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**Tektronix®**

**2215A  
OSCILLOSCOPE  
SERVICE**

INSTRUCTION MANUAL



## WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER TO THE OPERATORS SAFETY SUMMARY AND THE SERVICE SAFETY SUMMARY PRIOR TO PERFORMING ANY SERVICE.

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

# 2215A OSCILLOSCOPE SERVICE

## INSTRUCTION MANUAL

Tektronix, Inc.  
P.O. Box 500  
Beaverton, Oregon 97077  
070-4735-00  
Product Group 46


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

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### 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,<br>The Netherlands |

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## OPERATORS SAFETY SUMMARY

*The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply and do not appear in this summary.*

### Terms in This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

### Terms as Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property, including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

### Symbols in This Manual



This symbol indicates where applicable cautionary or other information is to be found. For maximum input voltage see Table 1-1.

### Symbols As Marked on Equipment



DANGER — High voltage.



Protective ground (earth) terminal.



ATTENTION — Refer to manual.

### Power Source

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

### Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

### Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

### Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

For detailed information on power cords and connectors see Figure 2-1.

### Use the Proper Fuse

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your product.

### Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

### Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

## SERVICING SAFETY SUMMARY

### FOR QUALIFIED SERVICE PERSONNEL ONLY

*Refer also to the preceding Operators Safety Summary.*

#### **Do Not Service Alone**

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

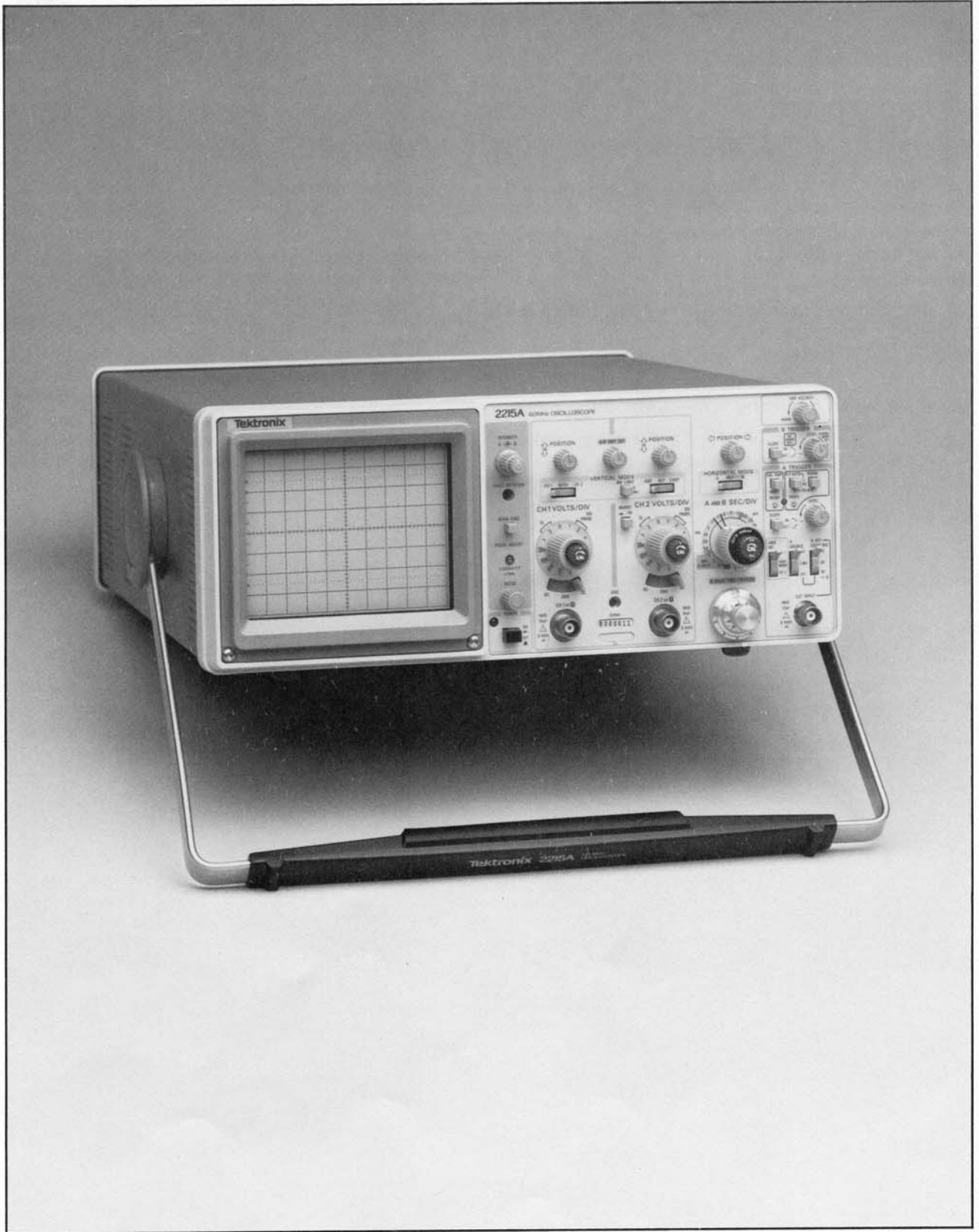
#### **Use Care When Servicing With Power On**

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections or components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

#### **Power Source**

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding connector in the power cord is essential for safe operation.



The 2215A Oscilloscope.

4735-01

# SPECIFICATION

## INTRODUCTION

The TEKTRONIX 2215A Oscilloscope is a rugged, lightweight, dual-channel, 60-MHz instrument that features a bright, sharply defined trace on an 80- by 100-mm cathode-ray tube (crt). Its vertical system provides calibrated deflection factors from 2 mV per division to 5 V per division. Trigger circuits enable stable triggering over the full bandwidth of the vertical system. The horizontal system provides calibrated sweep speeds from 0.5 s per division to 50 ns per division along with delayed-sweep features. A X10 magnifier circuit extends the maximum sweep speed to 5 ns per division when the A and B SEC/DIV switch is set to 0.05  $\mu$ s per division.

## ACCESSORIES

The instrument is shipped with the following standard accessories:

- 1 Operators Manual
- 2 Probe packages
- 1 Power Cord

For part numbers and information about instrument accessories, refer to the tabbed "Accessories" part of the Replaceable Mechanical Parts section in the back of this manual.

The service manual and all other optional accessories are orderable from Tektronix, Inc. A local Tektronix Field Office, representative, or the Tektronix product catalog can provide ordering and product information.

## PERFORMANCE CONDITIONS

The following electrical characteristics (Table 1-1) are valid for the 2215A when it has been adjusted at an ambient temperature between +20°C and +30°C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between 0°C and +50°C (unless otherwise noted).

Items listed in the "Performance Requirements" column are verifiable qualitative or quantitative limits, while items listed in the "Supplemental Information" column are either explanatory notes, calibration setup descriptions, performance characteristics for which no absolute limits are specified, or characteristics that are impractical to check.





**Table 1-1  
Electrical Characteristics**

| Characteristics                       | Performance Requirements  | Supplemental Information   |
|---------------------------------------|---|--|
| <b>VERTICAL DEFLECTION SYSTEM</b>     |   |  |
| Deflection Factor                     |   |  |
| Range                                 | 2 mV per division to 5 V per division in a 1-2-5 sequence                                 | 5 mV per division to 5 V per division gain is adjusted with VOLTS/DIV switch set to 10 mV per division.<br>2 mV per division gain is adjusted with VOLTS/DIV switch set to 2 mV per division   |
| Accuracy                              | ±3%   |  |
| Range of VOLTS/DIV Variable Control   | Continuously variable between settings. Increases deflection factor by at least 2.5 to 1. |  |
| Step Response Rise Time               |   | Rise time is calculated from the formula:  |
| Rise Time                             |   | $\frac{0.35}{\text{Bandwidth } (-3 \text{ dB})}$   |
| 0°C to +35°C                          |   |  |
| 5 mV per Division to 5 V per Division | 5.8 ns or less. <sup>a</sup>  |  |
| 0°C to +50°C                          |   |  |
| 2 mV per Division to 5 V per Division | 7.0 ns or less. <sup>a</sup>  |  |
| Bandwidth (-3 dB)                     |   | Measured with a vertically centered 6-division reference signal from a 50 Ω source driving a 50 Ω coaxial cable that is terminated in 50 Ω, both at the input connector and at the probe input, with the VOLTS/DIV Variable control in the CAL detent. |
| 0°C to +35°C                          |   |  |
| 5 mV per Division to 5 V per Division | Dc to at least 60 MHz.  |  |
| 2 mV per Division                     | DC to at least 50 MHz.  |  |
| 0°C to +50°C                          |   |  |
| 2 mV per Division to 5 V per Division | Dc to at least 50 MHz. <sup>a</sup>   |  |
| AC Coupled Lower Limit                | 10 Hz or less at -3 dB. <sup>a</sup>  |  |
| Bandwidth Limiter                     | Upper limits (-3 dB) bandpass at 10 MHz ±15%.   |  |
| Chop Mode Switching Rate              | 500 kHz ±30%. <sup>a</sup>  |  |
| Input Characteristics                 |   |  |
| Resistance                            | 1 MΩ ±2%. <sup>a</sup>  |  |
| Capacitance                           | 20 pF ±2 pF. <sup>a</sup>   |  |

<sup>a</sup>Performance Requirement not checked in Service Manual.

