

J16 PHOTOMETER/RADIOMETER

The Tektronix J16 is a portable digital photometer/radiometer capable of making a wide variety of light measurements—in the laboratory, in the field, or on the production floor. A J16 System consists of a J16 mainframe and one of seven detachable probes which can be either mounted on the J16 or on the end of an extension cable. All probes have a Hold switch which allows the displayed reading to be held.

Seven quickly interchangeable probes are available for measuring illuminance, irradiance, luminance, light-emitting diode output, and relative intensity. Recalibration is not necessary when probes are interchanged. Connection of a probe to the J16 automatically selects the correct front panel units indicator. The 3 1/2 digit LED display can be easily read under low ambient conditions.

All probes use silicon photodiodes individually corrected with multi-element glass filters for maximum stability and accuracy.

The optional BCD/analog output feature (Option 07) allows the user either a BCD output of the displayed reading or an analog signal (level) proportional to the light falling upon the sensor. The J16 Option 07 can be also used with a Tek MI 5010/50M30 Multifunction Interface System for interface with a GPIB system.

Under normal usage, the internal rechargeable nickel cadmium batteries will operate the J16 for four hours. An ac power supply is recommended for continuous operation.

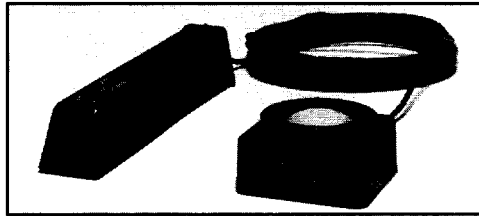
Power supplies or battery packs can be changed quickly by removing four screws on the J16's rear panel. The cabinet and probes have an internal threaded socket (1/4 in x 20 in) for convenient mounting on a tripod or optical bench.

J16-TV PACKAGE

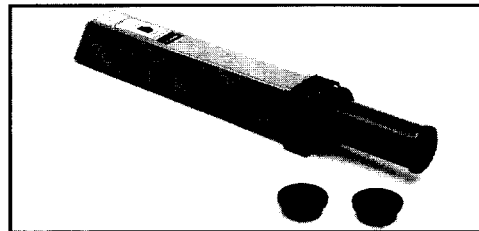
The J16-TV package is an excellent transfer mechanism which provides a simple, accurate method for adjustment of monitor screen color temperature. The primary colors are measured and adjusted to produce white color temperature balance.

The J16-TV with optional J6503 or J6523 probes measures monitor screen brightness on both color and black and white monitors. Other applications include measurement of studio lighting, camera lighting, and illumination of work areas.

The J16-TV package includes: J16 Battery-Operated Photometer, J6502-A Irradiance Probe, light occluder, probe extension cable, and battery charger. See Application Note 58A-2926-1 for additional information.



J6511 (shown), J6512-A (similar except no diffuser)



J6505 with LED adaptor and LED holders

CHARACTERISTICS

J16 MAINFRAME

Display – 3 1/2 digit LED readout and three LEDs automatically indicate correct units for probe in use. Metric version readout is also available (Option 02).

Stability – $\leq 2\%$ per year.

Linearity – $\leq 2\%$ over entire range (enables single point calibration).

Integration Time – ≈ 100 ms.

Calibration – Electrical calibration of the J16 mainframe is performed with a calibrated voltage source or DVM traceable to NIST. Calibrated probes can be used with any J16 without additional calibration.

POWER REQUIREMENTS

Standard and Opt. 01 – Has internal rechargeable NiCad batteries that require 16 hours for a full charge. The J16 will operate nominally four hours continuously on a charge.

Opt. 03 and Opt. 04 – AC only operation, no internal batteries.

PHYSICAL CHARACTERISTICS

(With Probe and Battery Pack Installed)

Dimensions	mm	in.
Width	123	4.6
Height	60	2.4
Depth	203	8.0
Weight \approx	kg	lb
Net	1.5	3.3
Domestic Shipping	2.3	5.0
Export-packed	4.5	10.0

FEATURES

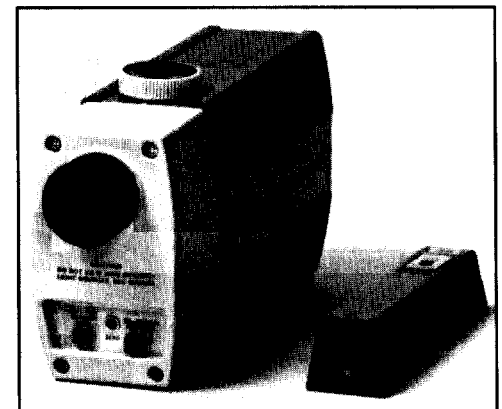
- Digital LED Readout
- Seven Silicon Sensor Probes Quickly Interchange Without Recalibration
- Accurate Spectral and Cosine Corrections
- Metric and US Versions Available
- AC or Internal Rechargeable Battery Versions
- Application Notes Available

BENEFITS

- Easy to Read in Dark Areas
- Rugged but Accurate
- Adaptable to Many Light Measurement Needs
- Use Anywhere



J16 with optional probe.



