



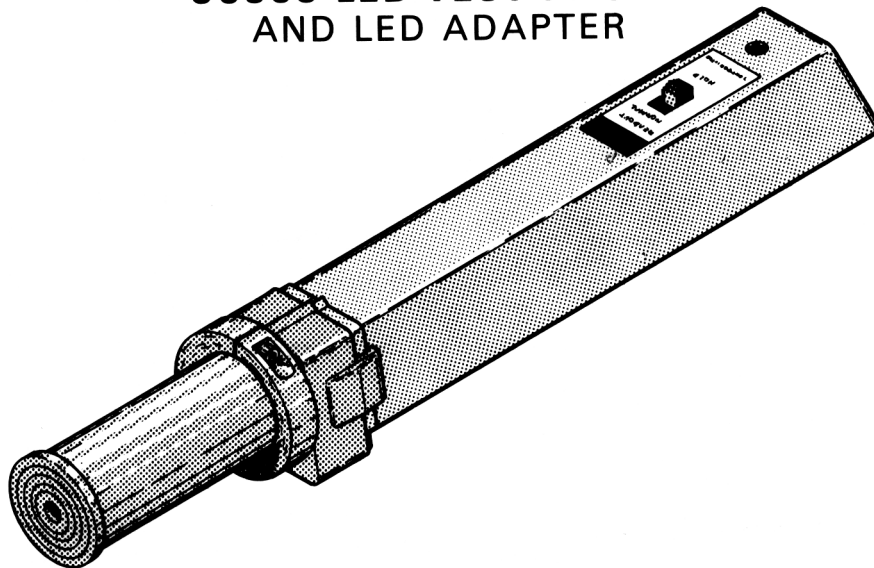
**TEKTRONIX®**

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**data sheet**

PARTS PUBLICATION

**J6505 LED TEST PROBE  
AND LED ADAPTER**



NO. 062-1567-00

DATE MAR. 1976(R)

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## J6505

The J6505 is designed for use with the J16 Digital Photometer to measure illuminance of light sources having spectral outputs in the range of 600 to 710 nanometers. The principal application is for the measurement of red light-emitting diode (LED) output. The J6505 measures illuminance in foot-candles, which can easily be converted into luminous intensity in candelas (see text under "Light-Emitting Diodes" in this description).

A silicon photodiode and multilayer glass filter are used to provide a very close spectral match in the red region to allow accurate LED measurements. This close match requires compromising in the 380 to 600 nanometer region, making this probe unsuitable for general illuminance measurements. For LED measurements in the yellow or green region, the LED Adapter (014-0047-00) should be used with the J6501 Probe, and the same conversion factor for luminous intensity applies.

The adapter supplied with the J6505 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 aperture inserts are supplied with the adapter to fit common sizes of LED's (0.080 inch, 0.125 inch, and 0.200 inch in diameter). These inserts are made of soft plastic that can be easily modified by the user.

A HOLD switch is provided on the probe to permit the reading to be stored at any time. A standard 0.25" - 20 mounting socket is located on the bottom for use in mounting on an optical bench or tripod.

### SPECIFICATIONS

(when used with the J16)

Measurement range:	0.0001 to 199.9 candelas
Max resolution:	0.01 millicandela
Spectral response:	Within 2% of CIE photopic curve from 600 to 710 nm.
Light acceptance angle:	50%, sensitivity at $48^{\circ}$ off axis.
Accuracy:	Within 5% of NBS standards and +1 digit in the last place. Probes are individually calibrated with a 656 nanometer monochromatic light source traceable to NBS.

ADJUSTING THE J16 ZERO FOR MAXIMUM  
SENSITIVITY MEASUREMENTS

To obtain maximum accuracy when making LED measurements on the most sensitive range, the J16 must be very carefully zeroed. The following procedure varies slightly from that given in the J16 manual.

1. The LED adapter should be attached to the J6505.
2. Preset instrument controls as listed below:

POWER	ON
READOUT Switch	NORMAL
Range Selected	X.1

3. Allow at least one minute of warmup before proceeding.
4. Completely cover the opening in the LED Adapter to block any ambient light. (A small piece of black plastic electrical tape is useful for this purpose.)
5. Adjust ZERO until the readout just turns zero and the minus sign begins to flicker on and off. Then, set the adjustment slightly away from the minus direction to the point where the last digit (to the right) reads "5" or so.

