor Controlled Functions
- High Voltage circuit for photomultipliers (300-1500 Volts)
- Thermo-electric coolers for Sensor and filter stabilization
- USB, RS-232, RS-485 and IEEE-488.2 Communications
- Analog Output
- Power Input: 12.0 volts DC
- Operating Temperature Range: 0 to 50° C
- Humidity: 0% to 95% RH non-condensing
- Length (flexOptometer): 13.00 inches (33.02 cm)
- Width (flexOptometer): 8.55 inches (21.72 cm)
- Height (flexOptometer): 5.22 inches (13.26 cm)

* Ranges based on system configured with a 1 square centimeter silicon sensor and corresponding accessories
** Model 221 Maximum integrated energy 4.0 microJoules/cm². Lower energy pulses will allow the average energy measurement to very accurate
*** Model 247 Maximum integrated energy 10.5 microJoules/cm². Lower energy pulses will allow the average energy measurement to very accurate
**** Model 211 Maximum integrated energy 450 lux*seconds. Lower energy pulses will allow the average energy measurement to very accurate
## Sensors & Accessories (see Photosensors & Sensor Heads datasheet for more information)

<table>
<thead>
<tr>
<th>UV/Visible</th>
<th>Photometric</th>
</tr>
</thead>
<tbody>
<tr>
<td>221</td>
<td>Silicon Sensor (350-1100nm) 1 cm² active area</td>
</tr>
<tr>
<td></td>
<td>211 Photometric Sensor with Cosine Receptor (Illuminance)</td>
</tr>
<tr>
<td>222</td>
<td>Silicon Sensor (200-400nm) 1 cm² active area</td>
</tr>
<tr>
<td></td>
<td>265 Photometric Display Brightness Sensor (Luminance)</td>
</tr>
<tr>
<td>268UVA</td>
<td>Low Profile UVA Optimized Sensor Head (365 nm)</td>
</tr>
<tr>
<td></td>
<td>268P Low-Profile Photometric Sensor with Cosine Receptor</td>
</tr>
<tr>
<td>268UVC</td>
<td>Low Profile UVC Optimized Sensor Head (254 nm)</td>
</tr>
<tr>
<td></td>
<td>2153 Photometric Sensor with 13 degree FOV Lens (Luminance)</td>
</tr>
<tr>
<td>268BLUE</td>
<td>Low Profile Blue Optimized 450 nm Sensor</td>
</tr>
<tr>
<td></td>
<td>424 LED Photometric Sensor (CIE 127 Luminous Intensity)</td>
</tr>
<tr>
<td>Radiometric</td>
<td>Laser Power</td>
</tr>
<tr>
<td>247</td>
<td>Flat Response Sensor</td>
</tr>
<tr>
<td></td>
<td>264 Miniature Attenuated Laser Sensor Head</td>
</tr>
<tr>
<td>268R</td>
<td>Low Profile Flat Response Sensor</td>
</tr>
<tr>
<td></td>
<td>268LP Low Profile Laser Sensor Head</td>
</tr>
<tr>
<td>424R</td>
<td>LED Radiometric Sensor (CIE 127 Radiant Intensity)</td>
</tr>
<tr>
<td></td>
<td>InfraRed</td>
</tr>
<tr>
<td></td>
<td>261 Miniature Infrared Germanium Sensor (800-1750nm)</td>
</tr>
<tr>
<td></td>
<td>280 Miniature Infrared InGaAs Sensor (800-1750nm)</td>
</tr>
</tbody>
</table>

*Standard Operating Range for Gamma Scientific Instruments- Temperature: Minimum: 0°C (32°F) - Maximum: 35°C (95°F); Relative Humidity (Non-Condensing): Minimum: 20% - Maximum 70%

**The information contained in this data sheet is based on Gamma Scientific's internal evaluation and is subject to change at any time without notice

***Revised on October 13, 2015
The UDT Instruments Model S471 is a high-performance handheld optometer, designed for use in both laboratory and field environments. Compatible with the full range of UDTi sensor heads, the Model S471 is easily configured as a high-performance radiometer or photometer with a dynamic range of over nine decades. The Model S471 features high sensitivity, sophisticated microprocessor control and three data-presentation options: Direct display with analog bar, RS-232 computer interface, and programmable analog voltage output.

The Model S471's sensitivity enables electrical measurements in the 10-pA range with less than 5% uncertainty. This makes the instrument ideally suited for challenging low-light measurement applications. The Model S471 also provides wide dynamic range and high sampling rates. The S471 can store nine spectral calibrations or fifty single-point calibrations. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

Operating conveniences include a large, backlit LCD for easy readout; intuitive operation via a simple touch keypad; a "calibration information center" that stores a wealth of calibration information for instant recall; long battery life (or direct external power); and an optional USB-to-serial bridge converter. The unit is enclosed in a ruggedized housing built to withstand the rigors of day-to-day field use.

**CONFIGURATION OPTIONS**

The S471 can be configured with a wide range of different sensors and calibrations in order to perform measurements of quantities including:

- Luminous Flux (lumen) or Radiant Flux (Watt)
- Illuminance (lux, foot-candle) or Irradiance (W/m²)
- Luminous Intensity (candela) or Radiant Intensity (W/sr)
- Luminance (cd/m², footLambert) or Radiance (W/m²sr)

**FEATURES**

- High-accuracy
- Wide dynamic range
- High sampling rates
- Programmable low-pass or boxcar averaging
- Electronic Temperature-drift compensation
- Large calibration capacity
- Calibration data/accessories information center
- Simple touch keypad controls
- Icon driven menus
- Large backlit LCD graphical display
- Portable and durable
- Compact and Light-weight
- Rechargeable NiMH battery or AC powered
- RS-232 or optional USB computer interface

The UDT Model S471 is compatible with the full range of UDTi sensor heads. The unit is shown here configured as a simple spot luminance meter.
Model S471 Portable Optometer

PRODUCT SUMMARY

Analogue to Digital Accuracy

<table>
<thead>
<tr>
<th></th>
<th>Full Scale</th>
<th>A to D Converter Resolution</th>
<th>% of Full Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.12 mA</td>
<td>8 nA</td>
<td>±.02%</td>
</tr>
<tr>
<td>B</td>
<td>412 μA</td>
<td>800 pA</td>
<td>±.02%</td>
</tr>
<tr>
<td>C</td>
<td>41.2 μA</td>
<td>80 pA</td>
<td>±.02%</td>
</tr>
<tr>
<td>D</td>
<td>4.13 μA</td>
<td>8 pA</td>
<td>±.02%</td>
</tr>
<tr>
<td>E</td>
<td>416 nA</td>
<td>800 fA</td>
<td>±.04%</td>
</tr>
<tr>
<td>F</td>
<td>45.4 nA</td>
<td>87 fA</td>
<td>±.04%</td>
</tr>
<tr>
<td>G</td>
<td>4.12 nA</td>
<td>8 fA</td>
<td>±.04%</td>
</tr>
</tbody>
</table>

Electrical Accuracy
± 1.2 % ± 2 counts

Dynamic Range
9½ Decades Linear (Power)
9½ Decades (Log)
9½ Decades (Energy)