Table 1-1 (cont)

| Characteristics  | Performance Requirements   | Supplemental Information   |
|--|--|--|
| <b>VERTICAL DEFLECTION SYSTEM (cont)</b>   |  |  |
| Maximum Safe Input Voltage  |  | See Figure 1-1 for derating curve.   |
| DC Coupled   | 400 V (dc + peak ac) or 800 V ac p-p to 10 kHz or less. <sup>a</sup> |  |
| AC Coupled   | 400 V (dc + peak ac) or 800 V ac p-p to 10 kHz or less. <sup>a</sup> |  |
| Common-Mode Rejection Ratio (CMRR)   | At least 20 to 1 at 25 MHz.  | Checked at 10 mV per division for common-mode signals of 6 divisions or less with VOLTS/DIV Variable control adjusted for best CMRR at 50 kHz. |
| Trace Shift with Attenuator Rotation   | 0.75 division or less. <sup>a</sup>                                  | VOLTS/DIV Variable control in CAL detent.  |
| Trace Shift as VOLTS/DIV Variable Control is Rotated   | 1.0 division or less. <sup>a</sup>                                   |  |
| Trace Shift with Invert  | 1.5 division or less. <sup>a</sup>                                   |  |
| Channel Isolation  | Greater than 100 to 1 at 25 MHz.                                     |  |
| <b>TRIGGER SYSTEM</b>  |  |  |
| A TRIGGER Sensitivity  |  | External trigger signal from a 50 $\Omega$ source driving a 50 $\Omega$ coaxial cable terminated in 50 $\Omega$ at the input connector.        |
| P-P AUTO and NORM/TV LINE Modes  |  |  |
| Internal   | 5 MHz      60 MHz<br>0.3 div      1.0 div                            |  |
| External   | 40 mV      150 mV  |  |
| Lowest Useable Frequency in P-P AUTO Mode  | 20 Hz with 1.0 division internal or 100 mV external. <sup>a</sup>    |  |
| TV FIELD Mode  | 1.0 division of composite sync. <sup>a</sup>                         |  |
| B TRIGGER Sensitivity (Internal Only)  | 10 MHz      60 MHz<br>0.4 div      1.5 div                           |  |
| <b>EXT INPUT</b>   |  |  |
| Maximum Input Voltage     | 400 V (dc + peak ac) or 800 V ac p-p at 10 kHz or less. <sup>a</sup> | See Figure 1-1 for derating curve.   |
| Input Resistance   | 1 M $\Omega$ $\pm$ 2%. <sup>a</sup>                                  |  |
| Input Capacitance  | 20 pF $\pm$ 2.5 pF. <sup>a</sup>                                     |  |
| AC Coupled   | 10 Hz or less at lower -3 dB point. <sup>a</sup>                     |  |

<sup>a</sup>Performance Requirement not checked in Service Manual.

Table 1-1 (cont)

| Characteristics                     | Performance Requirements   |                        | Supplemental Information  |
|-------------------------------------|--|------------------------|---|
| <b>TRIGGER SYSTEM (cont)</b>        |  |                        |   |
| LEVEL Control Range                 |  |                        |   |
| A TRIGGER (NORM)                    |  |                        |   |
| INT                                 | Can be set to any point of the trace that can be displayed. <sup>a</sup>   |                        |   |
| EXT, DC                             | At least $\pm 1.6$ V, 3.2 V p-p.   |                        |   |
| EXT, DC $\div 10$                   | At least $\pm 16$ V, 32 V p-p. <sup>a</sup>  |                        |   |
| B TRIGGER                           |  |                        |   |
| Internal                            | Can be set to any point of the trace that can be displayed. <sup>a</sup>   |                        |   |
| VAR HOLDOFF Control                 | Increases A Sweep holdoff time by at least a factor of 10. <sup>a</sup>  |                        |   |
| <b>HORIZONTAL DEFLECTION SYSTEM</b> |  |                        |   |
| Sweep Rate                          | 0.5 s per division to 0.05 $\mu$ s per division in a 1-2-5 sequence. X10 magnifier extends maximum sweep speed to 5 ns per division. |                        |   |
| Accuracy                            | <b>Unmagnified</b>   | <b>Magnified</b>       | Sweep accuracy applies over the center 8 divisions. Exclude the first 25 ns of the sweep for magnified sweep speeds and anything beyond the 100th magnified division. |
| +15°C to +35°C                      | $\pm 3\%$  | $\pm 4\%$              |   |
| 0°C to +50°C                        | $\pm 4\%$ <sup>a</sup>   | $\pm 5\%$ <sup>a</sup> |   |
| POSITION Control Range              | Start of sweep to 10th division in X1 or 100th divisions in X10 will position past the center vertical graticule line.               |                        |   |
| Sweep Linearity                     | $\pm 7\%$ .  |                        | Linearity measured over any 2 of the center 8 divisions. With magnifier in X10, exclude the first 25 ns and anything past the 100th division.                         |
| Variable Control Range              | Continuously variable between calibrated settings. Extends the A and B sweep speeds by at least a factor of 2.5.                     |                        |   |
| Delay Time                          | Applies to 0.5 $\mu$ s per division and slower.  |                        | Delay time is functional but not calibrated at sweep settings above 0.5 $\mu$ s per division.   |
| Dial Control Range                  | <0.5 + 300 ns to >10 divisions.  |                        |   |
| Jitter                              | One part or less in 20,000 (0.005%) of the maximum available delay time.   |                        |   |

<sup>a</sup>Performance Requirement not checked in Service Manual.

Table 1-1 (cont)

| Characteristics                                   | Performance Requirements   | Supplemental Information  |
|---|--|---|
| <b>HORIZONTAL DEFLECTION SYSTEM (cont)</b>        |  |   |
| Differential Time Measurement Accuracy            |  | Exclude delayed operation when A and B SEC/DIV knobs are locked together at any sweep speed or when a SEC/DIV switch is at 0.5 $\mu$ s per division or faster. Accuracy applies over the B DELAY TIME POSITION control range. |
| +15°C to +35°C                                    | $\pm 1\%$ +0.015 major dial division   |   |
| 0°C to +50°C                                      | $\pm 2\%$ +0.015 major dial division <sup>a</sup>                                    |   |
| <b>X-Y OPERATION (X1 MAGNIFICATION)</b>           |  |   |
| Deflection Factors                                | Same as Vertical Deflection System (with VOLTS/DIV Variable controls in CAL detent). |   |
| Accuracy  |  | Measured with a dc-coupled, 5-division reference signal.  |
| X-Axis  | $\pm 4\%$ .  |   |
| Y-Axis  | Same as Vertical Deflection System. <sup>a</sup>                                     |   |
| Bandwidth (–3 dB)                                 |  | Measured with a 5-division reference signal.  |
| X-Axis  | Dc to at least 2 MHz.  |   |
| Y-Axis  | Same as Vertical Deflection System. <sup>a</sup>                                     |   |
| Phase Difference Between X- and Y-Axis Amplifiers | $\pm 3^\circ$ from dc to 100 kHz. <sup>a</sup>                                       | With dc-coupled inputs.   |
| <b>PROBE ADJUST</b>                               |  |   |
| Output Voltage of PROBE ADJUST Jack               | 0.5 V $\pm 5\%$ .  |   |
| Repetition Rate                                   | 1 kHz $\pm 20\%$ . <sup>a</sup>  |   |
| <b>Z-AXIS INPUT</b>                               |  |   |
| Sensitivity                                       | 5 V causes noticeable modulation. Positive-going input decreases intensity.          | Useable frequency range is dc to 10 MHz.  |
| Maximum Safe Input Voltage                        | 30 V (dc + peak ac) or 30 VC p-p ac at 1 kHz or less. <sup>a</sup>                   |   |
| Input Resistance                                  | 10 k $\Omega$ $\pm 10\%$ . <sup>a</sup>  |   |
| <b>POWER SOURCE</b>                               |  |   |
| Line Voltage Ranges                               | 90 V to 250 V. <sup>a</sup>  |   |
| Line Frequency                                    | 48 Hz to 440 Hz. <sup>a</sup>  |   |
| Maximum Power Consumption                         | 40 W (70 VA). <sup>a</sup>   |   |
| Line Fuse   | 1.0 A, 250 V, slow-blow.   |   |
| <b>CATHODE-RAY TUBE</b>                           |  |   |
| Display Area                                      | 80 by 100 mm. <sup>a</sup>   |   |
| Standard Phosphor                                 | P31. <sup>a</sup>  |   |
| Nominal Accelerating Voltage                      | 14 kV. <sup>a</sup>  |   |

<sup>a</sup>Performance Requirement not checked in Service Manual.

