

**Tektronix®**

**211  
MAINTENANCE**



**INSTRUCTION MANUAL**

This page  
intentionally  
left blank

**Tektronix**<sup>®</sup>  
COMMITTED TO EXCELLENCE

NOTE:

SEE PRODUCT MOD INFO

**PLEASE CHECK FOR CHANGE INFORMATION  
AT THE REAR OF THIS MANUAL.**

**211  
MAINTENANCE**

INSTRUCTION MANUAL

Tektronix, Inc.  
P.O. Box 500  
Beaverton, Oregon 97077  
070-1160-00  
Product Group 40

Serial Number \_\_\_\_\_

First Printing OCT 1971  
Revised AUG 1982

Copyright © 1971 Tektronix, Inc. All rights reserved.  
Contents of this publication may not be reproduced in any  
form without the written permission of Tektronix, Inc.

Products of Tektronix, Inc. and its subsidiaries are covered  
by U.S. and foreign patents and/or pending patents.

TEKTRONIX, TEK, SCOPE-MOBILE, and  are  
registered trademarks of Tektronix, Inc. TELEQUIPMENT  
is a registered trademark of Tektronix U.K. Limited.

Printed in U.S.A. Specification and price change privileges  
are reserved.

### INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag,  
or stamped on the chassis. The first number or letter  
designates the country of manufacture. The last five digits  
of the serial number are assigned sequentially and are  
unique to each instrument. Those manufactured in the  
United States have six unique digits. The country of  
manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

# TABLE OF CONTENTS

<b>SECTION 1</b>	<b>211 SPECIFICATION</b>	<b>Page</b>	<b>Corrective Maintenance</b>	
	Introduction	1-1	Obtaining Replacement Parts	3-4
	Vertical Deflection System	1-1	Component Replacement	3-4
	Triggering	1-2	Recalibration After Repair	3-5
	Horizontal Deflection System	1-2	Instrument Repackaging	3-5
	Display	1-2		
	AC Operation	1-2	<b>SECTION 4 CALIBRATION</b>	
	Internal Battery Operation	1-2	Introduction	4-1
	General	1-3	Tektronix Field Service	4-1
			Using This Procedure	4-1
<b>SECTION 2</b>	<b>CIRCUIT DESCRIPTION</b>		Test Equipment Required	
	Introduction	2-1	General	4-1
	Block Diagram		Special Calibration Fixtures	4-1
	General	2-1	Index to Calibration Procedure	4-3
	Circuit Operation		Preliminary Procedure	4-3
	General	2-1	Preliminary Control Settings	4-3
	Vertical Input Amplifier	2-3	Power Supply And Display	4-4
	Vertical and Horizontal		Vertical System Adjustment	4-5
	Output Amplifiers	2-3	Trigger Circuit Adjustment	4-8
	Trigger/Sweep Generator	2-3	Horizontal System Adjustment	4-9
	Power Supply	2-3		
	CRT Circuit	2-4	<b>SECTION 5 ELECTRICAL PARTS LIST, DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS</b>	
<b>SECTION 3</b>	<b>MAINTENANCE</b>		Electrical Parts List	
	Introduction	3-1	Symbols and Reference Designators	
	Preventive Maintenance		Voltage and Waveform Test	
	General	3-1	Conditions	
	Cleaning	3-1	Diagrams	
	Lubrication	3-1	Circuit Board Photographs	
	Visual Inspection	3-1		
	Transistor Checks	3-1	<b>SECTION 6 MECHANICAL PARTS LIST</b>	
	Recalibration	3-1	Mechanical Parts List	
	Troubleshooting		Exploded View Illustration	
	Introduction	3-2	Std. Accessories & Repackaging	
	Troubleshooting Aids	3-2		
	Troubleshooting Equipment	3-3		

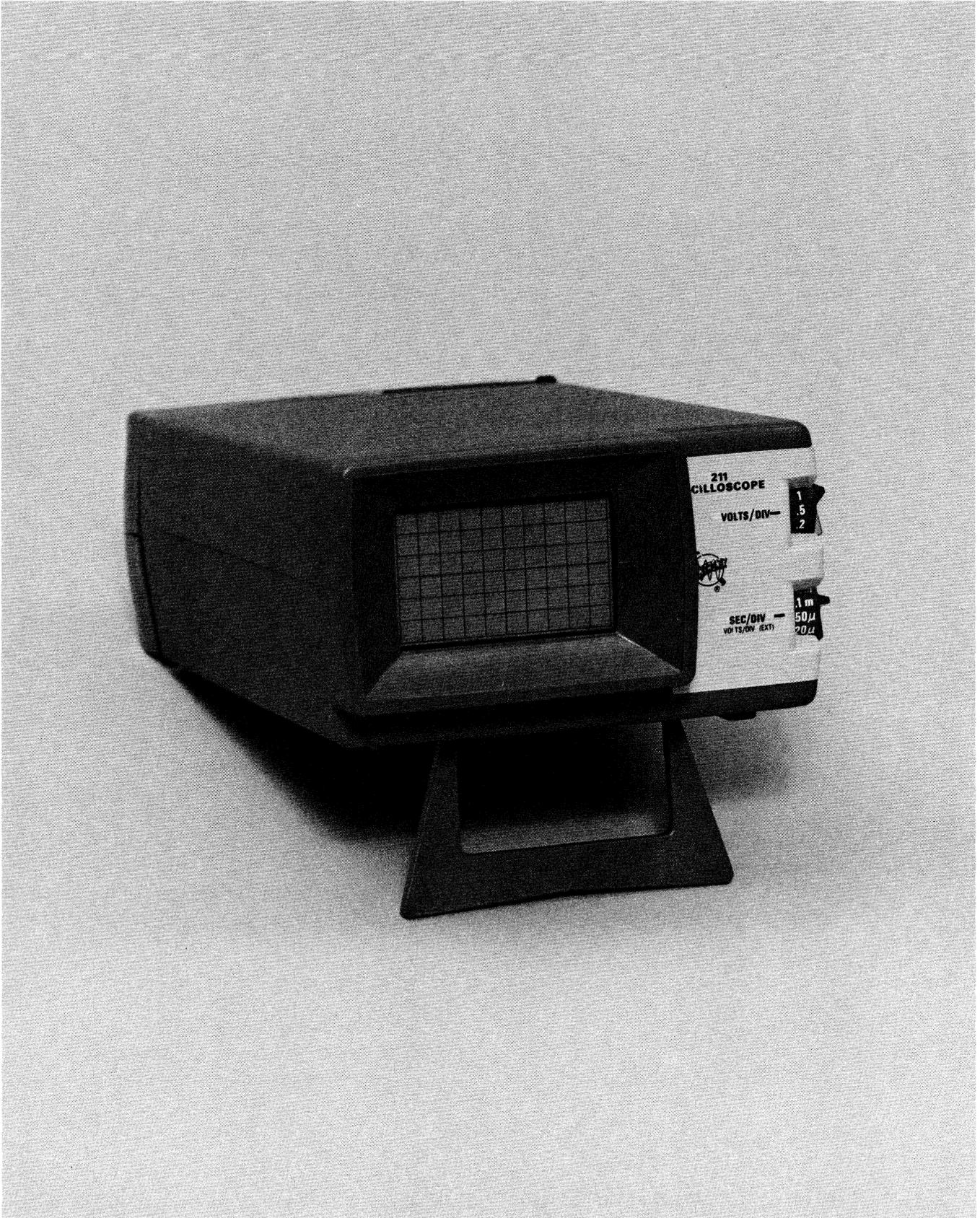


Fig. 1-1. 211 Oscilloscope.

# SECTION 1

## 211 SPECIFICATION

### Introduction

The 211 Oscilloscope is a single-channel, 500 kilohertz portable instrument using all solid state and integrated circuit components (except CRT). The small size of the 211 makes it an extremely portable oscilloscope for on-location maintenance in many fields of application. The instrument is mechanically constructed to withstand the shock, vibration, and other extremes associated with portability. The DC to 500 kilohertz vertical system provides vertical deflection factors from one millivolt (at reduced bandwidth) to 50 volts/division at the tip of the high-impedance probe. The trigger circuits provide stable triggering from about seven hertz to 500 kilohertz from either an internal or external source.

The horizontal deflection system provides calibrated sweep rates from 200 milliseconds to five microseconds/division. A continuously variable sweep magnifier provides uncalibrated sweep rates to at least five times the indicated sweep rate, for a maximum sweep rate of at least one microsecond/division. In addition, horizontal amplifier operation provides horizontal deflection factors of one and 10 volts/division. The resultant CRT display produced by the vertical and horizontal deflection systems is presented on a 6 X 10 division graticule (each division equals 0.203 inch).

The 211 can be operated either from AC line voltage or from internal rechargeable batteries. Maximum total power consumption is two watts. The internal batteries can be recharged from the AC power line by the integral battery charger (instrument off).

This instrument will meet the following electrical characteristics after complete instrument calibration as given in Section 4. Section 4 also provides a convenient method of checking instrument performance without making internal checks or adjustments. The following electrical characteristics apply over an ambient temperature range of  $-15^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ , except as otherwise indicated. Warmup time for given accuracy is five minutes.

### VERTICAL DEFLECTION SYSTEM

#### DEFLECTION FACTOR:

Calibrated Range; One millivolt to 50 volts/division. 15 steps in 1-2-5 sequence.

Accuracy; Within 5% with VOLTS/DIV VAR control in CAL position and gain correctly set at 50 mV/DIV.

Uncalibrated (variable) Range; Continuously variable between calibrated settings. Extends maximum deflection factor to at least 150 volts/division.

#### BANDWIDTH (with six-division reference):

10 mV/DIV to 50 V/DIV: DC to at least 500 kilohertz.

5 mV/DIV: DC to at least 400 kilohertz.

2 mV/DIV: DC to at least 200 kilohertz.

1 mV/DIV: DC to at least 100 kilohertz.

Lower Bandwidth Limit, AC (capacitive) Coupled; about 2 hertz at all deflection factors.

INPUT RESISTANCE: Approximately one megohm.

INPUT CAPACITANCE: Approximately 130 picofarads.

#### MAXIMUM USABLE INPUT VOLTAGE:

50 V/DIV to .1 V/DIV; 600 volts (DC + peak AC). 600 volts peak-to-peak AC (five megahertz or less).

50 mV/DIV to 1 mV/DIV; 600 volts (DC + peak AC). AC not over 2 kilohertz or risetime not less than 10 nanoseconds.

## TRIGGERING

**NORMAL TRIGGER SENSITIVITY:** (Trigger LEVEL/SLOPE control out of AUTO-PRESET detent)

Internal; AC coupled. 0.2 division from approximately 2 Hz to 500 kHz. (Below SN B020000, 7 Hz to 500 kHz and sweep free runs in absence of trigger signal or for trigger-repetition rates below 7 Hz.)

External; DC coupled. 1.0 to 20 V from DC to 500 kHz. (Below SN B020000, 7 Hz to 500 kHz and sweep free runs in absence of trigger signal or for trigger-repetition rates below 7 Hz.)

**AUTO PRESET TRIGGER LEVEL:** (Trigger LEVEL/SLOPE control in AUTO-PRESET detent position.)

Signal is triggered at preset level on positive slope of triggering signal. Sweep free-runs in absence of trigger signal or for trigger-repetition rates below 7 Hz.

Internal; 0.2 division from 7 Hz to 500 kHz.

External; 1.0 to 20 V from 7 Hz to 500 kHz.

**DISPLAY JITTER:** 0.5 microsecond or less at 500 kilohertz.

**EXTERNAL TRIGGER:**

Input Resistance; Approximately one megohm.

Input Capacitance; Approximately 30 picofarads.

Maximum Usable Input Voltage; for SN B090000-up 8 volts (DC + peak AC) 16 volts peak-to-peak AC. Below SN B090000 20 volts (DC + peak AC) 20 volts peak-to-peak AC (one megahertz or less).

## HORIZONTAL DEFLECTION SYSTEM

**SWEEP RATE:**

Calibrated Range; 200 milliseconds to five microseconds/division. 15 steps in 1-2-5 sequence.

Accuracy (over center eight divisions); Within 5% with HORIZ MAG control in CAL position and timing correctly set at 1 ms/DIV (disregard first 0.5 microsecond of total sweep length).

Linearity (any two division portion within center eight divisions); Within 5% (disregard first 0.5 microsecond of total sweep length).

Variable Magnifier; Continuously variable between calibrated settings. Extends maximum sweep rate to at least 1.0 microsecond/division.

**EXTERNAL HORIZONTAL OPERATION:**

Deflection Factor; One and 10 volts/division.

Accuracy; Within 10%.

Bandwidth (with six-division reference); DC to 75 kilohertz.

Input Resistance; Approximately 500 kilohms.

Input Capacitance; Approximately 30 picofarads.

Maximum Safe Input Voltage; 200 volts (DC + peak AC). 200 volts peak-to-peak AC.

## DISPLAY

**GRATICULE:**

Type; Internal Black line, non-illuminated.

Area; Six divisions vertical by 10 divisions horizontal. Each division equals 0.203 inch.

PHOSPHOR: P31 standard.

## ISOLATION

**PROBE COMMON TO AC LINE:** Maximum safe potential between probe common (floating circuit ground) and AC power line no greater than 250 V RMS sinusoidal minus the AC power line RMS voltage (i.e., when AC power line RMS voltage is 117 V, the maximum allowable potential on the probe common is  $250 - 117 = 133$  V RMS).

**PROBE COMMON TO 211 CASE EXTERIOR:** (When battery operated with AC power plug secured in insulated cover)

Maximum safe potential between probe common (floating circuit ground) and 211 case exterior not to exceed 500 V RMS or 700 V DC + peak AC.

**AC OPERATION**

**LINE VOLTAGE RANGE:** 110 to 126 volts, (other voltage ranges with options 1 and 2) sine wave AC. Batteries can not be charged during AC operation. Instrument can be operated between 104 and 110 volts with resulting slow discharge of internal batteries.

**LINE FREQUENCY:** 58 to 62 hertz sinusoidal (standard), 50 Hz (options 1 and 2).

**MAXIMUM POWER CONSUMPTION:** Two watts or less at 126 volts, 60 hertz.

**INTERNAL BATTERY OPERATION**

**BATTERIES:** 10 rechargeable AA nickel-cadmium cells.

**CHARGE TIME** (from AC line): 16 hours for full charge (instrument off during charge cycle).

**BATTERY CHARGE INDICATOR:** Expanded scale BATTERY meter indicates fully charged at 15 volts and discharged at 10 volts.

**BATTERY DEEP DISCHARGE PROTECTION:** Instrument operation automatically interrupted when battery charge drops to 10 volts  $\pm 0.5$  volt.

**TYPICAL OPERATING TIME** (at maximum trace intensity after full charge cycle at  $+20^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$ ):

Three to five hours. Longer operating time provided at lower trace intensity.

**TYPICAL CHARGE CAPACITY** (reference to charge/discharge at  $+20^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$ ):

Charge Temperature	Operating Temperature		
	$-15^{\circ}\text{C}$	$+20^{\circ}\text{C}$ to $+30^{\circ}\text{C}$	$+55^{\circ}\text{C}$
$0^{\circ}\text{C}$	40%	60%	50%
$+20^{\circ}\text{C}$ to $+30^{\circ}\text{C}$	65%	100%	85%
$+40^{\circ}\text{C}$	40%	65%	55%

**GENERAL**

**ENVIRONMENT:**

Temperature; Operating,  $-15^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ . Charging,  $0^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . Storage,  $-40^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .

Altitude; Operating, to 25,000 feet (maximum operating temperature decreased by  $1^{\circ}\text{C}$  per 1000 feet above 15,000 feet). Non-operating, to 50,000 feet.

Humidity (operating and non-operating); 5 cycles (120 hours) to 95% relative humidity reference to MIL-E-16400F.

Vibration (operating and non-operating); Tested for 15 minutes along each of three major axis at a total displacement of 0.025-inch P-P (4 g maximum).

Shock (operating and non-operating); Tested with two shocks at 150 g, one-half sine, two-millisecond duration each direction along three major axes.

**WEIGHT** (without accessories): 3.0 pounds (1.36 kilograms).

**DIMENSIONS** (measured at maximum points):

Height; 3.0 inches (7.6 centimeters).

Width; 5.2 inches (13.2 centimeters).

Depth; 8.9 inches (22.6 centimeters).

**STANDARD ACCESSORIES:**

1 Viewing Hood 016-0199-00

1 Instruction Manual 070-1160-00

1 Operators Manual 070-1163-00

1 Carrying Case 016-0512-00

**OPTIONAL ACCESSORIES**

10X Attenuator only 010-0378-00

10X Attenuator package 010-0378-01



# SECTION 2

## CIRCUIT DESCRIPTION

### Introduction

This section of the manual contains a description of the circuitry used in the 211 Oscilloscope. The description begins with a discussion of the instrument using the block diagram located in the Diagrams section at the rear of this manual. Then each circuit is described in detail, using detailed diagrams where necessary to show the interconnections between the stages in each major circuit and the relationship of the side-panel controls to the individual stages.

In addition to the block diagram, complete schematics are given in the Diagrams section. Refer to these diagrams throughout the following circuit description for electrical values and relationships.

### BLOCK DIAGRAM

#### General

The following discussion is provided to aid in understanding the overall concept of the 211 before the individual circuits are discussed in detail. The block diagram shows only basic interconnections between the individual blocks.

Signals to be displayed on the CRT are applied to the tip of the probe. The signals are then amplified by the Input Amplifier made up of a two-section source follower stage and two feed-back amplifiers. The Input Amplifier also contains vertical deflection factor, position, input coupling, variable attenuation, and balance controls.

The Trigger Generator circuit initiates the sweep signal produced by the Sweep Generator. The input signal to the Trigger Generator can be selected from the internal signal from the Input Amplifier, or from an external signal applied to the EXT TRIG OR HORIZ INPUT jack. The Trigger Generator circuit contains coupling and source controls in addition to a combination level/slope control.

The Sweep Generator circuit produces a linear sawtooth output signal when initiated by the Trigger Generator circuit. The slope of the sawtooth produced

is controlled by the SEC/DIV switch. The absence of an adequate trigger signal causes the sweep to free run when the trigger switch is placed in AUTO-PRESET position (below SN B020000 will free-run in any trigger position when adequate trigger signal is absent). The Sweep Generator circuit also produces an unblanking gate signal coincident with the sawtooth waveform. This gate signal unblanks the CRT to permit display presentation.

The output of the Sweep Generator circuit is amplified by the Horizontal Amplifier circuit to produce horizontal deflection for the CRT in all positions of the SEC/DIV switch except 1 V and 10 V. The Horizontal Amplifier contains a variable magnifier to increase the sweep rate up to a maximum of five times in any SEC/DIV switch position. Other horizontal deflection signals can be connected to the Horizontal Amplifier by using the external horizontal mode of operation. In this mode, with the SEC/DIV switch in either the 1 V or 10 V positions, the horizontal deflection signal is obtained from the EXT TRIG OR HORIZ INPUT jack.

The Power Supply and CRT circuits provide all the voltages necessary for operation of this instrument.

### CIRCUIT OPERATION

#### General

This section provides a description of the electrical operation and relationship of the circuits in the 211. Circuitry commonly used by Tektronix 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:

Tektronix Circuit Concepts Books (order from your local Tektronix Field Office or representative).

Cathode-Ray Tubes, Tektronix Part Number 062-0852-01.

Horizontal Amplifier Circuits, Tektronix Part No. 062-1144-00.

Oscilloscope Trigger Circuits, Tektronix Part No. 062-1056-00.

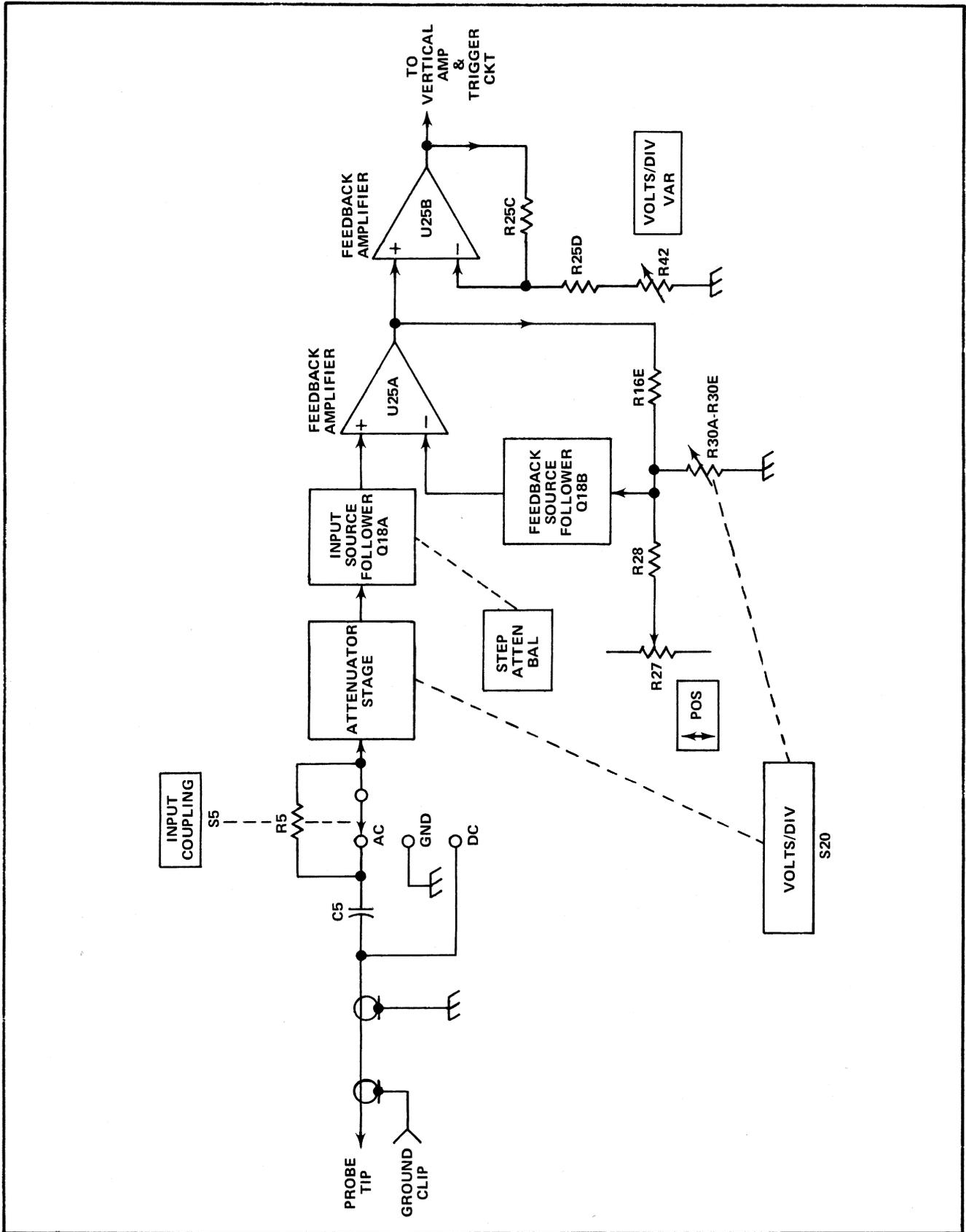


Fig. 2-1. Vertical Input Amplifier detailed block diagram.

Power Supply Circuits, Tektronix Part No. 062-0888-01.

Sweep Generator Circuits, Tektronix Part No. 062-1098-01.

Vertical Amplifier Circuits, Tektronix Part No. 062-1145-00.

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.

### Vertical Input Amplifier

Input signals for vertical deflection on the CRT of the 211 are applied to the tip of the probe. The Input Amplifier provides control of input coupling, vertical deflection factor, balance, and vertical position. Fig. 2-1 shows a detailed block diagram of the Vertical Input Amplifier circuit. A schematic of this circuit is shown on diagram 1 at the rear of this manual.

Input signals applied to the tip of the probe are connected to the Attenuator Stage through INPUT COUPLING switch S5. The effective overall deflection factor of the 211 is determined by the VOLTS/DIV switch. In all positions of the VOLTS/DIV switch below .1, the correct deflection factor is achieved by changing the gain of Feedback Amplifier U25A. In the .1 and up switch position, precision attenuators are used in addition to changing the gain of U25A to achieve the correct deflection factor. When the VOLTS/DIV VAR control is rotated, the gain of Feedback Amplifier U25B is changed, thereby offering variable (uncalibrated) deflection factors between the calibrated settings of the VOLTS/DIV switch. The STEP ATTEN BAL control adjusts for minimum trace shift when switching between deflection factors.

### Vertical And Horizontal Output Amplifiers

The Vertical and Horizontal Output Amplifiers provide the final amplification for the deflection signals. Fig. 2-2 shows a detailed block diagram of these Output

Amplifier circuits. A schematic of these circuits is shown on diagram 1.

Both amplifier circuits contain the same basic circuitry. The single-ended input signals are applied to paraphase amplifiers to convert the signals into push-pull output signals. The Vertical Paraphase Amplifier stage contains the VERT GAIN adjustment that sets the overall gain of the vertical system, and a Vertical Centering adjustment to set DC balance. The Horizontal Paraphase Amplifier stage contains the HORIZ GAIN adjustment, the HORIZ MAG control, and the Horizontal POS control. The output signals from the Paraphase Amplifiers receive final amplification in the common-base Output Amplifier stages.

### Trigger/Sweep Generator

Integrated circuit U65 is a combination Trigger/Sweep Generator. The Trigger portion derives trigger pulses from an AC-coupled sample of the Vertical Amplifier signal, or from an external signal (DC coupled) applied to the EXT TRIG OR HORIZ INPUT banana jack. Controls are provided in this circuit to select trigger level, slope, and source. Fig. 2-3 shows a detailed block diagram of the Trigger/Sweep Generator circuit. A schematic of this circuit is shown on diagram 1.