Data Presentation
Handheld Display
RS-232 Computer Interface
Analog Output

Analogue Output
± 4.0 Volts, selectable slope

Computer Interface
RS-232 or USB via optional serial to USB converter

Bandwidth
7.5 Hz

Sampling Rate
18.9 msec

Averaging Modes
Low pass or Boxcar average, programmable

Update Rates
RS-232 (Display enabled): 2 times / second
RS-232 (Display disabled): Up to 53 times / second

Communication Rate
9600 Baud

Calibration Capacity
9 spectral calibrations or 50 single point calibrations

Calibration Traceability
All calibrations traceable to the National Institute of Standards and Technology (NIST)

Sensor Configuration
Compatible with all UDT Instruments Sensors

Display
Monochrome Graphic 128x64 dot chip-on-glass LCD

Display Modes
Linear
Log
Analog (Bar graph)

Displayed Precision
Up to 4.5 Digits

Display Update Rate
2 Times / sec

Power Source (DC)
Rechargeable Integral Battery Pack
Five NiMH AA, 1800 mA hr batteries

Recharge Time
< 4 Hours

Operational Battery Life
Backlight Off: 32 Hours
Backlight On: 24 Hours

Power Source (AC)
100-240V 0.7A 50-60 Hz
Output: 12V DC, 2.5 A (Center Conductor Positive)
TUV, CSA, UL, CE Approved

Operating Temperature Range
10 deg C to 60 deg C

Storage Temperature Range
-20 deg C to 35 deg C for <1 year

Display Unit Dimensions
Height 36 mm (1.4")
Width 114 mm (4.5")
Length 234 mm (9.25")
Weight 590 g (1.3 lb)

Power Supply Dimensions
Height 41 mm (1.63")
Width 59 mm (2.3")
Length 112 mm (4.4")
Weight 267 g (0.59 lb)
Cable length 1.04 m (41.0")

UDT INSTRUMENTS
9926 Carroll Canyon Rd.
San Diego, CA 92131
858-279-8034
www.gamma-scl.com/udtinstruments
The UDT Instruments Model S450 is a high-performance handheld Power / Energy Optometer designed for both laboratory and field environments. The Model S450 features ultra-high sensitivity, sophisticated microprocessor control and three data-presentation options: Direct display with analog bar, RS-232 computer interface, and programmable analog voltage output. Compatible with the full range of UDT Instruments sensor heads, the Model S450 is easily configured as a high-performance radiometer, photometer or energy meter with a dynamic range of over nine decades.

The Model S450’s sensitivity enables electrical measurements in the 10-pA range with less than 5% uncertainty. This makes the instrument ideally suited for challenging low-light measurement applications. The Model S450 also provides wide dynamic range, high sampling rates, and programmable averaging in low-pass or boxcar modes. The S450 can store nine spectral calibrations or fifty single-point calibrations. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

Operating conveniences include a large, backlit LCD for easy readout; intuitive operation via a simple touch keypad; a "calibration information center" that stores a wealth of calibration information for instant recall; long battery life (or direct external power); and an optional USB-to-serial bridge converter. The unit is enclosed in a ruggedized housing built to withstand the rigors of day-to-day field use.

**FEATURES**
- Measures in Power or Energy mode
- High-accuracy
- Wide dynamic range
- Electronic Temperature-drift compensation
- High sampling rates
- Programmable low pass or boxcar averaging
- Large calibration capacity
- Calibration data/accessories information center
- RS-232 or optional USB computer interface
- Simple touch keypad controls
- Icon driven menus
- Large backlit LCD graphical display
- Rechargeable NiMH battery or AC powered
- Portable and durable
- Compact and Light-weight

**CONFIGURATION OPTIONS**

The S450 can be configured with a wide range of different sensors and calibrations in order to perform measurements of quantities including:

- Luminous Flux (lumen) or Radiant Flux (Watt)
- Illuminance (lux, foot-candle) or Irradiance (W/m²)
- Luminous Intensity (candela) or Radiant Intensity (W/sr)
- Luminance (cd/m², footLambert) or Radiance (W/m²sr)
- Pulse Energy (Joule)
Model S450  Power / Energy Optometer

**SPECIFICATIONS**

**Analog to Digital Accuracy**

<table>
<thead>
<tr>
<th></th>
<th>Full Scale</th>
<th>A to D Converter Resolution</th>
<th>% of Full Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.12 mA</td>
<td>8 nA</td>
<td>±.02%</td>
</tr>
<tr>
<td>B</td>
<td>412 μA</td>
<td>800 pA</td>
<td>±.02%</td>
</tr>
<tr>
<td>C</td>
<td>41.2 μA</td>
<td>80 pA</td>
<td>±.02%</td>
</tr>
<tr>
<td>D</td>
<td>4.13 μA</td>
<td>8 pA</td>
<td>±.02%</td>
</tr>
<tr>
<td>E</td>
<td>416 nA</td>
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</tr>
<tr>
<td>F</td>
<td>45.4 nA</td>
<td>87 fA</td>
<td>±.04%</td>
</tr>
<tr>
<td>G</td>
<td>4.12 nA</td>
<td>8 fA</td>
<td>±.04%</td>
</tr>
</tbody>
</table>

**Electrical Accuracy**

± 1.2 % ± 2 counts

**Dynamic Range**

$9^{1/2}$ Decades Linear (Power)
$9^{1/2}$ Decades (Log)
$9^{1/2}$ Decades (Energy)

**Data Presentation**

Handheld Display
RS-232 Computer Interface
Analog Output

**Analog Output**

± 4.0 Volts, selectable slope

**Computer Interface**

RS-232 or USB via optional serial to USB converter

**Bandwidth**

7.5 Hz

**Sampling Rate**

18.9 msec

**Averaging Modes**

Low pass or Boxcar average, programmable

**Update Rates**

RS-232 (Display enabled): 2 times / second
RS-232 (Display disabled): Up to 53 times per second

**Communication Rate**

9600 Baud

**Calibration Capacity**

9 spectral calibrations or 50 single point calibrations

**Calibration Traceability**

All calibrations traceable to the National Institute of Standards and Technology (NIST)

**Sensor Configuration**

Compatible with all UDT Instruments Sensors

**Display**

Monochrome Graphic 128x64 dot chip-on-glass LCD

**Display Modes**

Linear
Log
Energy
Analog (Bar graph)

**Displayed Precision**

Up to 4.5 Digits

**Display Update Rate**

2 Times / sec

**Power Source (DC)**

Rechargeable Integral Battery Pack
Five NiMH AA, 1800 mA hr batteries

**Recharge Time**

< 4 Hours

**Operational Battery Life**

Backlight Off: 32 Hours
Backlight On: 24 Hours

**Power Source (AC)**

100-240V 0.7A 50-60 Hz
Output: 12V DC, 2.5 A  (Center Conductor Positive)
TUV, CSA, UL, CE Approved

**Operating Temperature Range**

10 deg C to 60 deg C

**Storage Temperature Range**

-20 deg C to 35 deg C for <1 year

**Display Unit Dimensions**

Height 36 mm  (1.4”)
Width 114 mm (4.5”)
Length 234 mm (9.25”)
Weight 590 g  (1.3 lb)

**Power Supply Dimensions**

Height 41 mm (1.63”)
Width 59 mm (2.3”)
Length 112 mm (4.4”)
Weight 267 g (0.59 lb)
Cable length 1.04 m (41.0”)

9925 Carroll Canyon Rd.
San Diego, CA 92131
858-279-8034
www.gamma-scl.com/udtinstruments
Photosensors & Sensor Heads

OVERVIEW

SENSORS for PHOTOMETRY & RADIOMETRY

UDT Instruments offers a wide range of photosensors for both photometric and radiometric applications. Basic sensors, used alone, are suitable for illuminance or irradiance measurements. Each type of sensor can be combined with various types of optical adaptors to form sensor head assemblies suitable for measurements of flux, intensity, luminance, or radiance.