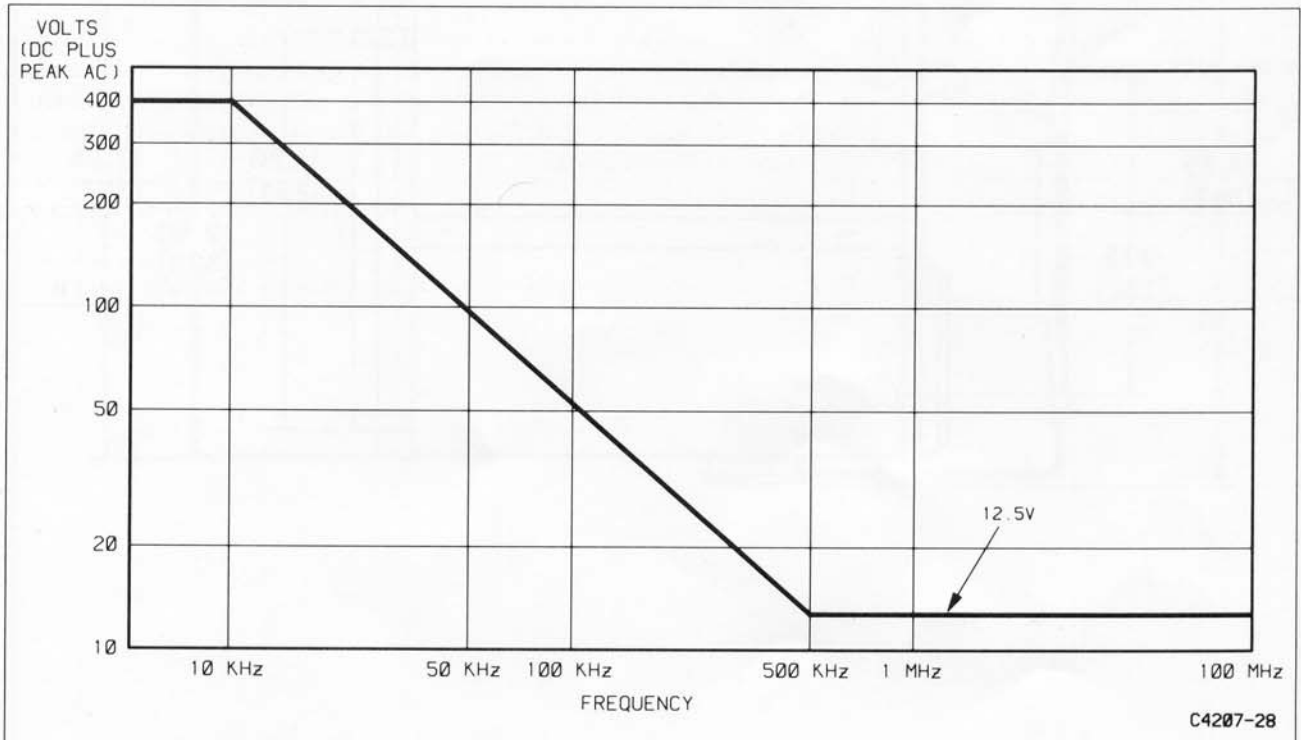


**Table 1-2  
Environmental Characteristics**

| Characteristics                       | Description   |
|---------------------------------------|---|
| Temperature<br>Operating              | <p style="text-align: center;">NOTE</p> <p><i>The instrument meets the requirements of MIL-T-28800C, paragraphs 4.5.5.1.3, 4.5.5.1.4, and 4.5.5.1.2.2 for Type III, Class 5 equipment, except where otherwise noted.</i></p> <p>0°C to +50°C (+32°F to +122°F).</p>   |
| Nonoperating                          | <p>–55°C to +75°C (–67°F to +167°F). Tested to MIL-T-28800C paragraphs 4.5.5.1.3 and 4.5.5.1.4, except in 4.5.5.1.3 steps 4 and 5 (0°C operating test) are performed ahead of step 2 (–55°C nonoperating test). Equipment shall remain off upon return to room ambient during step 6. Excessive condensation shall be removed before operating during step 7.</p> |
| Altitude<br>Operating                 | <p>To 4,500 m (15,000 ft). Maximum operating temperature decreased 1°C per 1,000 ft above 5,000 ft.</p>   |
| Nonoperating                          | <p>To 15,000 m (50,000 ft).</p>   |
| Humidity (Operating and Nonoperating) | <p>5 cycles (120 hours) referenced to MIL-T-28800C paragraph 4.5.5.1.2.2 for Type III, Class 5 instruments. Operating and non-operating at 95% +0% to –5% relative humidity. Operating at +50°C and +30°C. Non-operating at +30°C to +60°C.</p>   |
| Vibration (Operating)                 | <p>15 minutes along each of 3 major axes at a total displacement of 0.015 inch p-p (2.4 g's at 55 Hz) with frequency varied from 10 Hz to 55 Hz to 10 Hz in 1-minute sweeps. Hold for 10 minutes at 55 Hz in each of the 3 major axes. All major resonances must be above 55 Hz.</p>  |
| Shock (Operating and Nonoperating)    | <p>30 g's, half-sine, 11-ms duration, 3 shocks per axis each direction, for a total of 18 shocks.</p>   |
| EMI                                   | <p>Meets radiated and conducted emission requirements per VDE 0871 Class B.</p>   |

**Table 1-3**  
**Physical Characteristics**

| Characteristics                  | Description       |
|----------------------------------|-------------------|
| Weight With Power Cord           |                   |
| With Cover, Probes, and Pouch    | 6.2 kg (13.7 lb). |
| Without Cover, Probes, and Pouch | 5.2 kg (11.5 lb). |
| Domestic Shipping Weight         | 7.3 kg (16.0 lb). |
| Height                           |                   |
| With Feet and Handles            | 137 mm (5.4 in).  |
| Width                            |                   |
| With Handle                      | 360 mm (14.2 in). |
| Without Handle                   | 327 mm (12.9 in). |
| Depth                            |                   |
| With Front Cover                 | 445 mm (17.5 in). |
| Without Front Cover              | 440 mm (17.3 in). |
| With Handle Extended             | 511 mm (20.1 in). |



**Figure 1-1. Maximum input voltage vs. frequency derating curve for CH 1 OR X, CH 2 OR Y, and EXT INPUT connectors.**

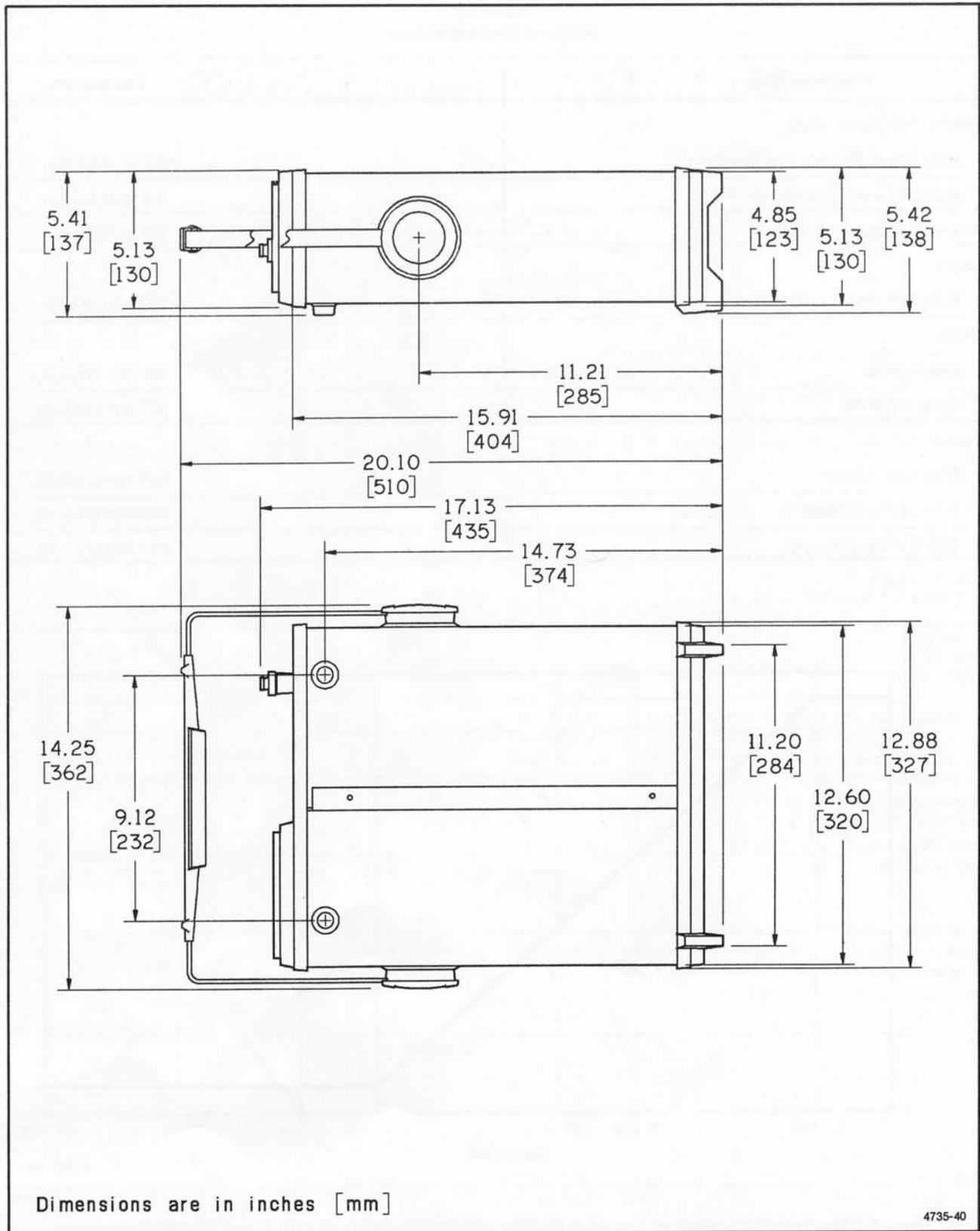


Figure 1-2. Physical dimensions of the 2215A Oscilloscope.