The Sweep Generator portion of U65 serves a dual purpose. In all positions of the SEC/DIV switch except 1 V and 10 V, the sweep generator is an integrator generating linear sawtooth voltage waveforms. The slope of the sawtooth voltage is controlled by the setting of the SEC/DIV switch. U65 also produces an unblanking gate signal coincident with the sawtooth waveform. This gate signal is amplified by Unblanking Amplifier Q134 and applied to the CRT to unblank the CRT during sweep presentation. In the 1 V and 10 V positions, the Sweep Generator section becomes a feedback amplifier to amplify the externally applied horizontal deflection signal.

### Power Supply

The Power Supply provides the necessary power to operate this instrument, or if the instrument is turned off, to recharge the batteries. Fig. 2-4 shows a detailed block diagram of this circuit. A schematic of this circuit is shown on diagram 2 at the rear of this manual.

When the instrument is connected to a power line, AC power is capacitively coupled to the Input Rectifier. The rectified DC is either used to run the instrument or to recharge the internal batteries. The batteries act as a large filter capacitor for the Input Rectifier. When the instrument is not connected to a power line, operating

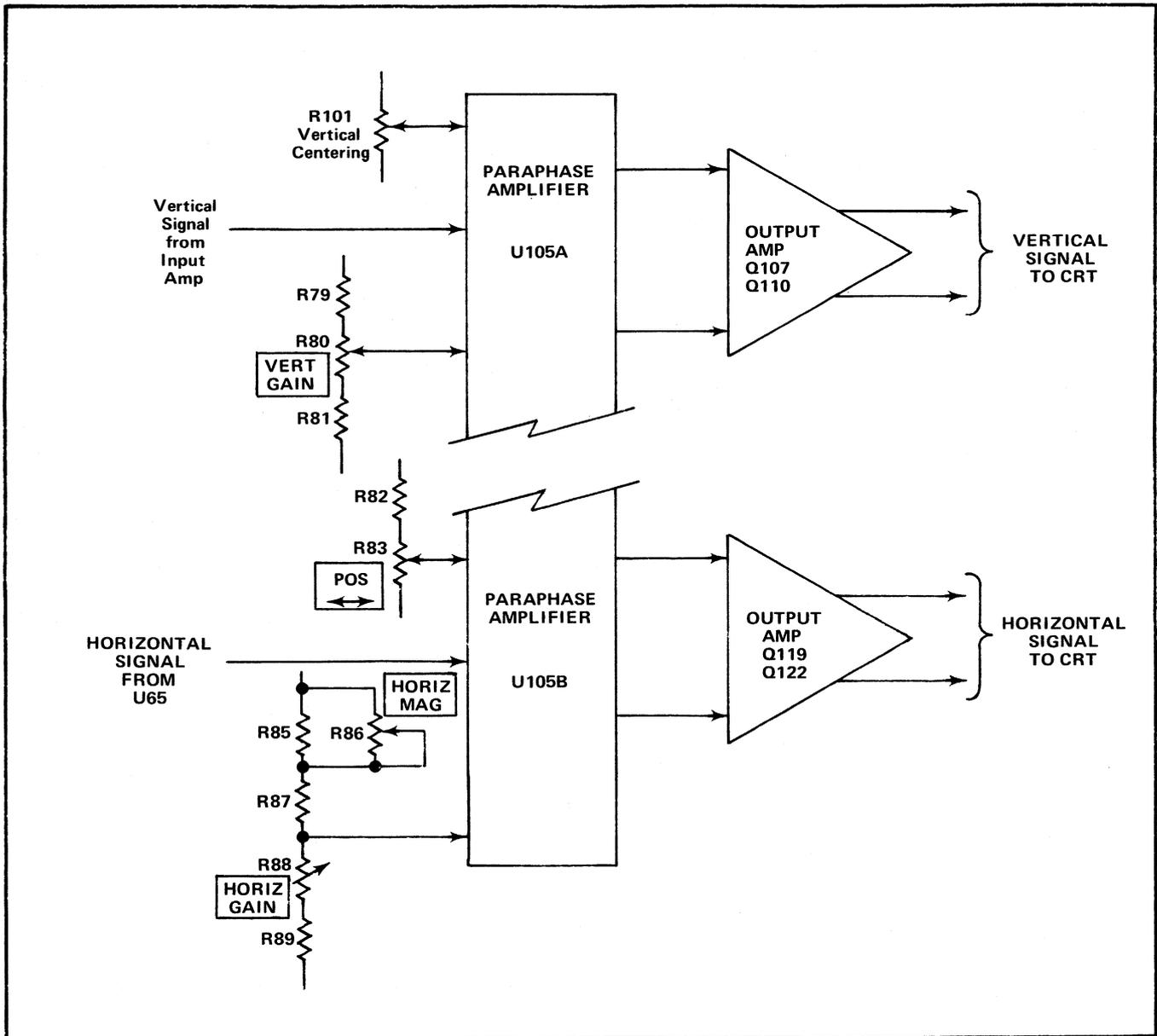


Fig. 2-2. Vertical and Horizontal Output Amplifiers detailed block diagram.

power is provided by the batteries. The Discharge Protection circuit prevents the Converter Multivibrator from functioning, and thereby over-discharging the batteries, when the charge level of the batteries falls below about 10 volts. The Converter Multivibrator changes DC into AC, which is rectified into the appropriate DC voltages in the Rectifier Circuit.

### CRT Circuit

The CRT Circuit provides the high voltage and control circuits necessary for operation of the cathode-

ray tube (CRT). Fig. 2-5 shows a detailed block diagram of the CRT Circuit. A schematic of this circuit is shown on diagram 2.

Rectifiers CR261 through CR268 provide the negative accelerating potential for the CRT. Voltage output is approximately  $-1000$  volts at the CRT cathode. Filament voltage for the CRT is provided by a separate winding of the power transformer. Display intensity and focus are controlled by R95 and R90 respectively. The Trace Rotation adjustment controls the current through L300 and affects both the vertical and horizontal rotation of the CRT beam.

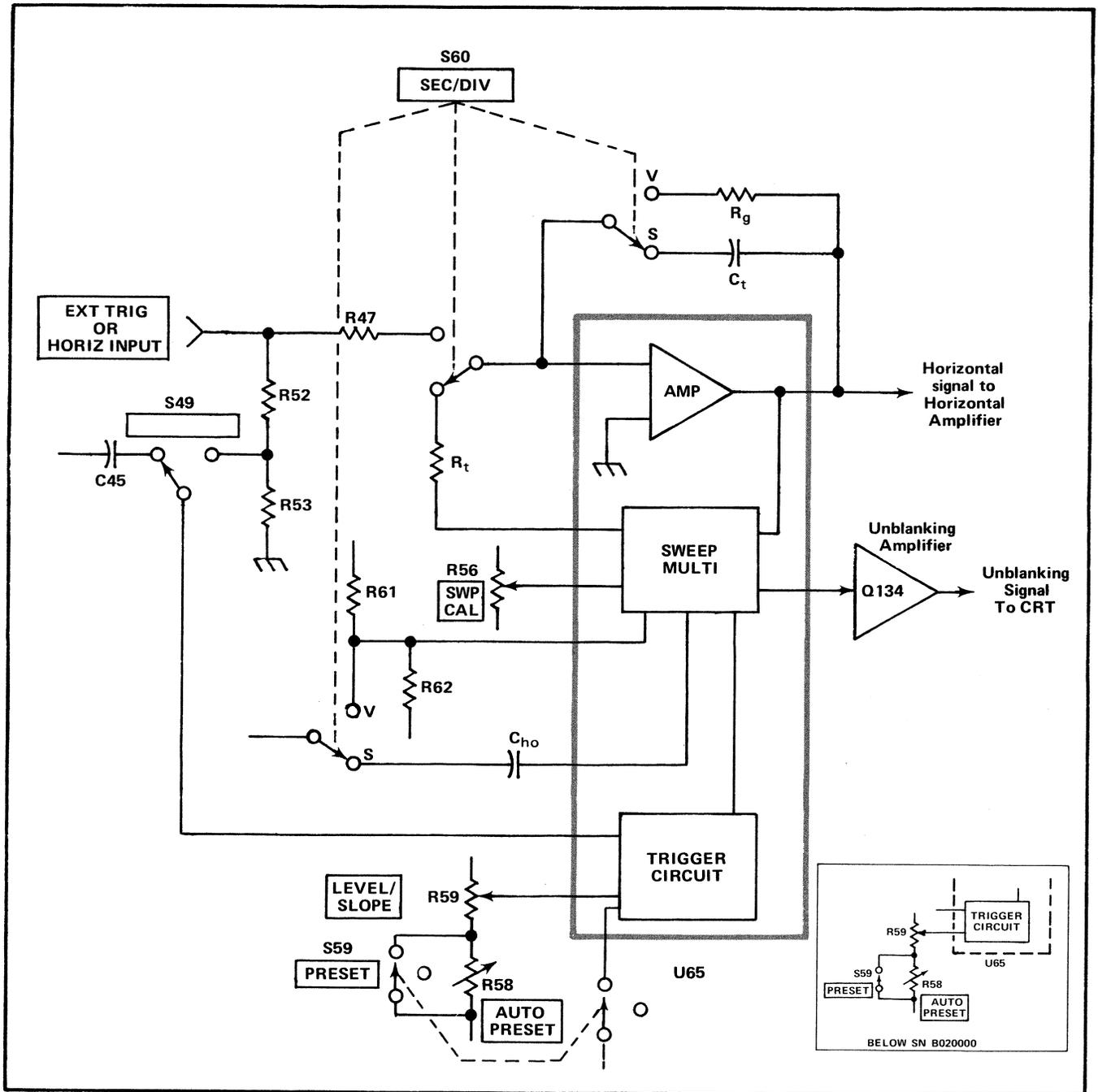


Fig. 2-3. Trigger/Sweep Generator detailed block diagram.

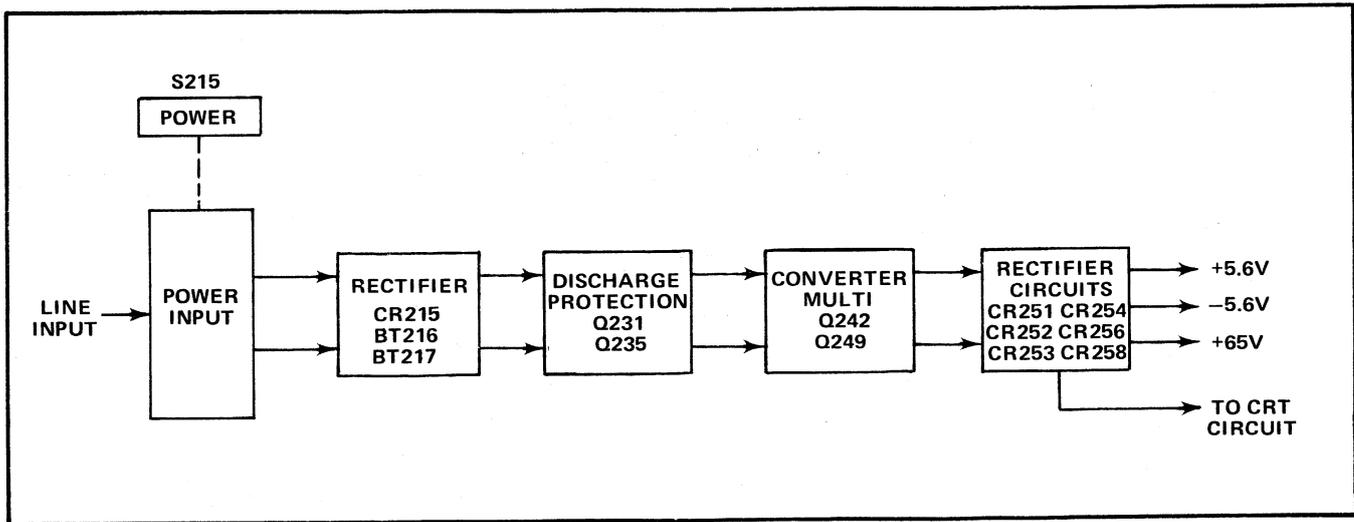


Fig. 2-4. Power Supply detailed block diagram.

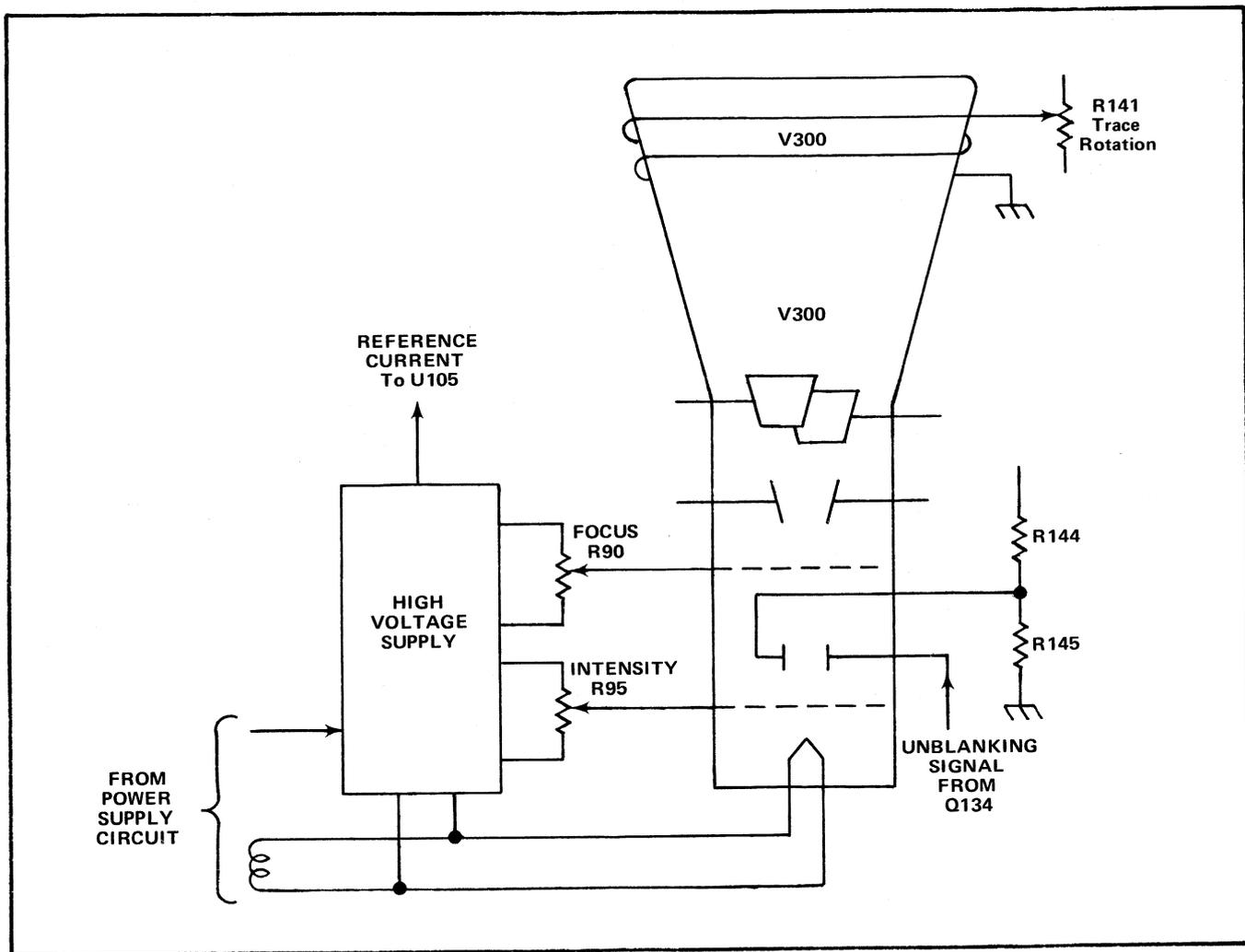


Fig. 2-5. CRT Circuit detailed block diagram.

# SECTION 3

## MAINTENANCE

### Introduction

This section of the manual contains maintenance information for use in preventive maintenance, corrective maintenance, or troubleshooting of the 211.

### CAUTION

*Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain hydrochloric acid, sodium hydroxide, or sulfuric acid.*

### PREVENTIVE MAINTENANCE

#### General

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. When performed on a regular basis, preventive maintenance can prevent instrument breakdown and may improve the reliability of this instrument. The severity of environment to which the 211 is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

#### Cleaning

The 211 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It also can provide an electrical conduction path.

The top and bottom covers provide protection against dust in the interior of the instrument. It should be only occasionally necessary to clean the interior. The best 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.

Loose dust accumulated on the outside of the 211 can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt on and around the side-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

#### Lubrication

Generally, there are no components in the 211 that require lubrication. No lubrication should be used on the contacts or rotary parts of the rotary switches. The reliability of potentiometers that are not permanently sealed can be maintained by lubrication with a lubricant that does not affect electrical characteristics (e.g., Tektronix Part No. 006-0220-00). Do not over-lubricate.

#### Visual Inspection

The 211 should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is obvious; 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.

#### Transistor Checks

Periodically checking the transistors in the 211 is not recommended. The best check of transistor performance is actual operation in the instrument. If it is desired to check the performance of a transistor out of the instrument, a dynamic checker such as a Tektronix Type 576 Transistor Curve Tracer or its equivalent is recommended.

#### Recalibration

To assure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. Complete calibration instructions are given in the Calibration section. The 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

### Introduction

The following information is provided to facilitate troubleshooting the 211. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles. See the Circuit Description section for more information.

### Troubleshooting Aids

**Diagrams.** Complete circuit diagrams are given on foldout pages in the Diagrams section. The component number and electrical value of each component in this instrument are shown on the diagrams (see first page of

the Diagrams section for definition of the reference designators used to identify components in this instrument). Important voltages and waveforms are also shown on the diagrams. The portions of the circuit mounted on circuit boards are enclosed with blue lines.

**Circuit Boards.** Fig. 3-6 shows the location of the circuit boards within this instrument along with the assembly numbers. The assembly numbers are also used on the diagrams and in the parts list to aid in locating the boards. Pictures of the circuit boards are shown in Figs. 5-1 through 5-4. These pictures are located in the Diagrams section, on the back of the page opposite the circuit diagram, to aid cross-referencing between the diagrams and the circuit-board pictures. Each electrical component on the boards is identified by its circuit number as well as the interconnecting wires and/or

Resistor and Capacitor Color Code

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

\* For capacitance of 10 pF or less.

\*\* For dipped tantalum capacitors only.

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

NOTE: Ⓣ and/or ⓉⓈ color code for capacitors depends upon manufacturer and capacitor type. May not be present in some cases.

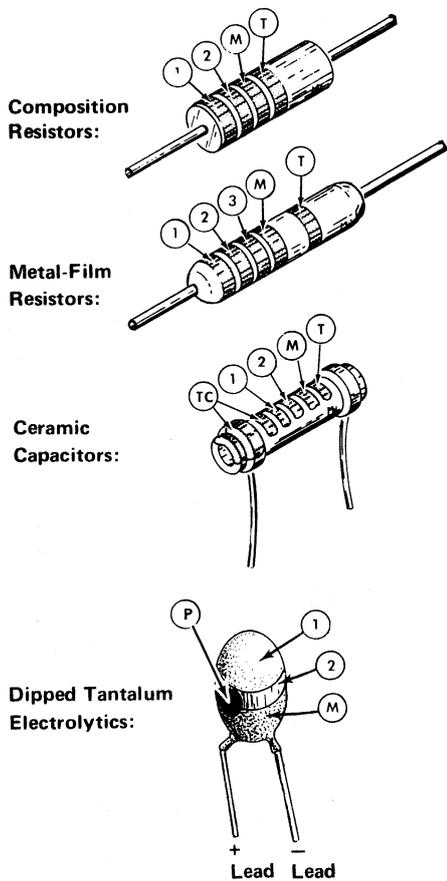


Fig. 3-1. Color-code for resistors, ceramic capacitors, and dipped tantalum electrolytic capacitors.

connectors. The circuit boards are also outlined on the diagrams with a blue line to show which portions of the circuit are located on a circuit board.

**Resistor Color-Code.** The resistors used in this instrument are either brown composition resistors or precision metal-film resistors. The resistance values are color-coded on the components with EIA color-code (some metal-film resistors may have the value printed on the body). The color-code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes which consist of two significant figures, a multiplier, and a tolerance value (see Fig. 3-1). Metal-film resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.

**Capacitor Marking.** The capacitance values of common disc capacitors and small tubular electrolytics are marked in microfarads on the side of the component body. The molded electrolytic and the white ceramic capacitors used in the 211 are color coded in picofarads using a modified EIA code (see Fig. 3-1).

**Diode Color Code.** The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. For most silicon or germanium diodes with a series of stripes, the color-code also identifies the Tektronix Part Number using the resistor color-code system (e.g., a diode color-coded pink, or blue-brown-gray-green indicates Tektronix Part Number 152-0185-00).

**Semiconductor Lead Configuration.** Fig. 3-2 shows the lead configurations of the semiconductors used in this instrument.

### Troubleshooting Equipment

The majority of troubleshooting to be done on the 211 can be accomplished with a 20,000 ohms/volt VOM such as a Triplett Model 630-NA or a Simpson Model 262. Use a dynamic transistor tester such as a Tektronix Type 576 Transistor-Curve Tracer to check the semiconductor devices used in the 211. To check waveforms in this instrument, use a test oscilloscope with a DC to

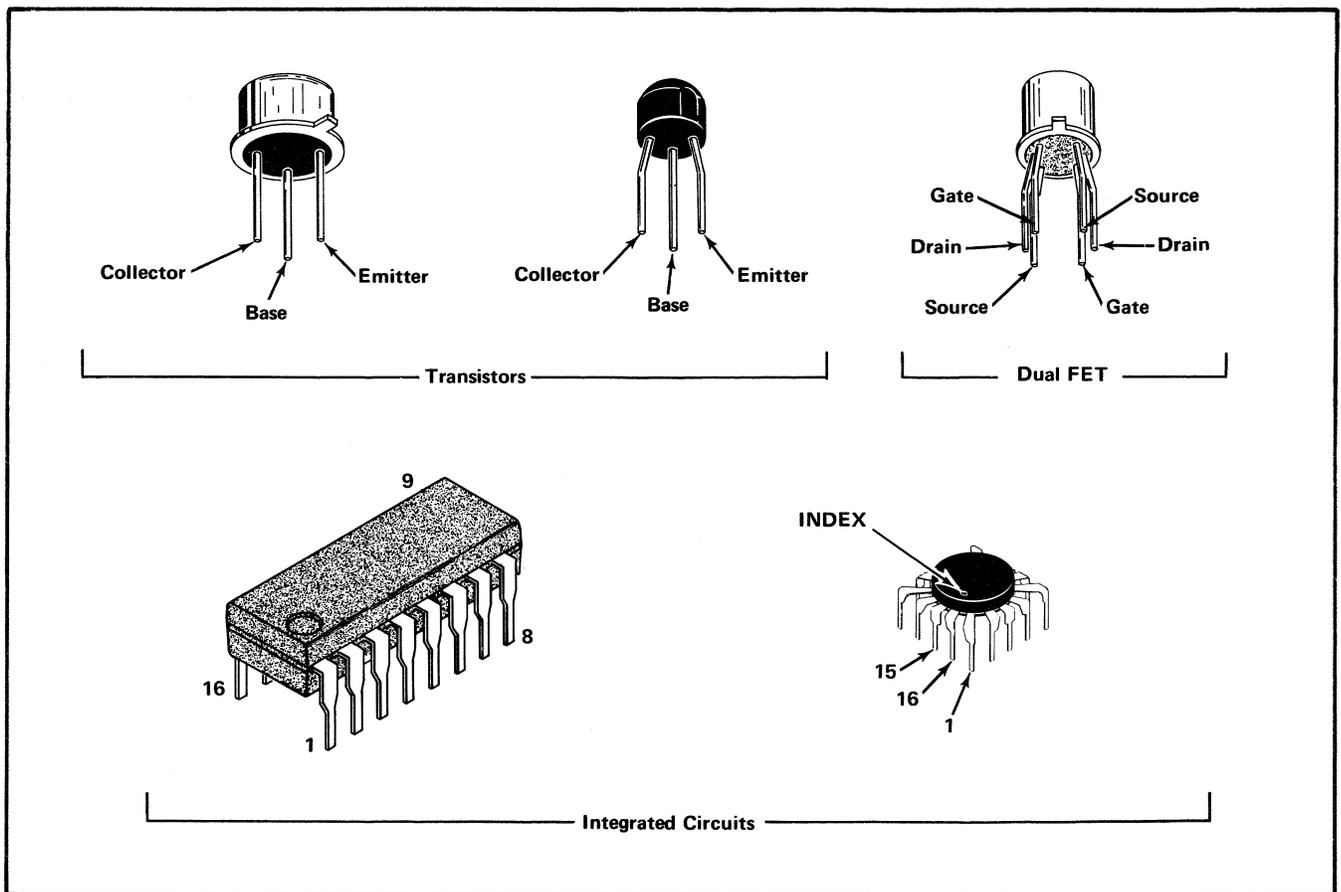


Fig. 3-2. Electrode configuration for semiconductors in this instrument.

500 kilohertz frequency response and one millivolt to 50 volt/division deflection factor.

## CORRECTIVE MAINTENANCE

### Obtaining Replacement Parts

**Standard Parts.** All electrical and mechanical part replacements for the 211 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 211. 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.

**Ordering Parts.** When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument type.
2. Instrument serial number.
3. A description of the part (if electrical, include circuit number).
4. Tektronix Part Number.