UDT photosensors and sensor heads are offered in three different mechanical configurations: Sensors from the Standard Series adapt for use with most accessories. The Miniature Series includes a similar range of sensors with a smaller-diameter package, compatible with UDT’s line of integrating sphere accessories. The Low-Profile Series is designed for applications with limited mechanical clearance.

<table>
<thead>
<tr>
<th>BASIC SENSORS</th>
<th>Photometric (Illuminance)</th>
<th>Simple Radiometric (Irradiance)</th>
<th>Radiometric, Modified (Irradiance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model#</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Standard Series</td>
<td>#211</td>
<td>#221 - Si</td>
<td>#247 - Flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#222 - Si (UV)</td>
<td>#228 - 633nm</td>
</tr>
<tr>
<td>Miniature Series</td>
<td>#263</td>
<td>#260 - Si</td>
<td>#262 - Flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#261 - Ge</td>
<td>#264 - Attenuated</td>
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<tr>
<td>Low-Profile Series</td>
<td>#268P</td>
<td>#268S - Si</td>
<td>#268R - Flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#268LP - Laser</td>
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<tr>
<td></td>
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<td>#268C - 254 nm</td>
</tr>
<tr>
<td></td>
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<td>#268A - 365 nm</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>#268BLUE - 450 nm</td>
</tr>
</tbody>
</table>

Photometric Sensors:
- Model 211: Illuminance Sensor Head
- Model 263: Illuminance Sensor Head - Miniature
- Model 268P: Illuminance Sensor Head - Low-profile

Radiometric Sensors:
- Model 221: Silicon Sensor Head
- Model 222: UV Sensor Head
- Model 247: Flat Response Sensor Head
- Model 260: Silicon Sensor Head - Miniature
- Model 261: Germanium Sensor Head
- Model 262: Flat Response Sensor Head - Miniature
- Model 264: Laser Sensor Head
- Model 280: InGaAs Sensor Head
- Model 268LP: Laser Sensor Head - Low Profile
- Model 268R: Flat Response Sensor Head - Low-Profile
- Model 268UVA: UVA Optimized Sensor Head
- Model 268UVC: UVC Optimized Sensor Head
- Model 268BLUE: UV/Blue Optimized Sensor Head
SENORS for PHOTOMETRY & RADIOMETRY (continued)

### SENSOR HEAD ASSEMBLIES

<table>
<thead>
<tr>
<th>Model#</th>
<th>Flux (Power)</th>
<th>LED Intensity</th>
<th>Luminance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Series</td>
<td>#224 #424 #424R</td>
<td></td>
<td>#2153</td>
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<tr>
<td>Miniature Series</td>
<td>#s2575 #s2575GE #s2575R</td>
<td></td>
<td>#265 #265M</td>
</tr>
</tbody>
</table>

### Photometric Sensor Heads:
- Model 424: LED Measurement Head
- Model 224: LED Measurement Head
- Model 2153: Brightness Sensor
- Model 265: Display Brightness Sensor
- Model 265M: Display Brightness Sensor - Mini

### Radiometric Sensor Heads:
- Model 424R: LED Measurement Head - Radiometric
- Model S2575: Silicon Sensor/Minisphere
- Model S2575GE: Germanium Sensor/Minisphere
- Model S2575R: Flat Response Sensor/Minisphere
**Model 211: Illuminance Sensor Head**

The model 211 is UDTi’s universal photometric head as it can be adapted for use with most accessories. It consists of a Standard Series silicon sensor a spectrally-matched photometric filter and a cosine diffuser to reduce directional sensitivity.

- **Standard Calibration(s)**: lux; fc
- **Photometric Filter Accuracy**: $< 1.0\%$
- **CIE V(λ) function**: $< f_1' \leq 3\%$
- **Sensor Active area (cm$^2$)**: 1
- **Dynamic Range**: $1.0E-02 - 5.0E+05$ lux
- **Typical response**: $3.2E-09$ A/lux @555 nm
- **Features**: High accuracy photometric filter ($f_1' < 3\%$)
- **Compatible Components**: 2525; 2500; 1153; 1120; 116; 124; 114; 105; 106; 107

**Model 263: Illuminance Sensor Head - Miniature**

The Model 263 is a scaled-down version of the Model 211 designed for use in confined spaces. It consists of a silicon sensor with a spectrally-matched photometric filter and a cosine diffuser to reduce directional sensitivity.

- **Standard Calibration(s)**: lux; fc
- **Photometric Filter Accuracy**: $< 1.0\%$
- **CIE V(λ) function**: $< f_1' \leq 3\%$
- **Sensor Active area (cm$^2$)**: 0.34
- **Dynamic Range**: $5.0E-01 - 5.0E+05$ lux
- **Typical response**: $7.3E-10$ A/lux @555 nm
- **Features**: High accuracy photometric filter ($f_1' < 3\%$)
- **Compatible Components**: 2575; With adaptor #1718: 2525; 2500

**Model 268P: Illuminance Sensor Head - Low-Profile**

The Model 268P is a low-profile illuminance sensor designed for applications with limited mechanical clearance. Like the Model 211 it consists of a silicon sensor with a spectrally-matched photometric filter and a cosine diffuser to reduce directional sensitivity.

- **Standard Calibration(s)**: lux; fc
- **Photometric Filter Accuracy**: $< 1.0\%$
- **CIE V(λ) function**: $< f_1' \leq 3\%$
- **Sensor Active area (cm$^2$)**: 1
- **Dynamic Range**: $1.0E-03 - 2.0E+04$ lux
- **Features**: High accuracy photometric filter ($f_1' < 3\%$)
Luminance Sensor Heads

**MODEL 2153: BRIGHTNESS SENSOR**

The model 2153 is the UDTi standard luminance head with an integral lens that provides a fixed field-of-view of 13 degrees. It is suitable for measurement of the brightness (luminance) of diffuse surfaces or uniform light sources.

- **Standard Calibration(s)**: nit (cd/m²); footlamberts
- **Photometric Filter Accuracy**: < 1.0%
- **CIE V(λ) function**: < f₁' ≤ 3%
- **Sensor Active area (cm²)**: 1
- **Dynamic Range**: 1.2E-02 - 1.0E+06 nit
- **Features**: High accuracy photometric filter (f₁' < 3%)

**MODEL 265: DISPLAY BRIGHTNESS SENSOR**

This luminance head was specifically designed for measuring display brightness. Its integral lens provides a fixed field-of-view of 13 degrees and a soft rubber light shade eliminates errors due to ambient light and keeps the display from being scratched during measurement.

