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INFORMATION AT THE REAR  
OF THIS MANUAL.**

**J16  
DIGITAL  
PHOTOMETER  
(SN B052000 & up)**

**Tektronix, Inc.  
P.O. Box 500  
Beaverton, Oregon 97077**

070-1879-00

**INSTRUCTION MANUAL**  
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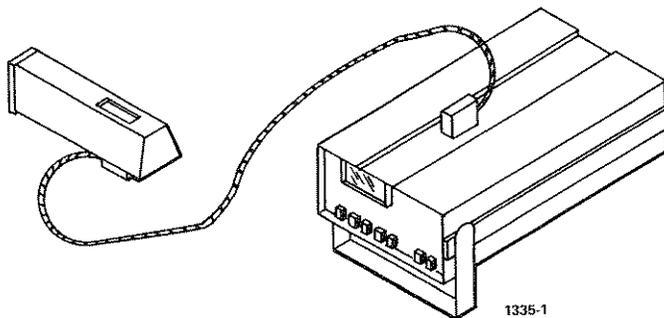
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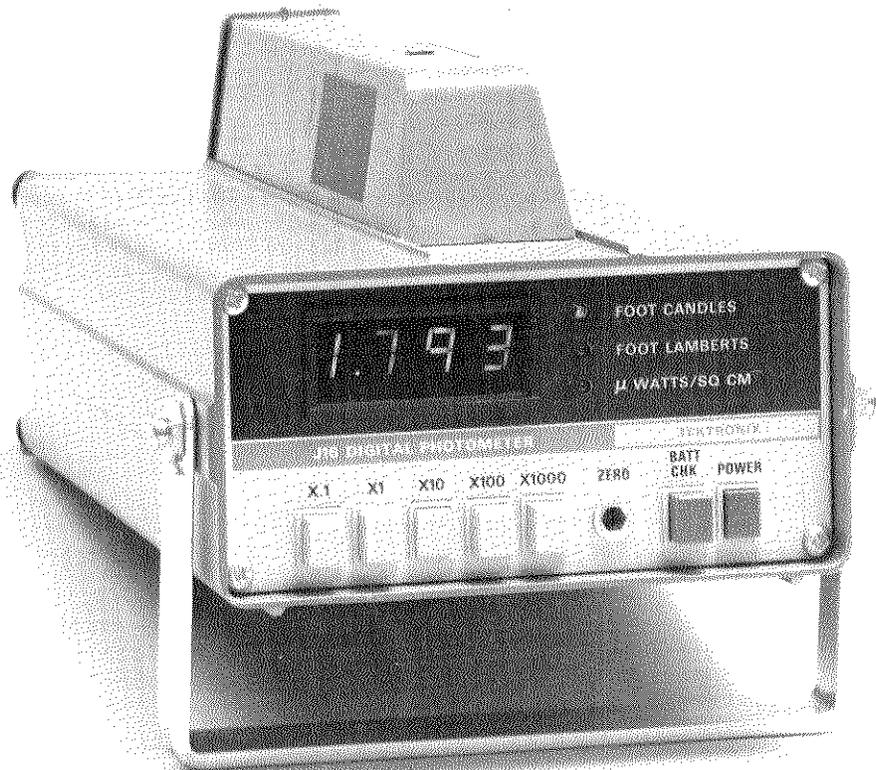
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## WARNING

When measuring high intensity light sources such as Lasers, Arc Lamps, the Sun etc, remove the probe from the J16 cabinet and do not look directly at the light source while reading the J16 meter.





1879-1

Fig. 1. J16 Digital Photometer/Radiometer.

J16 (SN B052000 & up)

@

# CHARACTERISTICS

The J16 Digital Photometer/Radiometer is a compact, battery- or ac-operated instrument primarily intended for calibrated measurements of the intensity of radiation over the 250-to-1200 nanometer (nm) wave-length range. Incorporated are five selectable decade multiplier ranges with measurements displayed on a three-and-a-half digit readout. Interchangeable probes allow measurement of relative levels or absolute level measurements in foot candle, foot lambert, or microwatts per square centimeter ( $\mu\text{W}/\text{cm}^2$ ) units. The probes can be either mounted on the instrument cabinet, a tripod or optical bench, or used with an extension cable available as an optional accessory.

The following instrument specifications apply over an ambient temperature range of  $-15^\circ\text{C}$  to  $+40^\circ\text{C}$  ( $+5^\circ\text{F}$  to  $+104^\circ\text{F}$ ), except as otherwise indicated<sup>1</sup>. Warmup time for the given accuracy is one minute. Completion of the calibration procedure (given later in this manual) ensures that this instrument meets the characteristics listed below.

<sup>1</sup>An additional decade of sensitivity is included and is usable if the J16 is carefully zeroed and used at a relatively stable temperature.

## ELECTRICAL CHARACTERISTICS

### Measurement Range (with Associated Probe)

J6501 or J6511 Illuminance Probes (foot candles):  
 $0.001^1$  to 1,999

J6502 or J6512 Irradiance Probes ( $\mu\text{W}/\text{cm}^2$ ):  $0.001^1$  to 1,999

J6503 or J6523 Luminance Probes (foot lamberts):  $0.1^1$  to 199,900

### Resolution (with Associated Probe)

Illuminance Probes: 0.0001 foot candle

Irradiance Probes:  $0.0001 \mu\text{W}/\text{cm}^2$

Luminance Probes: 0.01 foot lambert

### System Accuracy

Maximum absolute uncertainty of measurement is less than  $\pm 5\%$ ,  $\pm 1$  digit, on any range; uncertainty of linearity is  $\pm 2\%$  or less.

## **Power Source**

The J16 uses a built-in rechargeable nickel-cadmium Battery Pack. Typical operating time at +20°C to +30°C (+68°F to +86°F), starting with a fully-charged battery, is two hours.

The J16 Option 3 has a 115-volt AC Power Supply installed in place of the Battery Pack. J16 Option 4 is equipped with a 230-volt AC Power Supply.

## **ENVIRONMENTAL CHARACTERICS**

### **Temperature**

Operating, -15°C to +40°C (+5°F to +104°F)

Non-operating, -55°C to +75°C (-67°F to +167°F)

### **Altitude**

Operating, to 15,000 feet

Non-operating, to 50,000 feet

### **Humidity (operating and non-operating)**

5 cycles (120 hours) to 95% relative humidity, referenced to MIL-E-16400F.

## **Vibration (operating)**

Tested for 15 minutes along each of the three major axes at a total displacement of 0.025-inch peak-to-peak (4 g's at 55 Hz) with frequency varied from 10 to 55 to 10 Hz in one minute cycles. All major resonances must be above 55 Hz.

## **Shock (operating and non-operating)**

Tested with two guillotine-type shocks at 150 g's one-half sine, of eleven millisecond duration, in each direction along the three major axes.

## **MECHANICAL CHARACTERISTICS**

### **Weight (without accessories)**

3.25 pounds (1.5 kilograms)

### **Dimensions (measured at maximum points)**

Height: 2.375 inches (6 centimeters)

Width: 4.625 inches (12.3 centimeters)

Depth: 8 inches (20.3 centimeters)

# GENERAL INFORMATION

## Introduction

The following information is presented to acquaint the user with basic optical terminology in common use and with typical measurement levels encountered with using the J16. Further information may be found by referring to articles listed at the end of this section.

## Photometry

Photometry refers to the measurement of visible light, usually with a sensor having a spectral sensitivity curve similar to the average human eye.

The spectral sensitivity curve of the average human eye at typical light levels is called the C.I.E. Photopic Curve, established as a standard by the Commission Internationale de l'Eclairage (C.I.E.). See Fig. 2. As can be seen from the curve, the eye responds differently to light of different colors and has maximum sensitivity to yellow and green. For accurate photometric measurements of light of various colors or from differing types of light sources, the spectral sensitivity of a photometer must match the C.I.E. photopic curve very closely.

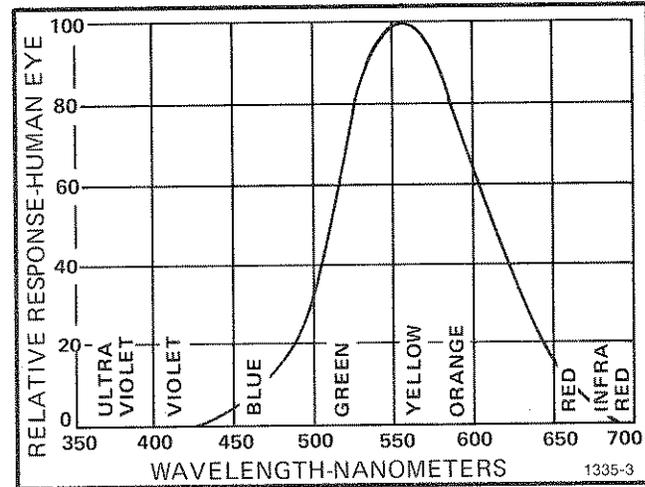


Fig. 2. C.I.E. Photopic Curve.

The following are commonly used photometric units:

#### Luminous Flux

The total light from a source, measured in lumens with a sensor spectrally matched to the average human eye.

#### Luminous Intensity

The luminous flux through a unit of solid angle. Usually measured in candelas (lumens/steradian).

#### Illuminance

The amount of luminous flux received by a unit of surface area. Usually measured in foot-candles (lumens/ft<sup>2</sup>). Illuminance values for normal outdoor light levels are listed in Table 1.

#### Luminance

The amount of light emitted or scattered by a surface. Usually measured in foot-lamberts. One foot-candle falling upon a perfectly diffusing white surface with no loss produces one foot-lambert. Luminances of several typical light sources are shown in Table 2.

**TABLE 1**  
**APPROXIMATE SCENE ILLUMINATION UNDER**  
**VARIOUS OUTDOOR CONDITIONS**

<b>Lighting Conditions</b>	<b>Scene Illuminance (Foot-candles)</b>
Direct sunlight	10,000
Full daylight*	1,000
Overcast day	100
Very dark day	10
Twilight	1
Deep Twilight	0.1
Full moon	0.01
Quarter moon	0.001
Starlight	0.0001
Overcast starlight	0.00001

\*Not direct sunlight.

**TABLE 2**  
**TYPICAL VALUES OF LUMINANCE**  
**(PHOTOMETRIC BRIGHTNESS)**  
**FOR VARIOUS SOURCES**

Source	Luminance (Foot-lamberts)
Sun's surface	$400 \times 10^6$
60 watt soft-white bulb	10,000
Cool-white fluorescent tube	2,500
White paper on a well-lit desk	100
Television screen highlights	30
Electroluminescent panel	5
White paper, 1 foot from a candle	1

### Radiometry

Radiometry generally refers to the measurement of radiation in the infrared, visible, and ultraviolet regions of the spectrum.

Instruments used to make radiometric measurements should have equal response to light of all the wavelengths to be measured in order to give truly comparative

readings. A silicon cell having its spectral response flattened with glass correction filters, such as the J6502 and J6512 Probes, results in a high sensitivity over the visible and near infrared portion of the spectrum.

The following are commonly used radiometric units:

Radiant Flux

The total radiation from a source, measured in watts.

Radiant Intensity

The radiant flux through a unit of solid angle, usually measured in watts/steradian.

Irradiance

The amount of radiant flux received by a unit of surface area, usually measured in  $W/cm^2$ . (Other units of irradiance, such as  $\mu W/cm^2$  and  $W/m^2$  are also used extensively and are easily converted by shifting decimal places).

Radiance

The amount of radiant energy emitted or scattered by a surface. Usually measured in watts/(meter<sup>2</sup>-steradian).

## Probes for J16

Following is a brief description of the presently available probes for the J16. Other probes are under development, and will be announced as soon as they are available. The probes attach (and detach) easily and rapidly. They do not require readjustment or calibration prior to use.

**J6501 and J6511 Illuminance Probes.** These probes are color-corrected (within 2% of C.I.E. Photopic Curve). Recovery from high light-levels is virtually instantaneous. Typical applications include measurement of roadway illumination, office lighting, and work-surface illumination. The J6511 includes a 25-foot cable for remote measurement applications and is accurately cosine corrected.

**J6502 and J6512 Irradiance Probes.** The response of these probes is flat within  $\pm 7\%$  from 450 to 950 nm. Typical applications are laser and infrared LED measurements.

**J6503 and J6523 Luminance Probes.** These probes are color-corrected to within 2% of C.I.E. Photopic Curve. Applications include measurement of television screen brightness, light reflected from work surfaces and movie

screens, and street sign brightness. The J6503 has an 8° field of view, and the J6523 has a 1° field of view. (8° represents 1.7 inches per foot of distance from the surface being measured; 1° represents 0.21 inch per foot.)

**J6504 and J6514 Uncorrected Probes.** These are the most sensitive probes and have the widest spectral range (250 to 1200 nm). Typical applications include relative measurements of light sources used in photoresist or photoprocessing, and comparisons of ultraviolet light sources. Readout is in relative units only.

**J6505 LED Probe.** The probe response is within 2% of C.I.E. Photopic Curve from 600 to 710 nm. This probe is specifically designed for measurements of the light output of light-emitting diodes (LED) having spectral outputs in the red region (600 to 710 nm). An adapter is included with the probe to provide a controlled spacing between the sensor and the LED under test. For LED's with a green or yellow spectral output, the J6501 Probe with 014-0047-00 LED Adapter is recommended.

For more detailed information on photometry/radiometry measurements, several application notes, listed below, are available through your local

Tektronix Field Engineer. Other sources of information in this field are:

Jenkins & White, Fundamentals of Optics, McGraw-Hill, 1957

Allen Stimson, Photometry and Radiometry For Engineers, John Wiley & Sons, 1974

Boris Merik, Light and Color of Small Lamps, G.E., 1971

John W.T. Walsh, Photometry, Dover Publications, 1958

Wyszecki & Stiles, Color Science, John Wiley & Sons, 1967

Zworykin & Ramberg, Photoelectricity, John Wiley & Sons, 1965

Electro Optics Handbook, Publication #EOH-11, RCA, 1974

IES Lighting Handbook, 5th Edition, Illuminating Engineering Society, 1972

Jurgen Meyer-Arendt, Introduction to Classical and Modern Optics, Prentiss Hall, 1972

Tektronix Application Notes—Analytical Instruments Publication List:

- #1. Luminous Intensity and Visible LED Measurements with the Tektronix J16 Photometer.
- #2. Measuring Pulsed Light Sources with the J16 and an Oscilloscope.
- #3. Radiant Intensity and Infrared Emitting Diode Measurements.
- #4. Radiometry and Photometry for the Electronics Engineer.
- #5. Television Station Applications for the J16 Photometer.
- #6. Practical Lighting Measurements with the Tektronix J16.
- #7. TV Picture Monitor Color Temperature Adjustment Using the Tektronix J16.
- #10. Laser Measurements with the Tektronix J16.
- 30T1.1. Photographic Exposure Measurements with the Tektronix J16.

# OPERATING INFORMATION

## Functions of Controls and Connectors

All controls required for the operation of the J16, with the exception of the READOUT switch (located on each probe), are located on the front panel of the instrument. The external dc input connector (EXT DC) is on the rear of the Battery Pack. To make full use of the capabilities of this instrument, the operator should be familiar with the function and use of each control and connector.

### FOOT CANDLES Indicator

Indicates that an illuminance probe is installed and measurements are being made in foot-candle units.

### FOOT LAMBERTS Indicator

Indicates that a luminance probe is installed and measurements are being made in foot-lambert units.

### $\mu$ WATTS/SQ CM Indicator

Indicates that an irradiance probe is installed and measurements are being made in  $\mu\text{W}/\text{cm}^2$  units.

### X.1, X1, X10, X100, and X1000 Sensitivity Switches

Self-canceling pushbutton switches for changing the input sensitivity. The reading must be multiplied by the indicated factor.

### ZERO Adjustment

Due to the high sensitivity of the J16 in the most sensitive range (X.1), some amount of drift may be expected in the zero point. To facilitate adjustment, the ZERO adjust is located on the front panel. No equipment (other than a small screwdriver) is required for this adjustment.

To adjust ZERO, proceed as follows:

1. The J16 should be in its case, with a probe attached.
2. Preset instrument controls as listed below:

POWER	ON
READOUT Switch	NORMAL
Range Selected	X.1

3. Completely cover the Probe Sensor to block any ambient light.
4. Adjust ZERO until the readout just turns zero and the minus sign begins to flicker on and off. Then set the adjustment very slightly away from the minus direction towards a reading of "1" or "2". If the minus sign remains on, this indicates that the adjustment is offset in the negative direction and will cause reading errors. In some cases during adjustment, the Integrator may 'hang up' in the negative direction and not respond to further adjustment. If this occurs, turn the adjustment several degrees towards a positive reading and momentarily depress the BATT CHK pushbutton. This applies a positive potential to the Integrator and permits normal adjustment.

#### BATT CHK Switch

A pushbutton switch that, when held in, causes the readout indicators to show the charge level of the internal batteries.

#### POWER Switch

A pushbutton switch that turns the instrument power on or off.

#### READOUT Switch

A slide switch located on the top side of each probe. See Fig. 3. This switch permits storing a reading when in

the HOLD position, and is useful for reading light levels when rapid, minor variations in a level cause difficulties in establishing the last digit or two. In the NORMAL position, readings change with changes in light levels.



Fig. 3. Location of READOUT switch.

## Battery Charger Connector

Allows connection of the Battery Charger to recharge the internal battery when using the Battery Pack. See Fig. 4.

## Input Power Requirements

The J16 is designed for operation from internal, rechargeable batteries for applications where portability and freedom from ac line connection are required.

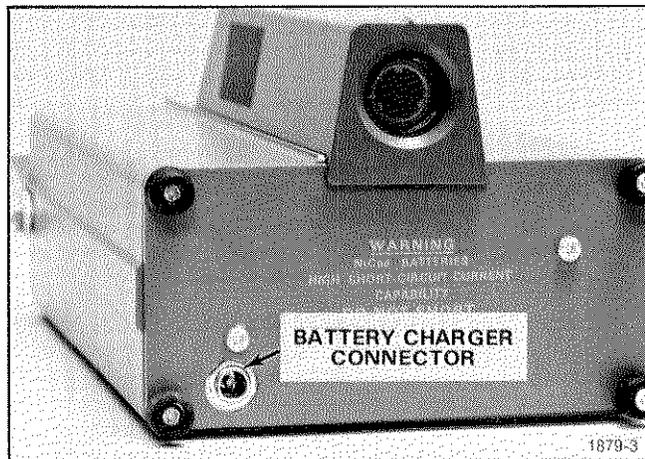


Fig. 4. Location of Battery Charger Connector.

The J16 may also be powered from an optional AC Power Supply when continuous service is desired. Power requirements with the AC Power Supply are 90 to 136 V ac, approximately 650 mA, 50 to 400 Hz. (Also available for 180 to 272 V ac operation.)

## Internal Battery Operation

When using the Battery Pack, typical operating time (from a fully charged battery, operated in an ambient temperature of +20°C to +30°C, or (+68°F to +86°F) is two hours.

The BATT CHK switch provides an indication of the charge level of the internal battery. The J16 incorporates an automatic battery protection circuit to prevent excessive discharge and the resulting battery damage if the instrument is operated after the battery charge level falls to about +5.7 volts.