### Component Replacement

**Disassembly.** To gain access to the interior of the instrument, unwind both the power cord and the attached probe cord from the rear of the instrument.

Remove the five screws in the bottom cover of the instrument. See Fig. 3-3. Gently separate the bottom cover from the instrument and lay aside. The Power Supply circuit board with the batteries can be lifted up and pivoted out of the way. Most of the internal workings of the instrument are now accessible.

If it is necessary to have access to the front of the Input circuit board, remove the knobs from all of the external control shafts. Remove the two screws securing the instrument side panel to the Input circuit board and remove the instrument side panel.

#### WARNING

*Disconnect the instrument from any external power source before replacing components.*

**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 Mechanical Parts List for the completely wired boards.

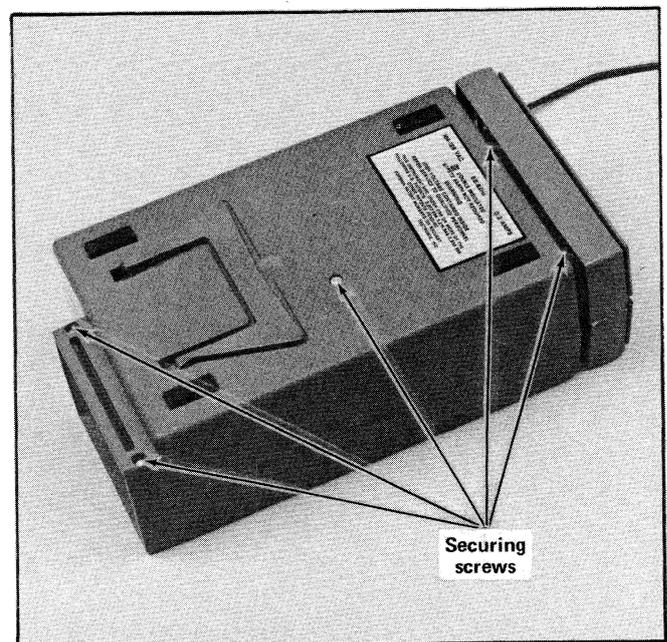


Fig. 3-3. Location of screws in instrument bottom cover.

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

Replacement transistors should be of the original type or a direct replacement. Fig. 3-2 shows the lead configuration of the transistors used in this instrument. Some plastic case transistors have lead configurations which do not agree with those shown here. If a transistor is replaced by a transistor which is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in this instrument are wired for the basing used for metal-case transistors.

**Rotary Switches.** Individual parts of the VOLTS/DIV and SEC/DIV rotary switches are replaceable. Refer to the Parts List for the applicable part numbers for replacement parts.

**Power Supply Capacitors.** When operating the instrument on power lines other than 115 VAC 60 Hz, it is necessary to change the electrical value of capacitors C210 and C212. Refer to Table 3-1 for the correct values of capacitance for three of the more commonly used line voltage/line frequency combinations.

#### NOTE

*Power line for this instrument must be sinusoidal.*

**TABLE 3-1**  
**POWER SUPPLY CAPACITORS**

Power Line	Capacitor Values	
	C210	C212
110 VAC 60 Hz (Standard)	1.7 $\mu$ F, $\pm 10\%$ , 200 VDC Tektronix PN 285-0924-00	3.3 $\mu$ F, $\pm 10\%$ , 200 VDC Tektronix PN 285-0925-00
110 VAC 50 Hz (Option 2)	2 $\mu$ F, 10%, 200 VDC Tektronix PN 285-0934-00	4 $\mu$ F, $\pm 10\%$ , 200 VDC Tektronix PN 285-0935-00
220 VAC 50 Hz (Option 1)	1 $\mu$ F, $\pm 10\%$ , 400 VDC Tektronix PN 285-0932-00	2 $\mu$ F, $\pm 10\%$ , 400 VDC Tektronix PN 285-0933-00

If the instrument is to be operated on some line voltage/line frequency combination other than one of

the above three examples, refer to Fig. 3-4 and 3-5 to select the correct values of capacitance. For example, if the instrument is to be operated on a 60 hertz line that will vary in voltage from 210 VAC to 230 VAC, refer to Fig. 3-5. Trace across the graph on the line representing 210 VAC to the point where that line crosses the first curve. This point represents the minimum values of capacitance that can be used for correct operation. Now trace across the graph on the line representing 230 VAC to the point where that line crosses the second curve. This point represents the maximum values of capacitance that can be used for correct operation. Read off the numbers directly under these points at the bottom of the graph (in this case, 2.3 and 2.8). To find the value of capacitance required for C210, multiply these numbers by 0.33 and for C212 multiply by 0.67. Thus, C210 can be a value between 0.759  $\mu$ F and 0.924  $\mu$ F and C212 can be a value between 1.541  $\mu$ F and 1.876  $\mu$ F. The voltage ratings of these capacitors should be at least 1.414 times the applied line voltage.

When replacing C210 and C212, apply a coat of Q-Dope around the base of each capacitor to provide some mechanical support. Q-Dope is available from G. C. Electronics by ordering part number GC #37-G.

C204 and C215 values must also be changed from the nominal value when the 211 is to be operated from other than 110 V 50 or 60 Hz power line. For 240 V 50 Hz operation, C204 and C215 should be replaced with .001  $\mu$ F 3 kV capacitors, Tektronix Part No. 283-0279-00 or equivalent.

### Recalibration After Repair

After any electrical component has been replaced, the calibration of that particular circuit should be checked, as well as the calibration of other closely related circuits. Since the power supply affects all circuits, calibration of the entire instrument should be checked if work has been done in the supply.

### Instrument Repackaging

If the 211 is to be shipped for long distances by commercial means of transportation, it is recommended that the instrument be repackaged in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. The Repackaging illustration in the Mechanical Parts Illustrations shows how to repackage the 211, and gives the part number for the repackaging components. New shipping cartons can be obtained from Tektronix, Inc. Contact your local Tektronix Field Office or representative.

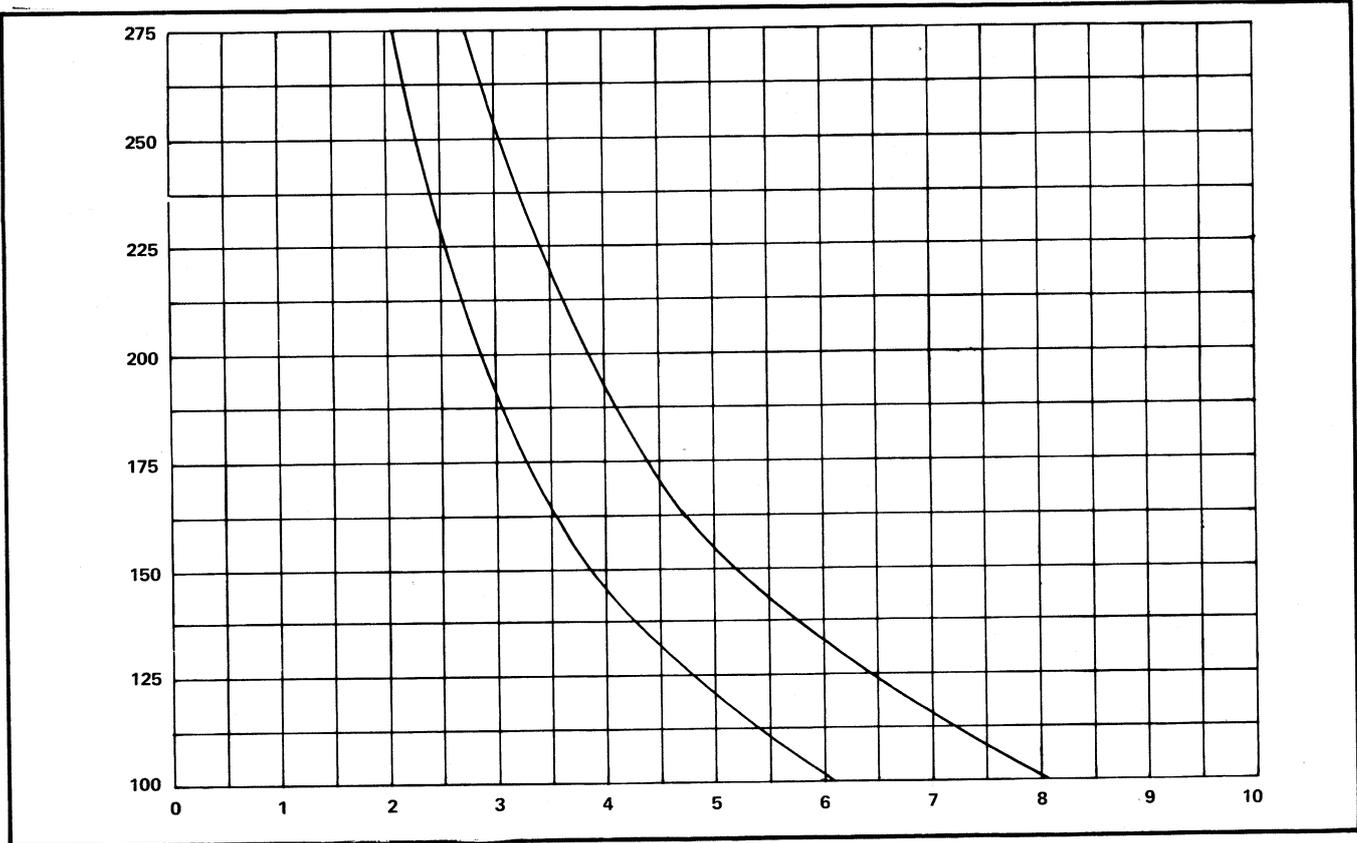


Fig. 3-4. Selecting power supply capacitors for 50 Hz sinewave operation.

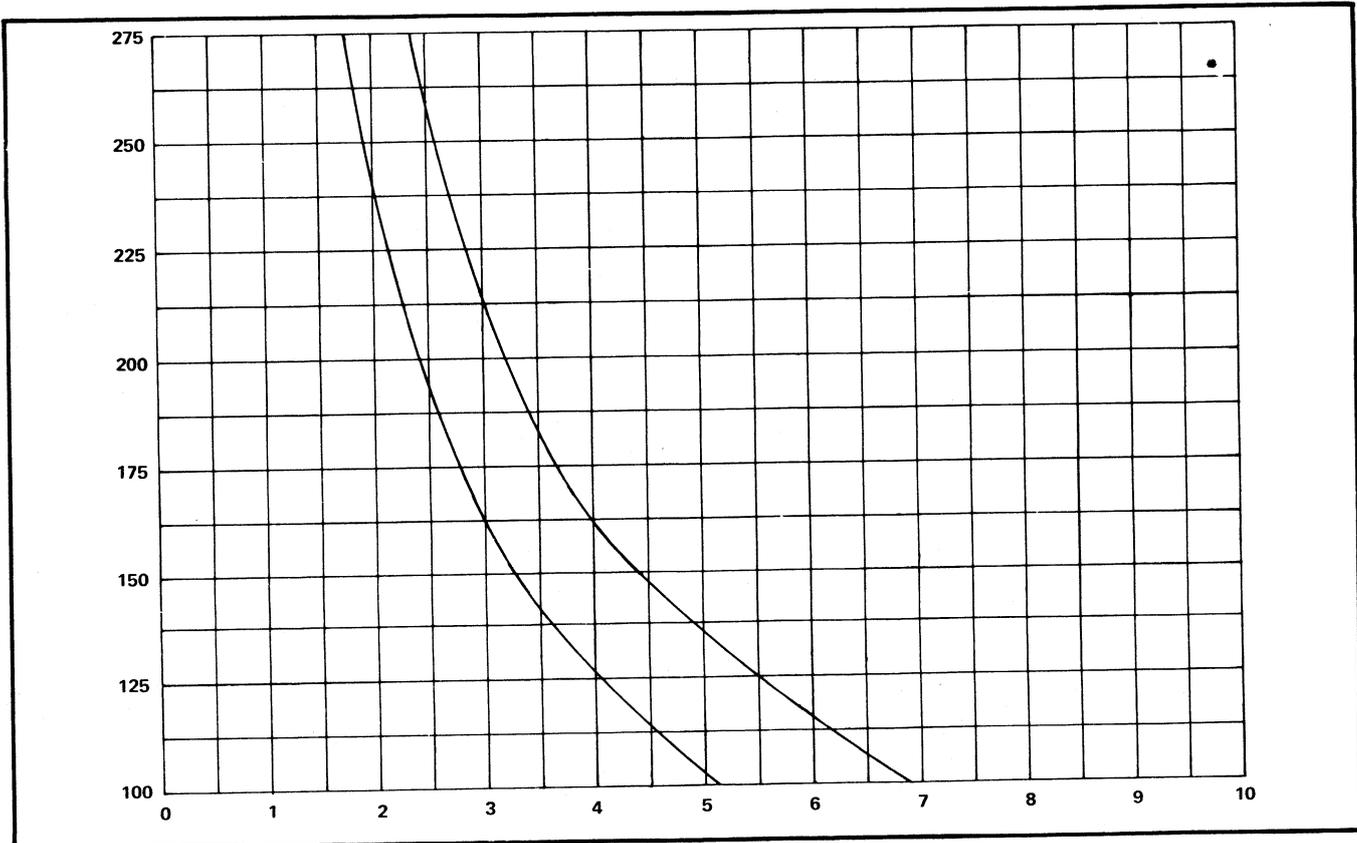


Fig. 3-5. Selecting power supply capacitors for 60 Hz sinewave operation

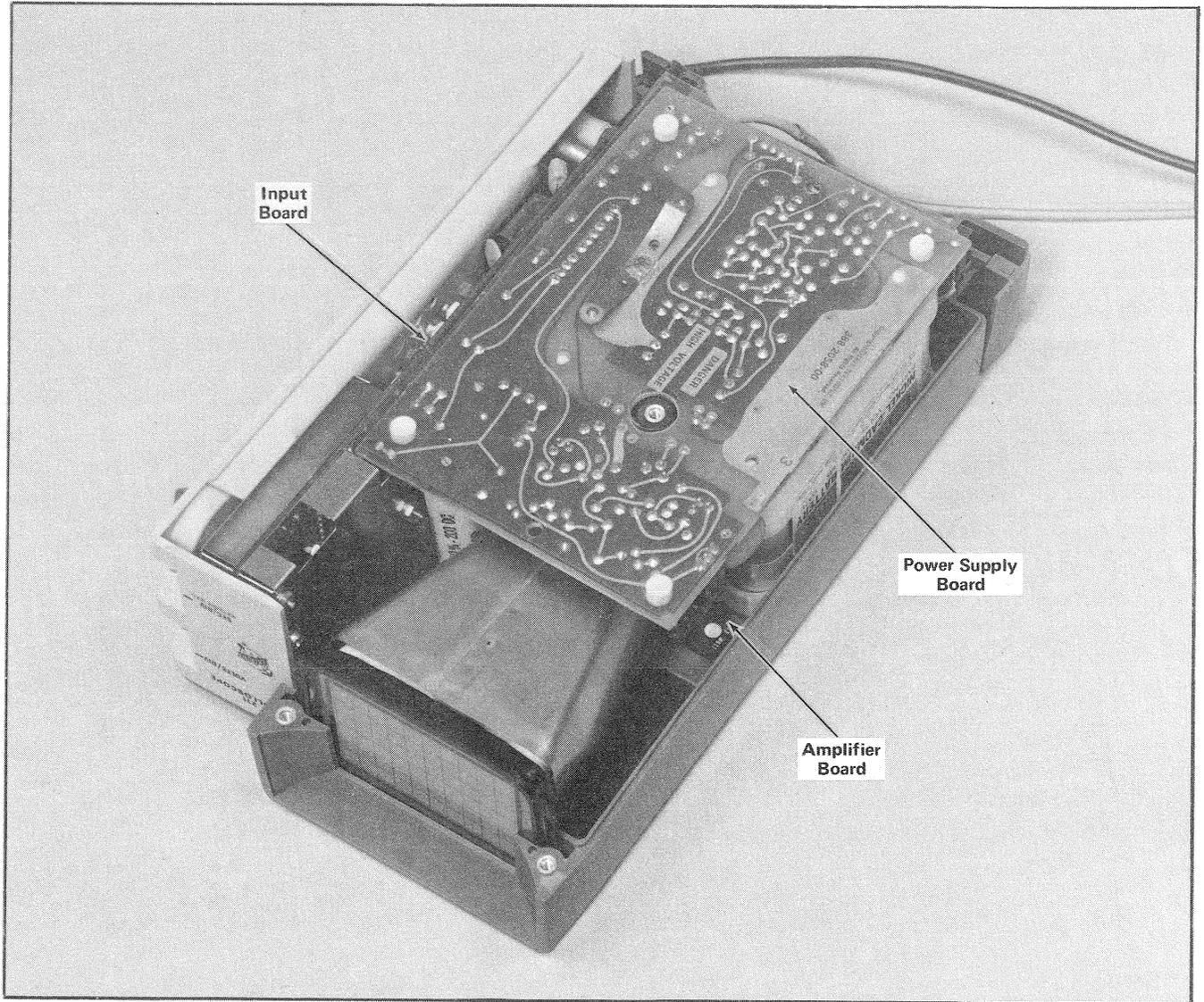


Fig. 3-6. Location of circuit boards in the 211.

This page  
intentionally  
left blank

# SECTION 4

## CALIBRATION

### Introduction

To assure instrument accuracy, check the calibration of the 211 every 1000 hours of operation, or every six months if used infrequently. Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Maintenance section.

### Tektronix Field Service

Tektronix, Inc. provides complete instrument repair and recalibration at local Field Service Centers and the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

### Using This Procedure

To aid in locating a step in the Calibration procedure, an index is given prior to the complete procedure. Completion of each step in the complete Calibration procedure insures that this instrument meets the electrical specifications given in Section 1. Where possible, instrument performance is checked before an adjustment is made. For best overall instrument performance when performing a complete calibration procedure, make each adjustment to the exact

setting even if the CHECK— step is within the allowable tolerance.

### TEST EQUIPMENT REQUIRED

#### General

The following test equipment and accessories, or its equivalent, is required for complete calibration of the 211. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, 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.

#### Special Calibration Fixtures

Special Tektronix calibration fixtures are used in this procedure only where they facilitate instrument calibration. These special calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

### TEST EQUIPMENT

Description	Minimum Specifications	Usage	Example
1. Time-Mark Generator	Marker outputs, 5 microseconds to 0.1 second; marker accuracy, within 0.1%.	Horizontal timing check and adjustment.	a. Tektronix 2901 Time-Mark Generator. b. Tektronix 184 Time-Mark Generator.
2. Standard Amplitude Calibrator	Amplitude accuracy, 0.25%; signal amplitude, 5 millivolts to 100 volts; output signal one-kilohertz square wave.	Vertical and horizontal amplifier gain checks and adjustments.	a. Tektronix calibration fixture Part Number 067-0502-01.
3. Square-Wave Generator	Frequency, one kilohertz; risetime, 100 nanoseconds or less; output amplitude, 0.4 volt to 40 volts.	Vertical amplifier compensation checks and adjustments.	a. Tektronix Type 106 Square-Wave Generator.
4. Low-Frequency Constant-Amplitude Signal Generator	Frequency, one kilohertz to 500 kilohertz; output amplitude, at least 200 millivolts.	Vertical Amplifier bandwidth check.	a. General Radio 1310-B Oscillator

## TEST EQUIPMENT (cont)

Description	Minimum Specifications	Usage	Example
5. DC Voltmeter	Range, zero to 1000 volts; accuracy, within 3%; input impedance, 20,000 $\Omega$ /volt.	Power supply output level checks. Vertical centering adjustment. CRT grid bias adjustment.	a. Triplet Model 630-NA. b. Simpson Model 262.
6. Cable	Impedance, 50 ohms; type, RG-58/U; length, 42 inches; connectors, BNC.	External trigger operation check. Horizontal gain check and adjustment.	a. Tektronix Part Number 012-0057-01.
7. Adapter	Connectors, BNC female and dual banana plug.	External trigger and external horizontal checks.	a. Tektronix Part Number 103-0090-00.
8. Adapter	Connectors, GR874 and BNC female.	Vertical amplifier compensation checks and adjustment.	a. Tektronix Part Number 017-0063-00.
9. Termination	Impedance, 50 ohms; accuracy, 2%; connectors, BNC.	Vertical amplifier compensation checks and adjustment.	a. Tektronix Part Number 011-0049-01.
10. Attenuator	Ratio, 10X; connectors, BNC; impedance, 50 ohms.	Vertical amplifier bandwidth check.	a. Tektronix Part Number 011-0059-01.
11. Adapter	Connectors, probe tip to BNC.	Used throughout procedure for signal interconnection.	a. Tektronix Part Number 013-0084-01.
12. T-Connector	Connectors, BNC.	External trigger operation checks.	a. Tektronix Part Number 103-0030-00.
13. Screwdriver	Three-inch shaft, 3/32 inch bit.	Used throughout procedure to adjust variable resistors.	a. Xcelite R-3323.
14. Low-Capacitance Screwdriver	1 1/2-inch shaft	Used to adjust variable capacitors.	a. Tektronix Part Number 003-0000-00.

**INDEX TO CALIBRATION PROCEDURE**

**Power Supply and Display**

- 1. Check Power Supply DC Levels Page 4-4
- 2. Adjust CRT Grid Bias Page 4-4
- 3. Adjust FOCUS Page 4-4
- 4. Adjust Trace Rotation Page 4-4

**Vertical System Adjustment**

- 5. Adjust Vertical DC Centering Page 4-5
- 6. Adjust STEP ATTEN BAL Page 4-5
- 7. Adjust VERT GAIN Page 4-5
- 8. Check VOLTS/DIV Accuracy and Variable VOLTS/DIV Range Page 4-6
- 9. Adjust VOLTS/DIV Switch Page 4-6
- 10. Check Vertical Amplifier Bandwidth Page 4-7

**Trigger Circuit Adjustment**

- 11. Adjust AUTO PRESET Page 4-8
- 12. Check Trigger Circuit Operation Page 4-8

**Horizontal System Adjustment**

- 13. Adjust Horizontal Gain Page 4-9
- 14. Adjust Sweep Calibration Page 4-9
- 15. Check HORIZ MAG Range Page 4-9
- 16. Check SEC/DIV Accuracy Page 4-9

**Preliminary Procedure**

*This instrument should be adjusted at an ambient temperature of +25°C (±5°C) for best overall accuracy.*

1. Remove the instrument covers as outlined in section 3.

2. Connect the instrument to a 117 VAC 60 Hz line source. If the batteries are not fully charged, leave the instrument connected to the line with the power switch turned off for a period of approximately one hour before continuing with the calibration procedure.

3. Set the instrument controls as given under Preliminary Control Settings. Allow at least five minutes of warmup before proceeding.

**NOTE**

*Titles for external controls of this instrument are capitalized in this procedure (e.g., INTENSITY). Internal adjustments are initial capitalized only (e.g., Sweep Cal).*

**Preliminary Control Settings**

Preset the instrument controls to the settings given below when starting a calibration procedure.

VOLTS/DIV	50 m
VAR VOLTS/DIV	CAL
SEC/DIV	1 m
HORIZ MAG	CAL
Position (vertical and horizontal)	Midrange
INTENSITY	Fully CCW
LEVEL/SLOPE	AUTO PRESET
Trigger Source	INT
INPUT COUPLING	GND
POWER	ON

**POWER SUPPLY AND DISPLAY**

**Equipment Required**

- 1. DC Voltmeter
- 2. Three-inch screwdriver

**Control Settings**

Preset instrument controls to the settings given under Preliminary Control Settings.

**1. Check Power Supply DC Levels**

**NOTE**

*If the instrument has been operating satisfactorily prior to recalibration, proceed with step 2.*

a. Using the DC voltmeter, measure the DC level of the power supplies given in Table 4-1. Observe proper meter polarity. See Fig. 4-1 for test point locations.

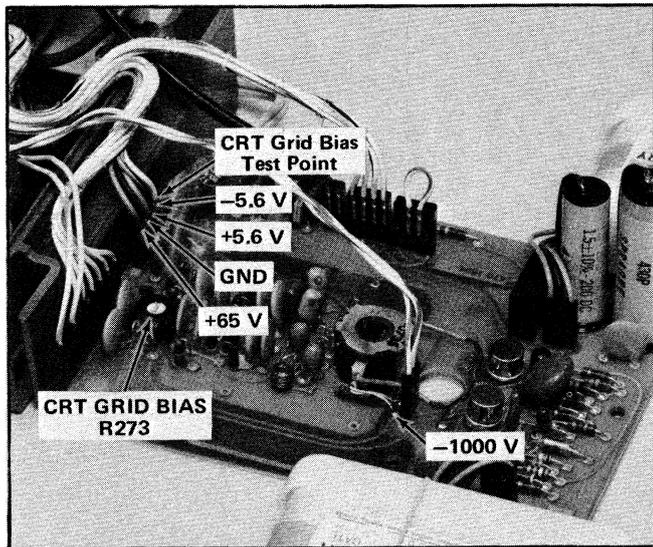
**Table 4-1**

**Power Supply Accuracy**

Supply	Measurement
-5.6 volt	-5.6 volts $\pm$ 0.4 volt
+5.6 volt	+5.6 volts $\pm$ 0.4 volt
+65 volt	+65 volts $\pm$ 4 volts
-1000 volt	-960 volts $\pm$ 40 volts

**2. Adjust CRT Grid Bias**

a. Connect the DC voltmeter between pin 5 and pin 2 of plug P3 (negative meter lead to pin 2) on the Power Supply Board. See Fig. 4-1.