- **Standard Calibration(s)**: nit (cd/m²); footlamberts
- **Photometric Filter Accuracy**: < 1.0%
- **CIE V(λ) function**: < f₁' ≤ 3%
- **Sensor Active area (cm²)**: 0.34
- **Dynamic Range**: 1.0E-03 - 1.0E+05 cd/m²
- **Typical response**: 1.1E-09 A/cd/m² @0 nm
- **Features**: High accuracy photometric filter (f₁' < 3%)

**MODEL 265M: DISPLAY BRIGHTNESS SENSOR - MINIATURE**

This luminance head was specifically designed for measuring display brightness. Its integral lens provides a fixed field-of-view of 13 degrees and a miniature fixed rubber light shade eliminates errors due to ambient light and keeps the display from being scratched during measurement.

- **Standard Calibration(s)**: nit (cd/m²); footlamberts
- **Sensor Active area (cm²)**: 0.34
- **Typical response**: 1.1E-09 A/cd/m² @0 nm
- **Features**: High accuracy photometric filter (f₁' < 3%)
**MODEL 424: LED MEASUREMENT HEAD**

This sensor head couples a high-performance photopic sensor (based on the Model 211) with a special fixture to measure the averaged luminous intensity of LEDs according to the recommendations of CIE Publication 127 (illustrated above; LED Sockets sold separately). The intensity fixture precisely sets the distance and alignment between the LED and the sensor, so that measurement accuracy and repeatability are ensured. The system can easily be configured for either of the CIE-prescribed geometries: Condition A or Condition B. Measurement results are expressed in units of candela (cd). The sensor is calibrated over the visible spectral range, so that the nominal peak wavelength of the device under test can be selected during measurement, ensuring maximum possible measurement accuracy.

**Standard Calibration(s)**
- Luminous Intensity (cd) for both CIE127 Conditions: A and B

**Dynamic Range**
- 1.0E-04 - 5.0E+04 cd

**MODEL 224: LED MEASUREMENT HEAD**

This sensor head makes use of a special fixture to measure lensed LEDs. This attachment fixes the distance and angle between the LED and the detector so that measurement accuracy and repeatability are ensured. **NOTE:** For most applications, this sensor head has been replaced by the Model 424 CIE 127 Intensity head. The Model 224 is presently offered to support legacy applications.

**Standard Calibration(s)**
- candela (cd) @ specified wavelength

**Photometric Filter Accuracy**
- < 1.0%

**CIE V(λ) function**
- ≤ 3%

**Dynamic Range**
- 1.0E-05 - 1.0E+03 cd
This sensor head couples a filtered silicon sensor with a flat spectral response (based on the Model 247) with a special fixture to measure the averaged radiant intensity of LEDs according to the recommendations of CIE Publication 127 (illustrated above; LED Sockets sold separately). The intensity fixture precisely sets the distance and alignment between the LED and the sensor, so that measurement accuracy and repeatability are ensured. The system can easily be configured for either of the CIE-prescribed geometries: Condition A or Condition B. Measurement results are expressed in units of watts per steradian (W/sr). The sensor’s response is approximately constant (within ±5%) from 450 nm to 950 nm, to allow quick measurements of devices with unknown peak wavelengths, etc. The sensor is calibrated over the a wider spectral range (350 - 1100 nm), so that the peak wavelength of the device under test (where known) can be selected during measurement, ensuring maximum possible measurement accuracy.

**Standard Calibration(s)**  
Radiant Intensity (W/sr) for both CIE127 Conditions: A and B  
**Calibration range**  
350 - 1100 nm in 10 nm steps  
**Spectral Flatness**  
5% - 7% over the 450 - 950 nm range
MODEL 221: SILICON SENSOR HEAD

The Model 221 is UDTi's basic silicon sensor. It can be adapted for use with Standard Series accessories.

- **Standard Calibration(s)**: Watt
- **Sensor Active area (cm²)**: 1
- **Dynamic Range**: 5.0E-11 - 2.4E-03 W
- **Calibration range**: 350 - 1100 nm in 10 nm steps
- **Typical response**: 5.1E-01 A/W @980 nm
- **Features**: High linearity; low noise
- **Peak Wavelength (nm)**: *
- **Compatible Components**: All Standard Series accessories. (Filters; diffusers; integrating spheres; spacers; etc.)

MODEL 222: UV SENSOR HEAD

The Model 222 is a Standard Series silicon sensor calibrated in the UV region (200 - 400 nm)

- **Standard Calibration(s)**: Watt
- **Sensor Active area (cm²)**: 1
- **Calibration range**: 200 - 400 nm in 10 nm steps
- **Typical response**: 1.5E-01 A/W @400 nm
- **Features**: High linearity; low noise
- **Peak Wavelength (nm)**: *

MODEL 247: FLAT RESPONSE SENSOR HEAD

The Model 247 is UDTi’s Standard Series flat response radiometric sensor. It can be adapted for use with Standard Series accessories.

- **Standard Calibration(s)**: Watt
- **Sensor Active area (cm²)**: 1
- **Dynamic Range**: 1.3E-10 - 6.4E-03 W
- **Calibration range**: 350 - 1100 nm in 10 nm steps
- **Typical response**: 1.9E-01 A/W @630 nm
- **Features**: Precision Radiometric Filter, Spectral Flatness 5%-7% over the spectral range: 450 - 950 nm
- **Compatible Components**: Standard Series accessories. (Diffusers; integrating spheres; spacers; etc.)
**Model 260: Silicon Sensor Head - Miniature**

The Model 260 is UDTi's Miniature Series silicon sensor. It can be adapted for use with Miniature Series integrating spheres and other accessories.

- **Standard Calibration(s)**: Watt
- **Sensor Active area (cm²)**: 0.34
- **Dynamic Range**: 5.0E-11 - 1.5E-03 W
- **Calibration range**: 350 - 1100 nm in 10 nm steps
- **Typical response**: 5.1E-01 A/W @980 nm
- **Features**: High linearity; low noise. Small package design.
- **Peak Wavelength (nm)**
- **Compatible Components**: All Miniature Series accessories. (Filters; diffusers; integrating spheres; spacers; etc.)

**Model 261: Germanium Sensor Head**

The Model 260 is UDTi's Germanium (Ge) sensor. It can be adapted for use with Miniature Series integrating spheres and other accessories.

- **Standard Calibration(s)**: Watt
- **Sensor Active area (cm²)**: 0.5
- **Dynamic Range**: 5.0E-10 - 6.0E-03 W
- **Calibration range**: 800 - 1750 nm in 10 nm steps
- **Typical response**: 7.6E-01 A/W @1300 nm
- **Features**: Responsive over a range of telecommunication wavelengths.
- **Peak Wavelength (nm)**
- **Compatible Components**: Miniature Series integrating spheres; and Standard series integrating spheres (with Model 1718 step-up adaptor)

**Model 262: Flat Response Sensor Head - Miniature**

The Model 247 is UDTi's Miniature Series flat response radiometric sensor. It can be adapted for use with Miniature Series accessories.