The charging characteristics of the nickel-cadmium cells used in the battery vary with the temperature at which they are charged. A battery charged at about +20°C to +30°C will deliver more energy than when the same battery is charged at a higher or lower temperature.

When the battery becomes discharged to a low operating level, recharge it by connecting the instrument to the battery charger provided (via the EXT DC connector on the rear of the instrument) or to an external constant-current source of 200 mA at +9 volts. The EXT DC connector is shown in Fig. 4. Allow at least 16 hours for the battery to reach full charge.

When the instrument is stored and not used for extended periods of time, the battery cells will self-discharge. The rate at which this self-discharge occurs is dependent upon the storage temperature and humidity. If this instrument is to be stored for extended periods, it is recommended that the battery be run through a full charge cycle every two weeks. For the longest operating life of the battery, increase the charge time to at least 24 hours once a month.

### Changing Power Pack

To convert the instrument from battery power to ac power, or vice versa, remove the probe by pulling it (from the switch end) up and back from the case. Next, extract

the Battery Pack or AC Power Supply by removing the four corner screws on the instrument rear panel and sliding the supply out the back of the instrument. See Fig. 5. Replace with the desired unit by reversing the above procedure.

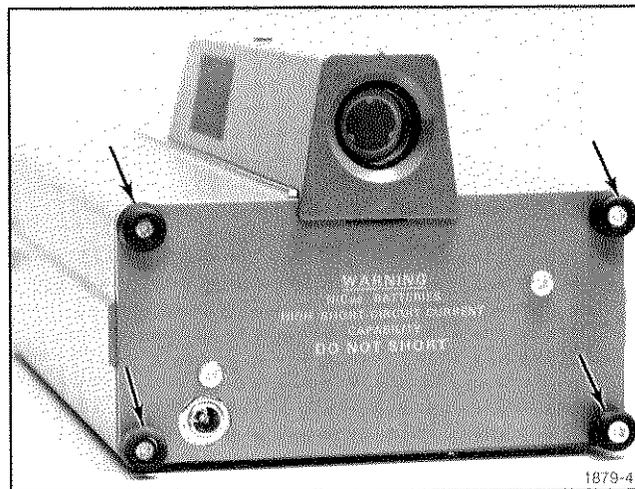


Fig. 5. Location of mounting screws for the Battery Pack or the AC Power Supply.

# FIRST-TIME OPERATION

This procedure is intended to aid the user in getting further acquainted with the J16, and also serves as a quick check on operation of the instrument.

With a probe attached to the instrument, preset controls as follows:

READOUT (on probe)	NORMAL
Range	X10
POWER	ON (For instruments equipped with an AC Power Supply, connect to a suitable ac line source.)

With the switches set as above, 3 or 4 digits should now be displayed on the readout. The first operation before using the instrument should be a check of the battery charge level if the instrument is powered by a Battery Pack.

## Battery Check

To check the charge level of the internal battery, press (and hold down) the BATT CHK pushbutton. Mentally position the decimal point between the two digits. A

reading of 6.5 volts or less indicates that the battery requires charging before attempting further use of the instrument.

## Reading Light Levels

After releasing the BATT CHK pushbutton, all digits may be rapidly blinking on and off, depending on the type of probe in use and intensity of the ambient light. If so, this indicates that the Range is set to provide more sensitivity than can be used with this lighting. Change the range to X100, and if all digits still blink, change to X1000.

If the digits were not blinking at the start, change the range to a higher sensitivity (X1 or X.1). Blinking will probably have started at one of these settings. If not, aim the probe sensor (at the rear of the instrument) towards a light source, such as a lamp or sunlight. Select the most sensitive range that can be used without having all digits blink.

Changing of the last digit by two or three numbers is a normal condition, caused by minor fluctuations in light levels. To obtain a stable display, aim the probe sensor towards the desired light source and then set the

READOUT switch (on probe) to HOLD. This will provide a steady, flicker-free display. Before new level readings may be taken, the READOUT switch must be returned to NORMAL.

## Probes

The probes, with their corresponding units of measure, presently available for use with the J16 are:

ILLUMINANCE PROBES (J6501 & J6511)—foot candles

IRRADIANCE PROBES (J6502 & J6512)— $\mu\text{W}/\text{cm}^2$

LUMINANCE PROBES (J6503 & J6523)—foot lamberts

UNCORRECTED PROBES (J6504 & J6514)—relative reading only

LED TEST PROBE (J6505)—foot candles (convertible to millicandelas at known measuring distances)

The correct readout units and decimal point are automatically indicated by coding circuitry built into each probe. Each probe is calibrated independently of the J16, permitting the probes to be interchanged without recalibration of either unit. The probes can be either mounted on the Photometer cabinet, a tripod, or used with the extension cable available as an optional accessory.

The illuminance and irradiance probes are used to measure the intensity of light falling upon a surface by

aiming the probe window towards the light source. The luminance probes are used for measurements of the intensity of light emitted or reflected from a surface, such as a television screen, desk or bench top. The surface must entirely fill the luminance probe's field of view for an accurate reading.

The illuminance and luminance probes each have a photodiode sensor with a filter to match its response to that of the C.I.E. Photopic Curve. In addition, the luminance probes restrict the field of view to either eight degrees or one degree, depending on the probe selected.

The irradiance probes have a filter to correct the photodiode sensor to have nearly equal response to all wave-lengths of light in the visible and near-infrared spectrum.

The uncorrected probes can be used without filters (for maximum sensitivity) or with special filters to meet individual needs.

The bottom of all probes and the J16 case have a standard 1/4-20 mounting socket for use on optical benches or tripods.

To correctly use the luminance probes, the surface under test must entirely fill the field of view of the sensor and should be uniformly illuminated. Therefore, the smaller the surface under test, the closer it must be to the probe window for a correct reading. The other types of probes are not restricted by distance for an accurate reading, excepting the LED Test Probe (J6505). This probe is provided with an adapter and spacers to fit common sizes of LED's (0.080-inch, 0.125-inch, and 0.200-inch in diameter). Other size LED's may be tested by drilling out a smaller adapter to fit.

#### NOTE

*Errors may occur, and should be considered, when measuring either monochromatic or narrow band light sources at extreme photometric wave-lengths. This is due to the inability to exactly match the probe sensor to the C.I.E. response curve.*

### Applications

The J16 is ideal for many areas of application, such as:

Lighting—Measurements of lamps, lighting fixtures, street lighting, and light levels of work areas.

Automotive—Measurement and distribution of headlamp brightness.

Television—Measurement of picture tube brightness and uniformity, set-up of color TV monitors, and studio lighting.

Electronics—Measurement of light-emitting diodes and electro-luminescent panels.

Photography—Measurement for standardization of light sources used for printing and film exposure.

Processing—Measurements of light sources such as xenon and mercury-vapor lamps used in photoresist processes.

Lasers—Measurement of output power and stability for low-power continuous-wave lasers operating in the 450 to 1000 nanometer range. Also usable for measuring average power of pulsed lasers if the repetition rate is greater than 30 Hz. Use neutral density filters if the peak power levels exceed 2 mW.

# MAINTENANCE

## Introduction

This section of the manual contains information for use in preventive maintenance, corrective maintenance, and replacement parts ordering for the J16.

Preventive maintenance consists of cleaning, visual inspection, and correction of obvious abnormalities. When performed on a regular basis, preventive maintenance, may prevent instrument breakdown and improves instrument reliability. The severity of environment to which the J16 is subjected will determine the frequency of maintenance required. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

## Disassembly Instructions

To gain access to the interior of the instrument, remove the probe by pulling it (from the switch end) up and back from the case. Next, extract the Battery Pack or AC Power Supply by removing the four corner screws on the instrument rear panel and sliding the supply out the back of the instrument. See Fig. 5.

Access to the internal circuit boards is gained by removing the four corner screws on the front panel and gently sliding the assembly out the front of the case. Remove the interconnecting cables from their connections on the DVM board to free the instrument from the case. Take care in removing and replacing the miniature coaxial connectors. The center conductor is easily bent, and may either short out or fail to make contact. If a center conductor becomes bent, it can be straightened with the aid of a pair of long-nose pliers. Fig. 6 shows the color-code for the connecting cable.

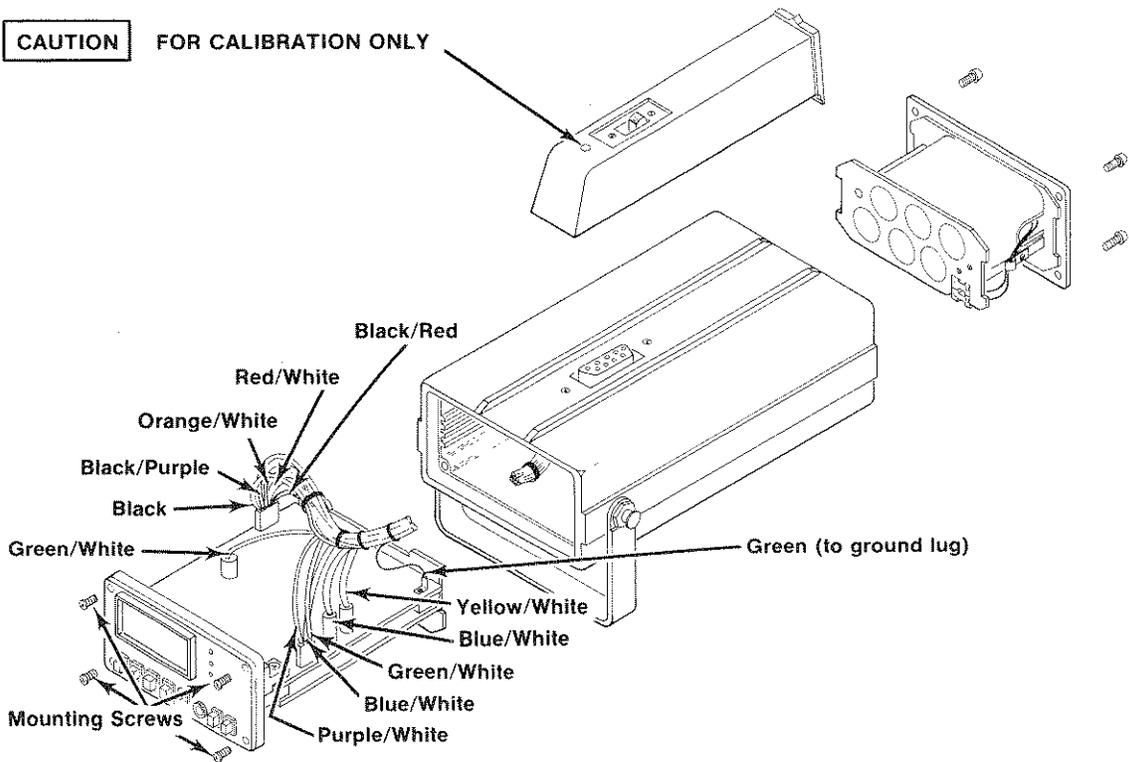
## Cleaning

Dirt on the probe window will cause inaccurate readings; therefore, the probe window should be kept clean at all times. A lens tissue is useful for wiping the surface of the window.

Loose dust accumulated on the outside of the J16 can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

**CAUTION**

**FOR CALIBRATION ONLY**



1879-5

Fig. 6. Disassembly and color-code of interconnecting cable.

## CAUTION

*Avoid the use of chemical cleaning agents that might damage the plastics used in this instrument. Avoid chemicals which contain acetones, methylene chloride, or trichloroethane.*

The external case provides protection against dust in the interior of the instrument. It should be only occasionally necessary to clean the interior. The recommended way to clean the interior is to blow off the accumulated dust with dry, low-velocity air. A soft-bristle brush or a cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate circuit components.

### Visual Inspection

The J16 should be inspected occasionally for such defects as broken connectors, improperly-seated semiconductors, damaged circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is apparent; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of the overheating be corrected to prevent recurrence of the damage.

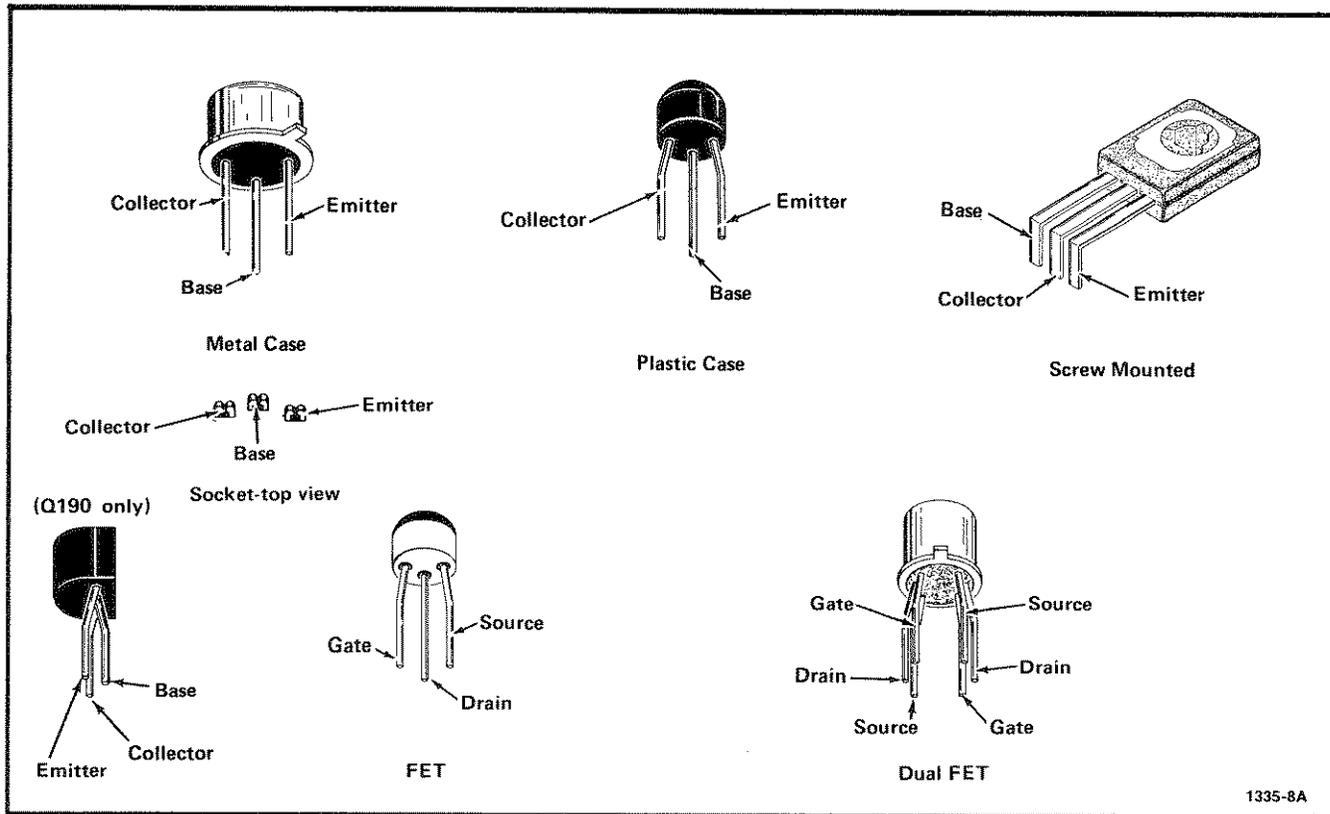
### Semiconductor Checks

Periodically checking the semiconductors used in the J16 is not recommended. The best check of semiconductor performance is actual operation of the instrument. If it is desired to check the performance of a semiconductor outside the instrument, a dynamic checker (such as the Tektronix Type 576 Transistor Curve Tracer) is recommended. Lead configuration of the semiconductors used in the J16 are shown in Figs. 7 and 8.

An extracting tool should be used to remove the 8-, 14-, and 16-pin flat integrated circuits to prevent damage to the pins. If an extracting tool is not available when removing an integrated circuit, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as the pins may be damaged. Be sure to key the semiconductor's index with that of the socket. Failure to do so may result in damaged components.

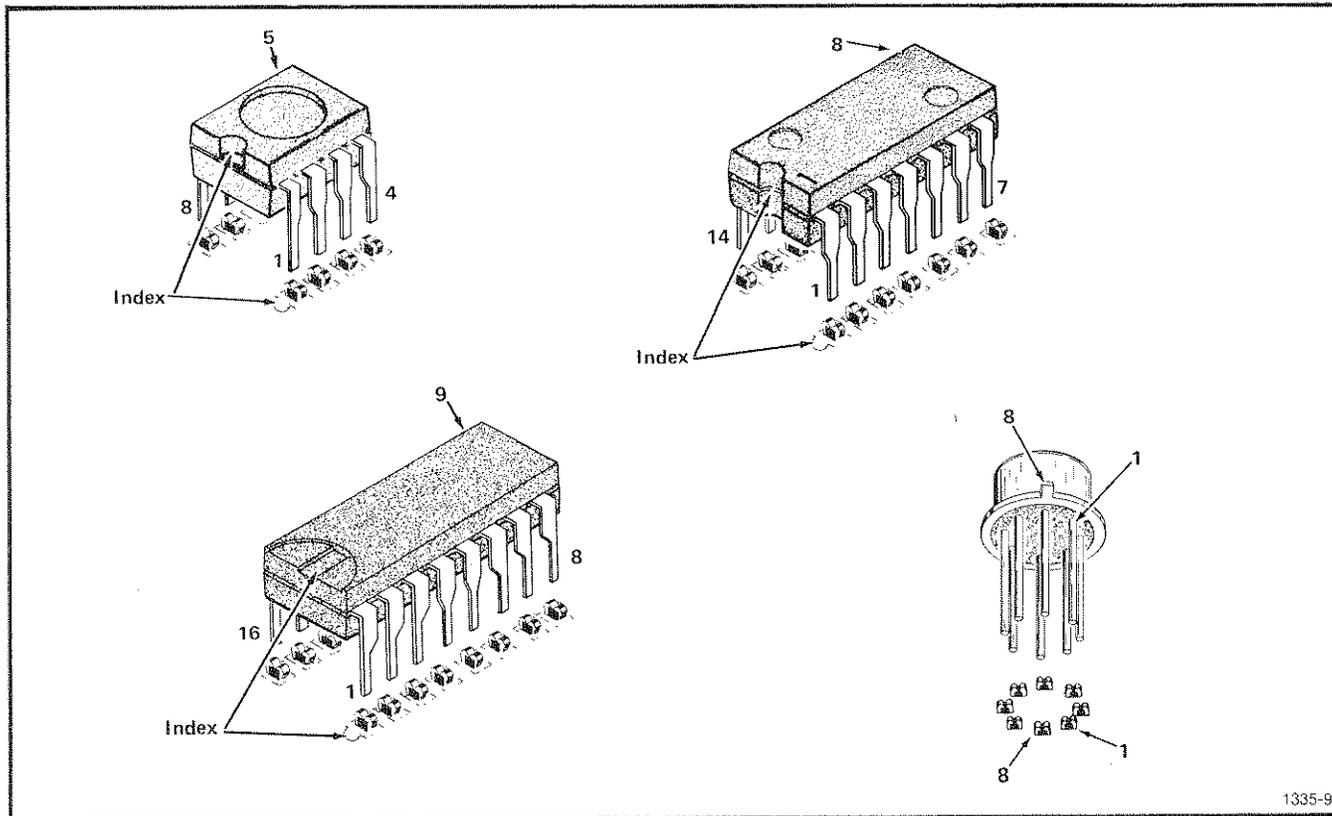
### Recalibration

The silicon photodiodes, glass correction filters, and solid-state circuitry of the J16 result in excellent long-term stability. However, rechecking the calibration on an annual or semiannual basis may be desirable to some users. In addition, replacement of components may necessitate recalibration of the affected circuits. The



1335-8A

Fig. 7. Electrode configuration for semiconductors used in this instrument.