J6523

J6501
J6502-A
J6503

J6511**Illuminance Probe**

- Highway Illumination
- Luminaires and Lamps
- Workstation Illumination
- Studio Lighting
- Office Lighting
- Lighting Equipment

**J6502-A/J6512-A
Irradiance Probes**

- Laser Research
- Display Color Balancing
- Radiant Efficiency
- Infrared LED Testing

J6503**8° Luminance Probe**

- TV and Computer Display Screens
- Projection Screens
- Surface Reflectance

J6523**1° Luminance Probe**

- Roadway Lighting
- TV and Computer Display Screens
- Photographic Equipment Testing
- Glare and Contrast Measurement

J6505**Red LED Probe**

- Output of Red LEDs (600-710 nm)

J6501**Illuminance Probe**

- For Yellow and Green LEDs

J6501 ILLUMINANCE PROBE

Where cosine correction is unnecessary, the standard J6501 probe is available with the same photopic correction and units as the J6511. The J6501 can be used to measure green and yellow LEDs using the optional LED Adapter (014-0047-00).

J6502-A/J6512-A IRRADIANCE PROBE

The J6502-A/J6512-A measure irradiance in microwatts/cm² (milliwatts/m² with Option 02). The spectral response is flat from 450 to 950 nanometers. The response is typically down 50% at 400 and 1030 nm.

An optional filter holder is available for the J6502-A to mount standard 1 inch diameter customer supplied filters of up to 3/8 inch thickness. Where high intensity sources are used (over 2 mW²), neutral density filters can be used to extend the range of the J16. (An ND 1 filter has 10% transmission; ND 2 has 1%, etc.)

Where the 1 sq cm sensor is not completely filled by the source, for example with a laser beam, the reading obtained represents microwatts instead of μ watts/cm² or milliwatts x 10⁻⁴ instead of milliwatts/m² (Option 02).

The J6512-A has a low-profile detector head and six-foot cable.

J6503 8° LUMINANCE PROBE

The J6503 measures luminance in foot-lamberts (candelas/m² (nit) with Option 02) where light scattered or emitted by a surface must be measured. The probe is pointed at the emitting surface.

The probe's response is closely matched to the CIE photopic curve, ensuring accurate results even when measuring spectrally different light sources.

The acceptance angle is approximately 8 degrees, which is determined by internal field stop apertures. Providing that the 8 degrees field is uniformly filled, the probe can be held at any distance from the source. The 8 degree acceptance angle represents about a 1.7 inch diameter measurement field at one foot and is proportionately larger at greater distances. The footlambert or candelas/m² (nit) (Option 02) indicator automatically lights when the J6503 is connected.

J6505 PROBE FOR RED LEDs

The J6505 measures illuminance in foot candles [lumens/m² (lux) with Option 02], which can easily be converted into luminous intensity in candelas. (See Application Notes 58-A-2635 and 58-A-2704-1.)

An adapter supplied with the probe provides a controlled spacing between the sensor and the LED under test. The adapter excludes ambient light and has internal baffles to prevent stray reflections during the measurement. Three inserts are supplied with the adapter to fit common sizes of LEDs (0.080 in, 0.125 in, and 0.200 in diameter). These inserts are made of soft plastic that can be easily modified by the user for other LED sizes.

With the adapter in place, a reading of 1 footcandle represents 100 millicandelas of luminous intensity. With a metric version of the J16/J6505 (Option 02), 1 lumen/m² represents 10 millicandelas.

In the J6505, the silicon photodiode-filter combination provides an excellent match to the photopic curve in the region 600 nm to 710 nm. This close match requires compromising in the 380 to 600 nm region, making this probe unsuitable for general illuminance measurements.

Note: For yellow or green LEDs use the J6501 probe; for infrared LEDs use the J6502-A probe.