**Fig. 4-1.** Location of power supply test points and CRT Grid Bias adjustment.

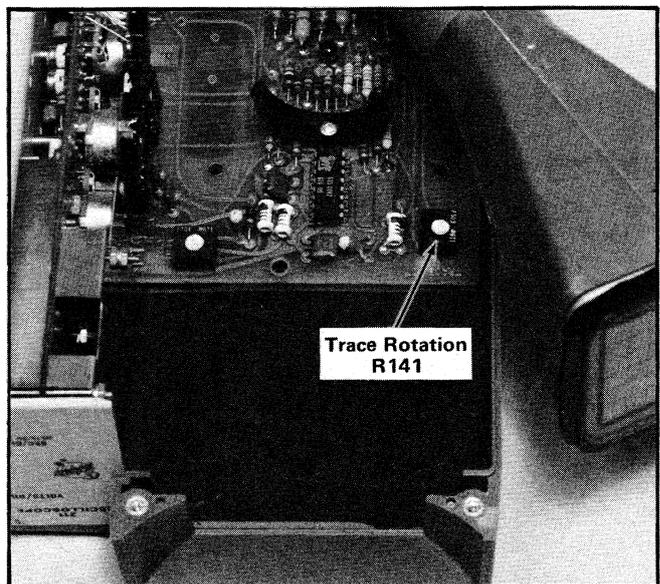
- b. Turn the INTENSITY control fully clockwise.
- c. CHECK—Meter reading of +1.9 volts.
- d. ADJUST—CRT Grid Bias adjustment R273 (see Fig. 4-1) for a meter reading of +1.9 volts.
- e. Disconnect all test equipment. Turn the INTENSITY control fully counterclockwise.

**3. Adjust FOCUS**

- a. Set the SEC/DIV switch to 10 V and adjust the INTENSITY control for nominal display intensity (approximately midrange).
- b. CHECK—CRT display for a well-defined dot.
- c. ADJUST—Focus adjustment R90 (located on instrument side panel) for a well defined dot.

**4. Adjust Trace Rotation**

- a. Set the SEC/DIV switch to 1 m.
- b. CHECK—Free-running sweep is parallel with horizontal graticule line.
- c. ADJUST—Trace Rotation adjustment R141 (located on Amplifier Board; see Fig. 4-2) so the trace is parallel with the horizontal graticule lines.



**Fig. 4-2.** Location of Trace Rotation adjustment.

## VERTICAL SYSTEM ADJUSTMENT

### Equipment Required

- |  |                                 |
|--|---------------------------------|
| 1. Standard Amplitude Calibrator                     | 7. Probe Tip-To-BNC Adapter     |
| 2. Square-Wave Generator                             | 8. 50 Ohm BNC Termination       |
| 3. Low Frequency Constant Amplitude Signal Generator | 9. 10X 50 Ohm Attenuator        |
| 4. DC Voltmeter                                      | 10. Three-Inch Screwdriver      |
| 5. 42-Inch 50 Ohm BNC Cable                          | 11. Low-Capacitance Screwdriver |
| 6. GR-To-BNC Female Adapter                          |                                 |

### Control Settings

Preset instrument controls to the settings given under Preliminary Control Settings except as follows:

INTENSITY

Visible Display

### 5. Adjust Vertical DC Centering

- a. Connect the DC voltmeter between pin 11 (SN B020000 and up) or pin 5 (below SN B020000) of U105 and ground. See Fig. 4-3.
- b. Adjust the Vertical Position control for a meter reading of 0 volts.
- c. CHECK—Trace should be within approximately 0.4 division of graticule center.

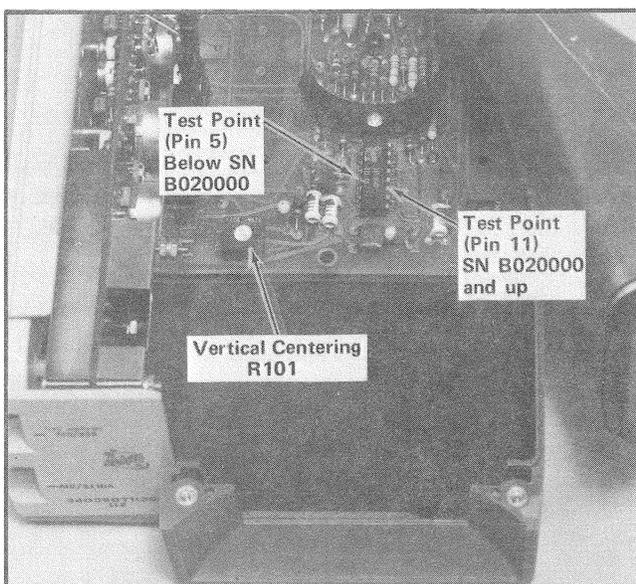


Fig. 4-3. Location of Vertical Centering adjustment and test point.

- d. ADJUST—Vertical Centering adjustment R101 (see Fig. 4-3) to position the trace to the center horizontal graticule line.

- e. Disconnect all test equipment.

### 6. Adjust STEP ATTEN BAL

- a. Rotate the VOLTS/DIV switch from 50 m to 1 m.
- b. CHECK—CRT display for 0.1 division or less trace shift between adjacent switch positions when rotating the VOLTS/DIV switch from 50 m to 1 m.
- c. ADJUST—STEP ATTEN BAL (located on instrument side panel) for minimum trace shift when rotating the VOLTS/DIV switch from 50 m to 1 m.

### 7. Adjust VERT GAIN

- a. Set the VOLTS/DIV switch to 50 m.
- b. Connect the 211 probe tip to the output of the Standard Amplitude Calibrator via a probe tip-to-BNC adapter.
- c. Set the Standard Amplitude Calibrator for a 0.2 volt output signal.
- d. Set the 211 INPUT COUPLING switch to DC.
- e. CHECK—CRT display for four divisions of deflection within 0.2 division.

## Calibration—211

f. ADJUST—VERT GAIN adjustment (located on instrument side panel) for exactly four divisions of deflection.

g. ADJUST—R29 1 mV/DIV gain.

**NOTE**

*R29 adjustment is located on the opposite side of the board and slightly above and to the rear of the VOLTS/DIV switch. To adjust, insert small screwdriver through access hole near the top front of the Input Board shield No. 1-12 on the CRT side of the board.*

Adjust the Standard Amplitude Calibrator for 5 mV output signal.

h. Set the VOLTS/DIV switch to 1 m.

i. Adjust R29 for 5 divisions of deflection on the CRT.

### 8. Check VOLTS/DIV Accuracy And Variable VOLTS/DIV Range

a. Rotate the Variable VOLTS/DIV control fully counterclockwise.

b. CHECK—CRT display for 1.33 divisions of deflection or less. 1.33 divisions of deflection indicates a Variable VOLTS/DIV range of at least 3:1.

**TABLE 4-2**

**Vertical Deflection Accuracy**

VOLTS/DIV Switch Setting	Standard Amplitude Calibrator Output	Vertical Deflection in Divisions	Maximum Error For $\pm 5\%$ Accuracy
1 m	5 millivolts	5	$\pm 0.25$ division
			Previously set by R29 in step 7.
2 m	10 millivolts	5	$\pm 0.25$ division
5 m	20 millivolts	4	$\pm 0.2$ division
10 m	50 millivolts	5	$\pm 0.25$ division
20 m	0.1 volt	5	$\pm 0.25$ division
50 m	0.2 volt	4	Previously set in step 7.
.1	0.5 volt	5	$\pm 0.25$ division
.2	1 volt	5	$\pm 0.25$ division
.5	2 volts	4	$\pm 0.2$ division
1	5 volts	5	$\pm 0.25$ division
2	10 volts	5	$\pm 0.25$ division
5	20 volts	4	$\pm 0.2$ division
10	50 volts	5	$\pm 0.25$ division
20	100 volts	5	$\pm 0.25$ division
50	100 volts	2	$\pm 0.1$ division

c. Set the Variable VOLTS/DIV control to CAL.

d. CHECK—Using the VOLTS/DIV switch and Standard Amplitude Calibrator settings given in Table 4-2, check to see if the deflection factor accuracy for each position is within 5%.

### 9. Adjust VOLTS/DIV Switch Compensation

a. Set the VOLTS/DIV switch to .1.

b. Connect the 211 probe tip to the high-amplitude output of the Type 106 Square-Wave Generator via a GR-to-BNC female adapter, a 50-ohm BNC termination, and a probe tip-to-BNC adapter.

c. Adjust the Square-Wave Generator for a four-division display of a one-kilohertz square wave.

d. CHECK—CRT display for flat-top waveform with no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.

**NOTE**

*If C8, C9, or C10 require adjustment, it will be necessary to remove the instrument side panel from the Input Board. Refer to Section 3 for removal procedure.*

e. ADJUST—C8 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.

f. Set the VOLTS/DIV switch to 1 and adjust the Square-Wave Generator for a four-division display.

g. CHECK—CRT display for flat-top waveform with no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.

h. ADJUST—C9 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.

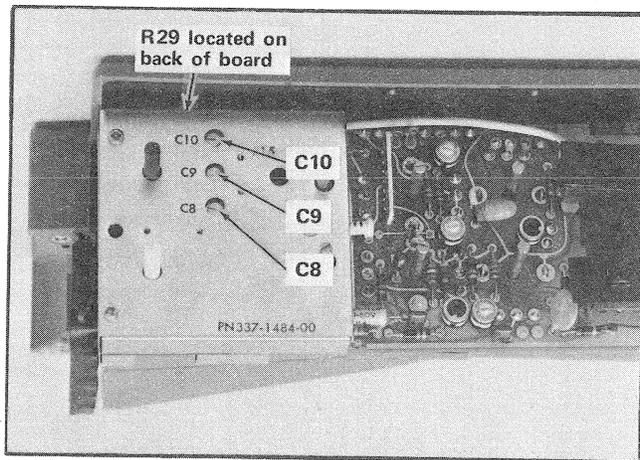


Fig. 4-4. Location of attenuator compensation capacitors.

i. Set the VOLTS/DIV switch to 10, remove the 50 ohm BNC termination from the test setup, and adjust the Square-Wave Generator for a four-division display.

j. CHECK—CRT display for flat-top waveform with no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.

k. ADJUST—C10 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.

l. Re-install the instrument side panel and disconnect all test equipment.

## 10. Check Vertical Amplifier Bandwidth

a. Set the VOLTS/DIV switch to 1 m.

b. Connect the 211 probe tip to the output of the Low Frequency Constant-Amplitude Signal Generator via a 50-ohm BNC 10X attenuator and a probe tip-to-BNC adapter.

c. Adjust the signal generator for a six-division display of a one-kilohertz signal.

d. Without changing the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.

e. CHECK—Signal generator output frequency must be at least 100 kilohertz.

f. Set the VOLTS/DIV switch to 2 m and adjust the signal generator for a six-division display of a one-kilohertz signal.

g. Without changing the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.

h. CHECK—Signal generator output frequency must be at least 200 kilohertz.

i. Set the VOLTS/DIV switch to 5 m and adjust the signal generator for a six-division display of a one-kilohertz signal.

j. Without changing the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.

k. CHECK—Signal generator output frequency must be at least 400 kilohertz.

l. Set the VOLTS/DIV switch to 10 m and adjust the signal generator for a six-division display of a one-kilohertz signal.

m. Without changing the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.

n. CHECK—Signal generator output frequency must be at least 500 kilohertz.

## TRIGGER CIRCUIT ADJUSTMENT

### Equipment Required

- |                                   |                               |
|-----------------------------------|-------------------------------|
| 1. Low Frequency Signal Generator | 4. BNC to Banana Plug Adapter |
| 2. Cable                          |                               |
| 3. BNC T-Connector                | 5. Three-Inch Screwdriver     |

### Control Settings

Preset instrument controls to the settings given under Preliminary Control Settings except as follows:

SEC/DIV	.1 m
INPUT COUPLING	DC

### 11. Adjust AUTO PRESET

- a. Connect the output of the Low Frequency Signal Generator to the 211 probe tip via a BNC T-connector and a probe tip-to-BNC adapter.
- b. Connect the unused output of the BNC T-connector to the 211 EXT TRIG OR HORIZ INPUT via a 42-inch BNC cable and a BNC-to-banana plug adapter.
- c. Adjust the signal generator for a .2-division display of a five kilohertz signal.
- d. CHECK—For a stable triggered display.
- e. ADJUST—AUTO PRESET (located through hole on 211 side panel) for a stable triggered .2-division display.

f. CHECK—AUTO PRESET bright trace. Momentarily slide INPUT COUPLING switch to GND and check for a bright trace remaining on CRT display. Return INPUT coupling switch to DC.

### 12. Check Trigger Circuit Operation

- a. Set the VOLTS/DIV switch to 1.0 and the SEC/DIV switch to 5  $\mu$ .
- b. Adjust the signal generator for a one-division display of a 500-kilohertz signal.
- c. Set the VOLTS/DIV switch to 5.
- d. CHECK—That a stable display can be obtained by rotating the LEVEL/SLOPE control out of the AUTO PRESET position and triggering on both the positive-going and negative-going slopes of the displayed waveform. Momentarily slide the INPUT COUPLING switch to GND and check that there is no trace displayed on the CRT. (For instruments below SN B020000 trace may remain on the CRT.) Return INPUT COUPLING switch to DC.
- e. Set the Trigger Source switch to EXT.
- f. CHECK—A stable display can be obtained by adjusting the LEVEL/SLOPE control to trigger on both the positive-going and negative-going slopes of the displayed waveform.
- g. Disconnect all test equipment.

## HORIZONTAL SYSTEM ADJUSTMENT

### Equipment Required

- |                                  |                               |
|----------------------------------|-------------------------------|
| 1. Standard Amplitude Calibrator | 4. BNC-To-Banana Plug Adapter |
| 2. Time-Mark Generator           | 5. Probe Tip-To-BNC Adapter   |
| 3. 42-Inch 50-Ohm BNC Cable      | 6. Three-Inch Screwdriver     |

### Control Settings

Preset instrument controls to the settings given under Preliminary Control Settings except as follows:

SEC/DIV	1 V
INPUT COUPLING	DC

### 13. Adjust Horizontal Gain

a. Connect the output of the Standard Amplitude Calibrator to the EXT TRIG OR HORIZ INPUT via a 42-inch BNC cable and the BNC-to-banana plug adapter.

b. Set the Standard Amplitude Calibrator for a five-volt output.

c. CHECK—CRT display for two dots separated horizontally by five divisions,  $\pm 0.5$  division.

d. ADJUST—HORIZ GAIN adjustment R88 (located on instrument side panel) for five divisions of deflection between dots.

e. Set the SEC/DIV switch to 10 V.

f. Set the Standard Amplitude Calibrator for a 50-volt output.

g. CHECK—CRT display for two dots separated horizontally by five divisions,  $\pm 0.5$  division.

h. Disconnect all test equipment.

### 14. Adjust Sweep Cal

a. Connect the 211 probe tip to the output of the Time-Mark Generator via a probe tip-to-BNC adapter.

b. Set the SEC/DIV switch to 1 m and the Time-Mark Generator for 1 millisecond markers.

c. Adjust the VOLTS/DIV switch for a display approximately three divisions in amplitude.

d. CHECK—CRT display for one time mark per division. With the second time mark aligned with the second vertical graticule line, the tenth time mark should align with the tenth vertical graticule line within 0.4 division.

e. ADJUST—SWEEP CAL adjustment R56 (located on instrument side panel) for exactly eight divisions of deflection between the second and tenth time marks.

### 15. Check HORIZ MAG Range

a. Rotate the HORIZ MAG control fully clockwise.

b. CHECK—CRT display for at least five divisions between time marks. Five-division spacing indicates a HORIZ MAG control range of at least 5:1.

c. Return the HORIZ MAG control to the CAL detent.

### 16. Check SEC/DIV Accuracy

a. CHECK—Apply the appropriate time marks and check each position of the SEC/DIV switch for proper timing over the center eight division portion of each sweep within 0.4 division. Disregard the first 0.5 microsecond of total sweep length.

This page  
intentionally  
left blank

# REPLACEABLE ELECTRICAL 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.

Change information, if any, is located at the rear of this manual.

## SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number  
00X Part removed after this serial number

### 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.

## ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
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
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04099	CAPCO, INC.	FORESIGHT INDUSTRIAL PARK, PO BOX 2164	GRAND JUNCTION, CO 81501
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
15238	ITT SEMICONDUCTORS, A DIVISION OF INTER NATIONAL TELEPHONE AND TELEGRAPH CORP.	P.O. BOX 168, 500 BROADWAY	LAWRENCE, MA 01841
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
51642	CENTRE ENGINEERING INC.	2820 E COLLEGE AVENUE	STATE COLLEGE, PA 16801
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
58756	CTS OF ELKHART INC.	1142 W. BEARDSLEY AVE.	ELKHART, IN 46514
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
71450	CTS CORP.	905 N. WEST BLVD	ELKHART, IN 46514
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
76493	BELL INDUSTRIES, INC., MILLER, J. W., DIV.	19070 REYES AVE., P O BOX 5825	COMPTON, CA 90224
79727	C-W INDUSTRIES	550 DAVISVILLE RD., P O BOX 96	WARMINISTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80031	ELECTRA-MIDLAND CORP., MEPCO DIV.	22 COLUMBIA ROAD	MORRISTOWN, NJ 07960
84411	TRW ELECTRONIC COMPONENTS, TRW CAPACITORS	112 W. FIRST ST.	OGALLALA, NE 69153
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET	INDIANAPOLIS, IN 46206
91418	RADIO MATERIALS COMPANY, DIV. OF P.R. MALLORY AND COMPANY, INC.	P. O. BOX 372	CHICAGO, IL 60646
91637	DALE ELECTRONICS, INC.	4242 W BRYN MAWR P. O. BOX 609	COLUMBUS, NE 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-1506-00	B010100	B079999	CKT BOARD ASSY:INPUT	80009	670-1506-00
A1	670-1506-01	B080000		CKT BOARD ASSY:INPUT	80009	670-1506-01
A2	670-1505-00			CKT BOARD ASSY:AMPLIFIER	80009	670-1505-00
A3	670-1504-00	B010100	B114649	CKT BOARD ASSY:POWER SUPPLY	80009	670-1504-00
A3	670-1504-11	B114650		CKT BOARD ASSY:POWER SUPPLY	80009	670-1504-11
A3	670-1504-21	XB114650		CKT BOARD ASSY:POWER SUPPLY (OPTION 01 ONLY)	80009	670-1504-21
	-----					
A3	670-1504-31	XB114650		CKT BOARD ASSY:POWER SUPPLY (OPTION 02 ONLY)	80009	670-1504-31
	-----					
BT216	146-0033-00			BATTERY ASSY:2 SETS OF 5	80009	146-0033-00
BT217	146-0033-00			BATTERY ASSY:2 SETS OF 5	80009	146-0033-00
C5	285-0697-06			CAP.,FXD,PLSTC:0.1UF,+5-15%,600V	80009	285-0697-06
C7A	283-0175-00			CAP.,FXD,CER DI:10PF,5%,200V	72982	8101B210C0G0100J
C7B	283-0213-00			CAP.,FXD,CER DI:300PF,5%,100V	72982	8121N130C0G0301J
C7C	283-0294-00			CAP.,FXD,CER DI:3300 PF,20%,50V	04222	18125A332MA2065
C8	281-0178-00			CAP.,VAR,PLSTC:1-3.5PF,500V	80031	2805D013R5BH02F0
C9	281-0178-00			CAP.,VAR,PLSTC:1-3.5PF,500V	80031	2805D013R5BH02F0
C10	281-0178-00			CAP.,VAR,PLSTC:1-3.5PF,500V	80031	2805D013R5BH02F0
C12	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C16A	-----			(FURNISHED AS A UNIT WITH R16A,B,C,D,E)		
C16B	-----			(FURNISHED AS A UNIT WITH R16A,B,C,D,E)		
C32	283-0256-00			CAP.,FXD,CER DI:130PF,5%,100V	51642	200-100N1500131J
C36	290-0535-00	B010100	B079999	CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C36	290-0535-01	B080000		CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C38	290-0535-00	B010100	B079999	CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C38	290-0535-01	B080000		CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C39	281-0510-00			CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	59660	301-000C0G0220M
C45	283-0023-00	B010100	B020279	CAP.,FXD,CER DI:0.1UF,+80-20%,12V	91418	MX0104Z1205R5
C45	283-0111-00	B020280		CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C47	283-0182-00			CAP.,FXD,CER DI:51PF,5%,400V	72982	8121N400A510J
C52	281-0505-00			CAP.,FXD,CER DI:12PF,+/-1.2PF,500V	59660	301-012C0G0120K
C53	281-0550-00			CAP.,FXD,CER DI:120PF,10%,500V	04222	7001-1373
C59	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N061Z5U0103M
C62	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N061Z5U0103M
C65	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C66	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C68	283-0201-00			CAP.,FXD,CER DI:27PF,10%,200V	72982	8101B210X7R0270K
C72	295-0144-00			CAP SET,MATCHED:1UF,0.001UF,MATCHED	84411	TEK101-0009R5
C73	-----			(INDIVIDUAL TIMING CAPACITORS IN THIS ASSEMBLY		
C74	-----			MUST BE ORDERED BY THE 9 DIGIT PART NUMBER,		
	-----			LETTER SUFFIX AND TOLERANCE PRINTED ON THE		
	-----			TIMING CAPACITOR TO BE REPLACED. THE LETTER		
	-----			SUFFIX AND THE TOLERANCE SHOULD BE THE SAME		
	-----			FOR ALL OF THE TIMING CAPACITORS IN THE		
	-----			ASSEMBLY. EXAMPLE: 285-XXXX-XX F-)		
C75	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N061Z5U0103M
C76	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C77	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C78	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C101	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C103	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C104	281-0591-00			CAP.,FXD,CER DI:5600PF,20%,200V	72982	393001Z5V0562Z
C113	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C115	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C125	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C127	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C129	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C145	290-0522-00			CAP., FXD, ELCTLT:1UF, 20%, 50V	56289	196D105X0050HA1
C150	281-0591-00			CAP., FXD, CER DI:5600PF, 20%, 200V	72982	393001Z5V0562Z
C153	281-0591-00			CAP., FXD, CER DI:5600PF, 20%, 200V	72982	393001Z5V0562Z
C204	283-0280-00	B010100	B109999	CAP., FXD, CER DI:2200PF, 10%, 2000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE)	59660	0818590Y5500222K
C204	283-0263-00	B110000		CAP., FXD, CER DI:0.0022UF, 20%, 3000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE)	56289	33C319
C204	283-0279-00	B114650		CAP., FXD, CER DI:0.001UF, 20%, 3000V (OPTION 01 ONLY)	59660	878-530 Y5S0102M
C206	283-0057-00	B010100	B114159	CAP., FXD, CER DI:0.1UF, +80-20%, 200V	56289	2C20Z5U104Z200B
C206	283-0068-00	B114160		CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C207	283-0057-00	B010100	B114159	CAP., FXD, CER DI:0.1UF, +80-20%, 200V	56289	2C20Z5U104Z200B
C207	283-0068-00	B114160		CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C210	285-0924-00			CAP., FXD, PLSTC:1.7UF, 10%, 200V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE)	04099	C703C175K
C210	285-0932-00	XB114650		CAP., FXD, PLSTC:1UF, 10%, 400V (OPTION 01 ONLY)	14752	A-1478
C210	285-0934-00	XB114650		CAP., FXD, PLSTC:2.2UF, 10%, 200V (OPTION 02 ONLY)	56289	430P238
C212	285-0925-00			CAP., FXD, PLSTC:3.3UF, 10%, 200V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE.) (STANDARD ONLY)	84411	TEK121-33592
C212	285-0933-00	XB114650		CAP., FXD, PLSTC:2UF, 10%, 400V (OPTION 01 ONLY)	14752	C2477
C212	285-0935-00	XB114650		CAP., FXD, PLSTC:4.4UF, 10%, 200V (OPTION 02 ONLY)	56289	430P179
C215	283-0280-00	B010100	B109999	CAP., FXD, CER DI:2200PF, 10%, 2000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE.) (STANDARD ONLY)	59660	0818590Y5500222K
C215	283-0263-00	B110000		CAP., FXD, CER DI:0.0022UF, 20%, 3000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE.) (STANDARD ONLY)	56289	33C319
C215	283-0279-00	XB114650		CAP., FXD, CER DI:0.001UF, 20%, 3000V (OPTION 01 ONLY)	59660	878-530 Y5S0102M
C216	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C236	283-0000-00			CAP., FXD, CER DI:0.001UF, +100-0%, 500V	59660	831-519-Y5P-102P
C238	290-0534-00			CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C239	290-0283-00			CAP., FXD, ELCTLT:0.47UF, 10%, 35V	56289	162D474X9035BC2
C241	283-0028-00			CAP., FXD, CER DI:0.0022UF, 20%, 50V	56289	19C606
C247	290-0519-00			CAP., FXD, ELCTLT:100UF, 20%, 20V	90201	TDC107M020WLD
C251	290-0535-00	B010100	B079999	CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0010KA1
C251	290-0535-01	B080000		CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0010KA1
C253	290-0535-00	B010100	B079999	CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0010KA1
C253	290-0535-01	B080000		CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0010KA1
C256	290-0517-00			CAP., FXD, ELCTLT:6.8UF, 20%, 35V	56289	196D685X0035KA1
C257	283-0057-00			CAP., FXD, CER DI:0.1UF, +80-20%, 200V	56289	2C20Z5U104Z200B
C258	290-0517-00			CAP., FXD, ELCTLT:6.8UF, 20%, 35V	56289	196D685X0035KA1
C260	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C261	283-0177-00			CAP., FXD, CER DI:1UF, +80-20%, 25V	56289	273C5
C262	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C263	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C264	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C265	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C266	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C267	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C268	283-0068-00			CAP., FXD, CER DI:0.01UF, +100-0%, 500V	72982	871-533E103P
C269	283-0001-00			CAP., FXD, CER DI:0.005UF, +100-0%, 500V	72982	831-559E502P