1335-9

Fig. 8. Electrode configuration for integrated circuits used in this instrument.

calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed and/or corrected by recalibration.

## Troubleshooting

The following information is provided to facilitate troubleshooting the J16. Information contained in other parts of this manual should be used along with the following information to aid in locating the defective component. An understanding of circuit operation as given in the Circuit Description portion of this manual is very helpful in locating troubles.

**Diagrams.** Complete circuit diagrams are located in the rear of this manual. Block diagrams may be found in the Circuit Description section. The component number and electrical value of each component are shown on the diagrams along with pertinent voltages and waveforms. The portions of circuits mounted on circuit boards are enclosed with blue lines.

Fig. 9 shows the location of the circuit boards within this instrument, along with the board assembly numbers. The assembly numbers are also shown on the diagrams to

aid in locating the boards. Pictures of the circuit boards are shown to aid in cross-referencing between the diagrams and the circuit boards. Each electrical component on the boards is identified in the pictures by its circuit number, along with interconnecting leads and/or connectors.

**Component Color Coding.** The resistors used in this instrument are either composition resistors or precision resistors. The resistance values are color-coded on the components with EIA color code (some precision resistors may have the value printed on the body). The color code is read starting with the stripe nearest the end of the resistor body. Composition resistors have four stripes that consists of two significant figures, a multiplier, and a tolerance value (see Fig. 10). Precision resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.

The capacitance values of common disc capacitors and small tubular electrolytics are marked in microfarads on the side of the component body. The dipped or molded electrolytic capacitors are color-coded in picofarads (see Fig. 10).

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot.

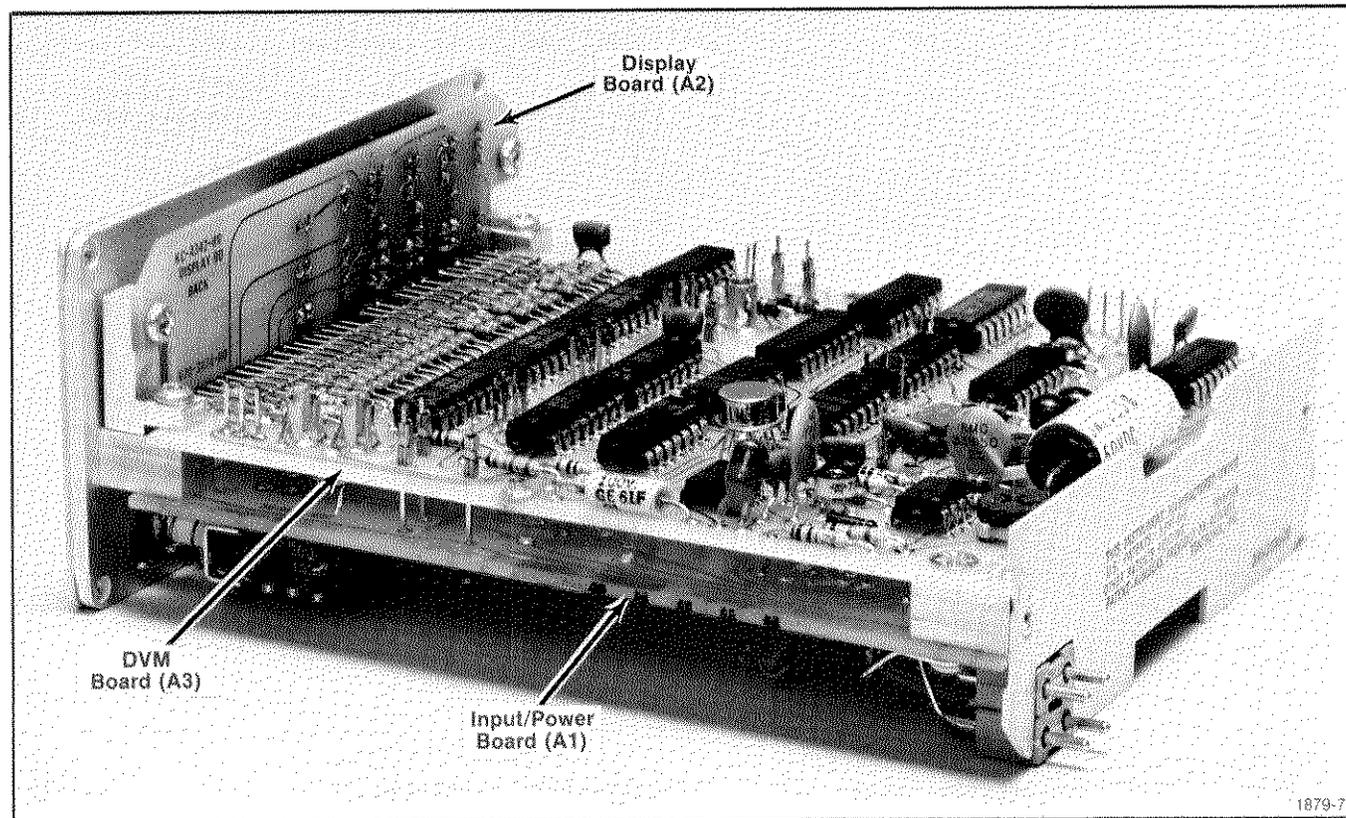
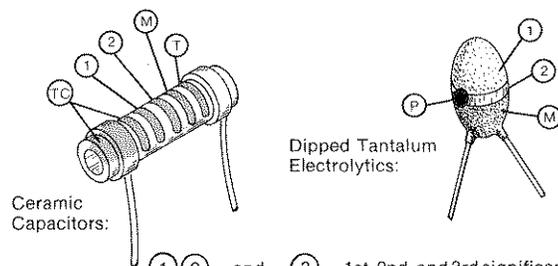
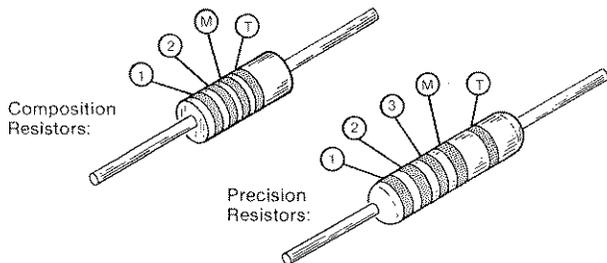


Fig. 9. Location of circuit boards in the J16.



- ① ② and ③ 1st, 2nd, and 3rd significant figures:  
 (M) —multiplier; (T) —tolerance:  
 (TC) —temperature coefficient:  
 (P) —polarity and voltage rating.

NOTE: (T) and/or (TC) color code for capacitors depends upon manufacturer and capacitor type. May be present in some cases.

Resistor and Capacitor Color Code

Color	Figures	Multiplier		Tolerance		Voltage Rating**
		Resistors	Capacitors	Resistors	Capacitors	
Silver	---	$10^{-2}$	---	$\pm 10\%$	---	---
Gold	---	$10^{-1}$	---	$\pm 5\%$	---	---
Black	0	1	1	---	$\pm 20\%$ or $2 \text{ pF}^*$	4 VDC
Brown	1	10	10	$\pm 1\%$	$\pm 1\%$ or $0.1 \text{ pF}^*$	6 VDC
Red	2	$10^2$	$10^2$	$\pm 2\%$	$\pm 2\%$	10 VDC
Orange	3	$10^3$	$10^3$	$\pm 3\%$	$\pm 3\%$	15 VDC
Yellow	4	$10^4$	$10^4$	$\pm 4\%$	+100% -0%	20 VDC
Green	5	$10^5$	$10^5$	$\pm 0.5\%$	$\pm 5\%$ or $0.5 \text{ pF}^*$	25 VDC
Blue	6	$10^6$	$10^6$	---	---	35 VDC
Violet	7	---	---	---	---	50 VDC
Gray	8	---	$10^{-2}$	---	+80% -20% or $0.25 \text{ pF}^*$	---
White	9	---	$10^{-1}$	---	$\pm 10\%$ or $1 \text{ pF}^*$	3 VDC
(none)	---	---	---	$\pm 20\%$	$\pm 10\%$ or $1 \text{ pF}^*$	---

\* For capacitance of 10 pF or less.

\*\* For dipped tantalum capacitors only.

1879-6

Fig. 10. Color-code for resistors, ceramic capacitors, and dipped tantalum electrolytic capacitors.

**Semiconductor Lead Configuration.** Fig. 7 shows the lead configurations of the transistors and FET's used in this instrument. Lead configurations and indexing of the integrated circuits used in the J16 are shown in Fig. 8.

### Obtaining Replacement Parts

**Standard Parts.** All electrical and mechanical parts replacements for the J16 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

#### NOTE

*When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect the instrument performance.*

**Special Parts.** In addition to the standard electronic components, some special components are used in the J16. These components are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

### Component Replacement

#### **WARNING**

*Disconnect the instrument from any power source before replacing any component.*

**Circuit Board Replacement.** If a circuit board is damaged beyond repair, the entire assembly including all soldered-on components can be replaced. Part numbers are given in the Electrical Parts List for the completely wired boards (assemblies).

**Semiconductor Replacement.** Semiconductors should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the calibration of this instrument. When semiconductors are replaced, check the operation of that part of the instrument which may be affected.

Replacement semiconductors should be of the original type or a direct replacement. Figs. 7 and 8 show the lead configurations of the semiconductors used in this instrument. Some plastic-case transistors have lead configurations that do not agree with those shown here. If a replacement transistor is made by a manufacturer other than that of the original, check the replacement manufacturer's basing diagram for correct basing. All transistor sockets in the J16 are wired for the basing used for metal-cased transistors.

When re-inserting an integrated circuit, align the integrated circuit's index with that of the socket. Failure to do so can result in damaged components. All integrated circuits located on the DVM board are keyed either to the rear or to the right side of the J16.

#### Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

#### Instrument Repackaging

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted. Include complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

# CALIBRATION PROCEDURE

## Introduction

To ensure instrument accuracy, check the calibration of the J16 and probes every year. Before complete calibration, thoroughly clean and inspect the instrument as outlined in the Maintenance instructions of this manual. Completion of the Calibration Procedure ensures that this instrument meets the performance limits as specified under Characteristics.

## Tektronix Field Service

Tektronix, Inc. provides complete instrument repair and recalibration at local Field Service Centers and the Factory Service Center. Because of the difficulty in obtaining the test equipment required for accurate calibration of the sensor probes for the J16, it is highly recommended that the facilities provided at the Service Centers be utilized for recalibration of the probes.

Therefore, only basic probe calibration information is given in this procedure. Contact your local Tektronix Field Office or representative for further information.

## Test Equipment Required

The following test equipment and accessories, or their equivalents, are required for complete calibration of the J16 and probes. Specifications given for the test equipment are the minimum necessary for accurate calibration. The specifications of any test equipment used must meet or exceed the listed specifications. All test equipment is assumed to be correctly calibrated and operating within the listed specifications. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

**TABLE 3**  
**Test Equipment**

Equipment	Specifications	Usage	Example
Digital Voltmeter	Accurate within 0.5%	Power Supply Check J16 Internal DVM Adjustment	Tektronix 7D13 or Tektronix DM501
Standard "D" Cell Battery		J16 Internal DVM Adjustment	EverReady No. 950
Calibrated Light Source	Accurate within 2%	Probe Calibration	
Resistor	1 M $\Omega$ , 1/2 W, 1%	J16 Internal DVM Adjustment	

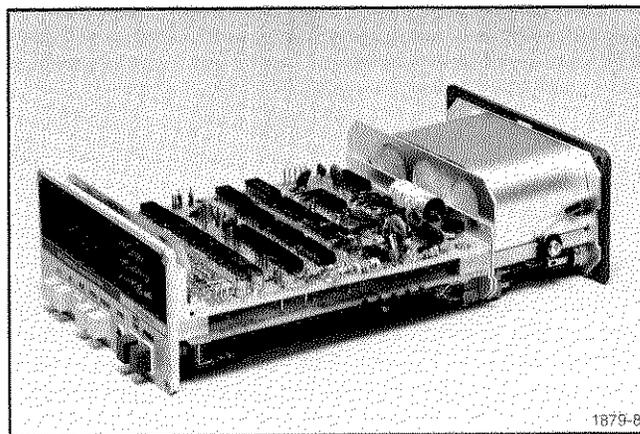
### Preliminary Procedure

1. If the J16 is battery powered, check the battery charge level; use a fully charged Battery Pack or an AC Power Supply when calibrating the J16.

2. Disassemble the instrument as outlined in the Maintenance instructions.

3. Connect the fully-charged Battery Pack or the AC Power Supply to the internal circuit boards. See Fig. 11.

4. Disconnect the probe socket from the instrument case by removing the screws on either side of the socket.



**Fig. 11. Preliminary calibration set-up for checking J16 Power Supply and adjusting Internal DVM.**

5. Connect the socket cable to the DVM board as shown in Fig. 6.

6. Connect a shorting strap between pins 8 and 15 of the probe socket. See Fig. 14.

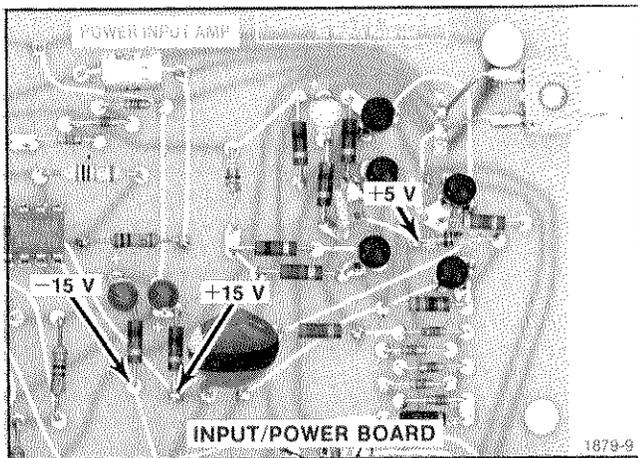


Fig. 12. Location of Power Supply test points.

7. Set the instrument controls as given under Preliminary Control Settings. Allow at least one minute of warmup before proceeding.

### Preliminary Control Settings

Preset the instrument controls to the settings listed below before starting the calibration procedure.

POWER	ON
BATT CHK	Disengaged
READOUT	NORMAL
Range Selected	X1

### PROCEDURE

#### 1. Check Power Supply DC Levels

a. Preset instrument controls as listed under Preliminary Control Settings.

b. Allow at least one minute of warmup before proceeding.

c. Using the external Digital Voltmeter, measure the dc level of each power supply listed in Table 4. Observe proper meter polarity. See Fig. 12 for test point locations.

**TABLE 4**  
**Power Supply Accuracy**

Supply	Measurement
+5 volts	+5 volts, $\pm 0.25$ volt
+15 volts	+15 volts, $\pm 1$ volt
-15 volts	-15 volts, $\pm 1$ volt

## 2. Adjust ZERO

a. Preset instrument controls as listed in Preliminary Control Settings except as follows:

Range Selected—X.1

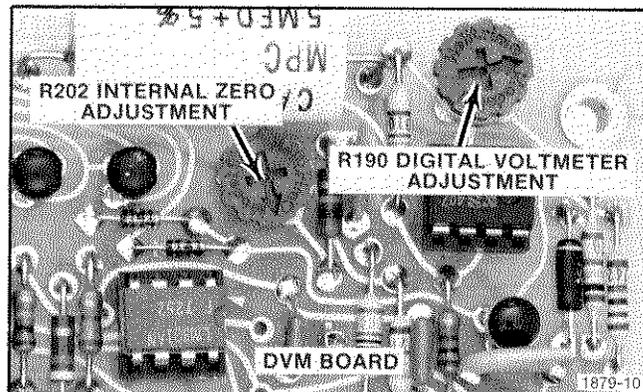
b. Adjust the front-panel ZERO (R166) until the readout numerals just turn zero and the minus sign just flickers off. If the minus sign remains on, or flickers on and off, this indicates that the adjustment is offset in the negative direction and will cause reading errors. Adjust very slightly towards the positive direction (a reading which flickers between zero and "1" or "2").

## 3. Adjust Internal Zero

a. Change the sensitivity range to X1000.

b. Adjust Internal Zero (R202) in the same manner as Step 2 (b). The location of R202 is shown in Fig. 13.

c. Change the sensitivity range back to X.1 and repeat Step 2.



**Fig. 13.** Location of Internal Zero and Digital Voltmeter adjustments.

#### 4. Set Internal DVM of J16

a. Preset instrument controls to the same as in Step 3.

b. Attach a standard "D" cell through a 1 megohm resistor to pins 1 and 2 of the probe socket as shown in Fig. 14. The shorting strap should still be connected between pins 8 and 15 of the socket. Press the X10 input sensitivity switch pushbutton.

c. Observing proper meter polarity, monitor the voltage from the "D" cell between pin 2 and pins 8 and 15 of the probe socket.

d. Adjust R190 until the J16 readout displays a reading which matches the reading on the external Digital Voltmeter. See Fig. 13 for location of R190.

e. Remove the "D" cell, Digital Voltmeter connections, and the shorting strap. Reconnect the probe socket to the case and reassemble the instrument.

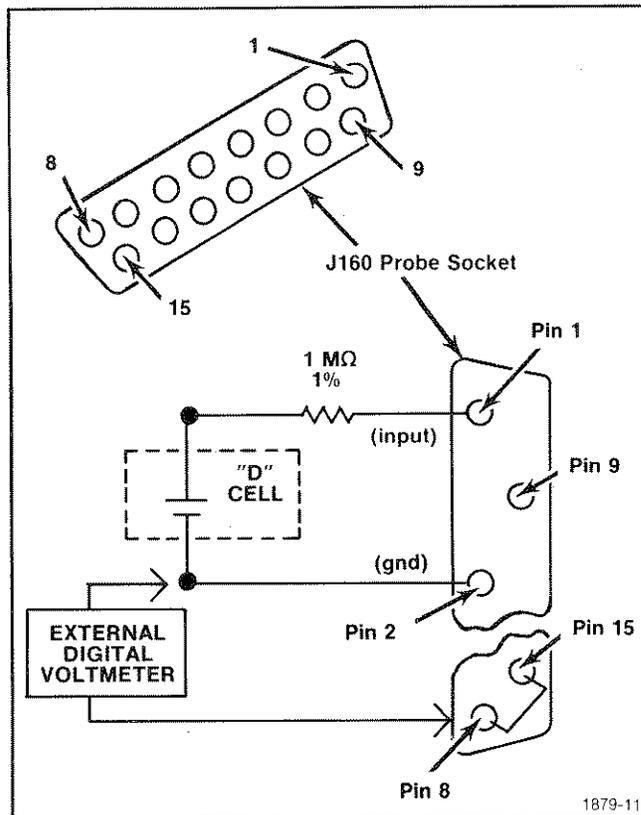


Fig. 14. Proper connection of "D" cell, resistor, and external Digital Voltmeter to J16.