- **Standard Calibration(s)**: Watt
- **Sensor Active area (cm²)**: 0.34
- **Dynamic Range**: 1.3E-10 - 4.0E-03 W
- **Calibration range**: 350 - 1100 nm in 10 nm steps
- **Typical response**: 1.9E-01 A/W @630 nm
- **Features**: Precision Radiometric Filter Spectral Flatness 5%-7% over the spectral range: 450 - 950 nm
- **Compatible Components**: Miniature Series accessories. (Diffusers; integrating spheres; spacers; etc.)
MODEL 264: LASER SENSOR HEAD

The Model 264 is a Miniature Series sensor specifically designed for laser power measurement. It consists of a Model 260 type sensor with a built-in diffuser and reduced aperture for attenuation of optical power.

Standard Calibration(s)  
Watt - at single user-specified wavelength (350 - 1100 nm)

Aperture diameter (mm)  
7

Dynamic Range  
3.5E-08 - 4.0E-02 W

Typical response  
2.4E-03 A/W @630 nm

Features  
Laser Attenuator (diffuser)

MODEL 280: INGaAS SENSOR HEAD

The Model 280 is UDTi's Indium-Gallium-Arsenide (InGaAs) sensor. It can be adapted for use with Miniature Series integrating spheres and other accessories.

Standard Calibration(s)  
Watt

Aperture diameter (mm)  
3

Dynamic Range  
1.4E-04 - 2.2E-03 W

Calibration range  
800 - 1750 nm in 10 nm steps

Typical response  
9.5E-01 A/W @1550 nm

Features  
Dynamic range: -8.5 to +3.5 dBm. Very low noise. Optimal sensor for measurement at 1550 nm.

Compatible Components  
Miniature Series integrating spheres; and Standard series integrating spheres (with Model 1718 step-up adaptor)
**MODEL 268LP: LASER SENSOR HEAD - LOW PROFILE**

The Model 268LP is a Low-Profile Series flat response radiometric sensor designed for Laser power measurement.

**Standard Calibration(s)**
- Power (W) at user-specified wavelength

**Aperture diameter (mm)**
- 18

**Dynamic Range**
- 7.0E-10 - 6.0E-02 W

**Calibration range**
- 350 - 1100 nm in * nm steps

**Typical response**
- 3.0E-02 A/W @633 nm

**Features**
- Radiometric Filter; Diffuser; 4.5 inch “lollipop”-style handle.

**MODEL 268R: FLAT RESPONSE SENSOR HEAD - LOW PROFILE**

The Model 268R is a Low-Profile Series flat response radiometric sensor.

**Standard Calibration(s)**
- Power (W) at user-specified wavelength

**Sensor Active area (cm²)**
- 1

**Dynamic Range**
- 1.3E-10 - 6.0E-03 W

**Calibration range**
- 350 - 1100 nm in * nm steps

**Typical response**
- 2.0E-01 A/W @633 nm

**Features**
- Radiometric Filter; 4.5 inch “lollipop”-style handle.

**Spectral Flatness**
- 5%-7% over the 450 - 950 nm range
MODEL 268UVA: UVA OPTIMIZED SENSOR HEAD

The Model 268UVA is a Low-Profile Series radiometric sensor optimized for measurements in the UVA region (320 - 400 nm).

**Standard Calibration(s)**
- Irradiance (W/cm²) at 365 nm

**Sensor Active area (cm²)**
- 1

**Aperture diameter (mm)**
- 18

**Dynamic Range**
- 5.0E-10 - 1.0E-01 W/cm²

**Typical response**
- 2.0E-02 A/W/cm² @365 nm

**Features**
- 365 nm Bandpass Filter; internal opal glass diffuser

MODEL 268UVC: UVC OPTIMIZED SENSOR HEAD

The Model 268UVC is a Low-Profile Series radiometric sensor optimized for measurements in the UVC region (200 - 280 nm).

**Standard Calibration(s)**
- Irradiance (W/cm²) at 254 nm

**Sensor Active area (cm²)**
- 1

**Aperture diameter (mm)**
- 11

**Dynamic Range**
- 5.0E-08 - 5.0E-01 W/cm²

**Typical response**
- 2.4E-03 A/W/cm² @254 nm

**Features**
- 254 nm Bandpass Filter; internal Teflon diffuser

MODEL 268BLUE: UV/BLUE OPTIMIZED SENSOR HEAD

The Model 268BLUE is a Low-Profile Series radiometric sensor optimized for measurements in the blue region centered at 450nm.

**Standard Calibration(s)**
- Irradiance (W/cm²) at 450 nm

**Sensor Active area (cm²)**
- 1

**Dynamic Range**
- 5.0E-10 - 5.0E-02 W/cm²

**Typical response**
- 3.1E-02 A/W/cm² @450 nm

**Features**
- 450 nm Bandpass Filter; Cosine Diffuser
**MODEL S2575: SILICON SENSOR/MINISPHERE**

The Model S2575 consists of a Model 260 Silicon sensor coupled to a Model 2575 Integrating sphere.

- **Standard Calibration(s)**: Power (W) at user-specified wavelength
- **Dynamic Range**: 3.0E-08 - 9.5E-01 W
- **Calibration range**: 450 - 1100 nm in * nm steps
- **Typical response**: 1.7E-03 A/W @940 nm
- **Features**:
  - Mini Integrating Sphere
  - Sphere diameter (mm): 50
  - Entrance Aperture diameter (mm): 5

---

**MODEL S2575GE: GERMANIUM SENSOR/MINISPHERE**

The Model S2575GE consists of a Model 261 Germanium sensor coupled to a Model 2575 Integrating sphere.

- **Standard Calibration(s)**: Power (W) at 1300 nm and 1550 nm
- **Dynamic Range**: 3.0E-09 - 1.6E+00 W
- **Calibration range**: 800 - 1750 nm in * nm steps
- **Typical response**: 1.9E-03 A/W @1300 nm
- **Features**:
  - Mini Integrating Sphere
  - Sphere diameter (mm): 50
  - Entrance Aperture diameter (mm): 5

---

**MODEL S2575R: FLAT RESPONSE SENSOR/MINISPHERE**

The Model S2575R consists of a Model 262 Flat-response sensor coupled to a Model 2575 Integrating sphere.

- **Standard Calibration(s)**: Power (W) at user-specified wavelength
- **Dynamic Range**: 6.0E-08 - 1.8E+00 W
- **Calibration range**: 350 - 1100 nm in * nm steps
- **Typical response**: 9.0E-04 A/W @740 nm
- **Features**:
  - Radiometric Filter; Mini Integrating Sphere
  - Sphere diameter (mm): 50
  - Entrance Aperture diameter (mm): 5
OPTICAL ACCESSORIES for PHOTORECORDER SYSTEMS

Photosensors can be equipped with various types of optical adaptors to form sensor head assemblies suitable for diverse types of measurements. In addition to a range of preconfigured sensor heads, UDTi offers the following optical components to enable configuration of custom sensor heads for the measurement of flux, illuminance, irradiance, intensity, luminance, or radiance.