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C273	283-0105-00			CAP., FXD, CER DI:0.01UF, +80-20%, 2000V	72982	DHR22Y5S103Z2KV
C274	283-0001-00			CAP., FXD, CER DI:0.005UF, +100-0%, 500V	72982	831-559E502P
CR12	152-0246-00			SEMICON D DEVICE: SW, SI, 40V, 200MA	03508	DE140
CR39	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR49	152-0246-00			SEMICON D DEVICE: SW, SI, 40V, 200MA	03508	DE140
CR215	152-0488-00			SEMICON D DEVICE: SILICON, 200V, 1500MA	04713	SDA317
CR240	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR241	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR251	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR252	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR253	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR254	152-0141-02			SEMICON D DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR256	152-0333-00			SEMICON D DEVICE: SILICON, 55V, 200MA	07263	FDH-6012
CR258	152-0333-00			SEMICON D DEVICE: SILICON, 55V, 200MA	07263	FDH-6012
CR261	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR261	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR262	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR262	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR263	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR263	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR264	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR264	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR265	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR265	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR266	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR266	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR267	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR267	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
CR268	152-0107-00	B010100	B109999	SEMICON D DEVICE: SILICON, 400V, 400MA	01295	G727
CR268	152-0107-03	B110000		SEMICON D DEVICE: SILICON, 375V, 400MA, SEL	01295	G727
F201	159-0103-00			FUSE, CARTRIDGE: 0.4A, 125V, 0.25SEC, 1.0 LEAD	75915	279.400
L108	108-0654-00	B010100	B010249	COIL, RF: 2.2MH	76493	01872
L108	108-0691-00	B010250		COIL, RF: 1.8MH	76493	02279
L111	108-0654-00	B010100	B010249	COIL, RF: 2.2MH	76493	01872
L111	108-0691-00	B010250		COIL, RF: 1.8MH	76493	02279
L257	108-0654-00			COIL, RF: 2.2MH	76493	01872
L300	-----			(FURNISHED AS A UNIT WITH CRT)		
M310	149-0031-01			METER, ELEC FREQ: 0-200VA, +/-15%	80009	149-0031-01
Q18	151-1057-00			TRANSISTOR: SILICON, FE, N-CHANNEL, DUAL	80009	151-1057-00
Q107	153-0601-00	B010100	B079999	SEMICON D DEVICE: 2N3565, SEL	80009	153-0601-00
Q107	151-0432-00	B080000		TRANSISTOR: SILICON, NPN	27014	ST07391D
Q110	153-0601-00	B010100	B079999	SEMICON D DEVICE: 2N3565, SEL	80009	153-0601-00
Q110	151-0432-00	B080000		TRANSISTOR: SILICON, NPN	27014	ST07391D
Q119	153-0601-00	B010100	B079999	SEMICON D DEVICE: 2N3565, SEL	80009	153-0601-00
Q119	151-0432-00	B080000		TRANSISTOR: SILICON, NPN	27014	ST07391D
Q122	153-0601-00	B010100	B079999	SEMICON D DEVICE: 2N3565, SEL	80009	153-0601-00
Q122	151-0432-00	B080000		TRANSISTOR: SILICON, NPN	27014	ST07391D
Q134	153-0601-00	B010100	B079999	SEMICON D DEVICE: 2N3565, SEL	80009	153-0601-00
Q134	151-0432-00	B080000		TRANSISTOR: SILICON, NPN	27014	ST07391D
Q231	151-0341-00			TRANSISTOR: SILICON, NPN	07263	S040065
Q235	151-0220-00			TRANSISTOR: SILICON, PNP	07263	S036228
Q242	151-0136-00			TRANSISTOR: SILICON, NPN	02735	35495
Q249	151-0136-00			TRANSISTOR: SILICON, NPN	02735	35495
R5	316-0105-00			RES., FXD, CMPSN: 1M OHM, 10%, 0.25W	01121	CB1051

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R7A) R7B) R7C) R7D) R7E) R7F)	307-0307-00			NTWK, HYB CKT: ATTENUATOR	80009	307-0307-00
R11	315-0107-00			RES., FXD, CMPSN: 100M OHM, 5%, 0.25W	01121	CB1075
R12	316-0474-00			RES., FXD, CMPSN: 470K OHM, 10%, 0.25W	01121	CB4741
R13	316-0473-00	B010100	B020279	RES., FXD, CMPSN: 47K OHM, 10%, 0.25W	01121	CB4731
R13	316-0273-00	B020280		RES., FXD, CMPSN: 27K OHM, 10%, 0.25W	01121	CB2731
R15	311-1258-00			RES., VAR, NONWIR: 50 OHM, 10%, 0.50W	32997	3329P-L58-500
R16A) R16B) R16C) R16D) R16E)	307-0310-00			RES., FXD, FILM: HYBRID CKT, FET	80009	307-0310-00
R25A) R25B) R25C) R25D) R25E)	307-0311-00			RES., FXD, FILM: HYBRID CKT, BIASING	80009	307-0311-00
R26	315-0153-00	XB090000		RES., FXD, CMPSN: 15K OHM, 5%, 0.25W	01121	CB1535
R27	311-1170-00			RES., VAR, NONWIR: 20K OHM, 20%, 0.25W	58756	UPE270
R28	316-0124-00			RES., FXD, CMPSN: 120K OHM, 10%, 0.25W	01121	CB1241
R29	311-0634-00	B010100	B010280	RES., VAR, NONWIR: TRMR, 500 OHM, 0.5W	32997	3326H-G48-501
R29	311-0622-00	B010281		RES., VAR, NONWIR: 100 OHM, 10%, 0.50W	32997	3329H-G48-101
R30B) R30C) R30D) R30E)	307-0309-00	B010100	B010280	RES., FXD, FILM: HYBRID CKT, GAIN	80009	307-0309-00
R30A) R30B) R30C) R30D) R30E)	307-0309-01	B010281		RES., FXD, FILM: 180 OHM, 5%	80009	307-0309-01
R36	316-0150-00			RES., FXD, CMPSN: 15 OHM, 10%, 0.25W	01121	CB1501
R38	316-0150-00			RES., FXD, CMPSN: 15 OHM, 10%, 0.25W	01121	CB1501
R42	311-1174-00			RES., VAR, NONWIR: 5K OHM, 20%, 0.25W	71450	200-YA5542
R46	316-0105-00			RES., FXD, CMPSN: 1M OHM, 10%, 0.25W	01121	CB1051
R47	316-0105-00			RES., FXD, CMPSN: 1M OHM, 10%, 0.25W	01121	CB1051
R50A) R50B) R50C) R50D) R50E) R50F)	307-0308-00			RES., FXD, FILM: TIMING, HYBRID CKT	80009	307-0308-00
R52	316-0105-00			RES., FXD, CMPSN: 1M OHM, 10%, 0.25W	01121	CB1051
R53	316-0104-00			RES., FXD, CMPSN: 100K OHM, 10%, 0.25W	01121	CB1041
R56	311-1272-00			RES., VAR, NONWIR: 100K OHM, 10%, 0.50W	32997	3329P-L58-104
R58	311-1269-00			RES., VAR, NONWIR: 20K OHM, 10%, 0.50W	32997	3329P-L58-203
R59	311-1173-00			RES., VAR, NONWIR: 20K OHM, 20%, 0.25W (FURNISHED AS A UNIT WITH S59)	71450	200-YA5541
R60	315-0103-00	XB020000		RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R61	316-0223-00	B010100	B049999	RES., FXD, CMPSN: 22K OHM, 10%, 0.25W	01121	CB2231
R61	315-0223-00	B050000		RES., FXD, CMPSN: 22K OHM, 5%, 0.25W	01121	CB2235
R62	316-0223-00	B010100	B049999	RES., FXD, CMPSN: 22K OHM, 10%, 0.25W	01121	CB2231
R62	315-0273-00	B050000		RES., FXD, CMPSN: 27K OHM, 5%, 0.25W	01121	CB2735

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
R70	315-0203-00			RES., FXD, CMPSN: 20K OHM, 5%, 0.25W	01121	CB2035
R71	315-0204-00			RES., FXD, CMPSN: 200K OHM, 5%, 0.25W	01121	CB2045
R77	316-0102-00	XB080000		RES., FXD, CMPSN: 1K OHM, 10%, 0.25W	01121	CB1021
R79	316-0223-00			RES., FXD, CMPSN: 22K OHM, 10%, 0.25W	01121	CB2231
R80	311-1269-00			RES., VAR, NONWIR: 20K OHM, 10%, 0.50W	32997	3329P-L58-203
R80	316-0223-00			RES., FXD, CMPSN: 22K OHM, 10%, 0.25W	01121	CB2231
R82	316-0683-00			RES., FXD, CMPSN: 68K OHM, 10%, 0.25W	01121	CB6831
R83	311-1171-00			RES., VAR, NONWIR: PNL, 100K OHM, 0.25W	71450	FX9406
R84	316-0333-00			RES., FXD, CMPSN: 33K OHM, 10%, 0.25W	01121	CB3331
R85	315-0333-00			RES., FXD, CMPSN: 33K OHM, 5%, 0.25W	01121	CB3335
R86	311-1172-00			RES., VAR, NONWIR: PNL, 50K OHM, 0.2W, W/SW	71450	200-YA5540
R87	316-0103-00			RES., FXD, CMPSN: 10K OHM, 10%, 0.25W	01121	CB1031
R88	311-1269-00			RES., VAR, NONWIR: 20K OHM, 10%, 0.50W	32997	3329P-L58-203
R89	316-0472-00			RES., FXD, CMPSN: 4.7K OHM, 10%, 0.25W	01121	CB4721
R90	311-1275-00			RES., VAR, NONWIR: 1M OHM, 10%, 0.50W	32997	3329P-L58-105
R91	316-0225-00			RES., FXD, CMPSN: 2.2M OHM, 10%, 0.25W	01121	CB2251
R95	311-1169-00			RES., VAR, NONWIR: PNL, 2M OHM, 0.2W	58756	MODEL 270
R101	311-1235-00			RES., VAR, NONWIR: 100K OHM, 20%, 0.50W	32997	3386F-T04-104
R105	321-0201-00	B010100	B010249	RES., FXD, FILM: 1.21K OHM, 1%, 0.125W	91637	MFF1816G12100F
R105	321-0218-00	B010250		RES., FXD, FILM: 1.82K OHM, 1%, 0.125W	91637	MFF1816G18200F
R106	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R107	323-0314-00	B010100	B010249	RES., FXD, FILM: 18.2K OHM, 1%, 0.50W	75042	CECT0-1822F
R107	322-0331-00	B010250		RES., FXD, FILM: 27.4K OHM, 1%, 0.25W	01121	OB D
R108	316-0223-00			RES., FXD, CMPSN: 22K OHM, 10%, 0.25W	01121	CB2231
R109	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R110	323-0314-00	B010100	B010249	RES., FXD, FILM: 18.2K OHM, 1%, 0.50W	75042	CECT0-1822F
R110	322-0331-00	B010250		RES., FXD, FILM: 27.4K OHM, 1%, 0.25W	01121	OB D
R111	316-0223-00			RES., FXD, CMPSN: 22K OHM, 10%, 0.25W	01121	CB2231
R117	321-0230-00	B010100	B010249	RES., FXD, FILM: 2.43K OHM, 1%, 0.125W	91637	MFF1816G24300F
R117	321-0260-00	B010250		RES., FXD, FILM: 4.99K OHM, 1%, 0.125W	91637	MFF1816G49900F
R118	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R119	321-0343-00	B010100	B010249	RES., FXD, FILM: 36.5K OHM, 1%, 0.125W	91637	MFF1816G36501F
R119	321-0373-00	B010250		RES., FXD, FILM: 75K OHM, 1%, 0.125W	91637	MFF1816G75001F
R121	316-0471-00			RES., FXD, CMPSN: 470 OHM, 10%, 0.25W	01121	CB4711
R122	321-0343-00	B010100	B010249	RES., FXD, FILM: 36.5K OHM, 1%, 0.125W	91637	MFF1816G36501F
R122	321-0373-00	B010250		RES., FXD, FILM: 75K OHM, 1%, 0.125W	91637	MFF1816G75001F
R125	316-0150-00			RES., FXD, CMPSN: 15 OHM, 10%, 0.25W	01121	CB1501
R127	316-0150-00			RES., FXD, CMPSN: 15 OHM, 10%, 0.25W	01121	CB1501
R129	321-0146-00	B010100	B010249	RES., FXD, FILM: 324 OHM, 1%, 0.125W	91637	MFF1816G324ROF
R129	321-0169-00	B010250		RES., FXD, FILM: 562 OHM, 1%, 0.125W	91637	MFF1816G562ROF
R132	315-0123-00			RES., FXD, CMPSN: 12K OHM, 5%, 0.25W	01121	CB1235
R134	321-0354-00			RES., FXD, FILM: 47.5K OHM, 1%, 0.125W	91637	MFF1816G47501F
R135	321-0377-00			RES., FXD, FILM: 82.5K OHM, 1%, 0.125W	91637	MFF1816G82501F
R136	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W	01121	CB3325
R137	315-0202-00			RES., FXD, CMPSN: 2K OHM, 5%, 0.25W	01121	CB2025
R141	311-1232-00			RES., VAR, NONWIR: 50K OHM, 20%, 0.50W	32997	3386F-T04-503
R144	321-0354-00			RES., FXD, FILM: 47.5K OHM, 1%, 0.125W	91637	MFF1816G47501F
R145	321-0377-00			RES., FXD, FILM: 82.5K OHM, 1%, 0.125W	91637	MFF1816G82501F
R150	316-0470-00			RES., FXD, CMPSN: 47 OHM, 10%, 0.25W	01121	CB4701
R151	315-0153-00			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W	01121	CB1535
R153	316-0470-00			RES., FXD, CMPSN: 47 OHM, 10%, 0.25W	01121	CB4701
R154	315-0273-00	B010100	B019999	RES., FXD, CMPSN: 27K OHM, 5%, 0.25W	01121	CB2735
R154	315-0473-00	B020000		RES., FXD, CMPSN: 47K OHM, 5%, 0.25W	01121	CB4735
R155	316-0392-00			RES., FXD, CMPSN: 3.9K OHM, 10%, 0.25W	01121	CB3921
R204	316-0225-00	B010100	B109999	RES., FXD, CMPSN: 2.2M OHM, 10%, 0.25W	01121	CB2251
R204	316-0475-00	B110000		RES., FXD, CMPSN: 4.7M OHM, 10%, 0.25W	01121	CB4751
R205	316-0225-00	B010100	B109999	RES., FXD, CMPSN: 2.2M OHM, 10%, 0.25W	01121	CB2251

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R205	316-0475-00	B110000		RES., FXD, CMPSN: 4.7M OHM, 10%, 0.25W	01121	CB4751
R208	316-0225-00			RES., FXD, CMPSN: 2.2M OHM, 10%, 0.25W	01121	CB2251
R209	316-0225-00			RES., FXD, CMPSN: 2.2M OHM, 10%, 0.25W	01121	CB2251
R210	302-0154-00			RES., FXD, CMPSN: 150K OHM, 10%, 0.50W	01121	EB1541
R211	302-0120-00			RES., FXD, CMPSN: 12 OHM, 10%, 0.50W	01121	EB1201
R212	302-0154-00			RES., FXD, CMPSN: 150K OHM, 10%, 0.50W	01121	EB1541
R213	302-0120-00			RES., FXD, CMPSN: 12 OHM, 10%, 0.50W	01121	EB1201
R225	315-0123-00			RES., FXD, CMPSN: 12K OHM, 5%, 0.25W	01121	CB1235
R227	316-0103-00			RES., FXD, CMPSN: 10K OHM, 10%, 0.25W	01121	CB1031
R229	316-0102-00			RES., FXD, CMPSN: 1K OHM, 10%, 0.25W	01121	CB1021
R230	315-0222-00			RES., FXD, CMPSN: 2.2K OHM, 5%, 0.25W	01121	CB2225
R231	316-0472-00			RES., FXD, CMPSN: 4.7K OHM, 10%, 0.25W	01121	CB4721
R232	316-0393-00			RES., FXD, CMPSN: 39K OHM, 10%, 0.25W	01121	CB3931
R235	316-0332-00			RES., FXD, CMPSN: 3.3K OHM, 10%, 0.25W	01121	CB3321
R236	315-0272-00			RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W	01121	CB2725
R238	316-0102-00			RES., FXD, CMPSN: 1K OHM, 10%, 0.25W	01121	CB1021
R241	315-0131-00			RES., FXD, CMPSN: 130 OHM, 5%, 0.25W	01121	CB1315
R264	316-0104-00			RES., FXD, CMPSN: 100K OHM, 10%, 0.25W	01121	CB1041
R268	315-0104-00	B010100	B099999	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
R268	315-0274-00	B100000		RES., FXD, CMPSN: 270K OHM, 5%, 0.25W	01121	CB2745
R271	316-0274-00			RES., FXD, CMPSN: 270K OHM, 10%, 0.25W	01121	CB2741
R272	316-0155-00	B010100	B079999	RES., FXD, CMPSN: 1.5M OHM, 10%, 0.25W	01121	CB1551
R272	315-0125-00	B080000	B109999	RES., FXD, CMPSN: 1.2M OHM, 5%, 0.25W	01121	CB1255
R272	315-0105-00	B110000		RES., FXD, CMPSN: 1M OHM, 5%, 0.25W	01121	CB1055
R273	311-1252-00			RES., VAR, NONWIR: 500K OHM, 20%, 0.50W	32997	3386F-T04-504
R278	316-0100-00			RES., FXD, CMPSN: 10 OHM, 10%, 0.25W	01121	CB1001
R279	316-0100-00			RES., FXD, CMPSN: 10 OHM, 10%, 0.25W	01121	CB1001
S5	260-0984-00	B010100	B114649	SWITCH, SLIDE: DP3T, 0.5A, 125V	79727	G-128-S-0012
S5	260-0984-01	B114650		SWITCH, SLIDE: DP3T W/PLASTIC PLATE	79727	G128 S 0034
S20	670-1506-00			CKT BOARD ASSY: ROTARY, VOLTS/DIV (SEE MPL FOR REPLACEMENT PARTS)	80009	670-1506-00
S49	260-0723-00			SWITCH, SLIDE: DPDT, 0.5A, 125VAC	79727	GF126-0028
S59	-----			(FURNISHED AS A UNIT WITH R59)		
S60	670-1506-00			CKT BOARD ASSY: ROTARY, SEC/DIV (SEE MPL FOR REPLACEMENT PARTS)	80009	670-1506-00
S215	260-0723-00			SWITCH, SLIDE: DPDT, 0.5A, 125VAC	79727	GF126-0028
T207	120-0738-00	B010100	B114836	TRANSFORMER, CMR:	80009	120-0738-00
T207	120-1043-00	B114837		TRANSFORMER, RF: COMMON MODE REJ, POT CORE	80009	120-1043-00
T207	120-1103-00			XFMR, RF: POT CORE	80009	120-1103-00
T250	120-0735-00			XFMR, PWR, SDN&SU:	80009	120-0735-00
T270	108-0395-00	XB030000		COIL, RF: 64UH	80009	108-0395-00
U25	155-0057-00			MICROCIRCUIT, LI: QUAD OPNL AMPL	80009	155-0057-00
R65	155-0048-00	B010100	B089999	MICROCIRCUIT, DI: TRIG & SWEEP AMPL	80009	155-0048-00
U65	155-0048-01	B090000		MICROCIRCUIT, DI: TRIGGER AND SWEEP, SEL	80009	155-0048-01
U105	155-0047-00			MICROCIRCUIT, LI: OUTPUT AMPLIFIER	80009	155-0047-00
V300	154-0642-00	B010100	B079999	ELECTRON TUBE: CRT, P31, INT SCALE	80009	154-0642-00
V300	154-0699-00	B080000		ELECTRON TUBE: CRT, P31, INT SCALE	80009	154-0699-00
VR228	152-0306-00			SEMICONV DEVICE: ZENER, 0.4W, 9.1V, 5%	15238	Z5409
VR238	152-0514-00			SEMICONV DEVICE: ZENER, 0.4W, 10V, 1%	80009	152-0514-00

## SYMBOLS AND REFERENCE DESIGNATORS

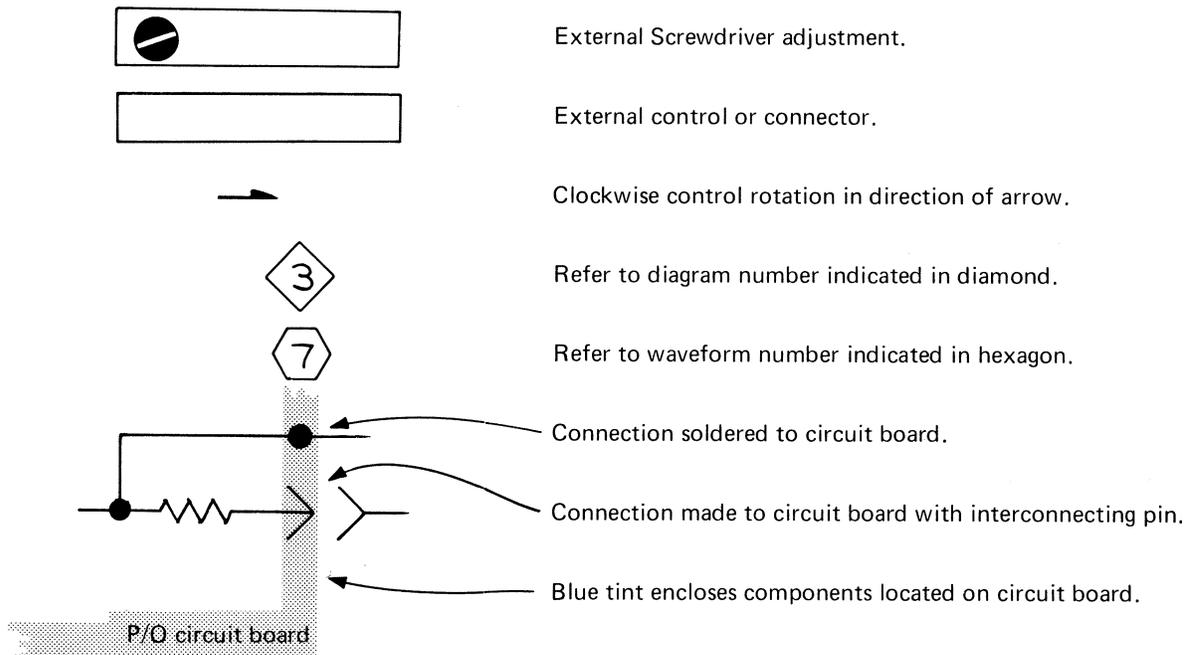
Electrical components shown on the diagrams are in the following units unless noted otherwise:

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 USA Standard Y32.2-1967.

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:



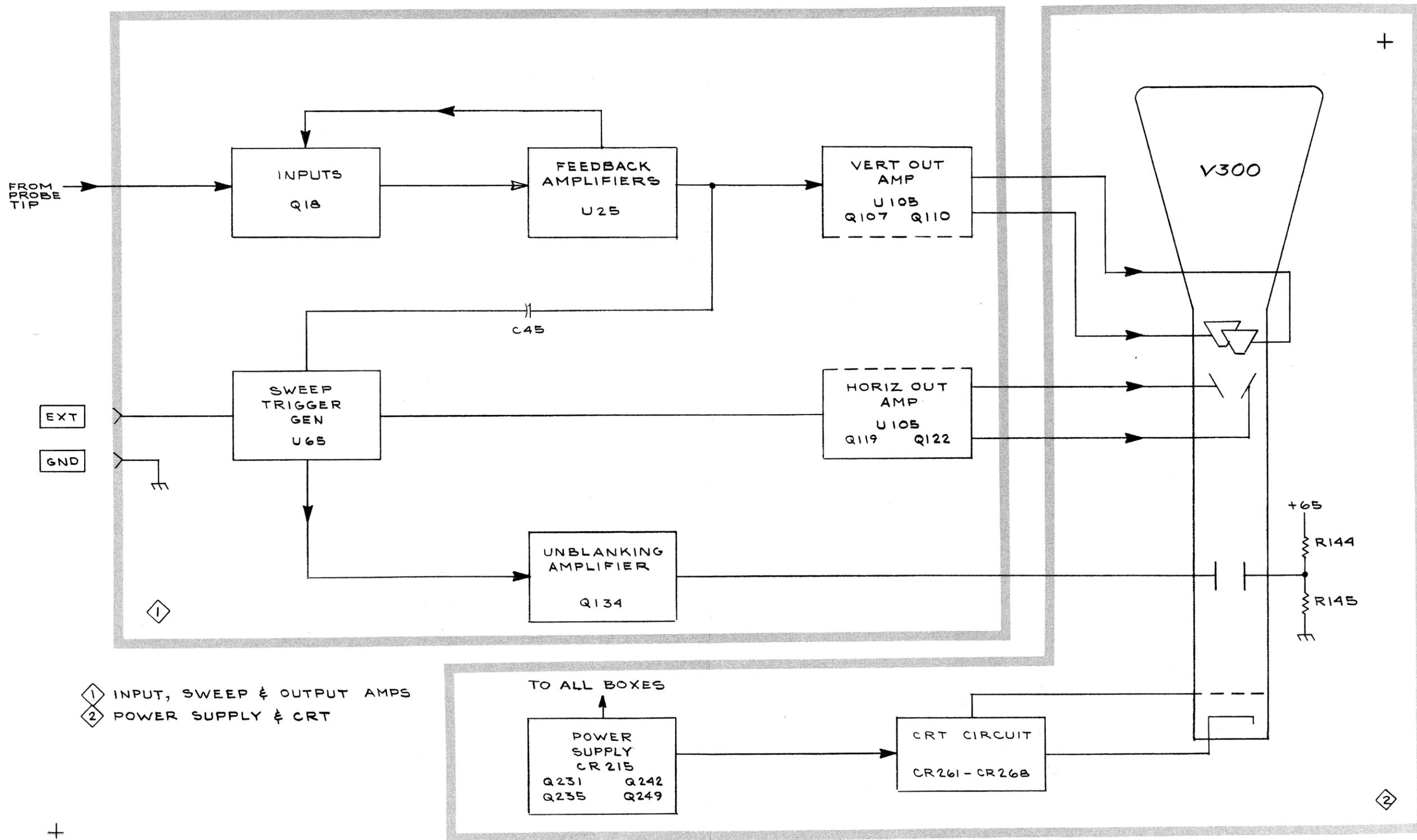
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	LR	Inductor/resistor combination
AT	Attenuator, fixed or variable	M	Meter
B	Motor	Q	Transistor or silicon-controlled rectifier
BT	Battery	P	Connector, movable portion
C	Capacitor, fixed or variable	R	Resistor, fixed or variable
CR	Diode, signal or rectifier	RT	Thermistor
DL	Delay line	S	Switch
DS	Indicating device (lamp)	T	Transformer
F	Fuse	TP	Test point
FL	Filter	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
H	Heat dissipating device (heat sink, heat radiator, etc.)	V	Electron tube
HR	Heater	VR	Voltage regulator (zener diode, etc.)
J	Connector, stationary portion	Y	Crystal
K	Relay		
L	Inductor, fixed or variable		

## VOLTAGE AND WAVEFORM TEST CONDITIONS

Typical voltage measurements and waveform photographs were obtained under the following conditions unless noted otherwise on the individual diagrams.