## 5. Calibrate Probe Gain

a. If a standard calibrated light source is available, adjust the Probe Gain resistance (R310) for the correct reading of light level. R310 is located on top of the probe body.

### NOTE

*Do not calibrate the probe gain until recalibration of the J16 has been completed, as this can result in*

*inaccurate measurements. Do not adjust R310 without the use of a standard calibrated light source.*

Contact your local Tektronix Field Office or representative for information concerning services available in repair and recalibration through the local Tektronix Field Service Centers and the Factory Service Center.

# CIRCUIT DESCRIPTION

This section of the manual contains a description of the circuitry in the J16. An understanding of circuit operation is essential when troubleshooting the instrument. Much of the following description can be followed using the overall block diagram in the rear of this manual. Where more detail is desired, refer to the detailed circuit schematics, also in the rear of the manual.

In addition to the overall block diagram, simplified block diagrams are included along with the discussion of each major stage. Refer to these diagrams and the schematics throughout the following description for electrical values and relationships.

## Circuit Operation

In this section, circuitry commonly used by Tektronix or by the electronic industry in general is only briefly explained. The theory of operation for circuits unique to this instrument is described in more detail. If more information is desired on the commonly used circuits, refer to the following textbooks:

Phillip Cutler, "Semiconductor Circuit Analysis", McGraw-Hill, New York, 1964

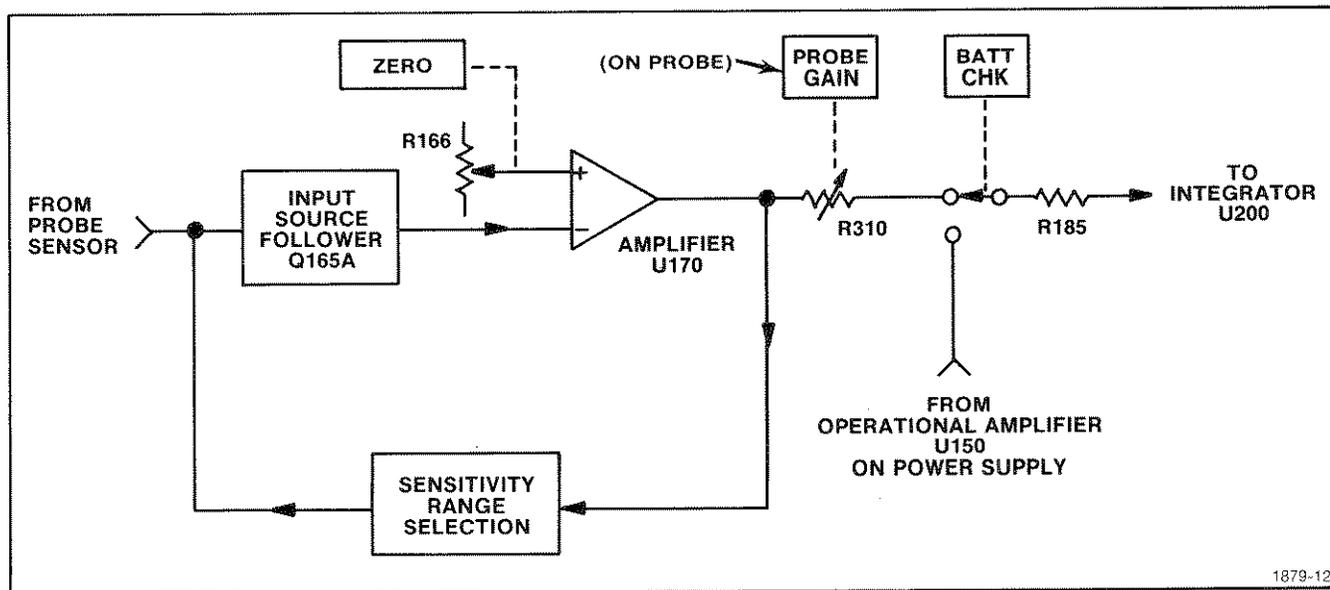
Lloyd P. Hunter (Ed.), "Handbook of Semiconductor Electronics", second edition, McGraw-Hill, New York, 1962

Jacob Millman and Herbert Taub, "Pulse, Digital, and Switching Waveforms", McGraw-Hill, New York, 1965

## Input Amplifier

A detailed block diagram of the input amplifier circuit is shown in Fig. 15, with a complete schematic on Diagram 2.

The photodiode Sensor in the probe (CR310) generates a current signal proportional to the intensity of applied light. Correct readout units and decimal point are automatically established by coding circuitry built into



1879-12

Fig. 15. Input Amplifier block diagram.

each probe. Changes in strap locations in the probe are coupled through the probe output connector to operate the proper unit and decimal point location.

Signals from the photodiode in the probe are coupled through the Input Amplifier (Q165 and U170), which is a FET input operational amplifier. X.1, X1, X10, X100, and X1000 Sensitivity Switching is accomplished by changing the feedback around the operational amplifier. ZERO is set by varying the drive to the positive side of the amplifier.

The output signal from the amplifier is resistively coupled to the Integrator (U200 and C200) through Probe Gain adjustment R310. At the input to the Integrator, BATT CHK switch S100A determines whether the battery charge-level signal (from U150) or the probe Sensor signal will be applied to the Integrator.

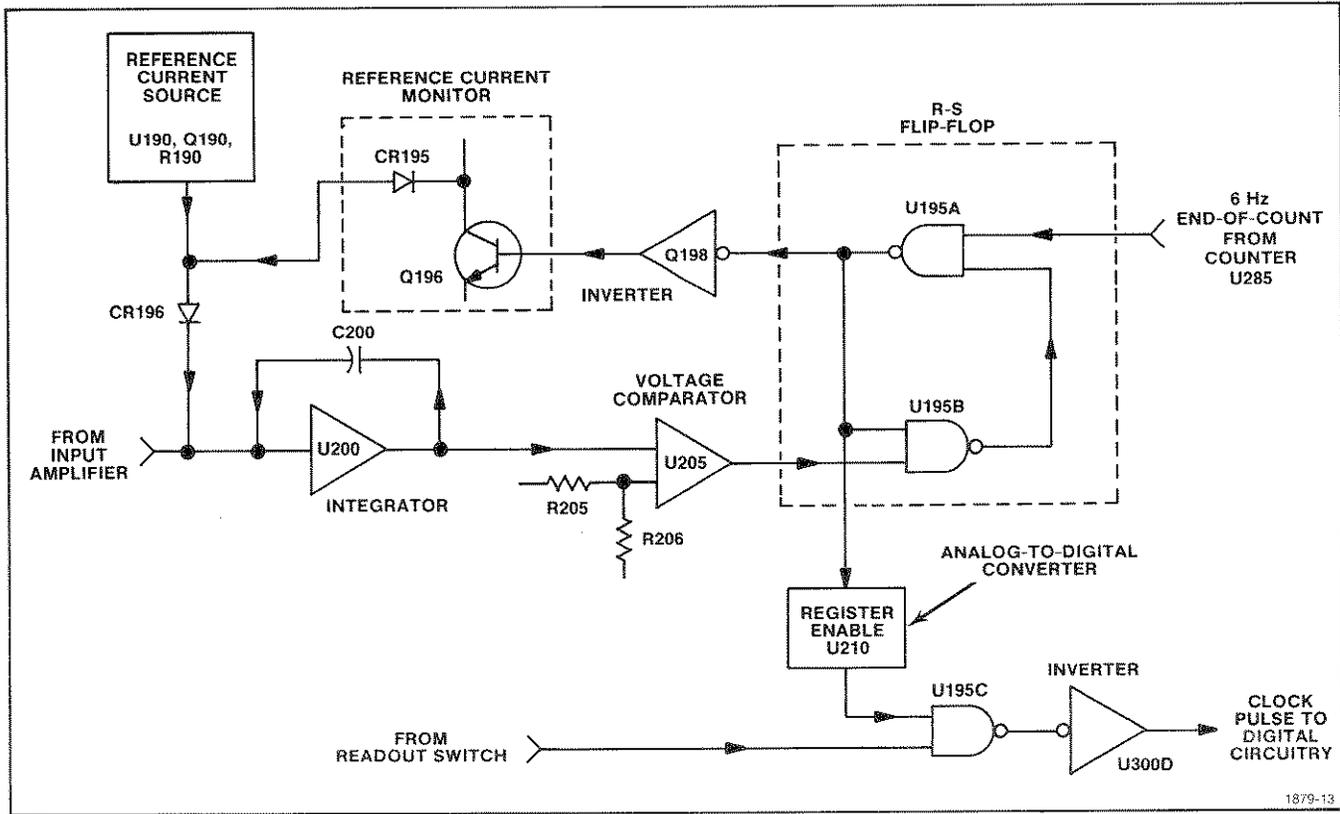
### Digital Voltmeter Circuitry

The Digital Voltmeter of the J16 includes counter circuits, analog processing/converter circuits, and the digital readout circuits. A block diagram of the analog processing/converter circuits is shown in Fig. 16, with a complete schematic on Diagram 2. A block diagram of the counters and digital readout circuits is given in Fig. 17, with the complete schematic on Diagram 3.

**Counter Circuitry.** The 36 kHz Oscillator (U220) supplies the continuous clocking pulses for the first stage of the Counter. The first, second, and third stage counters (U225, U245, and U265 respectively) are binary-coded decimal decade counters. Each supplies a count to the data (D) inputs of the appropriate Readout Register and to the following Counter stage. The fourth stage of Counters (U285) supplies a count to the Readout Register stages, the Over-Range Register (U290 and U295A), and the R-S Flip-Flop (U195A and U195B).

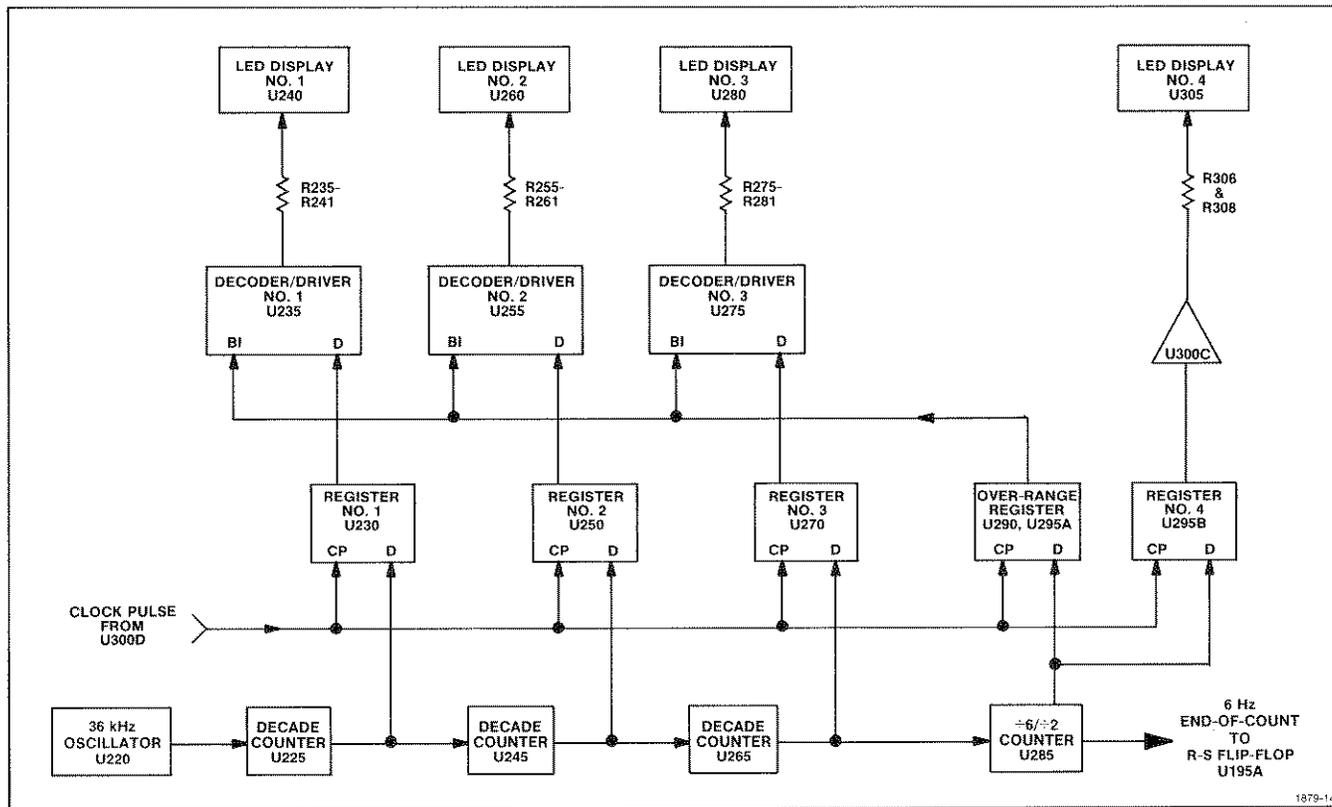
**Analog Processing/Converter Circuitry.** The signal current from the Input Amplifier is converted to a positive-going ramp by the Integrator. The Integrator will charge positive until the Counters reach full count.

When Counter U285 reaches full count, it produces an end-of-count negative spike, with a 6 Hz repetition rate, which is coupled to an input of the R-S Flip-Flop (pin 5 of U195A). The output of the flip-flop is inverted by Q198 and the resulting signal turns Q195 and CR195 off. This allows the reference current (developed by U190 and Q190) to discharge the Integrator. The Integrator discharges until the negative-going output ramp reaches approximately  $-10$  volts. The Integrator is then ready to charge positively once again with the signal from the Input Amplifier. When the Integrator reaches the null level of  $-10$  volts, Voltage Comparator U205 produces a positive spike, which is coupled to the other input of the R-S Flip-Flop.



1879-13

Fig. 16. Analog Processing/Converter circuitry block diagram.



1879-14

Fig. 17. Digital Readout circuitry block diagram.

The output of U195B in the R-S Flip-Flop remains high, (after the positive-spike input from the Comparator, through the operation of NAND gate U195A) until the other input of the R-S Flip-Flop receives an end-of-count spike from U285.

The positive-going signal from the output of U195A triggers Register Enable one-shot multivibrator U210, resulting in a positive spike to NAND gate U195C. The second input to U195C is from the READOUT switch on the probe. The READOUT switch (when engaged) thus over-rides the Readout Register's clock pulse and causes the displayed reading to be stored (held).

With the READOUT switch not engaged, the output of the Register Enable (coupled through U195C) supplies a negative spike to the inverter U300D. The positive, short-duration pulse from the inverter becomes the Clock Pulse for the Readout Registers and the Over-Range Register.

**Digital Readout Circuitry.** Readout Registers U230, U250, and U270 are four-bit bistable latches that temporarily store the counts present at their data (D) inputs. The count at the D input is transferred to the Q output when the Clock Pulse is present (high), and the Q output will follow the data input as long as the clock remains high. When the Clock Pulse is removed (goes low), the count present at the time the negative-going transition occurs is retained at the Q output until the clock again goes high.

Readout Register U295 is a positive-edge-triggered flip-flop whose output, when high, is inverted by U300C and results in a display of the numeral "1" on Readout Display diode U305.

The outputs of the first three Readout Registers (U230, U250, and U270) feed the inputs of Readout Decoder/Drivers U235, U255, and U275, which depend on the state of the inputs to drive the Readout Display light-emitting diodes U240, U260, and U280 respectively.

The positive pulse from the analog processing/converter circuitry is also coupled to the clock input of the Over-Range Register (U295A). This positive-edge-triggered flip-flop receives its data input from Counter U285, with necessary input gating provided by inverters U290A and U290B and NAND gate U290C. The output of the Over-Range Register is gated (with a six-hertz signal from the divide-by-two portion of Counter U285) in NAND gate U290D. The over-range output signal will blank display diodes U240, U260, and U280 (through the blanking input of the Readout Decoder/Drivers) when the blanking signal is in the low state. The six-hertz blanking of the Readout Display diodes gives a visual indication that the range selected in the Input Amplifier is too sensitive for the specific light intensity being measured.

## Power Supply

Fig. 18 is a block diagram of the Power Supply. The complete schematic is on Diagram 1.

The Power Supply circuit provides the +5 volt, +15 volt, and -15 volt supplies necessary for operation of this instrument.

J100, located on the inside at the rear of the instrument, provides a means of easy and rapid interchange of battery packs and the AC Power Supply. The EXT DC voltage input on the back panel of the Battery Pack provides a connection for external voltage to recharge the internal battery.

Operating power may be supplied by either the Battery Pack or the AC Power Supply. With either the AC Power Supply or a fully-charged Battery Pack, the dc level applied at the input to the Power Supply (J100, terminal B) is approximately +9 volts.

The DC-to-DC Converter-Regulator supplies +15 V and -15 V required for operation of the analog circuitry in the J16. Error amplification and control of the converter-regulator is provided by Q130 and Q120 respectively. A

Discharge Protection circuit (Q128, VR126) prevents the converter from functioning when the battery charge-level falls below about +6 volts (which would over-discharge and probably damage the battery). Regulated +5 volts to power the digital logic circuitry is provided by Q140, Q145, Q150, and VR150.

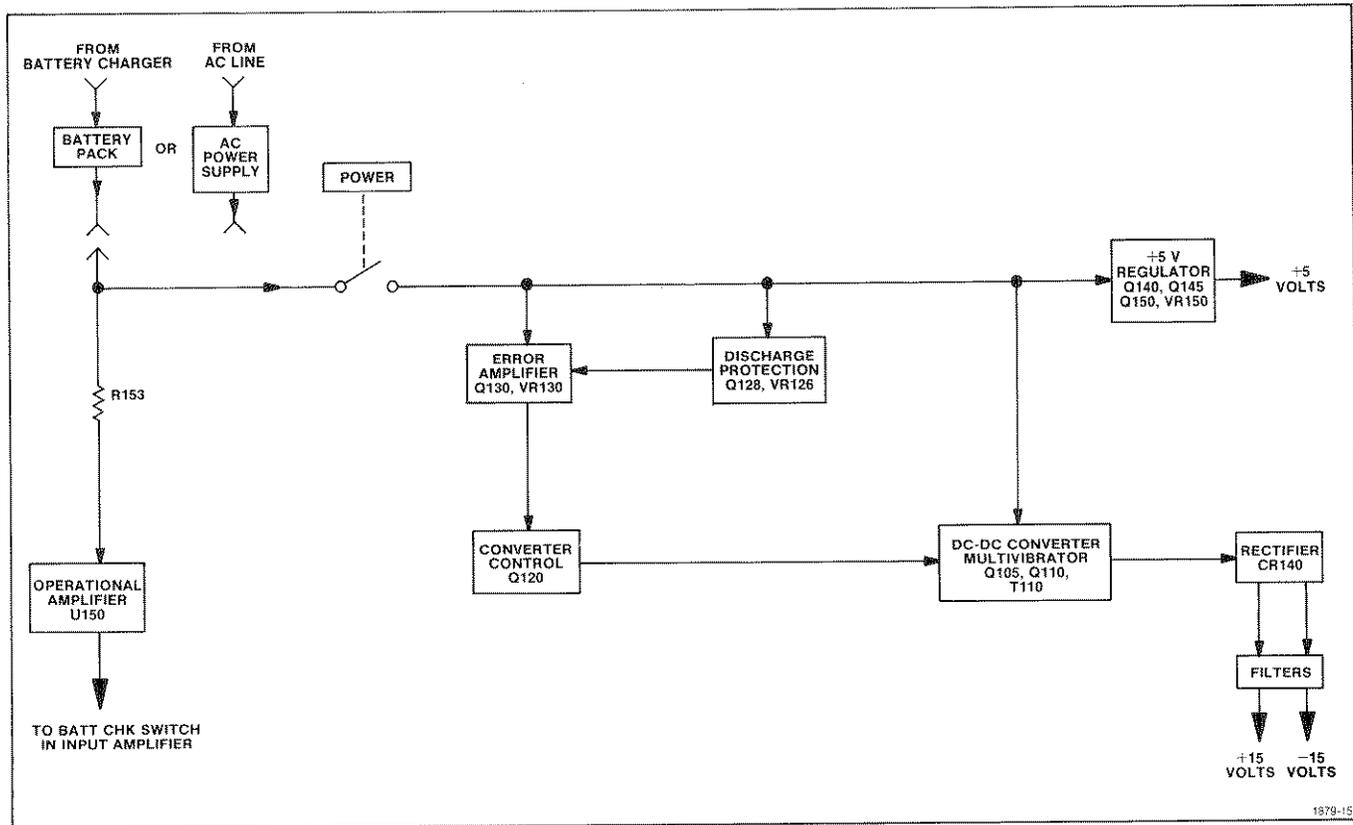
When the BATT CHK switch is held in, the battery level is coupled through Operational Amplifier U150 to the Integrator circuit to display the battery charge-level on the readout.