J6511 ILLUMINANCE PROBE

The J6511 is an illuminance probe with readout in footcandles [lumens/m² (lux) for the J6511 Option 02]. A multi-element glass filter and silicon photo-diode ensure a close match to the CIE photopic curve (color corrected). The silicon-sensor recovery time is virtually instantaneous; low-light levels can be measured immediately after exposure to bright sunlight.

The angular response is accurately cosine corrected, simulating an ideal 180° field-of-view detector. The low-profile sensor has a leveling indicator to ensure accurate measurements where a significant proportion of the illumination comes from sources at low angles to the horizon.

A 25-foot cable between the probe (J6511) and J16 allows the user to be out of the field of view while making measurements.

J6523 1° LUMINANCE PROBE

The J6523 will measure the luminance in footlamberts (candelas/m² with Option 02) of a spot as small as 0.32 inch in diameter. By using commercially available 55-mm stackable close-up lenses, areas as small as 0.035 inch (+10 diopters) can be measured. These 55-mm lenses are locally available from photography stores. (See Application Note 58-AX-3252.)

The 1 degree angle represents 0.21 inch per foot of distance from the probe to the source. Thus at 10 feet, the J6523 measures a 2.1 inch diameter spot.

The probe includes an optical sighting system with a 9 degree viewing field. The focusing range is 18 inches to infinity, closer with 55-mm close-up lenses. The spectral response is closely matched to the CIE photopic curve (color-corrected) for accurately measuring all commonly used light sources. The J6523 may be attached to the J16 or used with an optional probe extension cable. A standard 1/4 inch x 20 threaded socket allows it to be mounted on a tripod or an optical bench.

J16 OPTION 07

Option 07 adds a 25-pin connector on the J16's top. This connector provides parallel TTL logic and BCD outputs, a "hold" input line (TTL), and a linear analog signal output 0 to -2 V minimum (depending upon the probe used), for a full-scale readout. The analog bandwidth is approximately 0.8 Hz. A cable-end connector and cover are included.

DIGITAL PHOTOMETER/RADIOMETER J16

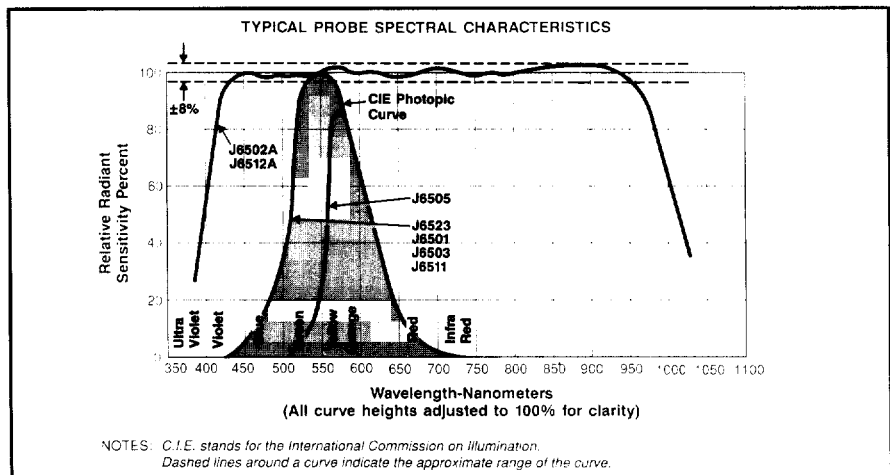
PROBE CHARACTERISTICS

Application	Illuminance	Irradiance	Luminance		Red LED	Green/Yellow LED	
Probe	J6511	J6502-A/J6512-A	J6503	J6523	J6505	J6501	
Range	US*	0.001 to 1999 footcandles*	0.001 to 1999 microwatts/cm ² *	0.1 to 199,900 footlamberts*	0.1 to 19,990 footlamberts*	0.001 to 1999 footcandles*†	0.001 to 1999 footcandles*†
	Metric (Opt. 02)	0.01 to 19,990 lumens/m ² (lux)*	0.01 to 19,990 milliwatts/m ² *	1 to 1,999,000 candelas/m ² (nits)*	1 to 199,900 candelas/m ² (nits)*	0.01 to 19,990 lumens/m ² (lux)*†	0.01 to 19,990 lumens/m ² (lux)*†
Accuracy (including J16)	Within 5% of NBS standards and ±1 digit in last place. Calibrated with a 3100° tungsten light source.	Same as J6511, except calibrated with a 762 nm filter	Within 5% of NIST standards and ±1 digit in last place. Calibrated with a 3100°K tungsten light source		Same as J6501, except calibrated with a 656 nm filter light source	Within 5% of NBS standards and ±1 digit in last place. Calibrated with a 3100° tungsten light source.	
Spectral Response	CIE photopic curve	Flat within ±7% from 600 to 950 nm 450-600 is ±8%	CIE photopic curve		CIE photopic curve from 600 to 710 nm (250 to 1200 nm)	CIE photopic curve	
Acceptance Angle	Cosine corrected (180°)	50% sensitivity at 48° off axis	8°	1°	50% sensitivity at 48° off axis	50% sensitivity at 48° off axis	
Stability and Repeatability	Within 2% per year						
Linearity	Within 2% over entire range enabling single point calibration						