# OPERATING INSTRUCTIONS

## PREPARATION FOR USE

### SAFETY

Refer to the "Operators Safety Summary" at the front of this manual for power source, grounding, and other safety considerations pertaining to the use of the 2215A. Before connecting the instrument to a power source, carefully read the following about line voltages, power cords, and fuses.

### LINE VOLTAGE

The instrument is capable of continuous operation using input voltages that range from 90 V to 250 V nominal at frequencies from 48 Hz to 440 Hz.

### POWER CORD

A detachable three-wire power cord with a three-contact plug is provided with each instrument to permit connection to both the power source and protective ground. The plug protective-ground contact connects (through the protective-ground conductor) to the accessible metal parts of the instrument. For electrical-shock protection, insert this plug only into a power outlet that has a securely grounded protective-ground contact.

Instruments are shipped with the required power cord as ordered by the customer. Available power-cord information is illustrated in Figure 2-1, and part numbers are listed on the "Accessories" page at the back of this manual. Contact your Tektronix representative or local Tektronix Field Office for additional power-cord information.

### LINE FUSE

The instrument fuse holder is located on the rear panel (see Figure 2-2) and contains the line fuse. The following procedure can be used to verify that the proper fuse is installed or to install a replacement fuse.


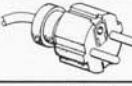




| Plug Configuration  | Usage                                | Line Voltage | Reference Standards                  |
|---|--------------------------------------|--------------|--------------------------------------|
|   | North American<br>120V/<br>15A       | 120V         | ANSI C73.11<br>NEMA 5-15-P<br>IEC 83 |
|   | Universal<br>Euro<br>240V/<br>10-16A | 240V         | CEE (7),II,IV,VII<br>IEC 83          |
|    | UK<br>240V/<br>13A                   | 240V         | BS 1363<br>IEC 83                    |
|   | Australian<br>240V/<br>10A           | 240V         | AS C112                              |
|   | North American<br>240V/<br>15A       | 240V         | ANSI C73.20<br>NEMA 6-15-P<br>IEC 83 |
|   | Switzerland<br>220V/<br>10A          | 220V         | SEV                                  |
| Abbreviations:<br>ANSI — American National Standards Institute<br>AS — Standards Association of Australia<br>BS — British Standards Institution<br>CEE — International Commission on Rules for the Approval of Electrical Equipment<br>IEC — International Electrotechnical Commission<br>NEMA — National Electrical Manufacturer's Association<br>SEV — Schweizerischer Elektrotechnischer Verein C4732-02 |                                      |              |                                      |

Figure 2-1. Optional power cords.

1. Unplug the power cord from the power-input source (if applicable).
2. Press in and slightly rotate the fuse-holder cap counterclockwise to release it.
3. Pull the cap (with the attached fuse inside) out of the fuse holder.



## Operating Instructions—2215A Service

4. Verify proper fuse value (1.0 A, 250 V, slow blow).
5. Reinstall the fuse (or replacement fuse) and the fuse-holder cap.

## INSTRUMENT COOLING

Always maintain adequate instrument cooling. The ventilation holes on both sides of the instrument cabinet and on the rear panel must remain free of obstruction.

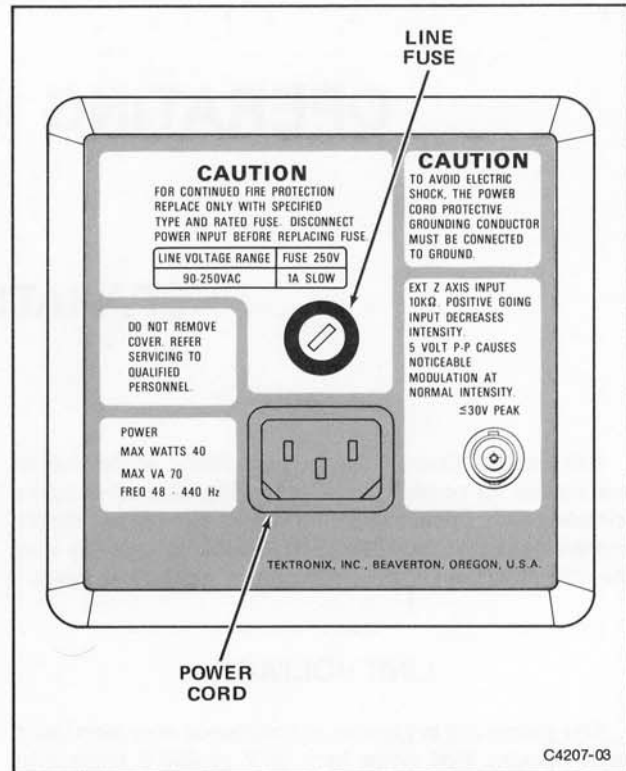


Figure 2-2. Fuse holder and power cord connector.

## CONTROLS, CONNECTORS, AND INDICATORS

The following descriptions are intended to familiarize the operator with the location, operation, and function of the instrument's controls, connectors, and indicators.

### DISPLAY, POWER, AND PROBE ADJUST

Refer to Figure 2-3 for location of items 1 through 8.

- 1 **Internal Graticule**—Eliminates parallax viewing error between the trace and graticule lines. Rise-time amplitude and measurement points are indicated at the left edge of the graticule.
- 2 **POWER Switch**—Turns instrument power on and off. Press in for ON; press again for OFF.
- 3 **Power Indicator**—An LED that illuminates when the instrument is operating.
- 4 **FOCUS Control**—Adjusts for optimum display definition.
- 5 **PROBE ADJUST Connector**—Provides an approximately 0.5 V, negative-going, square-wave voltage (at approximately 1 kHz) that permits an operator to compensate voltage probes and to check operation of the oscilloscope vertical system. It is not intended for verifying the accuracy of the vertical gain or time-base circuitry.
- 6 **BEAM FIND Switch**—When held in, compresses the display to within the graticule area and provides a visible viewing intensity to aid in locating off-screen displays.
- 7 **TRACE ROTATION Control**—Screwdriver adjustment used to align the crt trace with the horizontal graticule lines.
- 8 **A and B INTENSITY Controls**—Determines the brightness of the A and B Sweep traces.