## AC Power Supply

The optional AC Power Supply unit is a conventional full-wave bridge supply with dc regulation and filtering of the approximately +9 volt output. Continuous operation of the J16 may be performed when using the AC Power Supply.

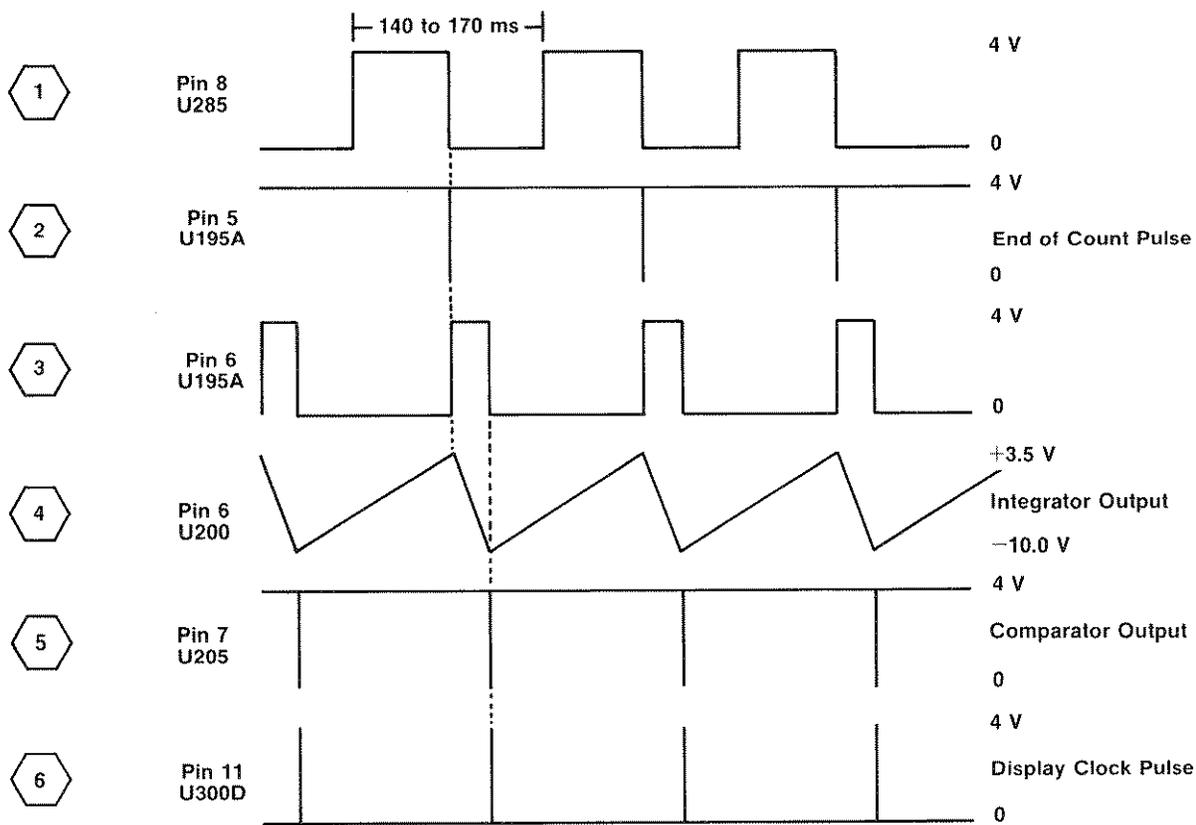
## Battery Charger

The battery charger is a conventional half-wave voltage doubler. During one half cycle, C1 is charged. During the next half cycle, the voltage across C1 is added to the winding voltage to supply charging current.



1879-15

Fig. 18. Power Supply block diagram.



Typical Waveforms for a Reading of "100" on any Scale.

1879-16

# REPLACEABLE PARTS

## PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

## FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

## ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1	2	3	4	5	Name & Description
					<i>Assembly and/or Component</i>
					<i>Attaching parts for Assembly and/or Component</i>
					---*---
					<i>Detail Part of Assembly and/or Component</i>
					<i>Attaching parts for Detail Part</i>
					---*---
					<i>Parts of Detail Part</i>
					<i>Attaching parts for Parts of Detail Part</i>
					---*---

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol ---\*--- indicates the end of attaching parts.

**Attaching parts must be purchased separately, unless otherwise specified.**

## ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICON	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OB	ORDER BY DESCRIPTION	SO	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCP	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDNT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

# CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01002	GENERAL ELECTRIC COMPANY, INDUSTRIAL AND POWER CAPACITOR PRODUCTS DEPARTMENT	JOHN STREET	HUDSON FALLS, NY 12839
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02660	BUNKER RAMO CORP., CONNECTOR DIVISION	2801 S 25TH AVENUE	BROADVIEW, IL 60153
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03888	KDI PYROFILM CORPORATION	60 S JEFFERSON ROAD	WHIPPANY, NJ 07981
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
06229	ELECTROVERT, INC.	86 HARTFORD AVENUE	MT. VERNON, NY 10553
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPARTMENT	NELA PARK	CLEVELAND, OH 44112
11237	CTS KEENE, INC.	3230 RIVERSIDE AVE.	PASO ROBLES, CA 93446
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
14552	MICRO SEMICONDUCTOR CORP.	2830 F FAIRVIEW ST.	SANTA ANA, CA 92704
16428	BELDEN CORP.	P. O. BOX 1331	RICHMOND, IN 47374
17516	MOORE, MAYNARD H., JR., INC.	430 MAIN ST.	STONEHAM, MA 02180
19209	GENERAL ELECTRIC CO., ELECTRONIC CAPACITOR AND BATTERY PRODUCTS DEPT. BATTERY PRODUCTS SEC.	P. O. BOX 114	GAINESVILLE, FL 32601
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
23050	PRODUCT COMPONENTS CORP	30 LORRAINE AVE.	MT VERNON, NY 10553
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
28520	HEYMAN MFG. CO.	147 N. MICHIGAN AVE.	KENILWORTH, NJ 07033
46384	PENN ENGINEERING AND MFG. CORP.	P O BOX 311	DOYLESTOWN, PA 18901
50522	MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS	3400 HILLVIEW AVENUE	PALO ALTO, CA 94304

## CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
53184	XCITON CORPORATION	5 HEMLOCK STREET	LATHAM, NY 12110
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
71279	CAMBRIDGE THERMIONIC CORP.	445 CONCORD AVE.	CAMBRIDGE, MA 02138
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71468	ITT CANNON ELECTRIC	666 E. DYER RD.	SANTA ANA, CA 92702
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
81312	WINCHESTER ELECTRONICS DIVISION		
82389	LITTON INDUSTRIES, INC. SWITCHCRAFT, INC.	MAIN ST. AND HILLSIDE AVE.	OAKVILLE, CT 06779
83309	ELECTRICAL SPECIALITY CO., SUBSIDIARY OF BELDEN CORP.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
83330	SMITH, HERMAN H., INC.	213 E. HARRIS AVE. SOUTH	SAN FRANCISCO, CA 94080
83385	CENTRAL SCREW CO.	812 SNEDIKER AVE.	BROOKLYN, NY 11207
86928	SEASTROM MFG. COMPANY, INC.	2530 CRESCENT DR.	BROADVIEW, IL 60153
87473	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201
90201	INSULECTRO, A DIVISION OF QUINTEC INDST. MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	343 CORAL CIRCLE	EL SEGUNDO, CA 90245
91637	DALE ELECTRONICS, INC.	3029 E. WASHINGTON STREET	
95987	WECKESSER CO., INC.	P. O. BOX 372	INDIANAPOLIS, IN 46206
98388	ROYAL INDUSTRIES, ACCURATE PRODUCTS DIV.	P. O. BOX 609	COLUMBUS, NE 68601
		4444 WEST IRVING PARK RD.	CHICAGO, IL 60641
		4370 JUTLAND DRIVE	SAN DIEGO, CA 92117

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-2268-01	B052000	B052163	CKT BOARD ASSY:POWER/INPUT AMPL	80009	670-2268-01
A1	670-2268-02	B052164		CKT BOARD ASSY:POWER/INPUT AMPL	80009	670-2268-02
A2	670-3874-00			CKT BOARD ASSY:DISPLAY	80009	670-3874-00
A3	670-3884-00			CKT BOARD ASSY:DVM	80009	670-3884-00
A4	670-2830-00			CKT BOARD ASSY:SWITCHING REGULATOR	80009	670-2830-00
BT90	146-0012-01			BATTERY, STORAGE:7.2V,1800 MAH	19209	41B002HD13
C1	290-0217-00			CAP.,FXD,ELCTLT:250UF,12V	90201	TT251U012C1D3P
C12	290-0324-00			CAP.,FXD,ELCTLT:750UF,+75-10%,40V	56289	D46454
C18	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C32	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C105	283-0067-00			CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C106	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	TDC107M020WLD
C130	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C131	290-0525-00			CAP.,FXD,ELCTLT:4.7UF,20%,50V	56289	196D475X0050KA1
C142	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	TDC107M020WLD
C143	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	TDC107M020WLD
C146	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C156	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C158	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C174	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0020HA1
C176	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C178	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-558Z5V0203Z
C180	283-0028-00			CAP.,FXD,CER DI:0.0022UF,20%,50V	56289	19C606
C182	283-0028-00			CAP.,FXD,CER DI:0.0022UF,20%,50V	56289	19C606
C200	285-0894-00			CAP.,FXD,PLSTC:5UF,5%,50V	56289	LP68A1A505J

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr	
		Eff	Dscont		Code	Mfr Part Number
C201	283-0003-00			CAP., FXD, CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C206	290-0527-00			CAP., FXD, ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C207	283-0144-00			CAP., FXD, CER DI:33PF,1%,500V	72982	801-547P2G330G
C209	283-0111-00			CAP., FXD, CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C210	283-0111-00			CAP., FXD, CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C213	283-0000-00			CAP., FXD, CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C215	283-0111-00			CAP., FXD, CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C222	285-0598-00			CAP., FXD, PLSTC:0.01UF,5%,100V	01002	61F10AC103
C224	290-0527-00			CAP., FXD, ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C225	283-0111-00			CAP., FXD, CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C226	283-0003-00			CAP., FXD, CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C265	283-0111-00			CAP., FXD, CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C266	283-0111-00			CAP., FXD, CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
CR1	152-0066-00			SEMICONV DEVICE:SILICON,400V,750MA	14433	LG4016
CR2	152-0066-00			SEMICONV DEVICE:SILICON,400V,750MA	14433	LG4016
CR12	152-0488-00			SEMICONV DEVICE:SILICON,200V,1500MA	04713	3N55 FAMILY
CR32	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR90	152-0066-01			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0066-01
CR130	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR131	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR132	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR133	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR134	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR140A	152-0333-00			SEMICONV DEVICE:SILICON,55V,200MA	07263	FDH-6012

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr	
		Eff	Dscont		Code	Mfr Part Number
CR140B	152-0333-00			SEMICON D DEVICE: SILICON, 55V, 200MA	07263	FDH-6012
CR140C	152-0333-00			SEMICON D DEVICE: SILICON, 55V, 200MA	07263	FDH-6012
CR140D	152-0333-00			SEMICON D DEVICE: SILICON, 55V, 200MA	07263	FDH-6012
CR181	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR182	152-0141-02	B052000	B052164X	SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR183	152-0141-02	B052000	B052164X	SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR184	152-0141-02	B052000	B052164X	SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR185	152-0141-02	B052000	B052164X	SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR195	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR200	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR300	150-1004-00	B052000	B082990	LAMP, LED: RED, 2.5V, 15MA	08806	SSL-12
CR300	150-1031-00	B082991		LT EMITTING DIO: RED, 650NM, 40MA MAX	53184	XC209R
CR303	150-1004-00	B052000	B082990	LAMP, LED: RED, 2.5V, 15MA	08806	SSL-12
CR303	150-1031-00	B082991		LT EMITTING DIO: RED, 650NM, 40MA MAX	53184	XC209R
CR305	150-1004-00	B052000	B082990	LAMP, LED: RED, 2.5V, 15MA	08806	SSL-12
CR305	150-1031-00	B082991		LT EMITTING DIO: RED, 650NM, 40MA MAX	53184	XC209R
F10	159-0114-00			FUSE, CARTRIDGE: 1A, 125VAC, FAST-BLOW	71400	GFA 1
F90	159-0059-00			FUSE, WIRE LEAD: 5A, FAST-BLOW	71400	GFA5
J1	134-0147-00			PLUG, TELEPHONE: MINI POWER	82389	760
J90	131-0148-00			CONNECTOR, RCPT, : FEMALE, 24 PIN	02660	26-190-24-1004
J100	131-1299-00			CONN, RCPT, ELEC: 2 CONTACT, MALE	81312	JFA 2P
J101	131-1299-00			CONN, RCPT, ELEC: 2 CONTACT, MALE	81312	JFA 2P
J160	131-0458-00			CONNECTOR, RCPT, : 15 PIN, FEMALE	71468	DA15S
J162	131-1003-00			CONN, RCPT, ELEC: CKT BD MT, 3 PRONG	80009	131-1003-00

Ckt No.	Tektronix		Serial/Model No.		Name & Description	Mfr	Mfr Part Number	
	Part No.	Part No.	Eff	Dscont		Code	Mfr	Part Number
J163	131-1003-00				CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00	
J164	131-1003-00				CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00	
L32	108-0749-00				COIL,RF:FIXED,1MH	80009	108-0749-00	
P100	131-1300-00				CONN,RCPT,ELEC:2 CONTACT,FEMALE	81312	JFA2S	
P101	131-1300-00				CONN,RCPT,ELEC:2 CONTACT,FEMALE	81312	JFA2S	
Q25	151-0136-00				TRANSISTOR:SILICON,NPN	02735	35495	
Q28	151-0134-00				TRANSISTOR:SILICON,PNP	80009	151-0134-00	
Q30	151-0364-00				TRANSISTOR:SILICON,PNP	80009	151-0364-00	
Q105	151-0260-00				TRANSISTOR:SILICON,NPN	80009	151-0260-00	
Q110	151-0260-00				TRANSISTOR:SILICON,NPN	80009	151-0260-00	
Q120	151-0342-00				TRANSISTOR:SILICON,PNP	07263	S035928	
Q128	151-0341-00				TRANSISTOR:SILICON,NPN	07263	S040065	
Q130	151-0341-00				TRANSISTOR:SILICON,NPN	07263	S040065	
Q140	151-0341-00				TRANSISTOR:SILICON,NPN	07263	S040065	
Q145	151-0341-00				TRANSISTOR:SILICON,NPN	07263	S040065	
Q150	151-0349-00				TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924	
Q151	151-0190-00			XB052164	TRANSISTOR:SILICON,NPN	07263	S032677	
Q165A,B	151-1047-00				TRANSISTOR:SILICON,JFE	80009	151-1047-00	
Q190	151-1066-00			B052000 B069999	TRANSISTOR:SILICON,FE,P-CHANNEL	80009	151-1066-00	
Q190	151-1097-00			B070000 B079999	TRANSISTOR:SILICON,FE	80009	151-1097-00	
Q190	151-0435-00			B080000	TRANSISTOR:SILICON,PNP	04713	SPS8335	
Q195	151-0341-00				TRANSISTOR:SILICON,NPN	07263	S040065	
Q198	151-0342-00				TRANSISTOR:SILICON,PNP	07263	S035928	
R13	315-0152-00				RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525	