### Flux Adaptors (Integrating Spheres):
- **Model 2500**: Integrating Sphere - Standard Series
- **Model 2525**: Integrating Sphere
- **Model 2575**: Miniature Integrating Sphere
- **Model 2575-10**: Mini Sphere-10mm Port

### Irradiance Adaptor (Diffuser):
- **MODEL 2550**: Attenuator - Standard Series

### Luminance/Radiance Adaptors:
- **Model 114**: Steradian Shade
- **Model 116**: Luminance Probe
- **Model 124**: Luminance Probe
- **Model 1120**: Reflex Viewing Module
- **Model 1153**: Lumilens

### Optical Adaptors

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<thead>
<tr>
<th>Model#</th>
<th>Flux (Power)</th>
<th>Illuminance/Irradiance</th>
<th>Intensity</th>
<th>Luminance/Radiance</th>
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<td>Miniature Series</td>
<td>2575 2575-10</td>
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</table>

**Flux Adaptors (Integrating Spheres):**
- Model 2500: Integrating Sphere - Standard Series
- Model 2525: Integrating Sphere
- Model 2575: Miniature Integrating Sphere
- Model 2575-10: Mini Sphere-10mm Port

**Luminance/Radiance Adaptors:**
- Model 114: Steradian Shade
- Model 116: Luminance Probe
- Model 124: Luminance Probe
- Model 1120: Reflex Viewing Module
- Model 1153: Lumilens

**Irradiance Adaptor (Diffuser):**
- Model 2550: Attenuator - Standard Series
OPTICAL FILTERS & FILTER HOLDERS

<table>
<thead>
<tr>
<th>Model#</th>
<th>ND Filters</th>
<th>Bandpass Filters</th>
<th>Aperture Set</th>
<th>Filter Holders</th>
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<tbody>
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<td>Standard Series</td>
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<td></td>
<td></td>
<td></td>
<td>104-Mini</td>
</tr>
</tbody>
</table>

Optical Filters:
- Model 105: ND Filter - ND1
- Model 106: ND Filter -ND2
- Model 107: ND Filter -ND3
- Model 1112: Bandpass Filter - 632.8 nm
- Model 1113: Bandpass Filter - 905 nm
- Model 1114: Bandpass Filter - 1064 nm
- Model 1115: Bandpass Filter - 514.8 nm

Filter Holders:
- Model 102: Filter Holder
- Model 104: Filter Holder/Coupler
- Model 104-MINI: Filter Holder/Coupler - Miniature

Aperture Assembly:
- Model 110: Sensor Holder and Aperture Set
MODELS 105, 106, 107: ND FILTERS - ND1, ND2, ND3

These metallic neutral density filters are used for attenuating incident radiation. The degree of attenuation is approximately constant over a wide range of wavelengths (spectrally neutral). Assembly includes a Model 102 Filter Holder.

**Attenuation**
- 10:1 (ND1)
- 100:1 (ND2)
- 1000:1 (ND3)

**Features**
- Metallic-type ND filter (Absorption-type filters are available by special order.)
- Spectral Flatness: ±1% over the spectral range: 350 - 800 nm

**Compatible Components** 211; 221; 222; 247

MODELS 1112, 1113, 1114, 1115: NARROW BANDPASS FILTERS

UDT Instruments' bandpass filters provide a 10 nm half-power bandpass (FWHM) at peak wavelengths corresponding to common laser lines. Assembly includes a Model 104 Filter Holder. Other types of bandpass filters are available as special order items.

**Features**
- Alternative peak and bandpass (FWHM) available upon request

**Peak Wavelengths (nm)**
- Model 1112: 632.8
- Model 1113: 905
- Model 1114: 1064
- Model 1115: 514.8

**Compatible Components** 221; 222; 247
**Model 1153: Lumilens**

The Model 1153 converts a Model 211 illuminance sensor to a Model 2153 Brightness Sensor. It is intended for users who wish to make both illuminance and luminance measurements with a single sensor.

*Standard Calibration(s)*  nit (cd/m²); footlamberts

*Compatible Components*  211; 221; 247

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**Model 114: Steradian Shade**

When used with a compatible sensor the Model 114 forms a 0.155 steradian field-of-view.

*Standard Calibration(s)*  cd/m² (nit); footlamberts; W/cm²sr

*Compatible Components*  211; 221; 247

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**Model 116: Luminance Probe**

For luminance measurements in difficult to reach places such as in photocopiers or photolithography systems UDT Instruments offers two luminance probes. Both are fiberoptic bundles. The model 116 is two feet long 0.25” fiber core which couple to the Model 211 sensor head.

*Standard Calibration(s)*  nit (cd/m²); footlamberts

*Aperture diameter (mm)*  6.35

*Dynamic Range*  1.0E-02 - 1.0E+05 cd/m²

*Compatible Components*  211

---

**Model 124: Luminance Probe**

For luminance measurements in difficult to reach places such as in photocopiers or photolithography systems UDT Instruments offers two luminance probes. Both are fiberoptic bundles. The model 124 is two feet long 0.0625” fiber core which couple to the Model 211 sensor head.

*Standard Calibration(s)*  nit (cd/m²); footlamberts

*Aperture diameter (mm)*  1.5

*Dynamic Range*  1.0E-01 - 1.0E+06 cd/m²

*Compatible Components*  211
**Optical Adaptors – Attenuators, Apertures**

**Model 2550: Attenuator - Standard Series**

The Model 2550 uses separate layers of diffuse material to attenuate radiation reaching a sensor thereby increasing input power capacity. It is compatible with Standard Series sensors.

<table>
<thead>
<tr>
<th>Standard Calibration(s)</th>
<th>Power (W) at user-specified wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation</td>
<td>100:1 (nominal)</td>
</tr>
<tr>
<td>Calibration range</td>
<td>350 - 1100 nm in * nm steps</td>
</tr>
</tbody>
</table>

**Features**

- Entrance Aperture diameter (mm) 7
- Compatible Components 221; 247

**Model 110: Sensor Holder and Aperture Set**

This accessory holds our standard 1cm² silicon photosensors. It is provided with five interchangeable apertures.

**Features**

- Five Interchangeable apertures - 5mm; 6mm; 7mm; 8mm; 9mm.

**Compatible Components** 211; 224; 221; 222; 247

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UDT Instruments
9925 Carroll Canyon Rd.
San Diego, CA 92131
858-279-8034
www.gamma-sci.com/udtinstruments
Since the Model 1120 provides a direct view of the measurement field, it is ideal for CRT measurements of a single pixel, small pixel cluster, or narrow scan line. But it also enables users to measure distant objects, small light sources, or to survey the distribution of light across luminous surfaces.

This accessory operates like a camera viewing system, since it splits the measurement and viewing fields. When attached to the front of the 1120, a camera lens or microscope objective focuses an object at the center of the internal 45° mirror. The user sees the object as an upright image in the eyepiece. A small hole in the center of the mirror allows a portion of the image to pass through. Then it is imaged by a relay lens onto the 211 sensor. To the user, the hole appears as a black spot on the object, corresponding to the actual area measured.