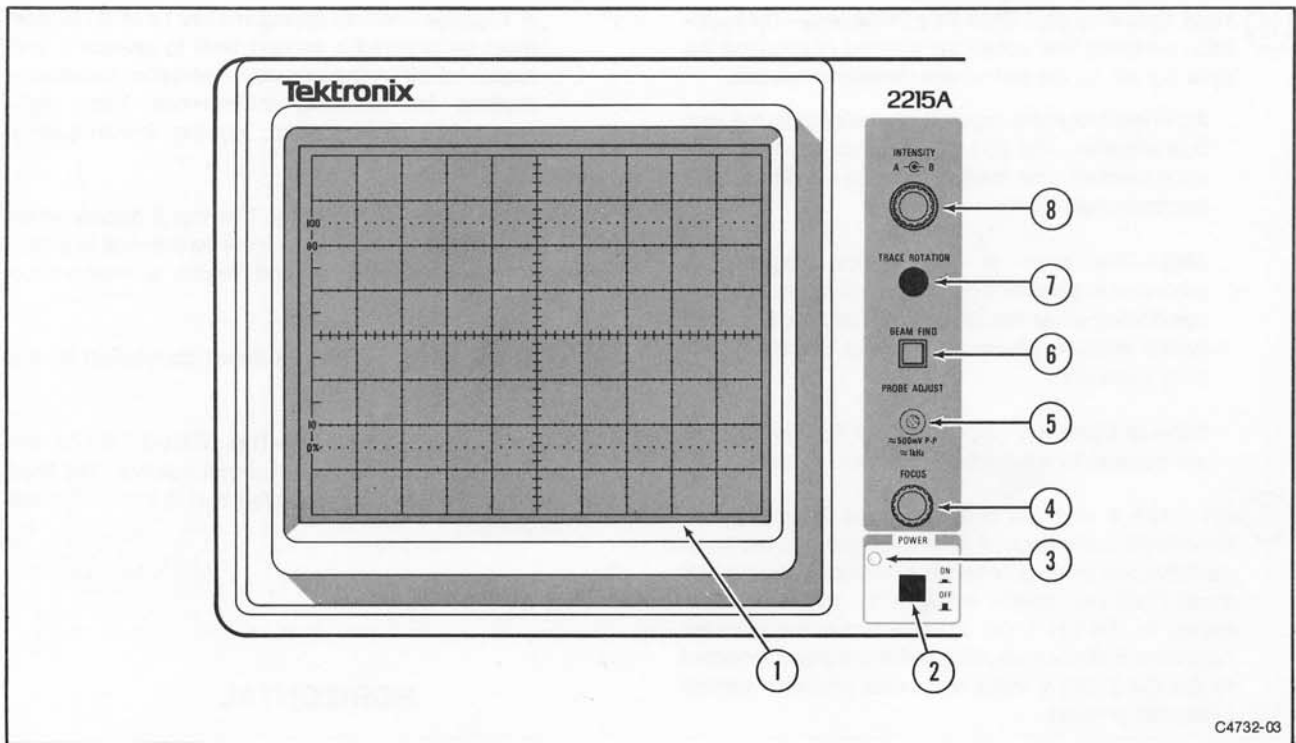


Figure 2-3. Power and display controls and indicators and PROBE ADJUST output.

## VERTICAL

Refer to Figure 2-4 for location of items 9 through 17.

- 9 **CH 1 VOLTS/DIV and CH 2 VOLTS/DIV Switches**—Used to select the vertical deflection factor in a 1-2-5 sequence. To obtain a calibrated deflection factor, the VOLTS/DIV variable control must be in the calibrated (CAL) detent (fully clockwise).

**1X**—Indicates the deflection factor selected when using either a 1X probe or a coaxial cable.

**10X PROBE**—Indicates the deflection factor selected when using a 10X probe.

- 10 **VOLTS/DIV Variable Controls**—When rotated counterclockwise out of their calibrated detent positions, these controls provide continuously variable, uncalibrated deflection factors between the calibrated settings of the VOLTS/DIV switches.

- 11 **POSITION Controls**—Used to vertically position the display on the crt. When the SEC/DIV switch is set to X-Y, the Channel 2 POSITION control moves the display vertically (Y-axis), and the Horizontal POSITION control moves the display horizontally (X-axis).

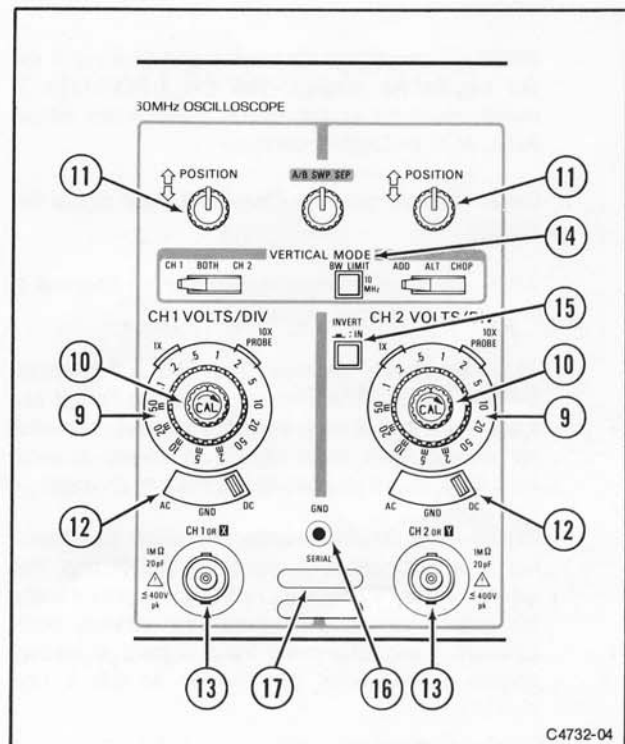


Figure 2-4. Vertical controls and connectors.

- 12 **Input Coupling (AC-GND-DC) Switches**—Three-position switches that select the method of coupling the input signals to the instrument deflection system.

**AC**—Input signal is capacitively coupled to the vertical amplifier. The dc component of the input signal is blocked. Low-frequency limit (−3 dB point) is approximately 10 Hz.

**GND**—The input of the vertical amplifier is grounded to provide a zero (ground) reference-voltage display (does not ground the input signal). This switch position allows precharging the input coupling capacitor.

**DC**—All frequency components of the input signal are coupled to the vertical deflection systems.

- 13 **CH 1 OR X and CH 2 OR Y Input Connectors**—Provide for application of external signals to the vertical deflection system or for an X-Y display. In the X-Y mode (SEC/DIV switch set to X-Y), the signal connected to the CH 1 OR X input connector provides horizontal deflection (X-axis) and the signal connected to the CH 2 OR Y input connector provides vertical deflection (Y-axis).

- 14 **VERTICAL MODE Switches**—Two three-position switches and one button switch are used to select the mode of operation for the vertical amplifier system.

**CH 1**—Selects only the Channel 1 input signal for display.

**BOTH**—Selects both Channel 1 and Channel 2 input signals for display. The CH 1-BOTH-CH 2 switch must be in the BOTH position for either ADD, ALT, or CHOP operation.

**CH 2**—Selects only the Channel 2 input signal for display.

**ADD**—Displays the algebraic sum of the Channel 1 and Channel 2 input signals.

**ALT**—Alternately displays Channel 1 and Channel 2 input signals. The alternation occurs during retrace at the end of each sweep. This mode is useful for viewing both input signals at sweep speeds from 0.05  $\mu$ s per division to 0.2 ms per division.

**CHOP**—The display switches between the Channel 1 and Channel 2 input signals during the sweep. The switching rate is approximately 500 kHz. This mode is useful for viewing both Channel 1 and Channel 2 input signals at sweep speeds from 0.5 ms per division to 0.5  $\mu$ s per division.

**BW LIMIT**—When pressed in, this button switch limits the bandwidth of the vertical amplifier and the

A Trigger system to approximately 10 MHz. Button must be pressed a second time to release it and regain full 60 MHz bandwidth operation. Provides a method for reducing interference from high-frequency signals when viewing low-frequency signals.

- 15 **INVERT Switch**—Inverts the Channel 2 display when button is pressed in. Button must be pressed in a second time to release it and regain a noninverted display.

- 16 **GND Connector**—Provides direct connection to the instrument chassis ground.

- 17 **SERIAL and Mod Slots**—The SERIAL slot is imprinted with the instrument's serial number. The Mod slot contains the option number that is installed in the instrument.

## HORIZONTAL

Refer to Figure 2-5 for location of items 18 through 24.

- 18 **A and B SEC/DIV Switches**—Used to select the sweep speeds for the A and B Sweep generators in a 1-2-5 sequence. To obtain calibrated sweep speeds, the A and B SEC/DIV Variable control must be in the calibrated detent (fully clockwise).

**A SEC/DIV**—The calibrated sweep speed is shown between the two black lines on the clear plastic skirt. This switch also selects the delay time for delayed-sweep operation when used in conjunction with the B DELAY TIME POSITION control.

**B SEC/DIV**—The B Sweep speed is set by pulling out the DLY'D SWEEP knob and rotating it clockwise to a setting opposite the white line scribed on the knob. The B Sweep circuit is used only for delayed-sweep operation.

- 19 **SEC/DIV Variable Control**—Provides continuously variable, uncalibrated A Sweep speeds to at least 2.5 times slower than the calibrated setting. It extends the slowest sweep speed to at least 1.25 s per division.

- 20 **X10 Magnifier Switch**—To increase displayed sweep speed by a factor of 10, pull out the SEC/DIV Variable knob. The fastest sweep speed can be extended to 5 ns per division. Push in the SEC/DIV Variable knob to regain the X1 sweep speed.

- 21 **POSITION Control**—Horizontally positions both the A Sweep and the B Sweep displays and horizontally positions X-axis in the X-Y mode.