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr	
		Eff	Dscont		Code	Mfr Part Number
R15	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R19	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R20	315-0622-00			RES., FXD, CMPSN: 6.2K OHM, 5%, 0.25W	01121	CB6225
R21	315-0132-00			RES., FXD, CMPSN: 1.3K OHM, 5%, 0.25W	01121	CB1325
R23	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R24	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R26	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R28	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W	01121	CB3325
R30	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R100	308-0710-00			RES., FXD, WW: 0.27 OHM, 10%, 1W	75042	BW20-R2700J
R105	316-0121-00			RES., FXD, CMPSN: 120 OHM, 10%, 0.25W	01121	CB1211
R110	315-0681-00			RES., FXD, CMPSN: 680 OHM, 5%, 0.25W	01121	CB6815
R120	316-0102-00			RES., FXD, CMPSN: 1K OHM, 10%, 0.25W	01121	CB1021
R126	316-0151-00			RES., FXD, CMPSN: 150 OHM, 10%, 0.25W	01121	CB1511
R127	316-0102-00			RES., FXD, CMPSN: 1K OHM, 10%, 0.25W	01121	CB1021
R130	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R131	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R132	315-0752-00			RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W	01121	CB7525
R146	316-0472-00			RES., FXD, CMPSN: 4.7K OHM, 10%, 0.25W	01121	CB4721
R150	315-0360-00			RES., FXD, CMPSN: 36 OHM, 5%, 0.25W	01121	CB3605
R151	321-0299-00	XB052164		RES., FXD, FILM: 12.7K OHM, 1%, 0.125W	91637	MFF1816G12701F
R152	321-0228-00	XB052164		RES., FXD, FILM: 2.32K OHM, 1%, 0.125W	91637	MFF1816G23200F
R153	321-0481-00			RES., FXD, FILM: 1M OHM, 1%, 0.125W	24546	NA4D1004F
R154	321-0296-00			RES., FXD, FILM: 11.8K OHM, 1%, 0.125W	91637	MFF1816G11801F
R156	316-0101-00			RES., FXD, CMPSN: 100 OHM, 10%, 0.25W	01121	CB1011
R158	316-0101-00			RES., FXD, CMPSN: 100 OHM, 10%, 0.25W	01121	CB1011
R160	321-0323-00			RES., FXD, FILM: 22.6K OHM, 1%, 0.125W	91637	MFF1816G22601F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
R162	321-0097-00		RES., FXD, FILM: 100 OHM, 1%, 0.125W	91637	MFF1816G100ROF
R164	321-0373-03		RES., FXD, FILM: 75K OHM, 0.25%, 0.125W	91637	MFF1816D75001C
R166	311-1395-00		RES., VAR, NONWIR: 5 TURN, 200 OHM, 20%	11237	VA305-6P1050
R168	321-0373-03		RES., FXD, FILM: 75K OHM, 0.25%, 0.125W	91637	MFF1816D75001C
R174	321-0289-00		RES., FXD, FILM: 10K OHM, 1%, 0.125W	91637	MFF1816G10001F
R176	321-0385-00		RES., FXD, FILM: 100K OHM, 1%, 0.125W	91637	MFF1816G10002F
R178	323-0481-07		RES., FXD, FILM: 1M OHM, 0.1%, 0.50W	75042	CECT9-1004B
R180	325-0081-00		RES., FXD, FILM: 11.17M OHM, 0.1%, 0.5W	03888	PME70-C11174B
R182	325-0122-01		RES., FXD, FILM: 100M OHM, 1%, 1W	80009	325-0122-01
R185	321-0222-00		RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R187	321-0222-00		RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R188	315-0100-00		RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R190	311-1572-00		RES., VAR, NONWIR: TRMR, 1K OHM, 0.5W	73138	91-92-0
R191	321-0275-00		RES., FXD, FILM: 7.15K OHM, 1%, 0.125W	91637	MFF1816G71500F
R193	321-0196-00		RES., FXD, FILM: 1.07K OHM, 1%, 0.125W	91637	MFF1816G10700F
R194	321-0193-00		RES., FXD, FILM: 1K OHM, 1%, 0.125W	91637	MFF1816G10000F
R195	315-0153-00		RES., FXD, CMPSN: 15K OHM, 5%, 0.25W	01121	CB1535
R196	315-0103-00		RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R197	315-0103-00		RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R198	316-0103-00		RES., FXD, CMPSN: 10K OHM, 10%, 0.25W	01121	CB1031
R200	316-0101-00		RES., FXD, CMPSN: 100 OHM, 10%, 0.25W	01121	CB1011
R201	315-0332-00		RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W	01121	CB3325
R202	311-1556-00		RES., VAR, NONWIR: 50K OHM, 20%, 0.50W	73138	91-78-0
R203	315-0475-00		RES., FXD, CMPSN: 4.7M OHM, 5%, 0.25W	01121	CB4755
R204	315-0272-00		RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W	01121	CB2725
R205	321-0260-00		RES., FXD, FILM: 4.99K OHM, 1%, 0.125W	91637	MFF1816G49900F
R206	321-0289-00		RES., FXD, FILM: 10K OHM, 1%, 0.125W	91637	MFF1816G10001F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R207	315-0106-00			RES., FXD, CMPSN: 10M OHM, 5%, 0.25W	01121	CB1065
R209	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R210	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R211	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R212	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R213	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R215	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R220	321-0232-00			RES., FXD, FILM: 2.55K OHM, 1%, 0.125W	91637	MFF1816G25500F
R222	321-0125-00			RES., FXD, FILM: 196 OHM, 1%, 0.125W	91637	MFF1816G196ROF
R235	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R236	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R237	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R238	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R239	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R240	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R241	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R255	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R256	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R257	316-0821-00			RES., FXD, CMPSN: 820 OHM, 10%, 0.25W	01121	CB8211
R258	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R259	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R260	316-0103-00			RES., FXD, CMPSN: 10K OHM, 10%, 0.25W	01121	CB1031
R261	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R275	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R276	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R277	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315

Ckt No.	Tektronix	Serial/Model No.	Name & Description	Mfr	Mfr Part Number
	Part No.	Eff		Dscont	
R278	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R279	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R280	321-0243-00		RES.,FXD,FILM:3.32K OHM,1%,0.125W	91637	MFF1816G33200F
R281	316-0102-00		RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R294	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R296	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R300	315-0301-00		RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R302	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R304	315-0301-00		RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R306	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R308	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R312	315-0162-00		RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R314	315-0162-00		RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R316	315-0162-00		RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
S100A,B	260-1431-00		SWITCH,PUSH:2 STA, NON-SHORT	80009	260-1431-00
S160	260-1432-00		SWITCH,PUSH:5 STA, INTERLOCK, NON-SHORT	80009	260-1432-00
T1	120-0834-00		XFMR,PWR,STPDN:BATTERY CHARGER	80009	120-0834-00
T10	120-0847-00		XFMR,PWR STPDN:AL POWER PACK	80009	120-0847-00
T110	120-0789-00		XFMR,PWR,STPDN:POT CORE	80009	120-0789-00
U17	156-0105-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN
U150	156-0067-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	85145
U170	156-0067-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	85145
U190	156-0067-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	85145
U195	156-0030-00		MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U200	156-0105-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U205	156-0096-00			MICROCIRCUIT,LI:VOLTAGE COMPARATOR	27014	LM311H
U210	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL,14 DIP	01295	SN74121(N OR J)
U220	156-0402-00			MICROCIRCUIT,LI:TIMER	27014	SL34829
U225	156-0079-00			MICROCIRCUIT,DI:DECADE COUNTER,TTL	80009	156-0079-00
U230	156-0040-00			MICROCIRCUIT,DI:QUAD LATCH,TTL	80009	156-0040-00
U235	156-0128-00			MICROCIRCUIT,DI:SGL BCD TO 7-SEG DCDR/DRVR	80009	156-0128-00
U240	150-1022-00			LAMP,LED,RDOUT:7 SEG NUMERIC,LH DEC ORANGE	50522	MAN72A
U245	156-0079-00			MICROCIRCUIT,DI:DECADE COUNTER,TTL	80009	156-0079-00
U250	156-0040-00			MICROCIRCUIT,DI:QUAD LATCH,TTL	80009	156-0040-00
U255	156-0128-00			MICROCIRCUIT,DI:SGL BCD TO 7-SEG DCDR/DRVR	80009	156-0128-00
U260	150-1022-00			LAMP,LED,RDOUT:7 SEG NUMERIC,LH DEC ORANGE	50522	MAN72A
U265	156-0079-00			MICROCIRCUIT,DI:DECADE COUNTER,TTL	80009	156-0079-00
U270	156-0040-00			MICROCIRCUIT,DI:QUAD LATCH,TTL	80009	156-0040-00
U275	156-0128-00			MICROCIRCUIT,DI:SGL BCD TO 7-SEG DCDR/DRVR	80009	156-0128-00
U280	150-1022-00			LAMP,LED,RDOUT:7 SEG NUMERIC,LH DEC ORANGE	50522	MAN72A
U285	156-0114-00			MICROCIRCUIT,DI:DIVIDE-BY-12,COUNTER	80009	156-0114-00
U290	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U295	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U300	156-0150-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7437N
U305	150-1022-00			LAMP,LED,RDOUT:7 SEG NUMERIC,LH DEC ORANGE	50522	MAN72A
VR14	152-0166-00			SEMICONV DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
VR126	152-0195-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
VR130	152-0236-00			SEMICONV,DEVICE:ZENER,0.4W,12.5V,4%	14552	TD333881
VR150	152-0395-00			SEMICONV DEVICE:ZENER,0.4W,4.3V,5%	14552	TD332317
VR193	152-0317-00			SEMICONV DEVICE:ZENER,0.25W,6.2V,5%	04713	SZG20012

## Symbols and Reference Designators

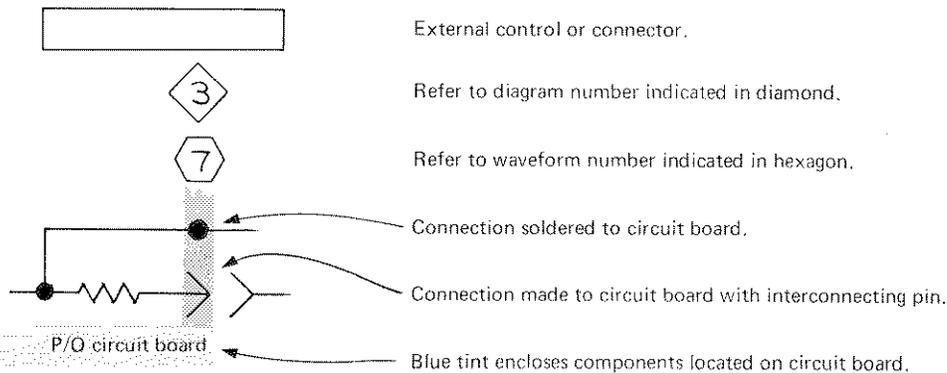
Electrical components shown on the diagrams are in the following units unless noted otherwise:

- Capacitors = Values one or greater are in picofarads (pF).  
 Values less than one are in microfarads ( $\mu$ F).  
 Resistors = Ohms ( $\Omega$ )

Symbols used on the diagrams are based on ANSI Y32.2-1970 and IEEE No. 315 March 1971.

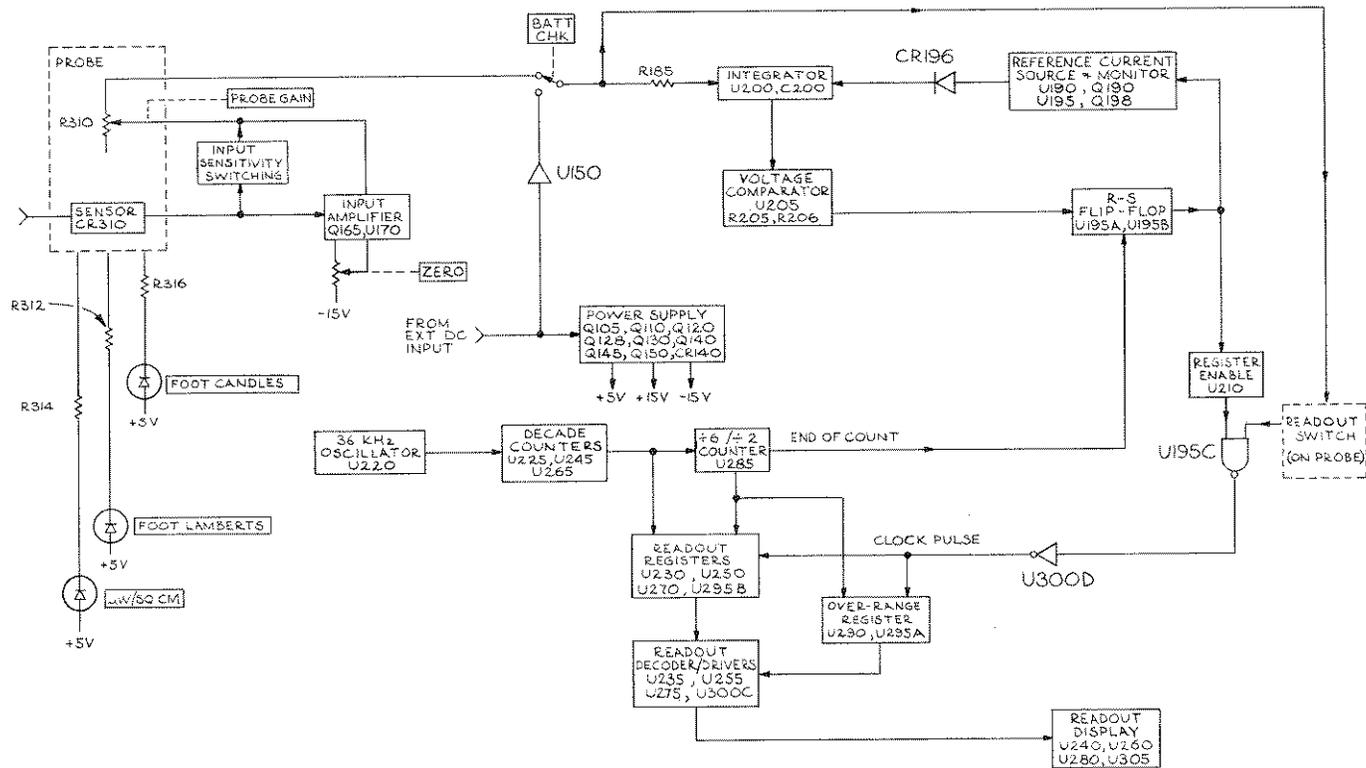
Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	P	Connector, movable portion
BT	Battery	R	Resistor, fixed or variable
C	Capacitor, fixed or variable	S	Switch
CR	Diode, signal or rectifier	T	Transformer
F	Fuse	TP	Test point
J	Connector, stationary portion	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
L	Inductor, fixed or variable	VR	Voltage regulator (zener diode, etc.)
Q	Transistor or silicon-controlled rectifier		



J16

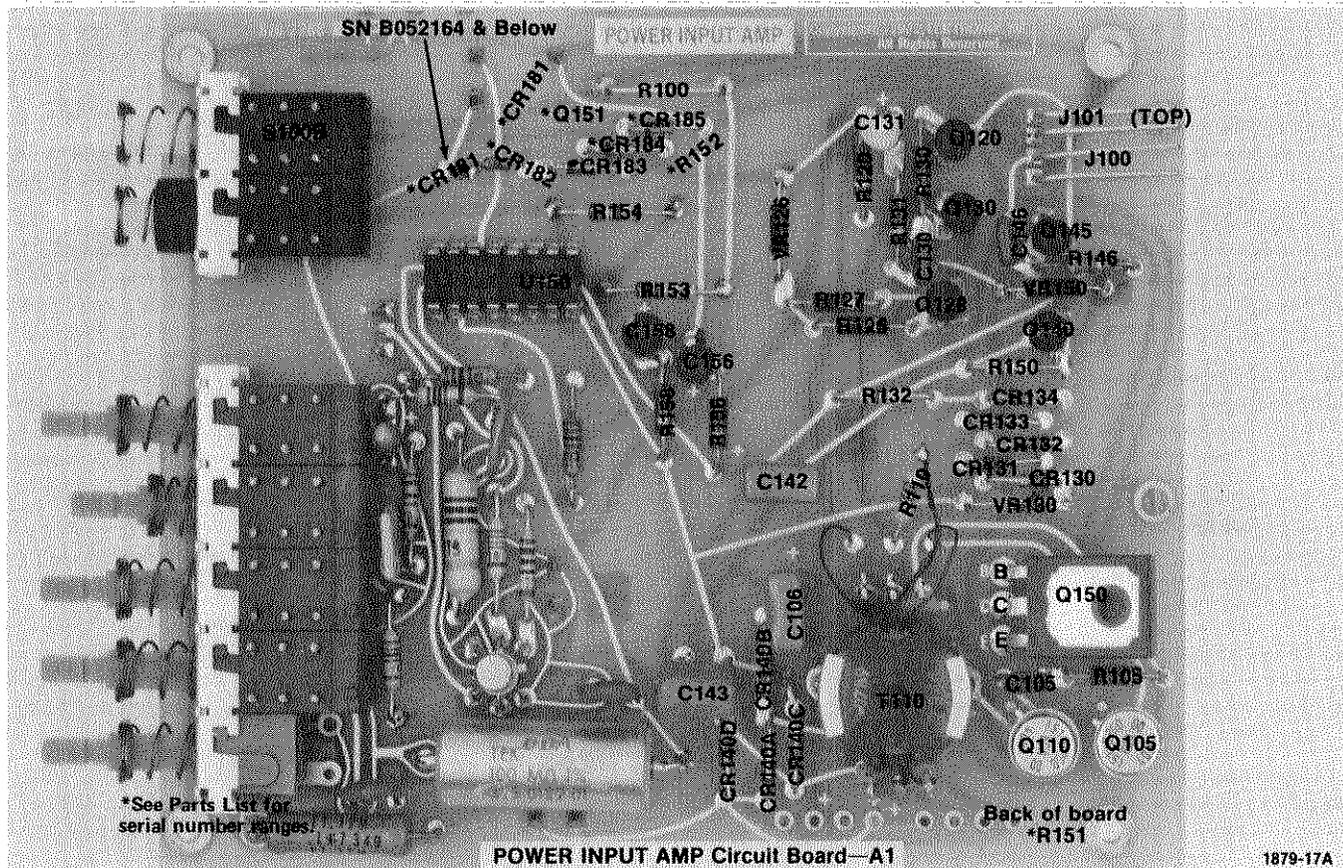
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BLOCK DIAGRAM (SN B052000 AND UP)

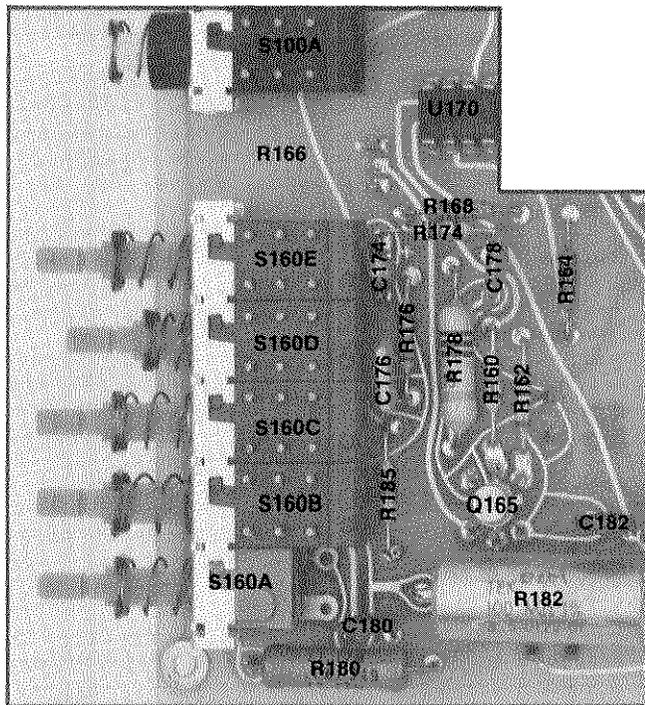
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J16 (SN B052000 & up)