6. For all readings on this range, subtract this 'zero' reading from the observed reading.
7. Recheck 'zero' periodically.

## NOTE

For maximum stability, the ac-powered version of the J16 is recommended. The J16 may then be left on continuously to allow the instrument to reach thermal equilibrium.

## LIGHT-EMITTING DIODES

Light-emitting diode measurements present special problems. First, they are usually peaked in the red region of the spectrum where a standard photopically-corrected sensor does not match the CIE photopic curve. To correct this, it is necessary to use a special sensor/filter combination such as the J6505, having close correction and calibration for this portion of the spectrum. These should not be used for measurement of light or colors other than red, since the accuracy for the rest of the spectrum is sacrificed to obtain an accurate red correction.

The second problem is in units. Foot-lamberts have been used by measuring light output of the emitting area of the chip with a sensor having a very

## J6505

narrow acceptance angle (the field of view must be smaller than the area being measured). While giving a good indication of the light output per unit area, the total light output of the LED is not necessarily indicated by this technique. To the eye, a chip having a large emitting area will appear brighter than a small one, even though both have the same output-per-unit area in foot-lamberts. Some way of indicating the total useful output light is therefore desirable.

Illuminance in foot-candles comes closer to meeting this requirement. The only drawback is that the distance from source to sensor must be specified due to the effects of inverse square law. A better approach is to use luminous intensity in candelas or millicandelas. The luminous intensity is a property of the light source and is independent of distance, although to measure it in actual practice requires the distance to be controlled. At one foot, one foot-candle is equivalent to one candela. At 3.8 inches, one foot-candle is equivalent to 100 millicandelas, and at 1.2 inches, one foot-candle is equivalent to 10 millicandelas. Since the effective sensor plane of the J6505 is 0.2 inch behind the front glass filter surface, all distances should be reduced by this amount.

The LED Adapter supplied with the J6505 is adjustable in length over a range of approximately 3.18 to 3.68

inches. This allows compensation for the differences in most common LED configurations to provide correct emitting plane-to-sensor spacing.

The principal remaining problems are those of geometry. Typical LED's emit light mainly in a forward direction, but some light is emitted from the sides. This is generally not useful light and should be prevented from reaching the sensor by proper baffling. Since LED output varies with viewing angle, it is also necessary to assure that the LED central axis is perpendicular to the sensor, and properly centered. Mechanical variations between manufacturers, types, and individual LED's must also be considered in setting sensor-to-source distances. Proper fixturing is the answer to the geometry-related problems. The LED Adapter supplied with the J6505 (014-0047-00) provides the necessary baffling, exclusion of room light, and adjustable source-to-sensor spacing (3.8 inches nominal). The spacing should be set to the emitting plane of the LED type to be tested. (see Figs. 2 and 3.)

A piece of small-diameter rod scribed at the desired spacing, plus the distance between the reference plane end emitting plane (see LED manufacturer's drawings) can be inserted through the LED opening. With the rod resting against the probe window, the proper distance may be set to the reference plane.