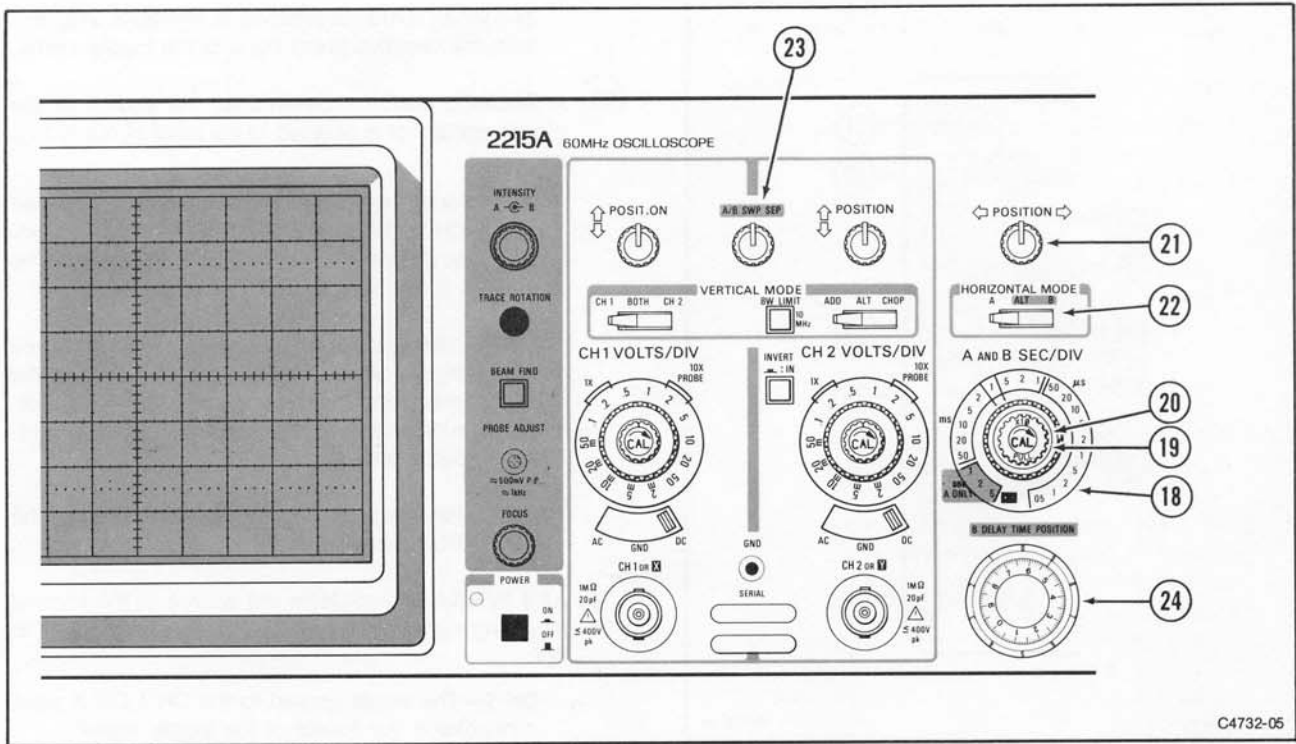


Figure 2-5. Horizontal controls.

**22 HORIZONTAL MODE Switch**—Three-position switch determines the mode of operation for the horizontal deflection system.

**A**—Horizontal deflection is provided by the A Sweep generator at a sweep speed determined by the A SEC/DIV switch setting.

**ALT**—Alternates the horizontal displays between the A Sweep (with an intensified zone) and the B Delayed Sweep. The A Sweep speed is determined by the setting of the A SEC/DIV switch. The B Sweep speed and the length of the intensified zone on the A Sweep are both determined by the B SEC/DIV switch setting.

**B**—Horizontal deflection is provided by the B Sweep generator at a sweep speed determined by the B SEC/DIV switch setting. The start of the B Sweep is delayed from the start of the A Sweep by a time determined by the settings of both the A SEC/DIV switch and the B DELAY TIME POSITION control.

**23 A/B SWP SEP Control**—Vertically positions the B Sweep trace with respect to the A Sweep trace when ALT HORIZONTAL MODE is selected.

**24 B DELAY TIME POSITION Control**—Selects the amount of delay time between the start of the A

Sweep and the start of the B Sweep. Delay time is variable from 0.5 times to 10 times the A SEC/DIV switch setting.

### TRIGGER

Refer to Figure 2-6 for location of items 25 through 34.

**25 A TRIGGER Mode Switches**—Three-section switch that determines the trigger mode for the A Sweep.

**SGL SWP RESET**—Press in the spring-return button momentarily to arm the A Trigger circuit for a single-sweep display. In this mode, the trigger system operates the same as NORM, except only one sweep is displayed for each trigger signal. Another sweep cannot be displayed until the SGL SWP RESET button is momentarily pressed in again to reset the A Trigger circuit. This mode is useful for displaying and photographing either nonrepetitive signals or signals that cause unstable conventional displays (e.g., signals that vary in amplitude, shape, or time).

**P-P AUTO-TV LINE**—Permits triggering on waveforms and division lines having repetition rates of at least 20 Hz. Sweep free-runs in the absence of an adequate trigger signal or when the repetition rate is below 20 Hz. The range of the A TRIGGER

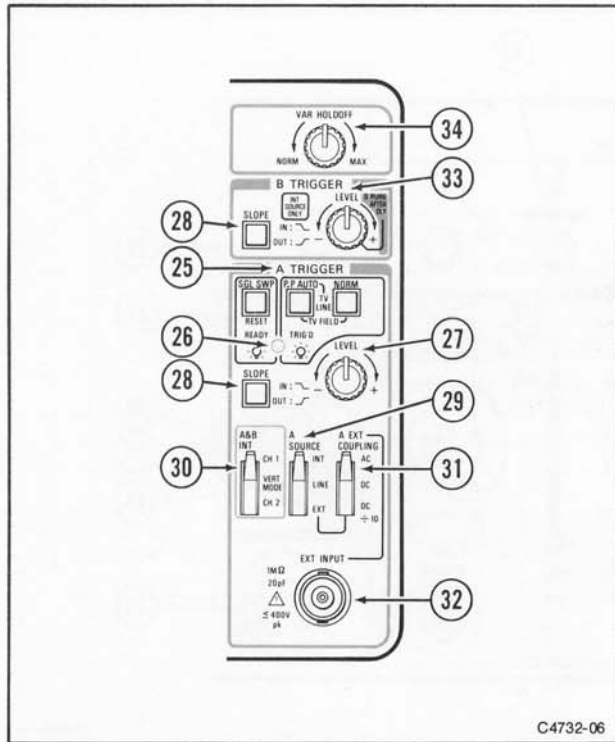


Figure 2-6. Trigger controls, connector, and Indicator.

LEVEL control is restricted to the peak-to-peak range of the trigger signal.

**NORM**—Sweep is initiated when an adequate trigger signal is applied. In the absence of a trigger signal, no baseline trace will be present.

**TV FIELD**—Press in both P-P AUTO and NORM buttons. Permits triggering on television field signals. TRIGGER LEVEL control should be rotated fully counterclockwise when triggering on TV signals with negative going sync and clockwise for positive going sync.

- 26 **TRIG'D-READY Indicator**—LED illuminates when either P-P AUTO or NORM Trigger Mode is selected and the A Sweep has been triggered (TRIG'D). In single-sweep display, the LED illuminates to indicate that the A Trigger circuit is armed (READY).
- 27 **A TRIGGER LEVEL Control**—Selects the amplitude point on the trigger signal at which the sweep is triggered.
- 28 **SLOPE Switches**—Selects the slope of the signal that triggers the sweep.

**OUT**—When button is released out, sweep is triggered from the positive-going slope of the trigger signal.

**IN**—When button is pressed in, sweep is triggered from the negative-going slope of the trigger signal.

- 29 **A SOURCE Switch**—Determines the source of the trigger signal that is coupled to the input of the A Trigger circuit.

**INT**—Permits triggering on signals that are applied to the CH 1 OR X and CH 2 OR Y input connectors. The source of the internal signal is selected by the A & B INT switch.

**LINE**—The power-source waveform is the source of the trigger signal. This trigger source is useful when vertical input signals are time related (multiple or submultiple) to the frequency of the power-input source voltage.

**EXT**—Permits triggering on signals applied to the EXT INPUT connector.

- 30 **A&B INT Switch**—Selects the source of the internal triggering signal when the A SOURCE switch is set to INT.

**CH 1**—The signal applied to the CH 1 OR X input connector is the source of the trigger signal.

**VERT MODE**—The internal trigger source is determined by the signals selected for display by the VERTICAL MODE switches. See Table 2-1 for VERT MODE trigger source.

Table 2-1  
VERT MODE Trigger Source

| VERT MODE     | Trigger Source   |
|---------------|--|
| CH 1          | CH 1 OR X input signal.  |
| CH 2          | CH 2 OR Y input signal.  |
| BOTH and ADD  | Algebraic sum of CH 1 OR X and CH 2 OR Y input signals.  |
| BOTH and CHOP | Algebraic sum of CH 1 OR and CH 2 OR Y input signals.  |
| BOTH and ALT  | Alternates between Channel 1 and Channel 2 on every other sweep (i.e. CH 1 OR X input signal triggers the sweep that displays Channel 1, and CH 2 OR Y input signal triggers the sweep that displays Channel 2). |

**CH 2**—The signal applied to the CH 2 OR Y input connector is the source of the trigger signal.



- 31 **A EXT COUPLING Switch**—Determines the method used to couple external signals to the A TRIGGER circuit from the EXT INPUT connector.

**AC**—Signals above 60 Hz are capacitively coupled to the input of the A Trigger circuit. Any dc components are blocked, and signals below 60 Hz are attenuated.

**DC**—All frequency components of the signal are coupled to the input of the A Trigger circuitry. This position is useful for displaying low-frequency or low-repetition-rate signals.