53

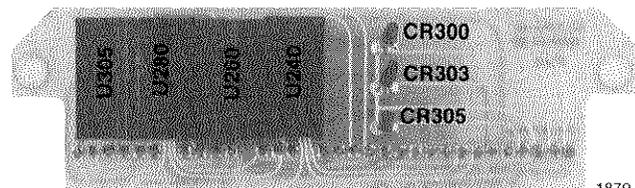






Partial POWER INPUT AMP Circuit Board—A1

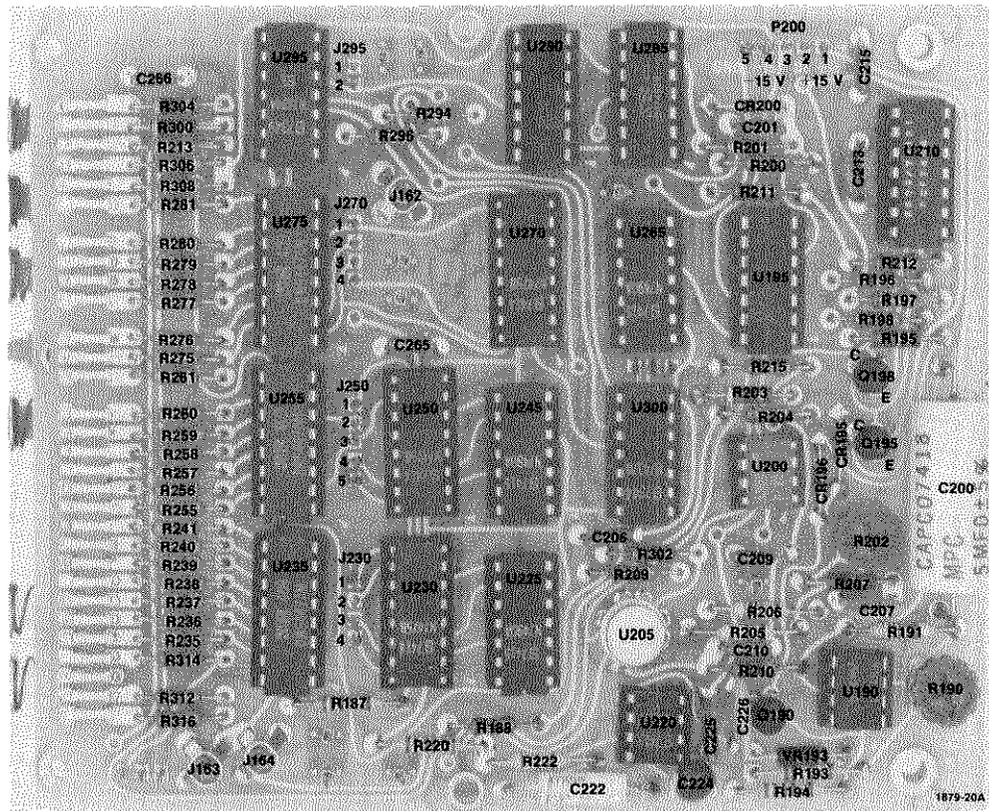
1879-19



1879-18

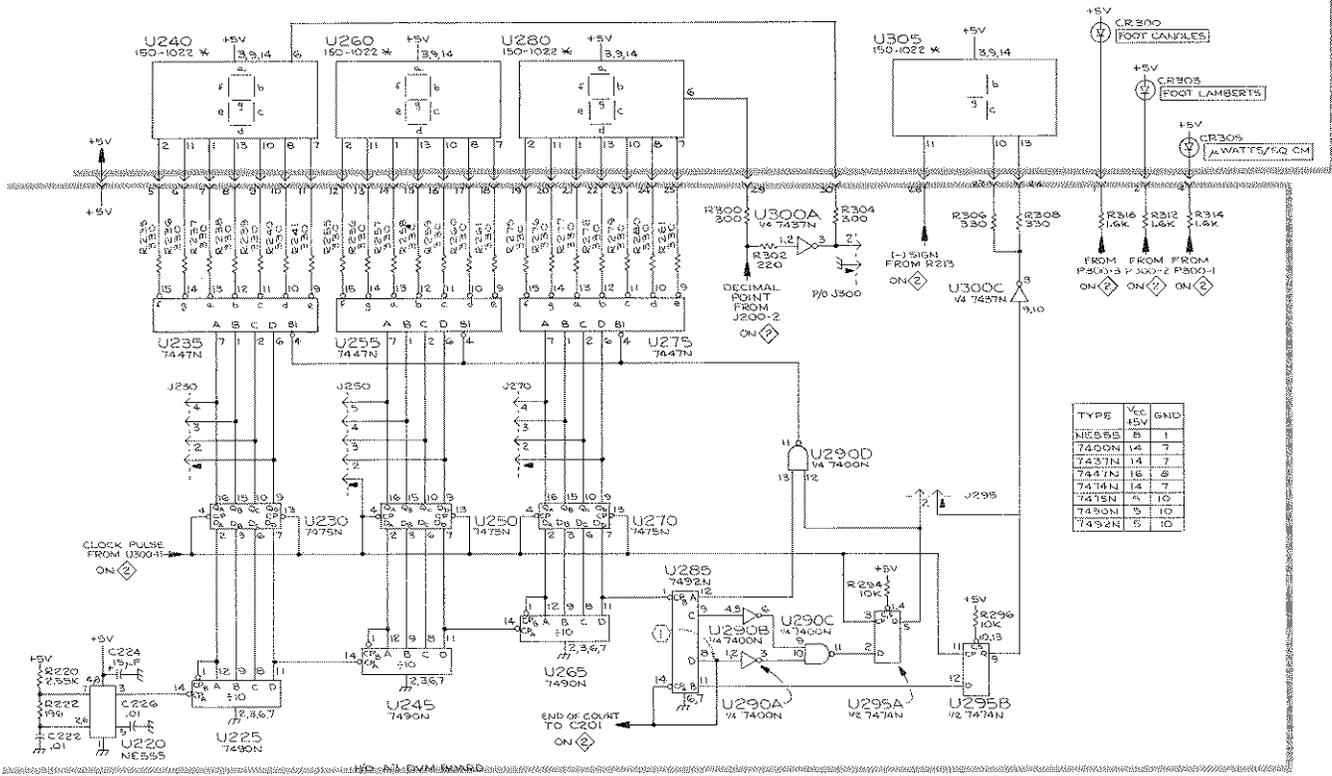
DISPLAY Circuit Board—A2





DVM Circuit Board—A3

\* DOUBLE ORIENTATION MARKS INDICATES TOP OF DEVICE.



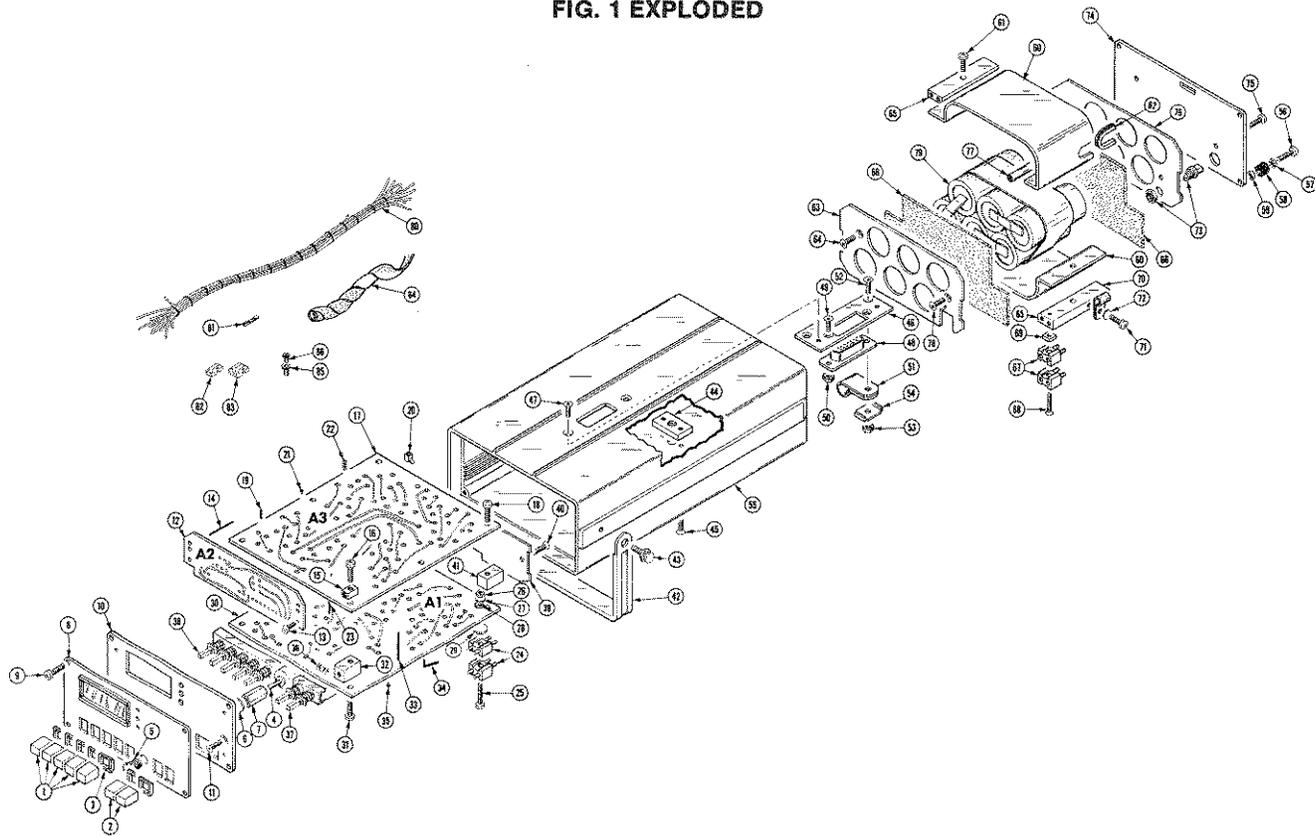
J16 PHOTOMETER

COUNTER & READOUT (4N B052000 / UP) GR5

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J16 (SN B052000 & up)

FIG. 1 EXPLODED



J-16 DIGITAL PHOTOMETER

Mechanical Parts List—J16 (SN B052000 & up)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	Name & Description					Mfr Code	Mfr Part Number
				1	2	3	4	5		
1-1	366-1257-00		5	PUSH BUTTON:GRAY PLASTIC					80009	366-1257-00
-2	366-1328-00		2	PUSH BUTTON:SLOW					80009	366-1328-00
-3	426-0681-00		7	FR,PUSH BUTTON:GRAY PLASTIC					80009	426-0681-00
-4	-----		1	RES.,VAR:(SEE R166 REPL) (ATTACHING PARTS)						
-5	358-0342-00		1	BSHG,MACH.THD:0.25 X 32 X 0.352 INCH LONG					80009	358-0342-00
-6	210-0046-00		1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS					78189	1214-05-00-0541C
-7	210-0471-00		1	NUT,SLEEVE:HEX.,0.312 X 0.594 INCH LONG -----*-----					80009	210-0471-00
-8	333-1615-00		1	PANEL,FRONT: (ATTACHING PARTS)					80009	333-1615-00
-9	211-0097-00		4	SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL -----*-----					83385	OBD
-10	386-2328-00		1	PLATE,FAN SCRIN:4.1 X 4.8 X 0.063,AL (ATTACHING PARTS)					80009	386-2328-00
-11	211-0101-00		2	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL -----*-----					83385	OBD
	361-0008-00	B052000 B082990X	3	SPACER,SLEEVE:0.11 ID X 0.25 OD X 0.28"H					80009	361-0008-00
-12	-----		1	CKT BOARD ASSY:DISPLAY(SEE A2 REPL) (ATTACHING PARTS)						
-13	211-0022-00		2	SCREW,MACHINE:2-56 X 0.188 INCH,PNH STL -----*-----					83385	OBD
	-----		-	. CKT BOARD ASSY INCLUDES:						
-14	131-0787-00		30	. CONTACT,ELEC:0.64 INCH LONG					22526	47359
-15	361-0720-00		1	. SPACER,CKT BD:0.5 L X 0.25 W X 0.737 H (ATTACHING PARTS)					80009	361-0720-00
-16	211-0012-00		2	. SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL -----*-----					83385	OBD

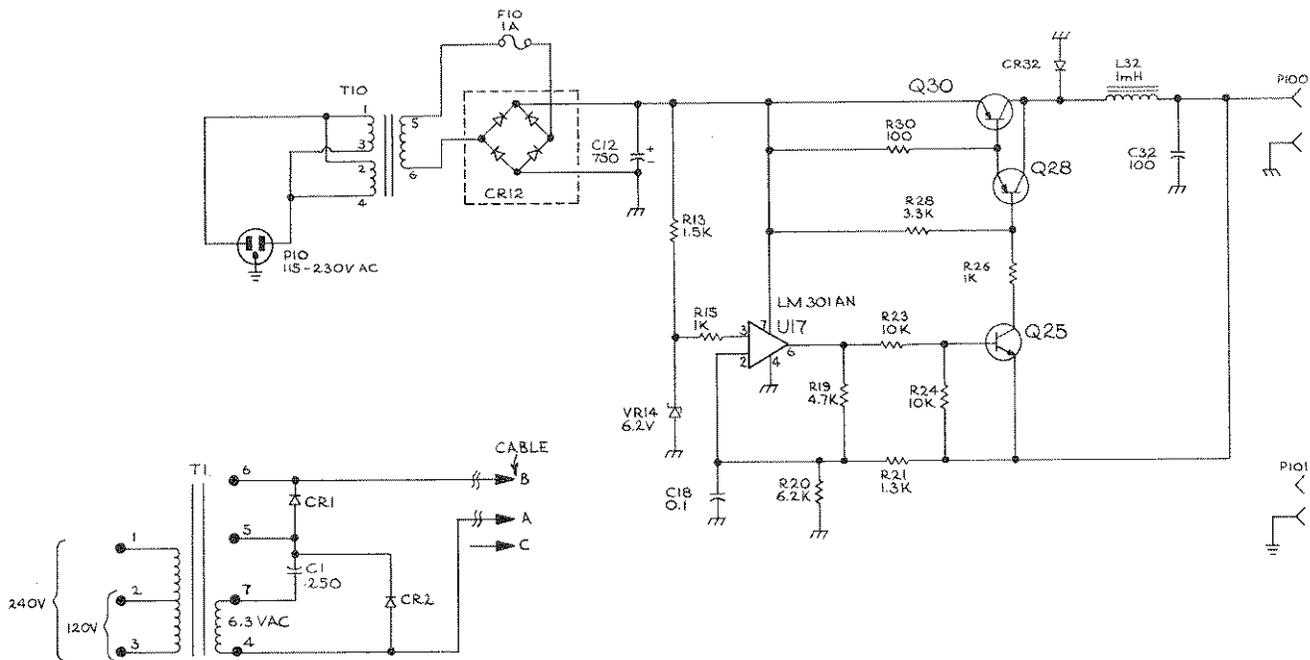
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscnt	Qty	Name & Description					Mfr Code	Mfr Part Number
					1	2	3	4	5		
1-17	-----	-----		-	CKT BOARD ASSY:DVM(SEE A3 REPL) (ATTACHING PARTS)						
-18	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL					83385	OBD
	210-0201-00			1	TERMINAL,LUG:SE #4					86928	A373-157-2
	210-0994-00			1	WASHER,FLAT:0.125 ID X 0.25" OD,STL					86928	5702-201-20
					- - - * - - -						
	-----	-----		-	. CKT BOARD ASSY INCLUDES:						
-19	131-0608-00			26	. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD					22526	47357
-20	131-1003-00			3	. CONN,RCPT,ELEC:CKT BD MT,3 PRONG					80009	131-1003-00
-21	136-0252-04			20	. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS					22526	75060-007
-22	136-0263-03			9	. SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN					00779	86250-2
-23	136-0328-02	B052000	B052339	30	. SOCKET,PIN TERM:HORIZONTAL					00779	86282-2
	136-0328-03	B052340		30	. SOCKET,PIN TERM:HORIZ,SQ PIN RCPT					22526	47710
	136-0260-02			6	. SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE					71785	133-51-92-008
	136-0269-02			14	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE					73803	CS9002-14
	136-0514-00			3	. SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP					73803	CS9002-8
-24	131-1299-00			2	CONN,RCPT,ELEC:2 CONTACT,MALE (ATTACHING PARTS)					81312	JFA 2P
-25	211-0100-00			1	SCREW,MACHINE:2-56 X 0.750 INCH,PNH,STL					83385	OBD
-26	210-0405-00			1	NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS					73743	2X12157-402
-27	210-0001-00			1	WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL					78189	1202-00-00-0541C
-28	210-1134-00			1	WASHER,FLAT:0.09 ID X 0.25 INCH OD,BRS					12327	OBD
-29	361-0493-00			1	SPACER,PLATE: - - - * - - -					80009	361-0493-00
-30	-----	-----		1	CKT BOARD ASSY:POWER/INPUT AMPL(SEE A1 REPL) (ATTACHING PARTS)						
-31	211-0007-00			4	SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL					83385	OBD
-32	391-0108-00			2	BLK,CKT BD MTG:AL,0.532 X 0.312 X 0.312 - - - * - - -					80009	391-0108-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscnt	Qty	1	2	3	4	5	Name & Description	Mfr	
											Code	Mfr Part Number
1-	-----			-						. CKT BOARD ASSY INCLUDES:		
-33	131-0591-00			9						. CONTACT,ELEC:0.835 INCH LONG	22526	47352
-34	131-0589-00			3						. TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
-35	136-0252-04	B052000	B052163	27						. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
	136-0252-04	B052164		23						. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
	136-0260-02	B052000	B052163	1						. SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	136-0260-02	B052164		2						. SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
-36	361-0492-00	B052000	B052570	8						. SPACER,PUSH SW:	80009	361-0492-00
	361-0384-00	B052571		8						. SPACER,PB SW:0.133 INCH LONG	80009	361-0384-00
-37	260-1431-00			1						. SWITCH,PUSH:2 STA,NON-SHORT	80009	260-1431-00
-38	260-1432-00			1						. SWITCH,PUSH:5 STA,INTERLOCK,NON-SHORT	80009	260-1432-00
	214-2403-00	XB060000		1						HEAT SINK,XSTR:TO-127,AL (ATTACHING PARTS)	80009	214-2403-00
	211-0105-00	XB060000		1						SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
	211-0507-00	XB060000		1						SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	210-0071-00	XB060000		1						WASHER,SPR TNSN:0.146 ID X 0.323" OD,STL	78189	4706-05-01-0531
	342-0202-00	XB060000		1						INSULATOR,PLATE-TRANSISTOR - - - * - - -	01295	10-21-023-106
-39	386-2336-00			1						PANEL,REAR: (ATTACHING PARTS)	80009	386-2336-00
-40	211-0101-00			2						SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL - - - * - - -	83385	OBD
-41	391-0108-00			2						BLK,CKT BD MTG:AL,0.532 X 0.312 X 0.312 (ATTACHING PARTS)	80009	391-0108-00
	211-0008-00			1						SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
	210-0201-00			1						TERMINAL,LUG:SE #4	86928	A373-157-2
	210-0994-00			1						WASHER,FLAT:0.125 ID X 0.25" OD,STL - - - * - - -	86928	5702-201-20