<b>Test Oscilloscope (with 10X Probe)</b>		<b>211 Conditions</b>	
Frequency Response	DC to 90 megahertz	Line Voltage	115 volts
Deflection Factor (w/probe)	50 millivolts to 50 volts/division	Signal Applied	Standard Amplitude Calibrator (067-0502-01) output signal connected to probe tip for waveforms only.
Input Impedance	10 megohms, 16 picofarads	Control Settings	As follows except as noted otherwise on individual diagrams
Probe Ground	211 chassis ground.	VOLTS/DIV	50 m
Trigger Source	External to indicate true time relationship between signals.	SEC/DIV	.1 m
Recommended Type	Tektronix 7503 with 7A16 plug-in unit.	POS	Midrange
	<b>Voltmeter</b>	POS	Midrange
Type	Non-loading digital multimeter	VOLTS/DIV VAR	CAL
Input Impedance	0 to 1.5 volts; 1 k $\Omega$	HORIZ MAG	CAL
	15 to 100 volts; 10 m $\Omega$	INTENSITY	Visible display
Range	0 to 1000 volts	LEVEL/SLOPE	AUTO PRESET
Reference Voltage	211 chassis ground	INPUT COUPLING	GND
Recommended Type (as used for voltages on diagrams)	Fairchild Model 7050	POWER	ON
		Trigger Source	INT

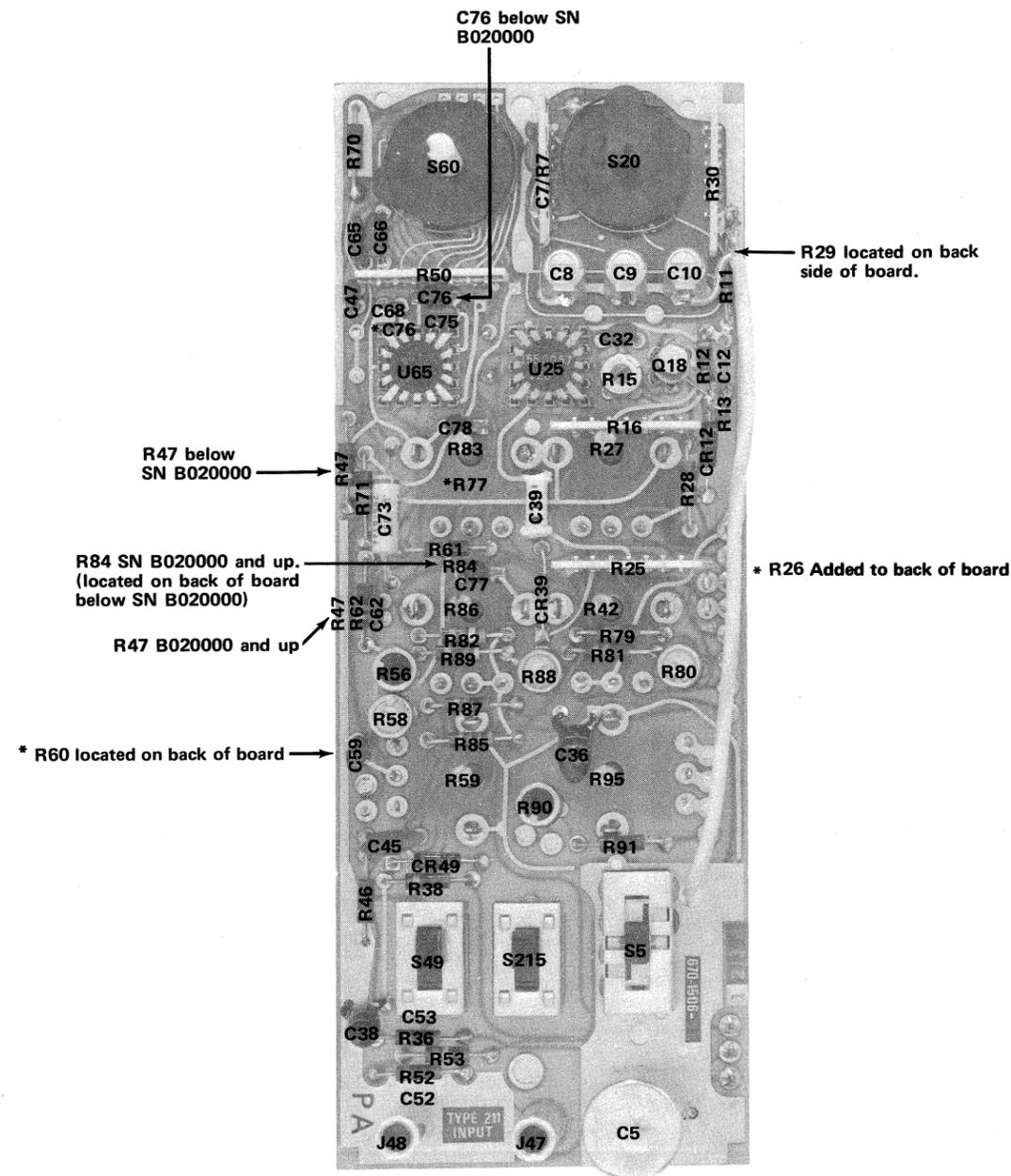
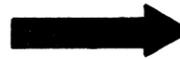


BLOCK DIAGRAM

- 1 INPUT, SWEEP & OUTPUT AMPS
- 2 POWER SUPPLY & CRT

A1 and P/O A2 Circuit Boards

FIG. 5-2A and 5-2B



NOTE-C72, C74, R5 and R29 mounted on back side of board. (also R84 below SN B020000)

\*See Parts List for serial number ranges.

Fig. 5-1. A1. Input circuit board.

REV. JAN 1974

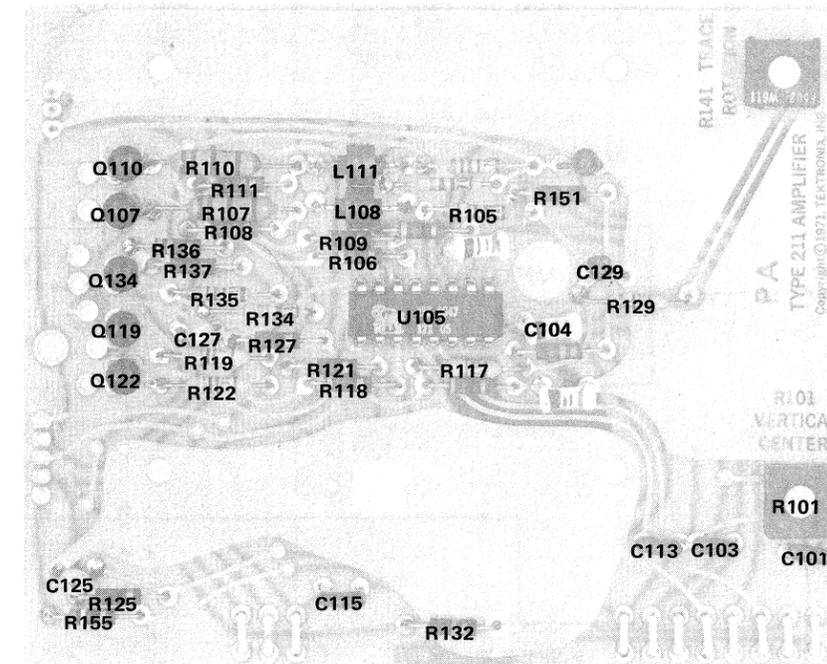


Fig. 5-2A. P/O A2 Partial Amplifier circuit board for instruments SN B010250 and up.

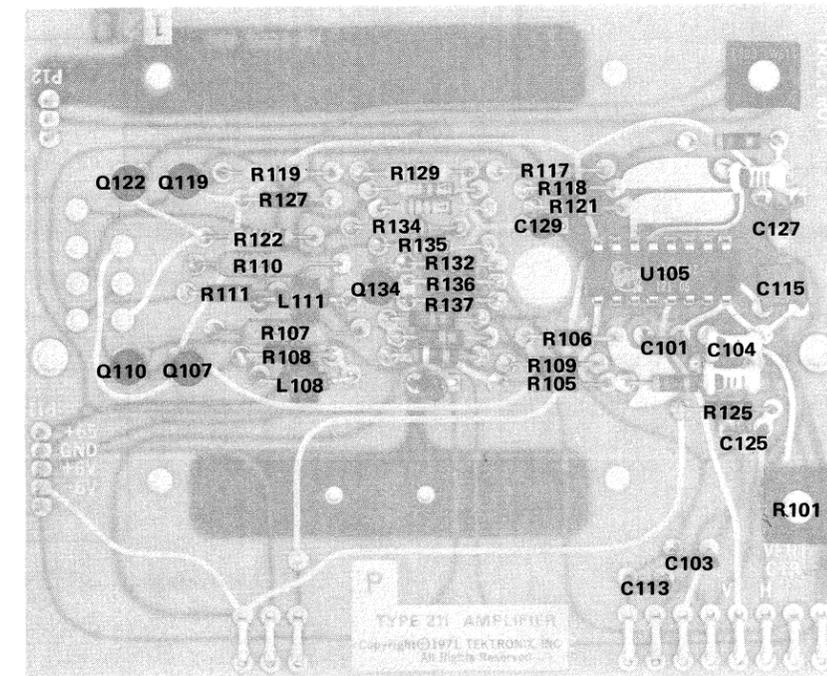
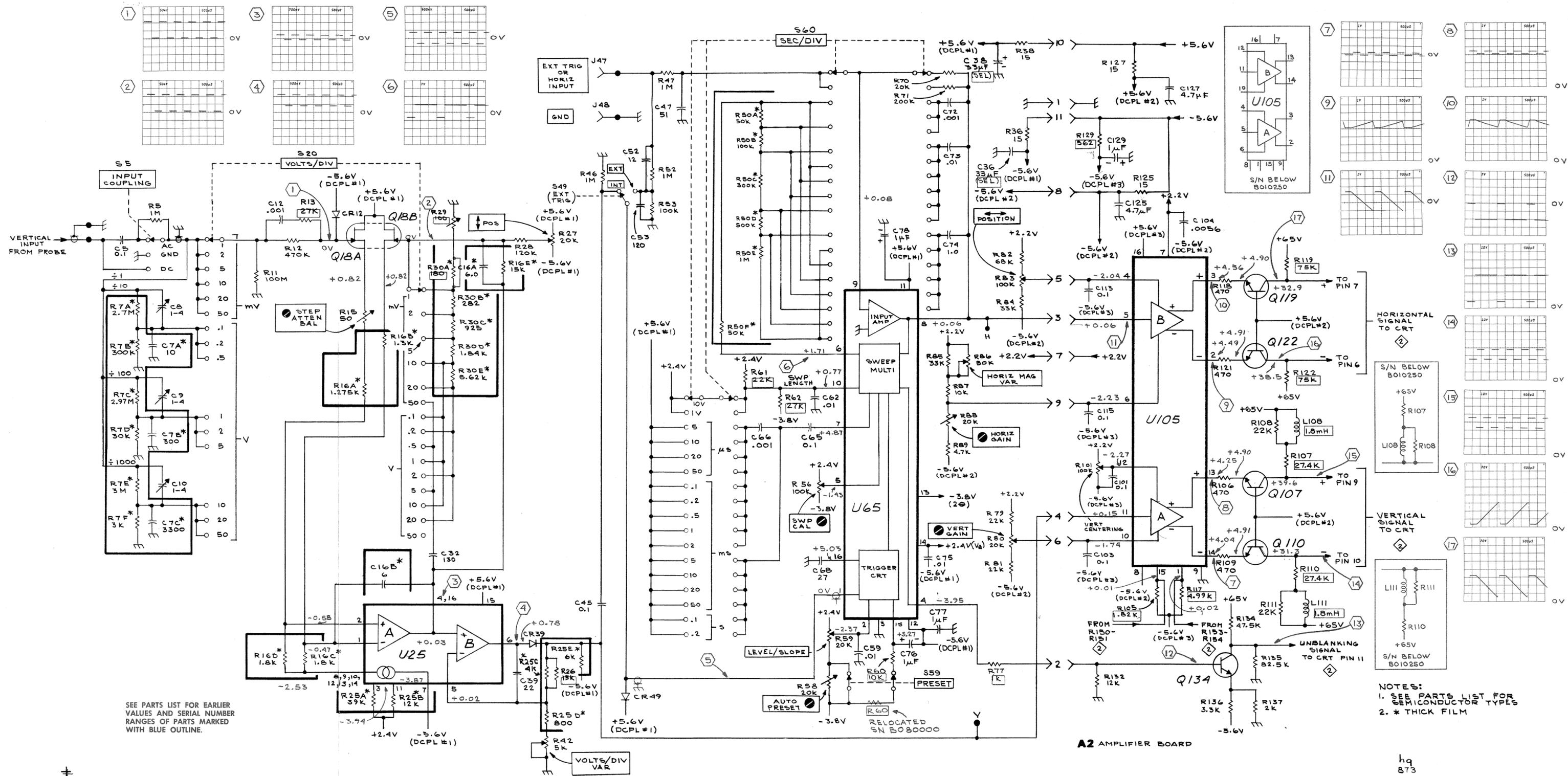


Fig. 5-2B. P/O A2 Partial Amplifier circuit board for instruments below SN B010250.

Ⓢ



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

NOTES:  
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES  
2. \* THICK FILM

VERTICAL & HORIZONTAL CIRCUITS

A1 INPUT BOARD

A2 AMPLIFIER BOARD

+

FIG. 5-4  
➔

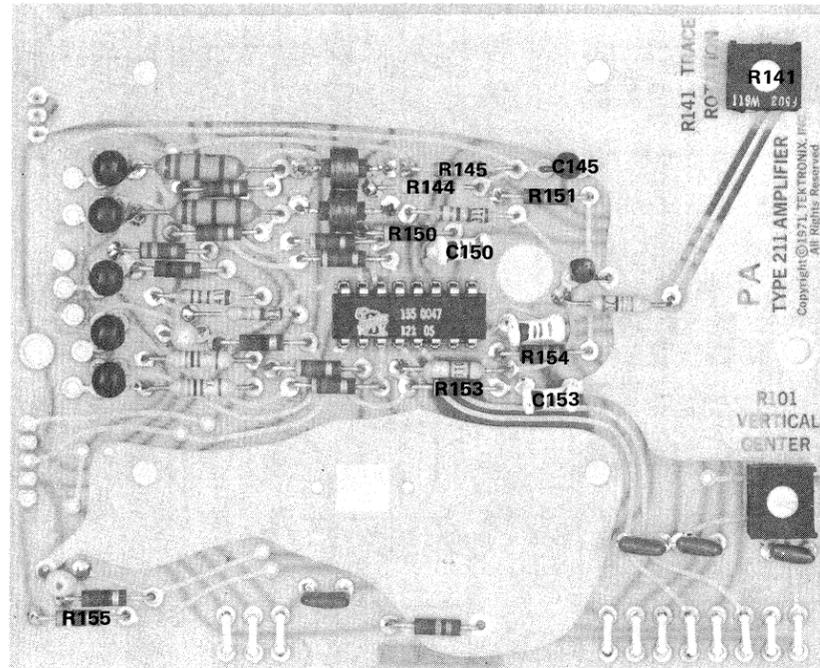


Fig. 5-3A. P/O A2 Amplifier circuit board for instruments SN B010250-up.

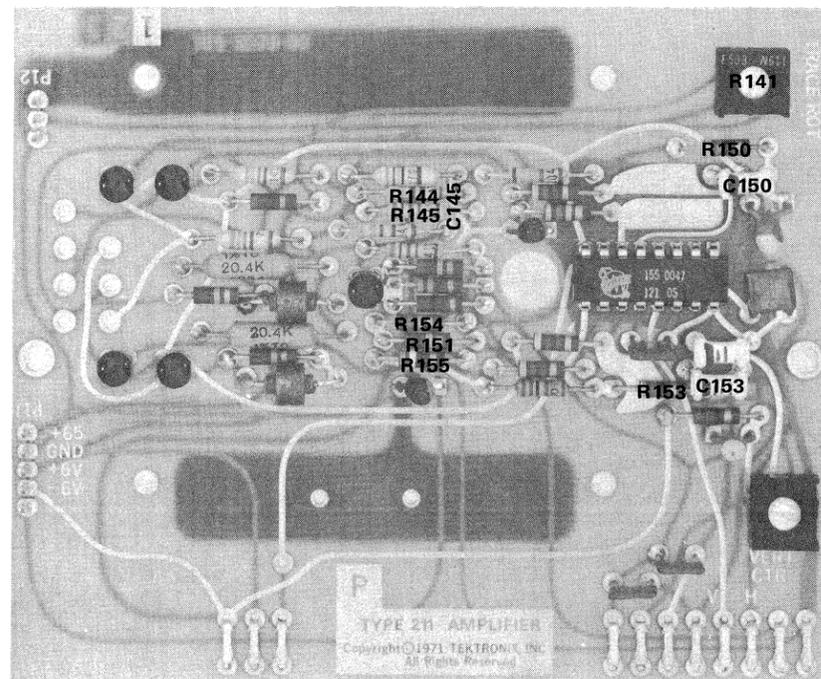


Fig. 5-3B. P/O A2 Amplifier circuit board for instruments below SN B010250.