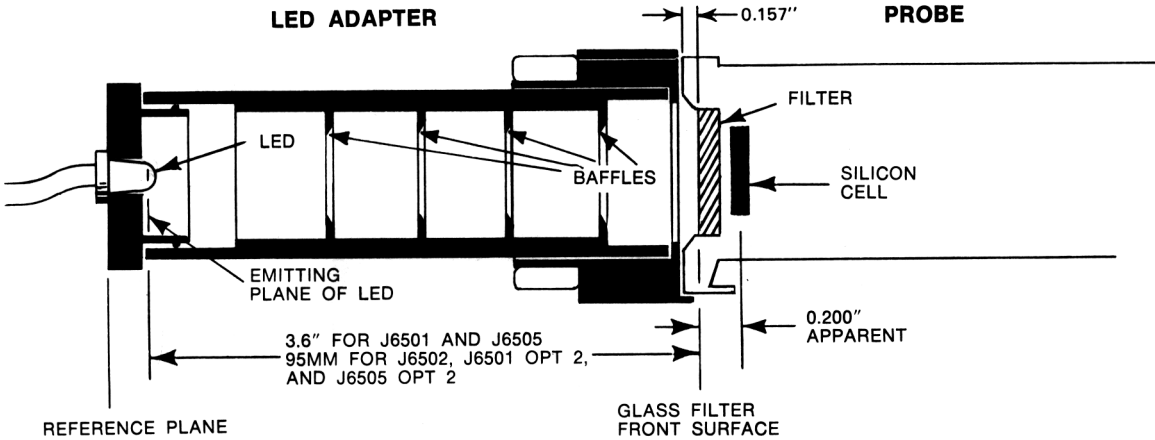


Fig. 2 Led Probe and Adapter

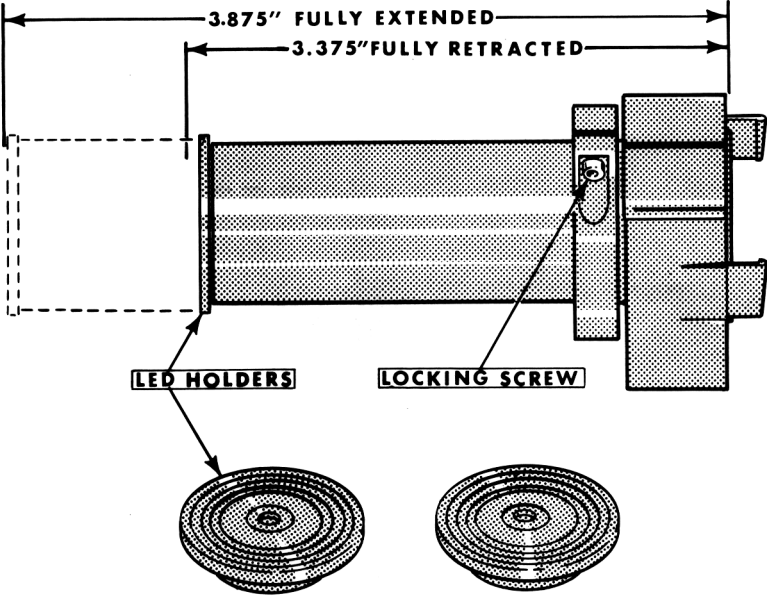
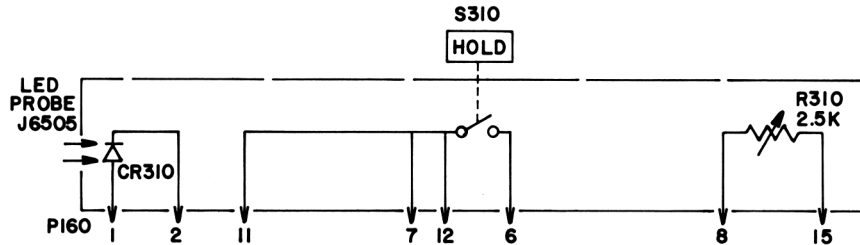


Fig. 3 Led Adapter with Led Holders

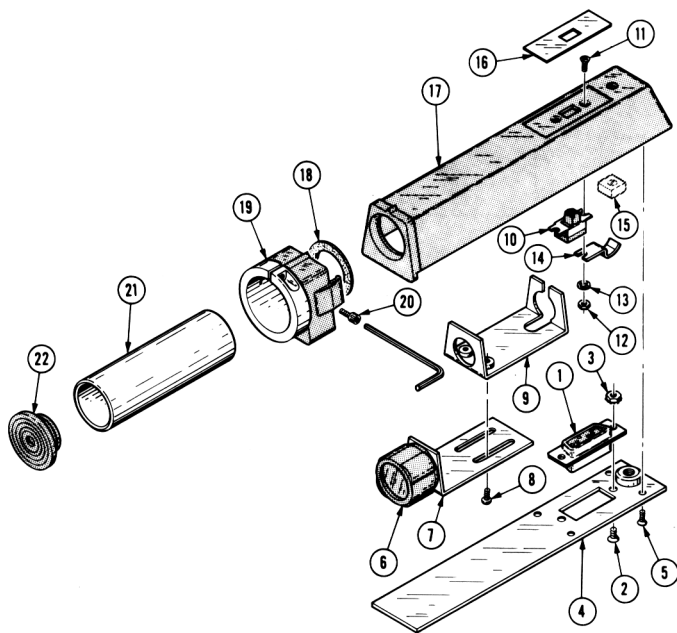


## CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
10389	CHICAGO SWITCH, INC.	2035 WABANSIA AVE.	CHICAGO, IL 60647
50394	STANDARD PRESSED STEEL CO., UNBRAKO DIV.	HIGHLAND AVENUE	JENKINTOWN, PA 19046
71785	TRW ELECTRONIC COMPONENTS, CINCH CONNECTOR OPERATIONS	1501 MORSE AVE.	ELK GROVE VILLAGE, IL 60007
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

NOTE

Replacement of any components indicated by an asterisk (\*) will require recalibration of the probe. Do not adjust R310 without the use of a standard calibrated light source. See your J16 Instruction Manual for further information.