**DC ÷ 10**—External trigger signals are attenuated by a factor of 10. All frequency components of the signal are coupled to the input of the A Trigger circuit.

- 32 **EXT INPUT Connector**—Provides a means of introducing external signals into the A Trigger circuit through the A EXT COUPLING switch.

- 33 **B TRIGGER LEVEL Control**—Selects the amplitude point on the trigger signals at which the sweep is triggered. When fully clockwise (B RUNS AFTER DLY), the B Sweep circuit runs immediately following the delay time selected by the A SEC/DIV and the B DELAY TIME POSITION control.

- 34 **VAR HOLDOFF Control**—Provides continuous control of holdoff time between sweeps. Increases the holdoff time by at least a factor of 10. This control improves the ability to trigger on aperiodic signals (such as complex digital waveforms).

### REAR PANEL

Refer to Figure 2-7 for location of item 35.

- 35 **EXT Z-AXIS Connector**—Provides a means of connecting external signals to the Z-Axis amplifier to in-

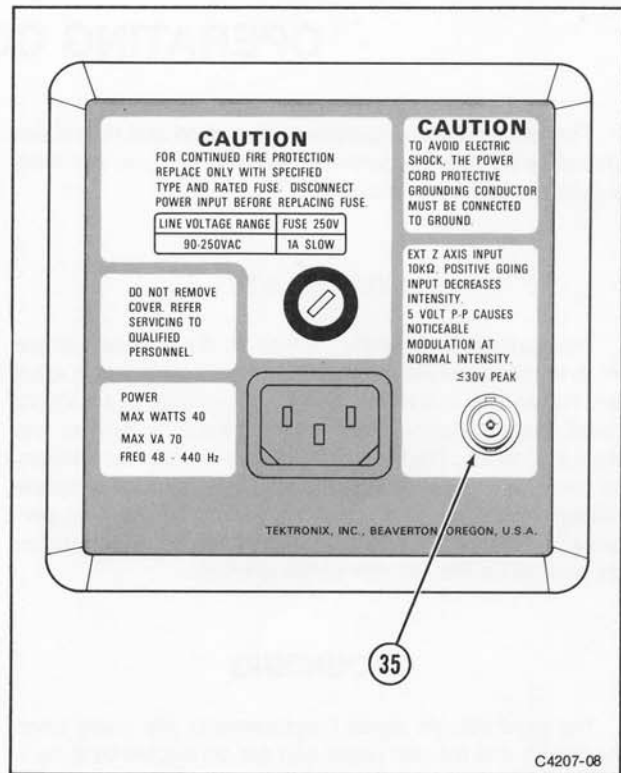


Figure 2-7. Rear-Panel connector.

tensity modulate the crt. Applied signals do not affect display waveshape. Signals with fast rise times and fall times provide the most abrupt intensity change, and a 5 V p-p signal will produce noticeable modulation. The Z-Axis signals must be time-related to the display to obtain a stable presentation on the crt.

## OPERATING CONSIDERATIONS

The following basic operating information and techniques should be considered before attempting to make any measurements with your instrument.

### GRATICULE

The graticule is internally marked on the faceplate of the crt to enable accurate measurements without parallax error (see Figure 2-8). It is marked with eight vertical and ten horizontal major divisions. Each major division is divided into five subdivisions. The vertical deflection factors and horizontal timing are calibrated to the graticule so that accurate measurements can be made directly from the crt. Also, percentage markers for the measurement of rise and fall times are located on the left side of the graticule.

### GROUNDING

The most reliable signal measurements are made when the 2215A and the unit under test are connected by a common reference (ground lead), in addition to the signal lead or probe. The probe's ground lead provides the best grounding method for signal interconnection and ensures the maximum amount of signal-lead shielding in the probe cable. A separate ground lead can also be connected from the unit under test to the oscilloscope GND connector located on the front panel.

### SIGNAL CONNECTIONS

Generally, probes offer the most convenient means of connecting an input signal to the instrument. They are shielded to prevent pickup of electromagnetic interference, and the supplied 10X probe offers a high input impedance that minimizes circuit loading. This allows the circuit under test to operate with a minimum of change from its normal condition as measurements are being made.

Coaxial cables may also be used to connect signals to the input connectors, but they may have considerable effect on the accuracy of a displayed waveform. To maintain the original frequency characteristics of an applied signal, only high-quality, low-loss coaxial cables should be used. Coaxial cables should be terminated at both ends in their characteristic impedance. If this is not possible, use suitable impedance-matching devices.

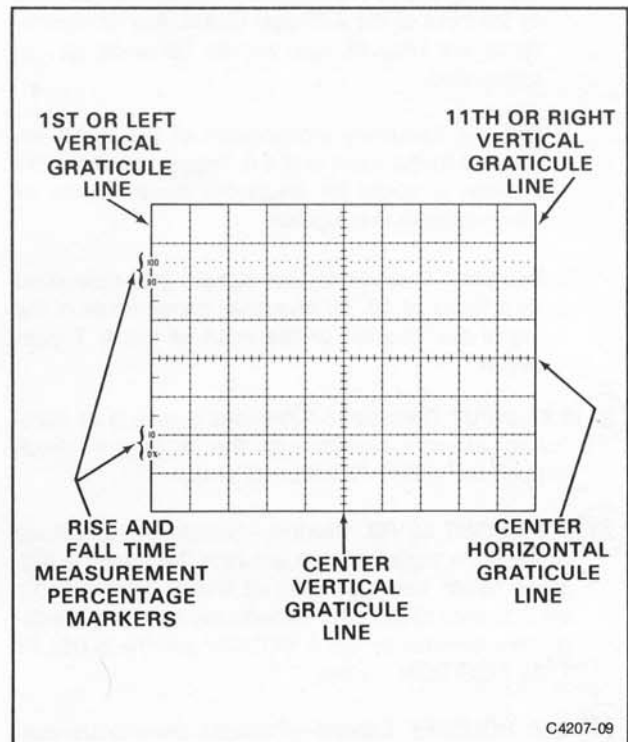


Figure 2-8. Graticule measurement markings.

### INPUT COUPLING CAPACITOR PRECHARGING

When the Input Coupling switch is set to GND, the input signal is connected to ground through the input coupling capacitor in series with a 1-M $\Omega$  resistor to form a precharging network. This network allows the input coupling capacitor to charge to the average dc-voltage level of the signal applied to the probe. Thus any large voltage transients that may accidentally be generated will not be applied to the amplifier input when the Input Coupling switch is moved from GND to AC. The precharging network also provides a measure of protection to the external circuitry by reducing the current levels that can be drawn from the external circuitry during capacitor charging.

The following procedure should be used whenever the probe tip is connected to a signal source having a different dc level than that previously applied, especially if the dc-



level difference is more than 10 times the VOLTS/DIV switch setting:

1. Set the Input Coupling switch to GND.
2. Insert the probe tip into the oscilloscope GND connector and wait several seconds for the input coupling capacitor to discharge.

3. Connect the probe tip to the signal source and wait several seconds for the input coupling capacitor to charge.

4. Set the Input Coupling switch to AC. The display will remain on the screen, and the ac component of the signal can be measured in the normal manner.

## OPERATOR'S ADJUSTMENTS

### INTRODUCTION

To verify the operation and accuracy of your instrument before making measurements, perform the following adjustment procedures. Adjustments beyond the scope of "Operator's Adjustments" are in the "Adjustment Procedure" Section 5 of this manual.

Before proceeding with these instructions, refer to "Preparation for Use" in this section for first-time start-up considerations.

Verify that the POWER switch is OFF (push button out), then plug the power cord into the power-source outlet.

### BASELINE TRACE

First obtain a baseline trace, using the following procedure.

1. Preset the instrument front-panel controls as follows:

#### Display

|                   |                        |
|-------------------|------------------------|
| A and B INTENSITY | Fully counterclockwise |
| FOCUS             | Midrange               |

#### Vertical (Both Channels)

|                    |                  |
|--------------------|------------------|
| POSITION           | Midrange         |
| VERTICAL MODE      | CH 1             |
| BW LIMIT           | Off (button out) |
| VOLTS/DIV          | 50 mV            |
| VOLTS/DIV Variable | CAL detent       |
| INVERT             | Off (button out) |
| Input Coupling     | AC               |

#### Horizontal

|                       |                        |
|-----------------------|------------------------|
| A/B SWP SEP           | Off midrange           |
| POSITION              | Midrange               |
| HORIZONTAL MODE       | A                      |
| A and B SEC/DIV       | 0.5 ms                 |
| SEC/DIV Variable      | CAL detent             |
| X10 Magnifier         | Off (knob in)          |
| B DELAY TIME POSITION | Fully counterclockwise |

#### B TRIGGER

|       |                 |
|-------|-----------------|
| SLOPE | OUT             |
| LEVEL | Fully clockwise |

#### A TRIGGER

|                |           |
|----------------|-----------|
| VAR HOLDOFF    | NORM      |
| Mode           | P-P AUTO  |
| SLOPE          | OUT       |
| LEVEL          | Midrange  |
| A&B INT        | VERT MODE |
| A SOURCE       | INT       |
| A EXT COUPLING | AC        |

2. Press in the POWER switch button (ON) and allow the instrument to warm up (20 minutes is recommended for maximum accuracy).