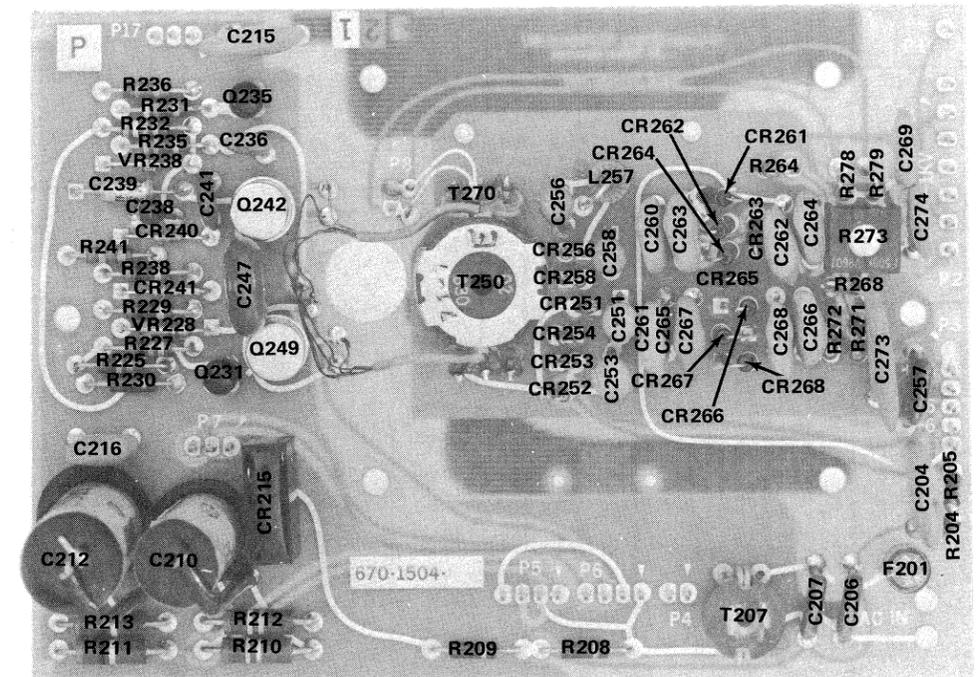


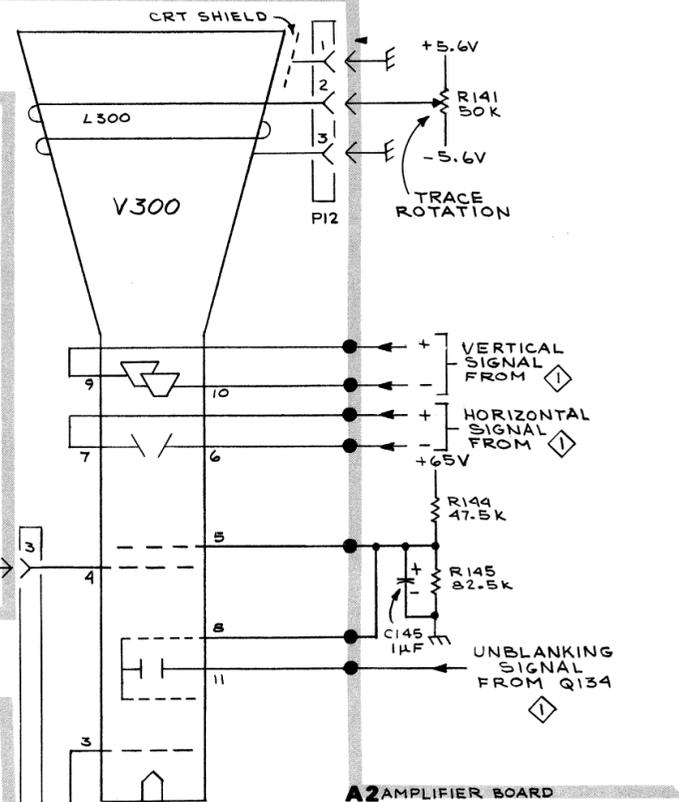
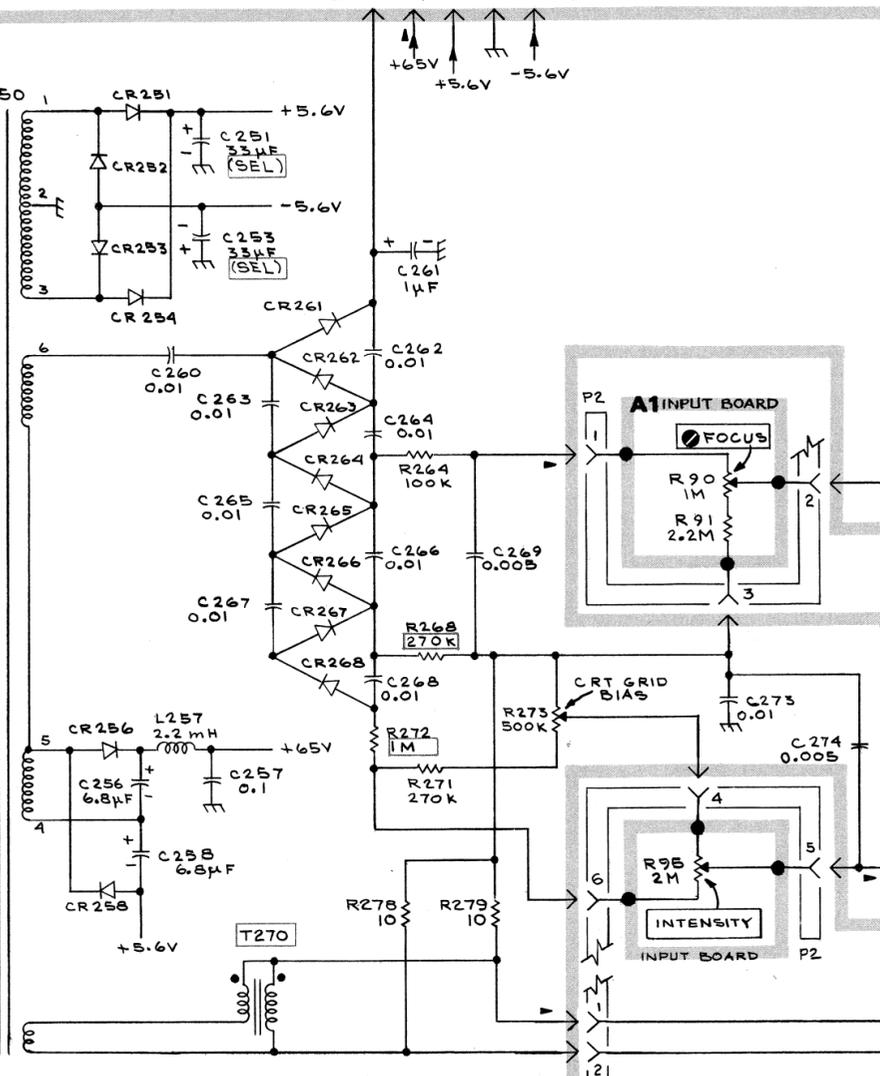
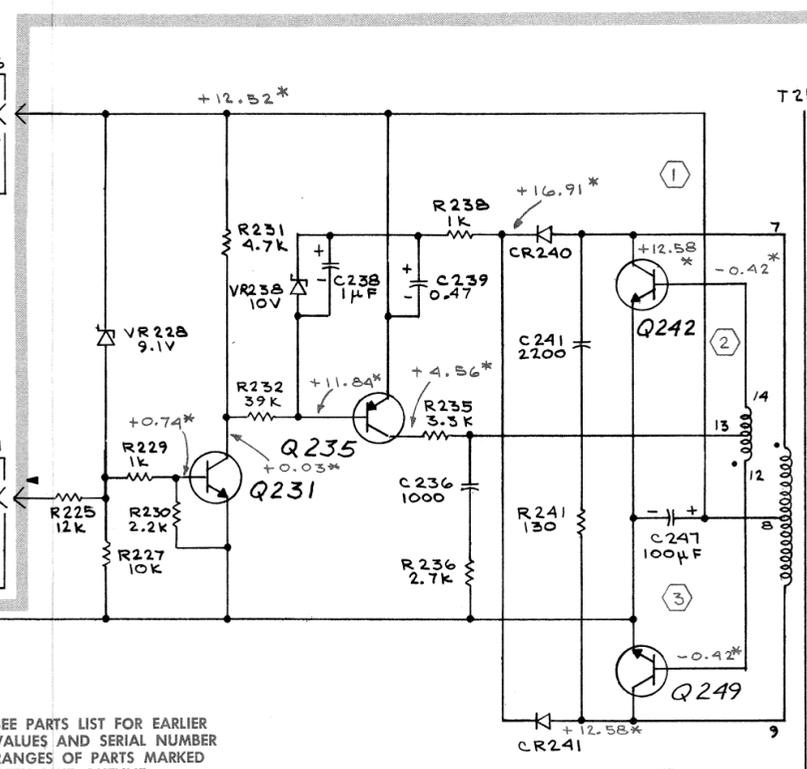
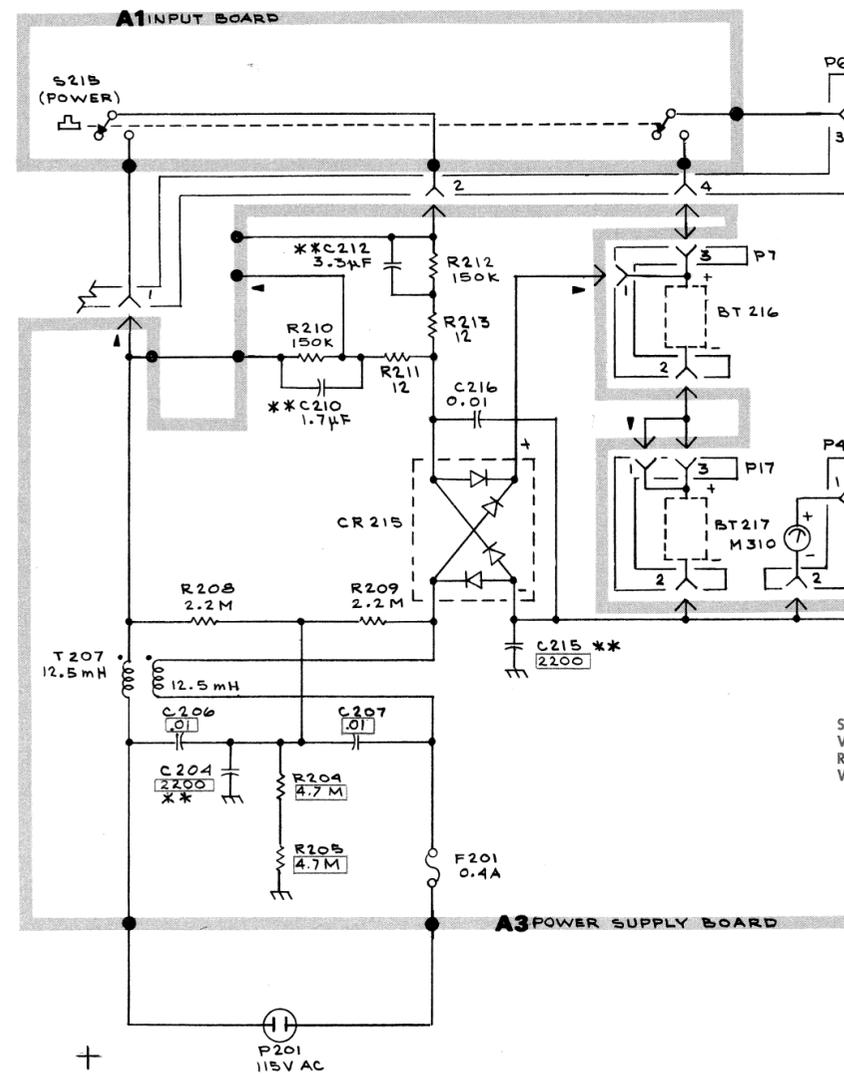
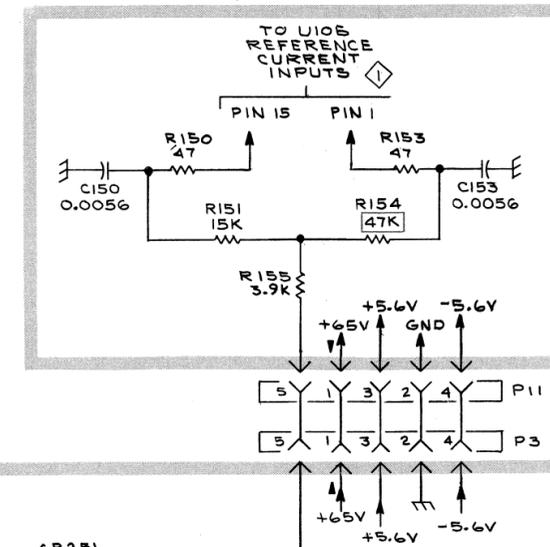
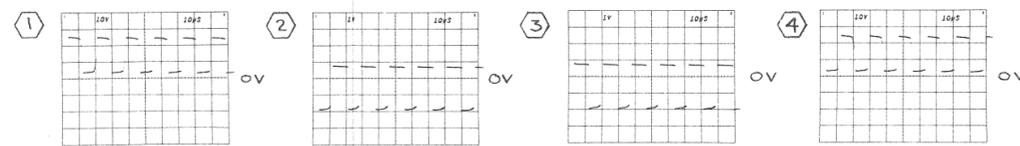
Fig. 5-4. A3 Power Supply circuit board.

A3 and P/O A2 Circuit Boards

Ⓐ

Ⓑ

Ⓑ



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

NOTE:  
SEE PARTS LIST FOR SEMICONDUCTOR TYPES  
\* REFERENCED TO PIN 2 OF P17. DISCONNECTED FROM AC LINE VOLTAGE  
\*\* SELECTED FOR LINE VOLTAGE RANGE

REV. F, DEC. 1974

This page  
intentionally  
left blank

# REPLACEABLE MECHANICAL 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.

Change information, if any, is located at the rear of this manual.

## SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number  
00X Part removed after this serial number

## FIGURE AND INDEX NUMBERS

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

## 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
Assembly and/or Component
Attaching parts for Assembly and/or Component
    --- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    --- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    --- * ---
    