**Fig. &  
Index  
No.**

**Tektronix Part No.**  
131-0459-00  
211-0101-00  
210-0586-00

**Serial/Model No.**  
**Eff**  
**Dscont**

**Qty**  
1 2 3 4 5

**Name & Description**  
CONN,RCPT,ELEC:15 PIN MALE, (J160)  
(ATTACHING PARTS)

2 SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL  
2 NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL

**Mfr  
Code**

71785  
83385  
78189

**Mfr Part Number**  
DA-15P  
OBD  
OBD

--- \* ---



Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	Name & Description					Mfr	Mfr Part Number	
				1	2	3	4	5	Code		
-4	200-1409-00	B010100 B020326	1	COVER,PROBE:BOTTOM					80009	200-1409-00	
	200-1409-02	B020327	1	COVER,PROBE:BOTTOM					80009	200-1409-02	
(ATTACHING PARTS)											
-5	211-0022-00	B010100 B020326	4	SCREW,MACHINE:2-56 X 0.188 INCH,PNH STL					83385	OBD	
	211-0030-00	B020327	4	SCREW,MACHINE:2-56 X 0.25"82 DEG,FLH STL					83385	OBD	
- - - * - - -											
-6	152-0558-00*	B010100 B020220	1	SEMICOND DVC,DI:PHOTOPTIC, (CR310)					80009	152-0558-00	
	152-0558-01*	B020221	1	SEMICOND DVC,DI:PHOTOPTIC, (CR310)					80009	152-0558-01	
-7	343-0380-00		1	CLAMP,TEST PROB:REAR					80009	343-0380-00	
	(ATTACHING PARTS)										
-8	211-0022-00		2	SCREW,MACHINE:2-56 X 0.188 INCH,PNH STL					83385	OBD	
	- - - * - - -										
-9	343-0379-00		1	CLAMP,TEST PROB:FRONT					80009	343-0379-00	
-10	260-0960-00		1	SWITCH,SLIDE:2A,120VAC,0.5A,120VDC, (S310)					10389	23-021-006	
	(ATTACHING PARTS)										
-11	211-0030-00		2	SCREW,MACHINE:2-56 X 0.25"82 DEG,FLH STL					83385	OBD	
-12	210-0405-00		2	NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS					73743	2X12157-402	
-13	210-0001-00		2	WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL					78189	1202-00-00-0541C	
	- - - * - - -										
-14	343-0406-00		1	CLAMP,VAR RES:					80009	343-0406-00	
-15	311-1239-00*		1	RES.,VAR,NONWIR:2.5K OHM,10%,0.50W, (R310)					73138	72Y-26-0-252K	
-16	334-2020-00		1	MARKER,IDENT:					80009	334-2020-00	
-17	380-0298-00	B010100 B020326	1	HSG ASSY,PROBE:TOP					80009	380-0298-00	
	380-0298-03	B020327	1	HSG ASSY,PROBE:TOP					80009	380-0298-03	
	014-0047-00	XB020260	1	ADAPTER,TEST:LIGHT EMITTING DIODE					80009	014-0047-00	
-18	214-1861-00		1	. GASKET:0.80 ID X 1.10 OD,FILTER,W/ADH BK					80009	214-1861-00	
-19	380-0319-01		1	. HSG,LED TEST AD:					80009	380-0319-01	
-20	211-0200-00		1	. . SCREW,CAP:4-40 X 0.250,SCH,SSST					50394	OBD	
-21	166-0563-01		1	. TUBE,LED:					80009	166-0563-01	
-22	352-0358-00		1	. HOLDER,LED:0.184-0.187 INCH DIAMETER					80009	352-0358-00	
	352-0361-00		1	. HOLDER,LED:0.077-0.080 INCH DIAMETER					80009	352-0361-00	
	352-0367-00		1	. HOLDER,LED:0.125-0.129 INCH DIAMETER					80009	352-0367-00	
	334-2063-00		1	MARKER,IDENT:"CALIB SEAL"					80009	334-2063-00	