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscnt	Qty	Name & Description					Mfr Code	Mfr Part Number
					1	2	3	4	5		
1-42	367-0165-00			1	HANDLE, CARRYING: (ATTACHING PARTS)					80009	367-0165-00
-43	213-0179-00			1	SCREW, CAP: 6-32 X 0.394, HEX HD, STL - - - * - - -					80009	213-0179-00
-44	391-0106-00			1	BLK, METER MTG: AL, 0.85 X 0.5 X 0.188 (ATTACHING PARTS)					80009	391-0106-00
-45	211-0101-00			2	SCREW, MACHINE: 4-40 X 0.25, 100 DEG, FLH STL - - - * - - -					83385	0BD
-46	361-0488-00			1	SPACER, CONN: (ATTACHING PARTS)					80009	361-0488-00
-47	211-0101-00			2	SCREW, MACHINE: 4-40 X 0.25, 100 DEG, FLH STL - - - * - - -					83385	0BD
-48	131-0458-00			1	CONNECTOR, RCPT, : 15 PIN, FEMALE (ATTACHING PARTS)					71468	DA15S
-49	211-0038-00			2	SCREW, MACHINE: 4-40 X 0.312, FLH, 100 DEG					83385	0BD
-50	210-0586-00			2	NUT, PL, ASSEM WA: 4-40 X 0.25, STL CD PL - - - * - - -					83385	0BD
-51	343-0004-00			1	CLAMP, LOOP: 0.312 INCH DIAMETER, PLSTC (ATTACHING PARTS)					95987	5-16-6B
-52	211-0038-00			1	SCREW, MACHINE: 4-40 X 0.312, FLH, 100 DEG					83385	0BD
-53	210-0586-00			1	NUT, PL, ASSEM WA: 4-40 X 0.25, STL CD PL					83385	0BD
-54	210-0863-00			1	WSHR, LOOP CLAMP: 0.187 ID U/W 0.5 W CLP, STL - - - * - - -					95987	C191
-55	380-0299-00			1	HSG, PHOTOMETER: ALUMINUM					80009	380-0299-00
	016-0539-01			1	BATTERY ASSY: (ATTACHING PARTS)					80009	016-0539-01
-56	211-0014-00			4	SCREW, MACHINE: 4-40 X 0.50 INCH, PNH STL					83385	0BD
-57	210-0994-00			4	WASHER, FLAT: 0.125 ID X 0.25" OD, STL					86928	5702-201-20

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscnt	Qty	1 2 3 4 5					Name & Description	Mfr Code	Mfr Part Number
1-58	348-0345-00			4						FOOT,CABINET:	98388	2062
-59	210-0569-00			4						NUT,PRESSMOUNT:4-40 X 0.25 OD,STL CD PL	46384	OBD
	-----			-						. BATTERY PACK INCLUDES:		
-60	343-0376-00			2						. CLAMP,RETAINING: (ATTACHING PARTS)	80009	343-0376-00
-61	211-0012-00			1						. SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL	83385	OBD
-62	252-0562-00			FT						. PLASTIC CHANNEL:0.100 X 0.120,POLYETHYLENE	06229	GS2
-63	386-2339-00			1						. PLATE,PWR SPLY:INSIDE (ATTACHING PARTS)	80009	386-2339-00
-64	211-0101-00			2						. SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
-65	391-0107-00			2						. BLOCK,MOUNTING:AL,1.96 X 0.5X 0.188	80009	391-0107-00
-66	214-1013-01			2						. INSULATOR,PLATE:	80009	214-1013-01
	342-0317-00	XB052237		1						. INSULATOR,FILM:BATTERY	80009	342-0317-00
-67	131-1300-00			2						. CONN,RCPT,ELEC:2 CONTACT,FEMALE (ATTACHING PARTS)	81312	JFA2S
-68	213-0202-00			1						. SCREW,MACHINE:2-56 X 0.625 INCH,FLH STL	83385	OBD
-69	210-1154-00			1						. WASHER,FLAT:0.22 SQUARE X 0.094 ID (ATTACHING PARTS)	80009	210-1154-00
-70	343-0144-00			1						. CLAMP,LOOP:0.125 INCH ID,BLK NYLON (ATTACHING PARTS)	95987	1-8-2
-71	211-0008-00	B052000	B052236	1						. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
	211-0213-00	B052237		1						. SCREW,MACHINE:4-40 X 0.312 INCH,PNH NYLON	23050	OBD

Fig. & Index No.	Tektronix Serial/Model No.		Qty	1	2	3	4	5	Name & Description	Mfr	Mfr Part Number
	Part No.	Eff								Dscont	
1-72	210-0994-00	B052000	B052236X	1	.	WASHER, FLAT:0.125 ID X 0.25" OD, STL			86928	5702-201-20	
	210-0261-00	B052237		1	.	TERMINAL, LUG:0.14 ID, PLAIN, BRASS			80009	210-0261-00	
	210-0849-00	XB052237		2	.	WSHR, SHOULDERED:0.11 ID X 0.188"OD, FIBER			83330	2151	
						- - - * - - -					
-73	134-0148-00			1	.	JACK, TELEPHONE:MINI POWER W/AUTO SW CKT			82389	712A	
	210-0048-00			1	.	WASHER, LOCK:0.313 X 0.425 INCH OD, STL			78189	1218-04	
	210-1025-00			1	.	WASHER, FLAT:0.312 ID X 0.469 OD, BRS			12327	OBD	
-74	386-2337-01			1	.	PANEL, REAR:			80009	386-2337-01	
						(ATTACHING PARTS)					
-75	211-0012-00			2	.	SCREW, MACHINE:4-40 X 0.375, PNH STL CD PL			83385	OBD	
						- - - * - - -					
-76	386-2338-01			1	.	PLATE, PWR SPLY:OUTSIDE			80009	386-2338-01	
	342-0317-00	XB052237		1	.	INSULATOR, FILM: BATTERY			80009	342-0317-00	
-77	162-0026-00	B052000	B052236X	FT	.	INS SLV, ELEC:BULK, 0.58 INCH OD			83309	OBD	
	131-0809-00	B052000	B052236X	1	.	TERMINAL, STUD:PNL MT, 4-40 TAP 1 END			71279	570-1510-01-0519	
						(ATTACHING PARTS)					
-78	211-0105-00	B052000	B052236X	1	.	SCREW, MACHINE:4-40 X 0.188, 100 DEG, FLH STL			83385	OBD	
						- - - * - - -					
-79	146-0012-01			1	.	BATTERY, STORAGE:7.2V, 1800 MAH			19209	41B002HD13	
-80	179-1831-01			1	.	WIRING HARNESS:CONNECTOR, W/EARTH GROUND			80009	179-1831-01	
-81	131-0707-00			8	.	CONNECTOR, TERM.:22-26 AWG, BRS& CU BE GOLD			22526	47439	
-82	352-0161-00			1	.	HLDR, TERM CONN:3 WIRE BLACK			80009	352-0161-00	
-83	352-0163-00			1	.	CONN BODY, PL, EL:5 WIRE BLACK			80009	352-0163-00	
-84	162-0579-00			IN	.	INS SLV, ELEC:0.25 ID, SPL WRAP			87473	OBD	
-85	210-0774-00			3	.	EYELET, METALLIC:0.152 OD X 0.245 INCH L, BRS			80009	210-0774-00	
-86	210-0775-00			3	.	EYELET, METALLIC:0.126 OD X 0.23 INCH L, BRS			80009	210-0775-00	



J16 & J16 OPTION 2

1879-26

OPTIONAL AC POWER SUPPLY  
AND  
BATTERY CHARGER  
(SN B052000 & UP)

**FIG. 2 AC POWER SUPPLY**

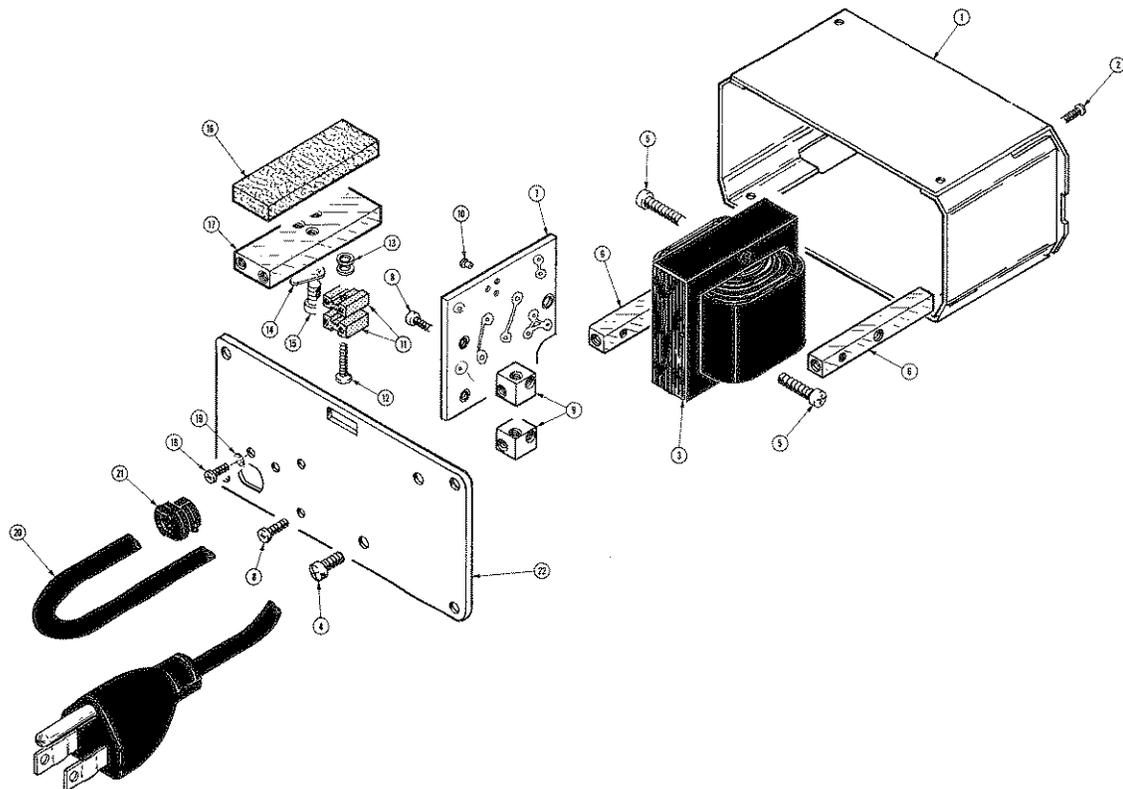


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscnt	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number	
												Mfr	Part Number
2-	119-0404-00			1						POWER SUPPLY:115VAC	80009	119-0404-00	
	119-0404-01			1						POWER SUPPLY:115VAC	80009	119-0404-01	
	-----			-						(OPTION 4 ONLY)			
-1	200-1549-00			1						. COVER,PWR SPLY:	80009	200-1549-00	
										(ATTACHING PARTS)			
-2	211-0101-00			3						. SCREW,MACHINE:4-40 X 0.25,100 DEG,FLH STL	83385	OBD	
										- - - * - - -			
-3	-----			1						. TRANSFORMER:(SEE T10 REPL)			
										(ATTACHING PARTS)			
-4	211-0504-00			2						. SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD	
-5	211-0018-00			2						. SCREW,MACHINE:4-40 X 0.875 PNH,STL	83385	OBD	
-6	391-0112-00			2						. BLOCK,XFMR MTG:AL,2.01 X 0.25 X 0.25	80009	391-0112-00	
										- - - * - - -			
-7	-----			1						. CKT BOARD ASSY:SWITCHING REG(SEE A4 REPL)			
										(ATTACHING PARTS)			
-8	211-0097-00			4						. SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD	
-9	220-0455-00			2						. NUT,BLOCK:0.281"SQ,THREE 4-40 THRU THDS	80009	220-0455-00	
										- - - * - - -			
				-						. . . CKT BOARD ASSY INCLUDES:			
-10	136-0252-04	B052000	B084078	14						. . . SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007	
	136-0252-04	B084079		8						. . . SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007	
	136-0365-00	XB084079		6						. SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0365-00	
-11	131-1300-00			2						. CONN,RCPT,ELEC:2 CONTACT,FEMALE	81312	JFA2S	
										(ATTACHING PARTS)			
-12	213-0202-00			1						. SCREW,MACHINE:2-56 X 0.625 INCH,FLH STL	83385	OBD	
-13	210-0994-00			2						. WASHER,FLAT:0.125 ID X 0.25" OD,STL	86928	5702-201-20	
										- - - * - - -			

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	No. Dscont	Qty	1 2 3 4 5					Name & Description	Mfr Code	Mfr Part Number
2-14	210-0201-00			2	.					TERMINAL, LUG: SE #4 (ATTACHING PARTS)	86928	A373-157-2
-15	211-0007-00			1	.					SCREW, MACHINE: 4-40 X 0.188 INCH, PNH STL - - - * - - -	83385	OBD
-16	348-0070-01			1	.					PAD, CUSHIONING: 0.69 INCH, RUBBER	80009	348-0070-01
-17	391-0113-00			1	.					BLOCK, CONN MTG: AL, 2.01 X 0.625 X 0.25 (ATTACHING PARTS)	80009	391-0113-00
-18	211-0007-00			2	.					SCREW, MACHINE: 4-40 X 0.188 INCH, PNH STL	83385	OBD
-19	210-0004-00			2	.					WASHER, LOCK: #4 INTL, 0.015THK, STL CD PL - - - * - - -	78189	1204-00-00-0541C
-20	161-0071-02	B052000	B083334	1	.					CABLE ASSY, PWR: 3 AWG 18, 115V, 7' LONG	80009	161-0071-02
	161-0033-04	B083335		1	.					CABLE ASSY, PWR:	16428	KH854-2
-21	358-0161-00			1	.					BSHG, STRAIN RLF: FOR 0.50 INCH HOLE, PLASTIC	28520	SR5P4
-22	386-2592-00			1	.					PANEL, REAR:	80009	386-2592-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscnt	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
3-									ACCESSORIES		
	119-0375-02		1						CHARGER, BATTERY:	80009	119-0375-02
-1	134-0147-00		1						. PLUG, TELEPHONE: MINI POWER	82389	760
-2	200-0488-00		1						. CABLE NIP, ELEC: 0.13 ID X 1.625 L, BLACK	80009	200-0488-00
-3	175-1364-00		1						. CABLE, SP, ELEC: 2.23 AWG STRD, GRY VNL JCKT (ATTACHING PARTS)	80009	175-1364-00
-4	358-0161-00		1						. BSHG, STRAIN RLF: FOR 0.50 INCH HOLE, PLASTIC - - - * - - -	28520	SR5P4
-5	386-2489-01		1						. PLATE, PWR SPLY: FRONT (ATTACHING PARTS)	80009	386-2489-01
-6	211-0511-00		2						. SCREW, MACHINE: 6-32 X 0.500, PNH, STL, CD PL - - - * - - -	83385	OBD
-7	200-0691-00		1						. COVER, PWR SPLY: PROBE	80009	200-0691-00
-8	-----		1						. TRANSFORMER: (SEE T1 REPL) (ATTACHING PARTS)		
-9	129-0137-00		2						. POST, ELEC-MECH: 0.312 HEX X 1.75 INCH L, AL - - - * - - -	80009	129-0137-00
-10	166-0037-00		2						. SPACER, SLEEVE: 0.180 ID X 0.250 D X 0.56" LG	80009	166-0037-00
-11	210-0202-00		1						. TERMINAL, LUG: 0.146 ID, LOCKING, BRZ TINNED	78189	2104-06-00-2520N
-12	210-0006-00		1						. WASHER, LOCK: #6 INTL. 0.018 THK, STL CD PL	78189	1206-00-00-0541C
-13	161-0049-00		1						. CABLE ASSY, PWR, : 80 INCH LONG, W/MALE CONN (ATTACHING PARTS)	80009	161-0049-00
-14	358-0091-00		1						. BSHG, STRAIN RLF: FOR 0.188 INCH DIA CABLE - - - * - - -	28520	SR-2M-4

**FIG. 3 ACCESSORIES**

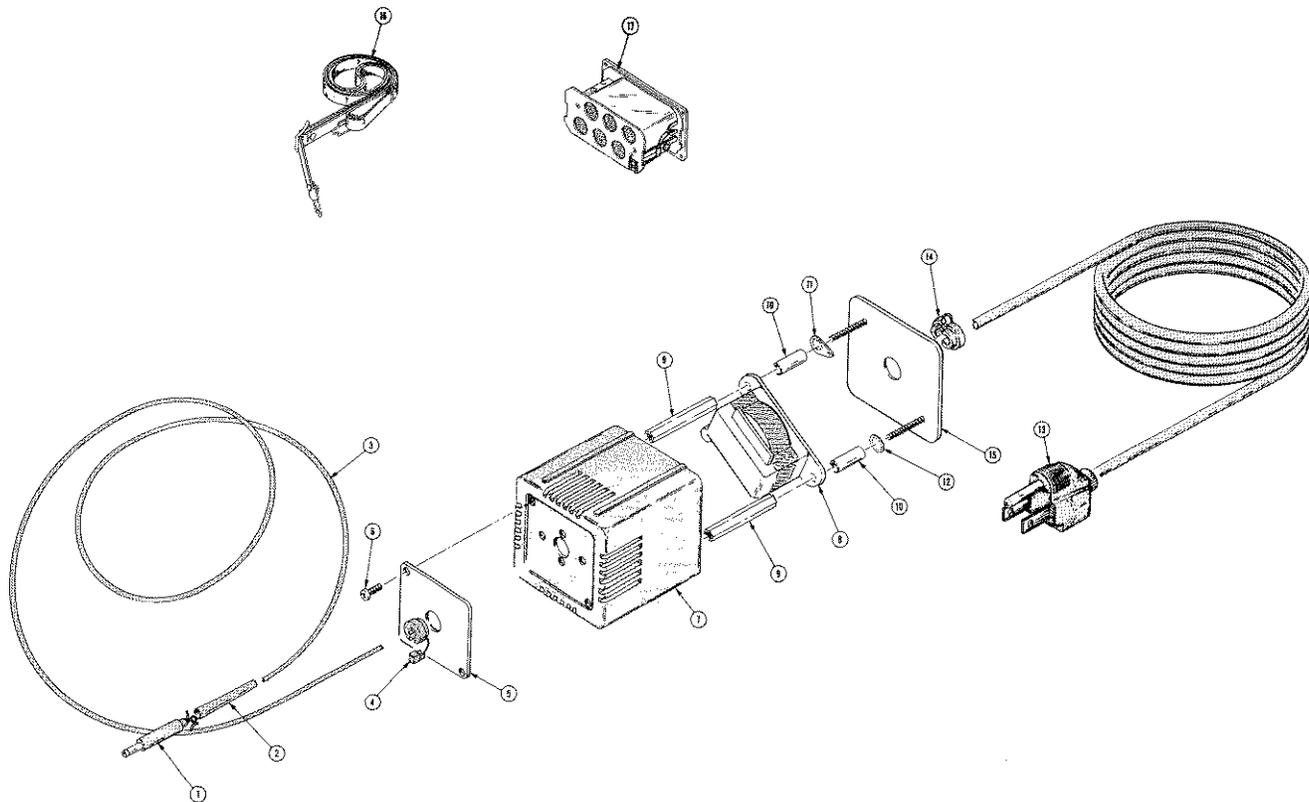


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	No. Dscont	Qty	1 2 3 4 5	Name & Description	Mfr	
							Code	Mfr Part Number
3-15	386-2490-00			1		PLATE, PWR SPLY: REAR	80009	386-2490-00
-16	346-0104-00			1		STRAP, CARRYING: 53 INCHES LONG	17516	4188-BA
-17	016-0539-01			1		BATTERY ASSY:	80009	016-0539-01
-18	070-1879-00			1		MANUAL, TECH:	80009	070-1879-00

STANDARD ACCESSORIES

-----				1		J6502 IRRADIANCE PROBE		
016-0305-00				1		OCCLUDER, LIGHT	80009	016-0305-00
012-0414-00				1		CA ASSY, SP, ELEC: EXTENDER	80009	012-0414-00
119-0375-02				1		CHARGER, BATTERY:	80009	119-0375-02
346-0104-00				1		STRAP, CARRYING: 53 INCHES LONG	17516	4188-BA
070-1879-00				1		MANUAL, TECH: INSTRUCTION	80009	070-1879-00

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