```

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.**

## 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.

## ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	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	SQ	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	HLCPS	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
000BC	BADGLEY MFG. COMPANY	1620 NE ARGYLE	PORTLAND, OR 97211
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
07111	PNEUMO DYNAMICS CORPORATION	4800 PRUDENTIAL TOWER	BOSTON, MA 02199
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
17516	MOORE, MAYNARD H., JR., INC.	430 MAIN ST.	STONEHAM, MA 02180
18121	WILSHIRE FOAM PRODUCTS, INC.	2665 COLUMBIA ST.	TORRANCE, CA 90503
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
24138	INTERNATIONAL ELECTRONIC CORP.	316 S SERVICE RD, HUNTINGTON STA	MELVILLE, L.I., NY 11746
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
76545	MUELLER ELECTRIC CO.	1583 EAST 31ST ST.	CLEVELAND, OH 44114
76854	OAK INDUSTRIES, INC., SWITCH DIV.	S. MAIN ST.	CRYSTAL LAKE, IL 60014
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
78471	TILLEY MFG. CO.	900 INDUSTRIAL RD.	SAN CARLOS, CA 94070
79727	C-W INDUSTRIES	550 DAVISVILLE RD., P O BOX 96	WARMINISTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80710	ALLEGHENY LUDLUM STEEL CORP., A DIVISION OF ALLEGHENY LUDLUM INDUSTRIES, INC.	BRACKENRIDGE WORKS, RIVER AVE.	BRACKENRIDGE, PA 15014
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
95987	WECKESSER CO., INC.	4444 WEST IRVING PARK RD.	CHICAGO, IL 60641
98278	MALCO A MICRODOT COMPANY, INC. CONNECTOR AND CABLE DIVISION	220 PASADENA AVE.	SOUTH PASADENA, CA 91030

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
1-1	366-1337-01		1						KNOB:GY,0.159 ID X 0.812 OD X 0.45 H	80009	366-1337-01
	214-1616-00		1						. SPR,HLCL,TRSN:0.23 ID X 0.282 OD X 0.15"L	80009	214-1616-00
-2	366-1337-02		1						KNOB:GY,0.157 ID X 0.812 OD X 0.45H	80009	366-1337-02
	214-1616-00		1						. SPR,HLCL,TRSN:0.23 ID X 0.282 OD X 0.15"L	80009	214-1616-00
-3	366-1322-01		1						KNOB:GRAY--POS	80009	366-1322-01
-4	366-1322-02		2						KNOB:DARK GRAY--VAR	80009	366-1322-02
-5	366-1322-03		1						KNOB:GY,INT,0.127 ID X 0.384 X 0.375 H	80009	366-1322-03
-6	366-1322-04		1						KNOB:GRAY--TRIG	80009	366-1322-04
-7	333-1444-00		1						PANEL, SIDE:	80009	333-1444-00
-8	337-1485-00		1						SHIELD,ELEC:INPUT CKT BD,BACK	80009	337-1485-00
-9	337-1484-00		1						SHIELD,ELEC:INPUT CKT BD	80009	337-1484-00
									(ATTACHING PARTS)		
-10	211-0111-00		2						SCREW,MACHINE:2-56 X 1.000,PNH,STL,CD PL	83385	OBD
-11	211-0187-00		1						SCREW MACHINE:2-56 X 1.000,OVH,SST	07111	OBD
-12	210-0405-00		3						NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	12157-50
-13	210-0001-00		3						WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL	78189	1202-00-00-0541C
-14	361-0454-00		4						SPACER,SLEEVE:0.375 L X 0.086 ID,BRS CD PL	76854	OBD
-15	210-1100-00		4						WASHER,FLAT:0.09 ID X 0.008 THK,0.184 OD	12327	OBD
									- - - * - - -		
-16	-----		1						CKT BOARD ASSY:INPUT(SEE A1 REPL)		
-17	343-0003-00		1						. CLAMP,LOOP:0.25 ID,PLASTIC	95987	1-4-6B
									(ATTACHING PARTS)		
-18	211-0016-00		1						. SCREW,MACHINE:4-40 X 0.625 INCH,PNH STL	83385	OBD
-19	210-1002-00		2						. WASHER,FLAT:0.125 ID X 0.25 INCH OD,BRS	12327	OBD
-20	210-0406-00		1						. NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	12161-50
-21	210-0958-00		1						. WASHER,FLAT:0.115 ID X 0.469 INCH OD,STL	78471	OBD
-22	210-0586-00		1						. NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	83385	OBD
-23	337-1514-00		1						. SHIELD,ELEC:INPUT CPLG SW,REAR	80009	337-1514-00
-24	337-1513-00		1						. SHIELD,ELEC:INPUT CPLG SW	80009	337-1513-00
-25	129-0312-00		2						. POST,CONTACT:HORIZONTAL INPUT & GROUND	80009	129-0312-00
-26	131-0787-00		11						. CONTACT,ELEC:0.64 INCH LONG	22526	47359
-27	136-0252-04		37						. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-28	337-1486-00		1						. SHIELD,ELEC:CAPACITOR,INPUT BD	80009	337-1486-00
-29	200-1232-00		2						. COVER,RTRY SW:CIRCUIT BOARD	80009	200-1232-00
									(ATTACHING PARTS)		
-30	210-0405-00		6						. NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	12157-50
									- - - * - - -		
-31	401-0127-01		2						. ROTOR,ELEC SW:W/CONTACTS	80009	401-0127-01
-32	214-1576-01		1						. DTT-CONT ASSY:3 CONTACT	80009	214-1576-01
-33	214-1577-01		1						. DTT-CONT ASSY:2 CONTACT	80009	214-1577-01
-34	214-1579-00		2						. SPRING,DETENT:0.59 ID X 0.08 W X 0.01 THK	80009	214-1579-00
-35	214-1127-00		2						. ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-36	380-0244-00		2						. HOUSING,SWITCH:POLYCARBONATE	80009	380-0244-00
-37	260-0984-00	B010100 B114649	1						. SWITCH,SLIDE:DP3T,0.5A,125V	79727	G-128-S-0012
	260-0984-01	B114650	1						. SWITCH,SLIDE:DP3T W/PLASTIC PLATE	79727	G128 S 0034
-38	260-0723-00		2						. SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
-39	342-0114-00		3						. INSULATOR,PLATE:POWER SUPPLY,ABS	80009	342-0114-00
-40	-----		6						. RESISTOR,VAR:		
-41	214-0579-00		2						. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-42	179-1697-00		1						. WIRING HARNESS:CHASSIS	80009	179-1697-00
	131-0707-00		14						. . CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	47439
-43	131-0621-00		6						. . CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	46231
-44	352-0162-00		1						. . HLDR,TERM CONN:4 WIRE BLACK	80009	352-0162-00
-45	352-0163-00		2						. . CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0163-00
-46	352-0202-00		1						. . HLDR,TERM CONN:6 WIRE BLACK	80009	352-0202-00
									(ATTACHING PARTS)		
-47	211-0116-00		1						SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	361-0459-00		1						SPACER,SLEEVE:0.115ID X 0.157OD X 0.406" L	76854	3-5162-258
-48	211-0019-00		1						SCREW,MACHINE:4-40 X 1.0 INCH,PNH STL	83385	OBD
									- - - * - - -		
-49	200-1237-00		1						COVER,CORD WRAP:BOTTOM	80009	200-1237-00
-50	200-1237-01		1						COVER,CORD WRAP:TOP	80009	200-1237-01
	337-1703-00		1						SHIELD,ELEC:UPPER	80009	337-1703-00

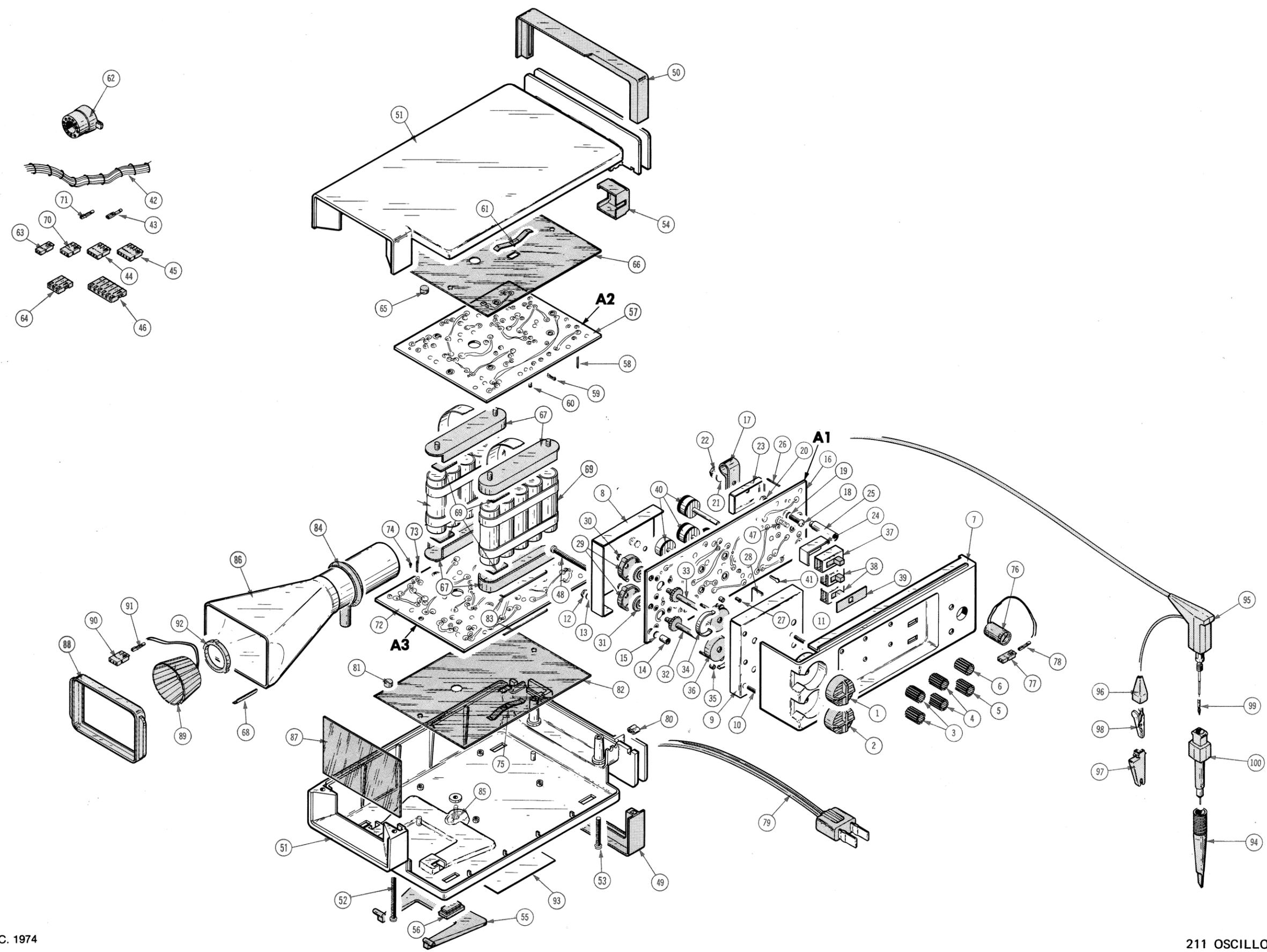
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-51	437-0146-01			1		CABINET, SCOPE: TOP & BOTTOM	80009	437-0146-01
	337-1704-00			1		SHIELD, ELEC: LOWER	80009	337-1704-00
						(ATTACHING PARTS)		
-52	211-0021-00	B010100	B069999	2		SCREW, MACHINE: 4-40 X 1.25 INCH, PNH STL	83385	OBD
	211-0170-00	B070000		2		SCREW, MACHINE: 4-40 X 2.75 INCH, PNH STL	83385	OBD
	355-0181-00	B070000		2		STUD, CRYG, HDL: 0.312 DIA X 0.50 INCH LONG	80009	355-0181-00
-53	211-0019-00			2		SCREW, MACHINE: 4-40 X 1.0 INCH, PNH STL	83385	OBD
						- - - * - - -		
-54	200-1369-00	B010100	B071999	1		COVER, PWR CORD: PLASTIC	80009	200-1369-00
	200-1400-00	B072000		1		COVER, PLUG: POWER CORD	80009	200-1400-00
-55	348-0285-00			1		FLIP-STAND, CAB: 1.94 H X 3.424 INCH WIDE	80009	348-0285-00
-56	348-0254-01			4		FOOT, CABINET: BLACK RUBBER	80009	348-0254-01
-57	-----			1		CKT BOARD ASSY: AMPLIFIER (SEE A2 REPL)		
-58	131-0608-00	B010100	B092949	9		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	131-0608-00	B092950		10		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
-59	136-0328-03			11		. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
-60	136-0252-04			31		. SOCKET, PIN TERM: U/W 0.016-0.018 DIA PINS	22526	75060-007
-61	131-1172-00			1		CONTACT, ELEC: CKT CARD GROUND	80009	131-1172-00
	136-0459-00			1		. SKT, PL-IN ELEK: ELCTR N TUBE, 7 CONT, W/LEADS	80009	1360459-00
-62	136-0453-00			1		. . SOCKET, PLUG-IN: 11 PIN, CRT	80009	136-0453-00
-63	352-0169-00			1		. . HLD R, TERM CONN: 2 WIRE BLACK	80009	352-0169-00
-64	352-0199-00			1		. . CONN BODY, PL, EL: 3 WIRE BLACK	80009	352-0199-00
	131-0707-00			2		. . CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
	131-0621-00			2		. . CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	46231
	131-0371-00			7		. . CONTACT, ELEC: FOR NO. 26 AWG WIRE	98278	122-0182-019
	131-1109-00	B010100	B113849	11		. . CONNECTOR, PLUG: CRIMP ON, FOR 0.4" OD PIN	00779	42869-6
	131-1109-00	B113850		9		. . CONNECTOR, PLUG: CRIMP ON, FOR 0.4" OD PIN	00779	42869-6
	131-1109-02	XB113850		2		. . CONNECTOR, TERM: CRIMP ON, FOR 0.4" OD PIN	00779	P73-7444
-65	253-0154-00			4		. TAPE, PRESS. SENS: 0.125" THK	18121	MT8
-66	342-0113-00			1		. INSULATOR, PLATE: CKT CARD, FILM	80009	342-0113-00
	146-0033-00			1		. BATTERY ASSY: 2 SETS OF 5	80009	146-0033-00
-67	200-1238-00			4		. COVER, BAT SET: PLASTIC	80009	200-1238-00
-68	253-0153-00			FT		. TAPE, PRESS. SENS: 0.25 W X 0.125" THK FOAM	18121	P7/PVC
-69	146-0016-00			2		. BATTERY SET: 6V, 660 MAH, A CELL	19209	41B906FD01-G1
-70	352-0161-00			2		HLD R, TERM CONN: 3 WIRE, BLACK	80009	352-0161-00
-71	131-0707-00			6		CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
-72	-----			1		CKT BOARD ASSY: POWER SUPPLY (SEE A3 REPL)		
-73	131-0589-00			27		. TERMINAL, PIN: 0.46 L X 0.025 SQ	22526	48283-029
-74	136-0252-04			12		. SOCKET, PIN TERM: U/W 0.016-0.018 DIA PINS	22526	75060-007
	136-0261-00			2		. SOCKET, PIN TERM: FOR 0.22 INCH PIN	00779	1-331677-6
-75	131-1172-00			1		. CONTACT, ELEC: CKT CARD GROUND	80009	131-1172-00
	-----			1		METER ASSEMBLY (SEE M310 REPL)		
-76	149-0031-00			1		. . METER, BTRY LVL: 0-350UA, 15%, 0.50 DIA, SCALE	24138	P-202
-77	352-0169-00			1		. . HLD R, TERM CONN: 2 WIRE BLACK	80009	352-0169-00
-78	131-0708-00			2		. . CONTACT, ELEC: 0.48" L, 28-32 AWG WIRE	22526	47437
-79	161-0077-01			1		. CABLE ASSY, PWR: 2, 18 AWG, 125V, 10.0 L	80009	161-0077-01
	161-0078-01			1		. CABLE ASSY, PWR: 2, 18 AWG, 125V, 48.0 L	80009	161-0078-01
-80	166-0548-00			1		. . FERRULE, RF CA: 0.144 ID X 0.227 OD, GND	80009	166-0548-00
-81	253-0154-00			4		. TAPE, PRESS. SENS: 0.125" THK	18121	MT8
-82	342-0115-00			1		. INSULATOR, PLATE: POWER SUPPLY, MYLAR	80009	342-0115-00
-83	334-1926-00	XB020397		2		. MARKER, IDENT: DANGER	80009	334-1926-00
-84	386-2185-00			1		SPRT, CRT SHIELD: REAR	80009	386-2185-00
						(ATTACHING PARTS)		
-85	211-0213-00			1		SCREW, MACHINE: 4-40 X 0.312 INCH, PNH NYLON	23050	OBD
						- - - * - - -		
-86	337-1458-00			1		SHLD, ELECTRON T: CATHODE RAY TUBE	80710	337-1458-00-D
-87	378-0691-00			1		FILTER, LT, CRT: BLUE	80009	378-0691-00
-88	386-1999-00			1		SUPPORT, CRT: FRONT	80009	386-1999-00
-89	-----			1		COIL: (SEE L300 REPL)		
-90	352-0161-00			1		HLD R, TERM CONN: 3 WIRE, BLACK	80009	352-0161-00
-91	131-0707-00			1		CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
-92	354-0423-00			1		RING, SPRT, CRT: RUBBER	80009	354-0423-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr	
		Eff	Dscont				Code	Mfr Part Number
1-93	334-1859-00			1		MARKER, IDENT: STANDARD	80009	334-1859-00
	334-1920-00			1		MARKER, IDENT: 90-110V	80009	334-1920-00
	334-1921-00			1		MARKER, IDENT: 220-260V	80009	334-1921-00
	-----			-		(OPTION 01 ONLY)		
	010-0262-00	B010100	B079999	1		LEAD, TEST: 48.55 INCH L, PROBE ONLY	80009	010-0262-00
	010-0262-01	B080000	B114836	1		PROBE, VOLTAGE: 212, 48.55 L, PROBE ONLY	80009	010-0262-01
	010-0262-05	B114837		1		PROBE, VOLTAGE: 1 MEG OHM/1 MEG OHM, DARK	80009	010-0262-05
-94	013-0107-02			1		. TIP, TEST PROD: RETRACTABLE HOOK	80009	013-0107-02
-95	175-1288-01	B010100	B114836	1		. CABLE ASSY, RF: 94 OHM COAX, 51.0 L	80009	175-1288-01
	175-1498-01	B114837		1		. CABLE ASSY, RF:	80009	175-1498-01
	175-0940-00	B010100	B114836	1		. . . LEAD, ELECTRICAL: STRD, 24 AWG, 12.5 L	80009	175-0940-00
	175-0940-01	B114837		1		. . . LEAD, ELECTRICAL: PROBE COMMON W/CLIP	80009	175-0940-01
-96	200-1281-00	B010100	B114836X	1		. . . CABLE NIP, ELEC: 0.125 ID-0.174 SQ X 0.75	80009	200-1281-00
-97	200-1280-00	B010100	B114836X	1		. . . COVER, ELEC CLIP: YELLOW VINYL	80009	200-1280-00
-98	344-0024-00	B010100	B114836X	1		. . . CLIP, ELECTRICAL: ALLIGATOR TYPE	76545	#30
-99	214-0592-00	B010100	B114836X	1		. . . CONTACT, ELEC: 0.429 INCH LONG	71785	318-20-00-003
-100	204-0490-03	B010100	B114836	1		. . . BODY, TEST PROD: DARK GRAY	80009	204-0490-03
	204-0594-01	B114837		1		. . . BODY ASSY, PROBE: 1X	80009	204-0594-01



+

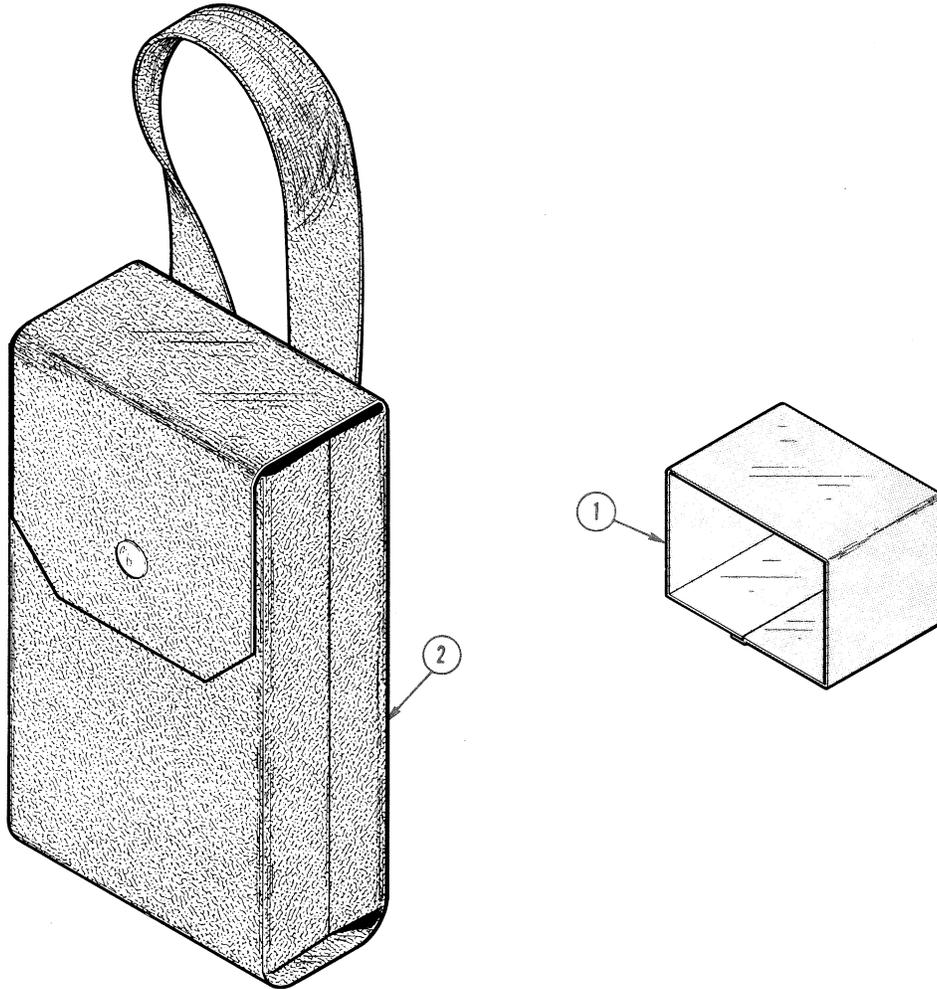
FIG. 1 EXPLODED



This page  
intentionally  
left blank

+

STANDARD ACCESSORIES



ACCESSORIES

+

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty						Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont		1	2	3	4	5			
2-1	016-0199-00	B010100	B069999	1						VISOR, CRT:	80009	016-0199-00
	016-0199-01	B070000		1						VISOR, CRT:	80009	016-0199-01
-2	016-0512-00			1						CASE, CARRYING:	000BC	OBD
	346-0104-00	XB070000		1						STRAP, CARRYING: 53 INCHES LONG	17516	4188-BA
	070-1160-00			1						MANUAL, TECH: INSTRUCTION	80009	070-1160-00
	070-1163-00			1						MANUAL, TECH: OPERATORS	80009	070-1163-00

This page  
intentionally  
left blank

## **MANUAL CHANGE INFORMATION**

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

This page  
intentionally  
left blank


**TEKTRONIX®**

 committed to  
technical excellence

# MANUAL CHANGE INFORMATION

 PRODUCT 211 Service

 CHANGE REFERENCE C5/875

EFF ALL SN

 DATE 8-13-75
**CHANGE:**
**DESCRIPTION**

## OPTION INFORMATION

Your instrument may be equipped with one or more options. This section describes those options or directs the reader to where the option is documented.

### OPTION 1

Option 1 equips the 211 for operation from a 220 to 250 V ac 48 to 52 Hz power line source. Option 1 parts values that differ from the standard 211 are listed here. A power cord cable assembly, for adapting to appropriate power plugs, is included with Option 1 instruments. Refer to the Maintenance and Diagrams sections of this manual for additional information concerning Option 1.

#### ELECTRICAL PARTS LIST DIFFERENCES FOR OPTION 1

A3	670-1504-21*	POWER SUPPLY Circuit Board Assembly (Option 1)
C204	283-0279-00	0.001 UF, 20%, 3 KV
C210	285-0932-00	1.0 UF, 10%, 400 V
C212	285-0933-00	2.0 UF, 10%, 400 V
C215	283-0279-00	0.001 UF, 20%, 3 KV

#### ADDITIONAL STANDARD ACCESSORIES FOR OPTION 1

161-0077-01 CABLE ASSEMBLY, POWER (Adapts to users plug type)

\*In some Option 1 instruments, the suffix number on the board may not be marked -21)

### OPTION 2

Option 2 equips the 211 for operation from a 90 to 110 V ac 48 to 52 Hz power line source. Option 2 parts values that differ from the standard 211 are listed here. Refer to the Maintenance and Diagrams sections of this manual for additional information concerning Option 2.

#### ELECTRICAL PARTS LIST DIFFERENCES FOR OPTION 2

A3	670-1504-31**	POWER SUPPLY Circuit Board Assembly (Option 2)
C210	285-0934-00	2.2 UF, 10%, 200V
C212	285-0935-00	4.4 UF, 10%, 200V

\*\*In some Option 2 instruments, the suffix number on the board may not be marked -31.

This page  
intentionally  
left blank



# MANUAL CHANGE INFORMATION

Date: 11-26-79 Change Reference: C7/1179

Product: 211 Manual Part No.: 070-1160-00

## DESCRIPTION

### REPACKAGING FOR SHIPMENT

If the 211 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.

This page  
intentionally  
left blank

---

# TEKTRONIX

## MANUAL MODIFICATION INSERT

---

### BATTERY REPLACEMENT

for

211 Serial Numbers B010100-- UP  
212 Serial Numbers B010100--B113453  
214 Serial Numbers B010100--B113464

Installed in Type \_\_\_\_\_ SN \_\_\_\_\_ Date \_\_\_\_\_

This modification insert is provided to supplement the manual for the above listed product(s). The information given in this insert supersedes that given in the manual.

Copyright © 1984 by Tektronix, Inc., Beaverton, Oregon. Printed in the United States of America. All rights reserved. Contents of this insert may not be reproduced in any form without the permission of the copyright owner.

### GENERAL INFORMATION

Battery Assembly, pn 146-0033-01, replaced Battery Assembly, pn 146-0033-00, which is no longer available. Use of the new assembly required removing CR215 from the Power Supply circuit board and replacing it with a circuit board, the A5 Rectifier Board.

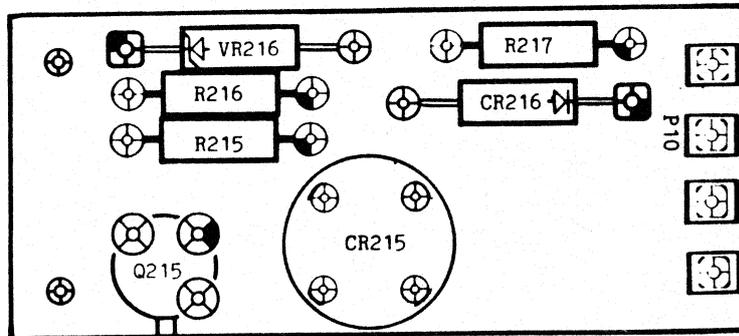
ADD:

CKT. NO.	PART NUMBER	DESCRIPTION
A5	670-8208-00	CKT BOARD ASSY: RECTIFIER
Q215	151-0503-00	SCR: SILICON
CR215	152-0585-00	SEMICON DVC. DI: RECT. SI. 200V. 1A
VR215	152-0590-00	SEMICON DVC. DI: ZEN. SI. 18V. 5%. 0.4W
F216	159-0220-00	FUSE, WIRE LEAD: 3A. 125V. FAST
F217	159-0220-00	FUSE, WIRE LEAD: 3A. 125V. FAST
R215	307-0103-00	RES. FXD. CMPSN: 2.7Ω. 5%. 0.25W
R216	315-0391-00	RES. FXD. CMPSN: 390Ω. 5%. 0.25W
R217	315-0391-00	RES. FXD. CMPSN: 390Ω. 5%. 0.25W

CHANGE TO:

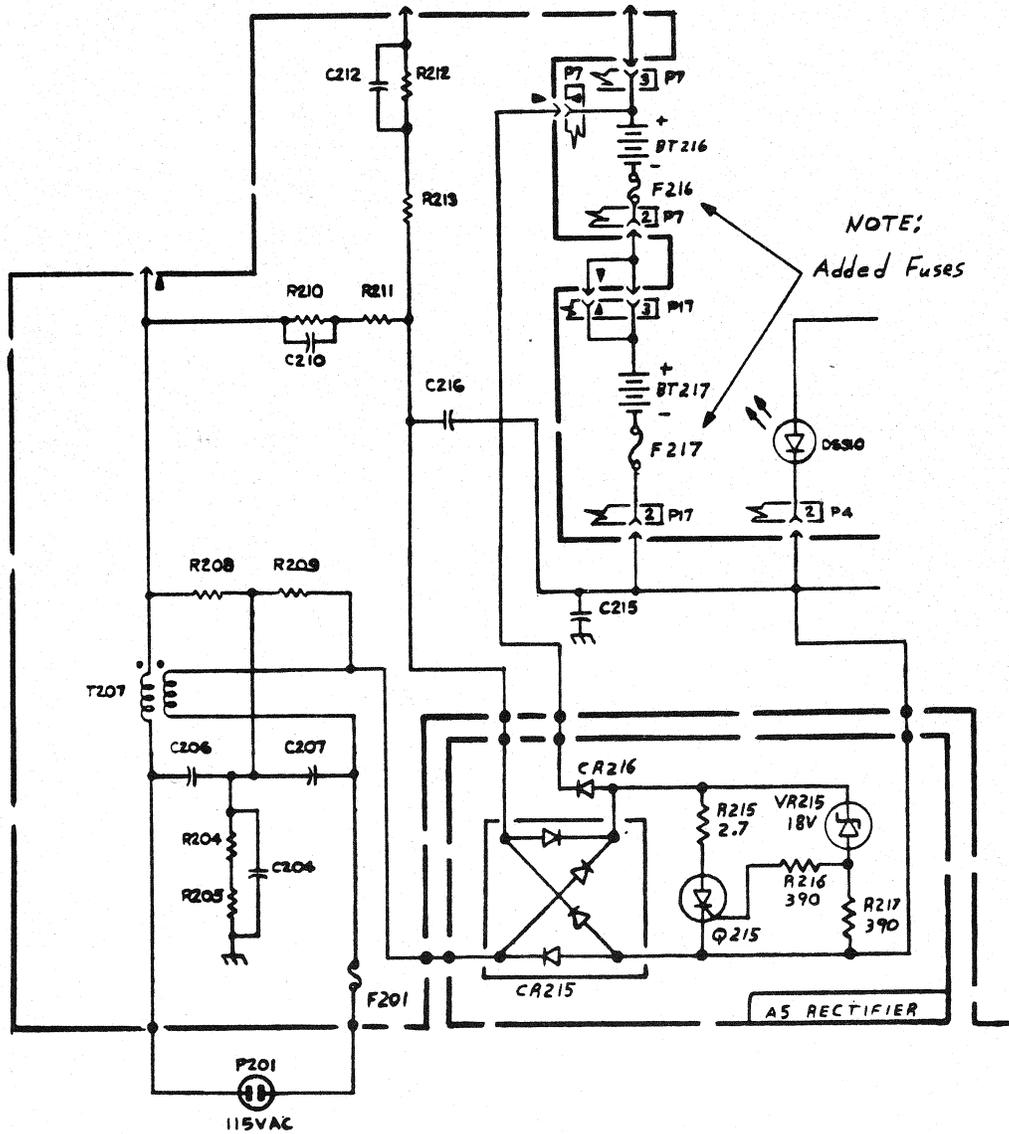
BT216	146-0033-01	BATTERY ASSY: SET OF 5
BT217	146-0033-01	BATTERY ASSY: SET OF 5

A5 RECTIFIER CIRCUIT BOARD



CR 215 on the Power Supply board has been replaced with the new A5 RECTIFIER BOARD. The partial diagram below indicates how the A5 board is wired to the Power Supply Board.

Note that there are also two fuses (F216 and F217) being added to the battery packs. These are also shown in the partial diagram below.



This page  
intentionally  
left blank



# product modification

050-1841-00

M35134

## BATTERY REPLACEMENT

For the following TEKTRONIX® Oscilloscopes:

- 211 Serial Numbers B010100--UP
- 212 Serial Numbers B010100--B103453
- 214 Serial Numbers B010100--B113464

Battery Assembly, pn 146-0033-01, replaces Battery Assembly, pn 146-0033-00, which is no longer available. Use of the new assembly requires removing CR215 from the Power Supply circuit board and replacing it with a circuit board, the A5 Rectifier Board.

2 11

### NOTE

If the instrument serial number is greater than those listed above, or this kit has already been installed, disregard these instructions and use pn 146-0033-01 as a direct replacement.

## KIT PARTS LIST:

Ckt. Number	Quantity	Part Number	Description
A5	2 EA	146-0033-01	BATTERY ASSY: SET OF 5
	1 EA	214-3012-00	FSTNR, SNAP-IN
	1 EA	670-8208-00	CKT BD ASSY: RECTIFIER
	1 EA	-----	LABEL, 050-1841-XX

## INSTRUCTIONS:

**WARNING**

*To avoid electric-shock hazard, disconnect the instrument from all other electrical equipment and the power source before proceeding.*

*The following instructions are for use by qualified service personnel only. To avoid personal injury, do not perform any of the following procedures unless you are qualified to do so.*

## BATTERY REMOVAL

- ( ) 1. Lay the instrument upside down on the workbench.
- ( ) 2. Remove the two screws located at the front of the instrument, under the crt.
- ( ) 3. Remove the nylon screw, located at the center of the case.
- ( ) 4. Unwrap the probes and power cord from the case.
- ( ) 5. Remove the two screws located at the rear of the case (the screws are covered when the probes are wrapped around the case).

- ( ) 6. Grasping the handle (on the bottom of the instrument) with one hand, and using the thumb of the other hand to press against the crt to hold it in place, and using a gentle rocking motion, lift the bottom case up and away from the instrument.

**NOTE**

*To facilitate reassembly of the instrument, draw a diagram which details the routing of the probe leads and the ac line cord inside the instrument case.*

- ( ) 7. Lift the entire assembly from the top cover (the side cover does not need to be removed).
- ( ) 8. Carefully lift the Power Supply board up off the assembly, and disconnect the batteries.

**NOTE**

*Before proceeding further, make a diagram detailing the orientation and location of all multipin connectors and cables, for use as a reference when reassembling the instrument.*

- ( ) 9. Disconnect the multipin connectors from the Power Supply circuit board.

**ADD A5 RECTIFIER CIRCUIT BOARD**

- ( ) 10. Locate CR215 on the Power Supply circuit board and remove it.
- ( ) 11. Solder the A5 Rectifier circuit board into the holes vacated by CR215. For 211 instruments, the "parts side" of the A5 circuit board should face C210 (See Fig. 1). For 212 and 214 instruments, the "parts side" of the A5 circuit board should face the crt (See Fig. 2). Clip any long leads flush with the board.
- ( ) 12. On 212/214 instruments, add the snap-in fastener to the Power Supply circuit board as shown in Fig. 2.

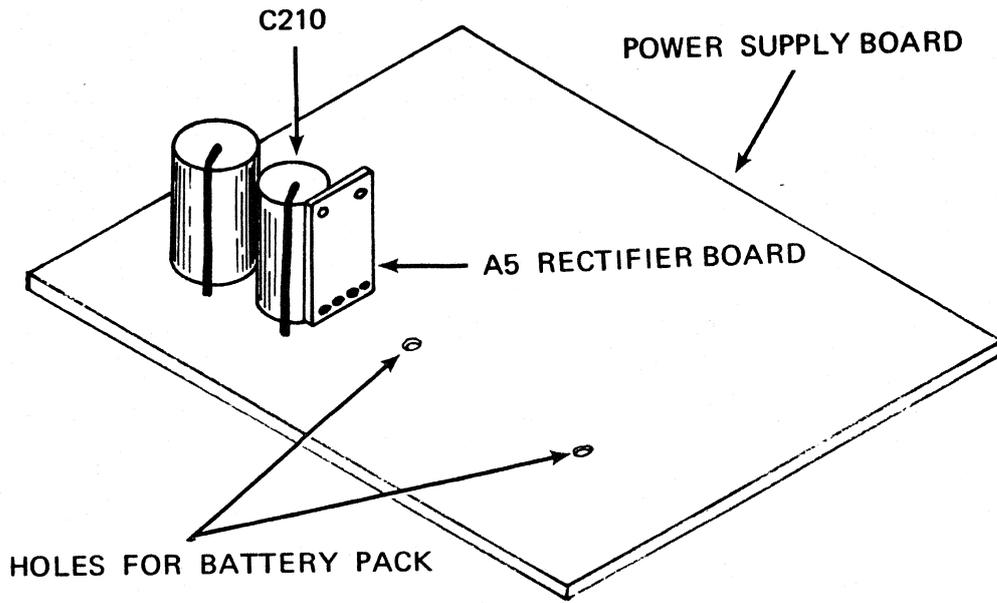


Fig. 1

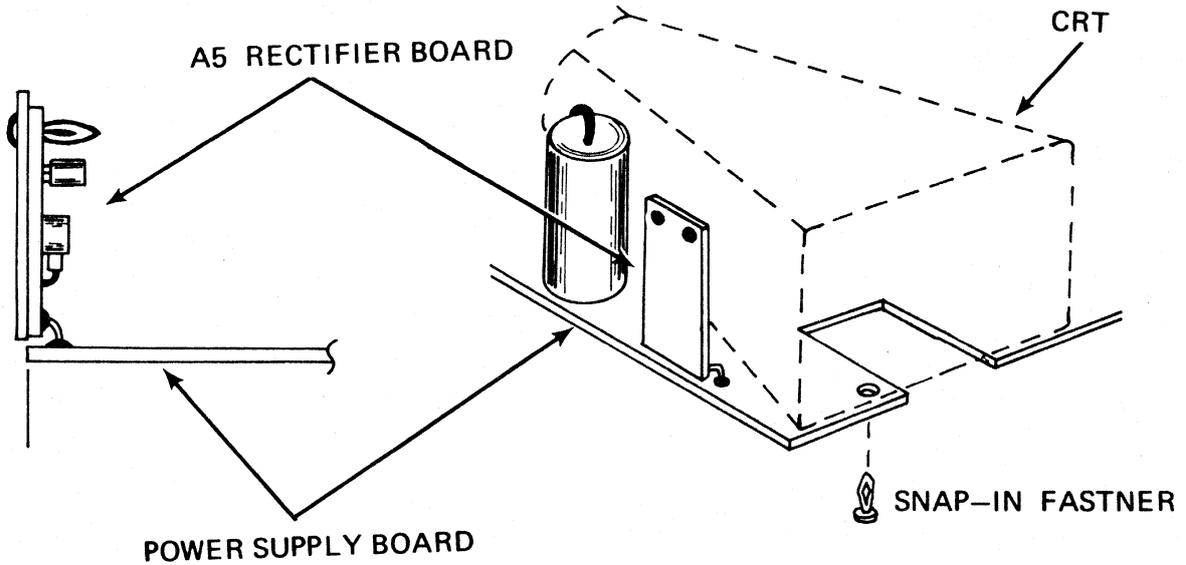


Fig. 2

- ( ) 13. **211'S ONLY.** In order to provide clearance for the battery pack on the Power Supply circuit board, the insulating board attached to the Rectifier circuit board **must** be removed. The insulating board **MUST NOT** be removed from 212/214 instruments.

#### REASSEMBLE INSTRUMENT

- ( ) 14. Reconnect the multipin connectors to the Power Supply circuit board.
- ( ) 15. Mount the batteries onto the Amplifier circuit board. The nibs on the plastic end caps mount into holes in the Amplifier circuit board. The batteries should mount flush against the circuit board, there shouldn't be any components between the batteries and the circuit board. It is best if the side of the battery pack on which the fuse is mounted faces the crt.
- ( ) 16. Connect the battery leads to the power Supply circuit board. Ensure proper orientation of the connector before pushing the connector onto the pins.

**CAUTION**

*Before mounting the Power Supply circuit board, there are a number of components on the circuit board which should be pushed down against the circuit board so that they won't touch the crt shield when the circuit board is mounted. The components which should be pushed down are; 212: C216, C236 R239 & VR238; 214: C216, C236, C512, VR238 & R239, and P22. If these parts are not pushed down, they may short against the crt shield, resulting in damage to the instrument.*

- ( ) 17. Route the heavy cabling (P1, P2, and P3) behind the crt, and the cabling for P6, and P4 between the battery and the Input circuit board. Lay the Power Supply circuit board down onto the instrument. Ensure that no cabling is caught between the circuit board and the battery packs. The nibs on the battery end caps fit into holes on the Power Supply circuit board.
- ( ) 18. Refer to the calibration section of your manual, test the instrument's performance and recalibrate as necessary.

- ( ) 19. Set the instrument. Amplifier circuit board down, into the top case, ensuring the mounting holes in the circuit board fit down over the mounting nibs on the case.
- ( ) 20. Ensure the crt filter is in place.
- ( ) 21. Carefully slide the front of the crt into the grooves in the case.
- ( ) 22. Route the probes and ac line cord according to the diagram made prior to step 7. Note that the metal bands (on the cables) should be inside the case so that they can prevent the cables from being pulled out of the instrument.
- ( ) 23. Set the bottom case down on top of the instrument. (Note for 212/214's: Push the new Rectifier circuit board in, so it won't tear the foil on the inside of the case) Note that there are mounting nibs on the inside of the bottom case which fit into mounting holes in the Power Supply circuit board. Make sure the side panel is properly seated.
- ( ) 24. Slide in the cord wrap spool (212/214's).
- ( ) 25. Check for any pinched cabling between the top and bottom cases.
- ( ) 26. Reinstall the two screws at the rear of the case.
- ( ) 27. Reinstall the two screws at the front of the case, under the crt.
- ( ) 28. Reinstall the nylon screw in the center of the case. Be very careful not to overtighten the screw.
- ( ) 29. Remove the protective backing from the 050-1841-XX label, included in the kit, and affix it to a clean area of the bottom case to indicate this kit has been installed.
- ( ) 30. Fasten the Manual Modification Insert, at the end of these instructions, into your manual for future reference.

CM: cm

# PRODUCT MODIFICATION KIT SUGGESTION/CORRECTION FORM

DATE \_\_\_\_\_

KIT NUMBER \_\_\_\_\_ STEP/PAGE \_\_\_\_\_

FIGURE NUMBER \_\_\_\_\_ PUBLICATION DATE \_\_\_\_\_

DISCREPANCY \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SUGGESTED CORRECTION/COMMENTS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

SUGGESTED BY: NAME/ORGANIZATION \_\_\_\_\_

(PLEASE TYPE OR PRINT LEGIBLY)

\_\_\_ REPLY REQUESTED

RETURN TO LOCAL FIELD OFFICE/SERVICE CENTER

FIELD OFFICE/SERVICE CENTER/DEL. STA. \_\_\_\_\_

SERVICE CENTER: RETURN TO FIELD MODS 73-860

---

## REPLY

\_\_\_ WILL MAKE CHANGE IMMEDIATELY

\_\_\_ WILL MAKE CHANGE AT NEXT PRINTING

\_\_\_ OTHER \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

SIGNED \_\_\_\_\_ DATE \_\_\_\_\_

This page  
intentionally  
left blank