The Model 1120’s field-of-view is established by the focal length of the lens affixed to it. Adapters are available to accept camera lenses or microscope objectives, converting the 1120 into a microphotometer or a telephotometer. Since UDT offers a variety of lens accessories, a system can be constructed to fit most any working-distance versus measurement-field-size requirement.

To ensure accuracy, the Model 1120 must be calibrated with each lens/aperture with which it is used. These calibrations are expressed in footlamberts or cd/m².
MODEL 1120 REFLEX VIEWING MODULE IN TELEPHOTOMETER CONFIGURATION

Telephotometer Configuration List

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1120</td>
<td>Reflex viewing module</td>
</tr>
<tr>
<td>211</td>
<td>Photometric sensor head</td>
</tr>
<tr>
<td>1350</td>
<td>Lens, 50 mm</td>
</tr>
<tr>
<td>1351</td>
<td>Lens, 55 mm Macro</td>
</tr>
<tr>
<td>1352</td>
<td>Lens, 135 mm</td>
</tr>
<tr>
<td>1706</td>
<td>Tabletop Tripod</td>
</tr>
<tr>
<td>109</td>
<td>Heavy-duty lab stand</td>
</tr>
</tbody>
</table>

Telephotometer Lens Performance Specifications

<table>
<thead>
<tr>
<th>Lens Model #</th>
<th>Focal Length</th>
<th>f/#</th>
<th>Minimum Focal Distance (m)</th>
<th>Internal Limiting Measurement Field-of-View</th>
<th>Aperture size (mm)</th>
<th>Typical sensitivity (A/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1350</td>
<td>50 mm</td>
<td>f/1.8</td>
<td>0.4</td>
<td>3.3 °</td>
<td>4.0</td>
<td>1.0 x 10^{-10}</td>
</tr>
<tr>
<td>1351</td>
<td>55 mm Macro</td>
<td>f/2.8</td>
<td>0.2 for 1:1 conjugates</td>
<td>3.3 °</td>
<td>1.6</td>
<td>1.8 x 10^{-10}</td>
</tr>
<tr>
<td>1352</td>
<td>135 mm</td>
<td>f/2.8</td>
<td>2.1</td>
<td>1.3 °</td>
<td>4.0</td>
<td>1.2 x 10^{-10}</td>
</tr>
</tbody>
</table>
MODEL 1120 REFLEX VIEWING MODULE IN MICROPHOTOMETER CONFIGURATION

Microphotometer Configuration List

- 1120 Reflex viewing module
- 211 Photometric sensor head
- 1713 Rack and pinion focus mount
- 1707 Micro-adapter tube (includes 4 1” adapter tubes)
- 1354-5/10/20 5x, 10x, or 20x microscope objectives
- 1354-40/60 40x or 60x microscope objectives
- 109 Heavy-duty lab stand

Microphotometer Lens Performance Specifications

<table>
<thead>
<tr>
<th>Model #</th>
<th>Power</th>
<th>Focal Length</th>
<th>NA</th>
<th>Working Distance</th>
<th>1707 with 4 Adapter Tubes</th>
<th>Typical Sensitivity (A/ft)</th>
<th>1707 with 8 Adapter Tubes</th>
<th>Typical Sensitivity (A/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1354-1</td>
<td>1x</td>
<td>1.36mm</td>
<td></td>
<td></td>
<td>2.60mm</td>
<td>1.30mm</td>
<td>3.7 x 10-12</td>
<td>3.4 x 10-12</td>
</tr>
<tr>
<td>1354-5</td>
<td>5x</td>
<td>30mm</td>
<td>10</td>
<td>20mm</td>
<td>0.8mm</td>
<td>9.8 x 10-12</td>
<td>0.4mm</td>
<td>3.7 x 10-12</td>
</tr>
<tr>
<td>1354-10</td>
<td>10x</td>
<td>16mm</td>
<td>3</td>
<td>6mm</td>
<td>0.4mm</td>
<td>8.7 x 10-12</td>
<td>0.2mm</td>
<td>3.4 x 10-12</td>
</tr>
<tr>
<td>1354-20</td>
<td>20x</td>
<td>9mm</td>
<td>2</td>
<td>3.2mm</td>
<td>0.25mm</td>
<td>6.0 x 10-12</td>
<td>0.1mm</td>
<td>2.5 x 10-12</td>
</tr>
<tr>
<td>1354-40</td>
<td>40x</td>
<td>5mm</td>
<td>1.5</td>
<td>0.3mm</td>
<td>0.1mm</td>
<td>3.7 x 10-12</td>
<td>0.06mm</td>
<td>1.6 x 10-12</td>
</tr>
<tr>
<td>1354-60</td>
<td>60x</td>
<td>3mm</td>
<td>1.2</td>
<td>&lt; 0.3mm</td>
<td>0.07mm</td>
<td>2.3 x 10-12</td>
<td>0.04mm</td>
<td>9.8 x 10-12</td>
</tr>
</tbody>
</table>

UDT INSTRUMENTS
9925 Carroll Canyon Rd.
San Diego, CA 92121
858-279-8034
www.gamma-sci.com/udt Instruments
UDT Instruments offers a variety of integrating spheres, as well as complete, preconfigured sphere systems, to meet diverse test and measurement requirements. UDTi integrating spheres are available in sizes from 50 mm to 2 m diameter, with designs optimized for applications including:

Applications:

- LED Test & Measurement
- Laser Power Measurement
- Fiber-Optic Testing
- General Photometry & Radiometry
- Plus: Custom Designs

The UDTi Advantage: Our line of integrating spheres and systems are distinguished by:

- Expert Design
- Quality Manufacturing - Mechanical and Optical
- Technical Support - for configuration, calibration, & use
- Value - top performance at reasonable prices

Choosing a UDTi Sphere Solution: Some of our most popular spheres are described in the following pages. A complete and up-to-date list of UDTi standard spheres is presented on our website in the form of a sphere selection chart; the attached system selection chart presents a list of preconfigured sphere-based system solutions. Specialized configurations and custom designs are also available.
**Model 2500: Integrating Sphere - Standard Series**

The model 2500 is a six-inch diameter integrating sphere with a 3/4 inch entrance port. It is suitable for both laser power measurement and LED photometry. It is compatible with Standard Series sensors.

<table>
<thead>
<tr>
<th>Standard Calibration(s)</th>
<th>Power (W) or Luminous Flux (lumen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation</td>
<td>6000:1 (nominal)</td>
</tr>
<tr>
<td>Features</td>
<td>High attenuation</td>
</tr>
<tr>
<td>Sphere diameter (mm)</td>
<td>150</td>
</tr>
<tr>
<td>Entrance Aperture diameter (mm)</td>
<td>19</td>
</tr>
<tr>
<td>Mounting Interface</td>
<td>1/4-20 - Female</td>
</tr>
<tr>
<td>Compatible Components</td>
<td>211; 221; 247</td>
</tr>
</tbody>
</table>

**Model 2525: Integrating Sphere**

This integrating sphere can be used with Standard Series sensors to determine the luminous or radiant flux of LEDs. The sphere has an internal baffle which makes it ideal for diverging light sources. It includes an input aperture disk with a standard 5mm port and a blank adaptor which can be drilled for other aperture sizes.