* An additional decade of sensitivity is included and is usable if the J16 is carefully zeroed and used at a relatively stable temperature.

† 0.000001 to 199.9 candelas when used with 014-0047-00 LED adapter or at 3.8 inches source-to-sensor spacing. Luminous intensity readings of higher intensity light sources may be easily made at correspondingly greater distances using the formula: Footcandles x d² = candelas where d is the distance from the source to the sensor in feet. (For metric readings, use lux x d² = candelas where d is distance from the source to the sensor in meters.) Request J16 Application Note 58A-2704-1 for further information.

US/Metric Conversions	US to Metric	Metric to US
Illuminance	fc x 10.764 = lux	lux x 0.0929 = fc
Luminance	fl x 3.426 = nits	nits x 0.2919 = fl



ORDERING INFORMATION

J16 Photometer/Radiometer Battery Version, with 115 Vac, 50 to 400 Hz
Includes: Battery charger (119-0375-02); shoulder strap (346-0104-00); battery pack (016-0539-01); instruction manual (070-1879-00); or Opt. 02 Instruction manual (070-1880-00). **\$1,495**

J16-TV Photometer/Radiometer Package for TV Color Monitor Set-Up
Includes: Same as J16 plus J6502A irradiance probe; light occluder (016-0305-00); 42 inch probe extension cable (012-0414-02). **\$2,265**

J16 OPTIONS

Opt. 01 - Battery version with 230 Vac, 50 to 400 Hz charger (119-0375-03). **NC**
 Opt. 02* - Metric readout **NC**
 Opt. 03 - 115 Vac only operation, 50 to 400 Hz **NC**
 Opt. 04 - 230 Vac only operation, 50 to 400 Hz **NC**
 Opt. 07 - BCD/Analog output **+\$150**

*1 Opt. 02 probes must be used.

For application specific information call:
1-800-835-9433 ext. 5429 (in USA only).

PROBES

Actual plotted spectral curve is included with each probe.
J6501 Illuminance Probe **\$675**
J6502-A Irradiance Probe **\$700**
J6503 8° Luminance Probe **\$675**
J6505 LED Probe, Includes Red LED Adapter and 3 LED holders **\$695**
J6511 Illuminance Probe, Cosine corrected (with 25-ft cable) **\$695**
J6512-A Irradiance Probe (with 6-ft cable) **\$750**
J6523 1° Luminance Probe **\$1,895**

PROBE OPTIONS

Opt. 02 - Metric probes required for metric readout J16s (Opt. 02). **NC**

OPTIONAL ACCESSORIES

42-Inch Probe Extender Cable** - Connects J16 to probe. Order 012-0414-02 **\$145**
Light Occluder - For TV color CRT balancing. Order 016-0305-00 **\$40**
Filter Holder** - Mounts 1 in. diameter filters, of up to 3/8 in. thickness, to probes (except J6511, J6512, J6523). Order 016-0527-00 **\$33**

LED Adapter - With 3 LED holders (included with J6505). Order 014-0047-00 **\$120**
Tripod - Order 016-0253-00 **\$200**

*2 Longer length extender cables are available as a modified product by contacting your local Tektronix Sales Office.

*3 Filters available from vendors such as: **ORIEL (203) 377-7877** or **CORION CORP. (508) 429-5065** and others.

POWER SUPPLIES

Power supplies can be quickly changed by removing four corner screws on the rear panel and sliding the power supply or battery pack out.
AC Power Supply - Allows J16 to be used without batteries. 115 Vac, 50 to 400 Hz (Included with Opt. 03) Order 119-0404-00 **\$295**
 230 Vac, 50 to 400 Hz (included with Opt. 04) Order 119-0404-01 **\$275**
Spare Battery Pack - Order 016-0539-01 **\$230**