<table>
<thead>
<tr>
<th>Standard Calibration(s)</th>
<th>Luminous Flux (lumen) or Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation</td>
<td>600:1 (nominal)</td>
</tr>
<tr>
<td>Features</td>
<td>Medium attenuation; aperture disks for LED measurement</td>
</tr>
<tr>
<td>Sphere diameter (mm)</td>
<td>150</td>
</tr>
<tr>
<td>Entrance Aperture diameter (mm)</td>
<td>19</td>
</tr>
<tr>
<td>Mounting Interface</td>
<td>1/4-20 - Female</td>
</tr>
<tr>
<td>Compatible Components</td>
<td>211; 221; 247</td>
</tr>
</tbody>
</table>

Sectional View - Model 2500 or 2525 - Note that the design of the two models differs only in the size of the aperture mounted at the sphere's sensor port.
**Model 2575: Miniature Integrating Sphere**

This 50 mm diameter integrating sphere features a 5 mm entrance aperture. This sphere is a favorite for test and measurement of lasers, LEDs, and fiber-optic illuminators. It is compatible with Miniature Series sensors.

**Standard Calibration(s)**
- Power (W) at user-specified wavelength
- Attenuation: 300:1 (nominal)
- Calibration range: 350 - 1750 nm in * nm steps

**Features**
- Low attenuation
- Sphere diameter (mm): 50
- Entrance Aperture diameter (mm): 5
- Compatible Components: 260; 261; 262; 280

**Model 2575-10: Miniature Integrating Sphere**

This 50 mm diameter integrating sphere features a 10 mm entrance aperture. This sphere is suitable for testing of larger fiber/beam diameters. Compatible with Miniature Series sensors.

**Standard Calibration(s)**
- Power (W) at user-specified wavelength
- Attenuation: 250:1 (nominal)
- Calibration range: 350 - 1750 nm in * nm steps

**Features**
- Low attenuation
- Sphere diameter (mm): 50
- Entrance Aperture diameter (mm): 10
- Compatible Components: 260; 261; 262; 280
MECHANICAL ACCESSORIES for PHOTOSSENSOR SYSTEMS

**HOLDERS, STANDS, & ADAPTORS**

<table>
<thead>
<tr>
<th>Model#</th>
<th>Couplers</th>
<th>Filter Holders</th>
<th>Stands</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Series</td>
<td>108</td>
<td>102 104 110</td>
<td>103 109</td>
<td>1706 101-1</td>
</tr>
<tr>
<td>Miniature Series</td>
<td>108-Mini</td>
<td>104-Mini</td>
<td></td>
<td>1700 Series F-O Adaptors</td>
</tr>
</tbody>
</table>

**Couplers:**
- Model 108: Male Coupler
- Model 108-MINI: Male Coupler - Miniature
- Model 1718: Step-Up Adapter

**Filter Holders:**
- Model 102: Filter Holder
- Model 104: Filter Holder/Coupler
- Model 104-MINI: Filter Holder/Coupler - Mini

**Stands for Sensor Heads:**
- Model 103: Standard Lab Stand
- Model 109: Heavy-Duty Lab Stand
- Model 1706: Tabletop Tripod

**Aperture Assembly:**
- Model 110: Sensor Holder and Aperture Set

**Other Fixtures:**
- Model 101-1: Universal Sensor Housing
- Model 1700 Series Fiber-Optic Adaptors
**MODEL 101-1: UNIVERSAL SENSOR HOUSING**

This Universal Sensor Housing holds a standard 1 cm² BNC detector package and is a component of UDTi Standard Series sensors. Includes a male-threaded adaptor (Model 108) which connects directly to Standard Series filter holder (Model 104) attenuators and integrating spheres.

**Mounting Interface** 1/4-20 - Female

**Compatible Components** Model 1223 and 1223-A series sensors

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**MODEL 1700 SERIES FIBER-OPTIC ADAPTORS**

1700-Series Fiber-Optic Adaptors are compatible with UDT Instruments Miniature Series Sensors (Model 260, 261 and 280). Details are provided in the following brochure:

**PDF Brochure:** UDTi Fiberoptic Connector Adapters
**Model 102: Filter Holder**

The model 102 Filter Holder holds any 25 mm diameter filter. It is female-threaded on one side for connection to Standard Series sensors.

**Compatible Components** 211; 221; 222; Standard 25 mm diameter filters.

---

**Model 104: Filter Holder/Coupler**

Designed to hold standard 25 mm diameter filters the Model 104 connects male-threaded Standard Series sensors and accessories. While the Model 102 Filter Holder is threaded on one side only both sides of the Model 104 are threaded to permit stacking of accessories.

**Compatible Components** 211; 221; 222; Standard 25 mm diameter filters.

---

**Model 104-Mini: Filter Holder/Coupler - Miniature**

Designed to hold 12.5 mm diameter filters the Model 104-MINI connects male-threaded Miniature Series sensors and accessories.

**Compatible Components** 260; 261; 280; 2575 series mini-spheres; Custom 12.5 mm diameter filters.
**MODEL 108: MALE COUPLER**

The Model 108 coupler is designed to connect two female-threaded Standard Series accessories.

**Compatible Components** 211; 221; 222; 247; 104 and other female-threaded Standard Series accessories

**MODEL 108-MINI: MALE COUPLER - MINIATURE**

The Model 108-MINI coupler is designed to connect two female-threaded Miniature Series accessories.

**Compatible Components** 260; 261; 280; 104-MINI and other female-threaded Miniature Series accessories

**MODEL 1718: STEP-UP ADAPTER**

The Model 1718 is designed to couple female-threaded Miniature Series sensors and accessories to male-threaded Standard Series accessories.

**Mounting Interface** 1/4-20 - Female

**Compatible Components** 260; 261; 280; 2550; Standard Series integrating spheres
**Model 103: Standard Lab Stand**

This lab stand has a 1/4-20 threaded post for holding Standard Series sensors.

**Compatible Components** 211; 221; 247; 2153; 101-1; 1153; 1718; 2500; 2525; 2575

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**Model 109: Heavy-Duty Lab Stand**

This lab stand has a 1/4-20 threaded post for holding UDTi sensors and accessories. Its extra-heavy base makes it suitable for use with large optical assemblies.

**Mounting Interface** 1/4-20 - Male

**Compatible Components** 211; 224; 2153; 221; 222; 247; 101-1; 1718; 2500; 2525; 1120; SLS-9400FC-Plus
**Model 1706: Tabletop Tripod**

Designed for use in display-measurement microphotometry and telephotometry applications, the Model 1706 provides tip, tilt, and pan capabilities for accurate pointing and alignment. It attaches to any sensor head with a 1/4-20 thread mount and is especially suitable for use with the Model 1120.

**Compatible Components**  
Model 1120; All UDTi Standard Series Sensors; Models 101-1; 1718; 2153