3. Adjust the A INTENSITY control for desired display brightness.

4. Adjust the Vertical and Horizontal POSITION controls as needed to center the trace on the screen.

### TRACE ROTATION

Normally, the resulting trace will be parallel to the center horizontal graticule line, and the Trace Rotation adjustment

## Operating Instructions—2215A Service

should not be required. If adjustment is needed, perform the following procedure:

1. Preset instrument controls and obtain a baseline trace.
2. Use the Channel 1 POSITION control to move the baseline trace to the center horizontal graticule line.
3. If the resulting trace is not parallel to the center horizontal graticule line, use small flat-bit screwdriver to adjust the TRACE ROTATION control and align the trace with the center horizontal graticule line.

### PROBE COMPENSATION

Misadjustment of probe compensation is a common source of measurement error. Most attenuator probes are equipped with a compensation adjustment. To ensure optimum measurement accuracy, always compensate the oscilloscope probes before making measurements. Probe compensation is accomplished as follows:

1. Preset instrument controls and obtain a baseline trace.
2. Connect the two 10X probes (supplied with the instrument) to the CH 1 and CH 2 input connectors.
3. Set both VOLTS/DIV switches to 10 mV and set both Input Coupling switches to DC.
4. Select CH 1 VERTICAL MODE and insert the tip of the Channel 1 probe into the PROBE ADJUST output jack.
5. Using the approximately 1-kHz PROBE ADJUST square-wave signal as the input, obtain a 5-division display of the signal.

6. Set the A SEC/DIV switch to display several cycles of the PROBE ADJUST signal. Use the Channel 1 POSITION control to vertically center the display.

7. Check the waveform presentation for overshoot and rolloff (see Figure 2-9). If necessary, adjust the probe compensation for flat tops on the waveforms. Refer to the instructions supplied with the probe for details of compensation adjustment.

8. Select CH 2 VERTICAL MODE and connect the Channel 2 probe tip to the PROBE ADJUST output jack.

9. Use the Channel 2 POSITION to vertically center the display and repeat step 7 for the Channel 2 probe.

10. Disconnect the probes from the instrument.

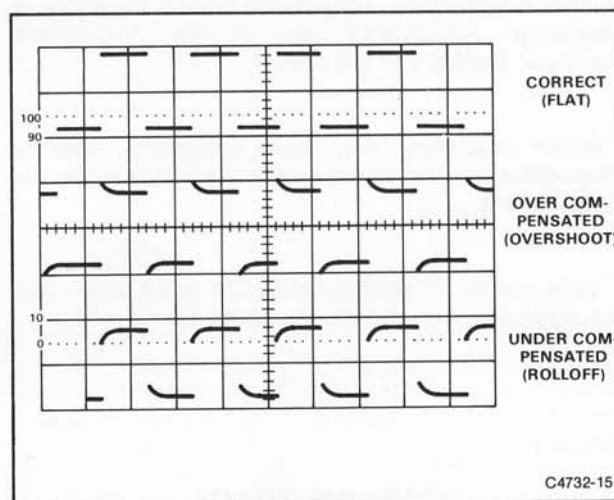


Figure 2-9. Probe compensation.

# THEORY OF OPERATION

## INTRODUCTION

### SECTION ORGANIZATION

This section of the manual contains a general summary of instrument functions followed by a detailed description of each major circuit. A basic block diagram, a detailed block diagram, and the schematic diagrams are located in the tabbed "Diagrams" section at the back of this manual. They are used to show the interconnections between parts of the circuitry, to indicate circuit components, and to identify interrelationships with the front-panel controls.

The schematic diagram number associated with each description is identified in the text and is shown on the block diagrams. For best understanding of the circuit being described, refer to the appropriate schematic diagram and the two block diagrams.

### INTEGRATED CIRCUIT DESCRIPTIONS

#### Digital Logic Conventions

Digital logic circuits perform many functions within the instrument. Functions and operation of the logic circuits are represented by logic symbology and terminology. Most logic functions are described using the positive-logic convention. Positive logic is a system of notation whereby the more positive of two levels is the TRUE (or 1) state; the more negative level is the FALSE (or 0) state. In this logic description the TRUE state is referred to as HI, and the FALSE state is referred to as LO. The specific voltages which constitute a HI or a LO state vary between specific devices. For specific device characteristics, refer to the manufacturer's data book.

#### Linear Devices

The functioning of individual linear circuit devices in this section use waveforms or other techniques such as voltage measurement and simplified diagrams to illustrate their operation.

## GENERAL DESCRIPTION

### NOTE

*When reading this general circuit description of the 2215A Oscilloscope, refer to the basic block diagram (Figure 9-4) and to the detailed block diagram (Figure 9-5) located in the "Diagrams" section of this manual. In Figures 9-4 and 9-5, the numbered diamond symbol in each major block refers to the appropriate schematic diagram number.*

Signals to be displayed on the crt are applied to either the CH 1 OR X input connector or the CH 2 OR Y input connector. These signals may be directly (DC) coupled to the Attenuator circuit or ac (AC) coupled through an input-coupling capacitor. The input signals may also be disconnected from the oscilloscope circuitry and the input attenuator grounded by setting the coupling switch to the GND position.

The output signal from the Attenuator circuit is applied to the Vertical Preamplifier for further amplification. Additionally, the Channel 2 Attenuator can invert the Channel 2 display on the crt. Trigger Pickoff Amplifiers in each channel supply an internal trigger signal from either or both channels to the Internal Trigger Amplifier.

Input signals are selected for display by the Channel Switching circuit under control of the front-panel VERTICAL MODE switches. The output signal from the Channel Switching circuit is applied to the Delay Line Driver stage. This stage converts a current input to a voltage output and provides an impedance match for the Delay Line. The Delay Line produces approximately 90 ns of delay in the vertical signal. This allows the Horizontal circuitry time to start the sweep so that the operator can see the signal that triggered the sweep.

Final amplification of the vertical signal is performed by the Vertical Output Amplifier. This Amplifier supplies the signal levels necessary for vertical deflection of the electron beam in the crt. The upper frequency response of the Amplifier can be reduced by enabling the Bandwidth Limit circuitry. For locating the position of off-screen displays, the dynamic range of the Amplifier can be limited with the Beam Find circuitry. This circuitry also intensifies the trace and limits horizontal deflection.

The A/B Sweep Separation circuitry supplies a dc-offset current to the Vertical Output Amplifier which vertically positions the B trace with respect to the A trace when Alt Horizontal Mode is selected.

The A Trigger circuitry uses either an Internal Trigger signal, an External Trigger signal, or a Line Trigger signal obtained from the ac power line to develop the gate signal for the A Sweep Generator. The B Trigger circuitry uses only the Internal Trigger signal to gate the B Sweep Generator. A P-P Auto Trigger circuit ensures that the range of the A TRIGGER LEVEL control tracks the peak-to-peak amplitude of the trigger signal when either the P-P Auto or TV Field trigger mode is selected. This allows triggering on most signals without needing to adjust the A TRIGGER LEVEL control. In Norm mode, the A TRIGGER LEVEL control must be adjusted for the correct trigger signal level before a sweep can be generated.

A TV Field sync circuit provides stable triggering on television vertical-sync pulses. Triggering at the television line rate is accomplished when either P-P Auto or Norm mode is selected.

The A Sweep Logic circuit controls sweep generation and Z-Axis unblanking for the A Sweep display. When the A TRIGGER Mode switches are set to either P-P AUTO or TV FIELD and no trigger signal is present, the Auto Baseline circuit causes the Sweep Logic circuit to produce a sweep for reference purposes. In the NORM setting, the Auto Baseline circuit is disabled and sweeps are inhibited until a trigger event occurs. This is useful for triggering on low-repetition-rate signals. The SGL SWP setting enables only one sweep to be generated after being reset. Following the single sweep, the A Trigger circuit is disabled until the SGL SWP RESET button is pressed again.

The A Sweep Logic circuit controls the operation of the A Miller Sweep Generator circuit. The Sweep circuit produces a linear sweep output with a ramp time that is controlled by the A SEC/DIV switch. The sweep signal is applied to the Horizontal Preamplifier for initial amplification and then to the Horizontal Output Amplifier to drive the crt horizontal deflection plates.

The Horizontal Preamplifier gain is increased by a factor of 10 when the X10 Magnifier is used. Horizontal positioning of the display is accomplished in the Horizontal Preamplifier circuit.

In the X-Y mode of operation, the Channel 1 signal from the Internal Trigger circuitry passes through the X-Y Amplifier to the Horizontal Preamplifier. In this operating mode, the Channel 1 Internal Trigger signal supplies the horizontal deflection to the crt, and the Miller Sweep circuit is disabled to inhibit sweep generation.

The Alternate B Sweep circuitry controls the Alt and B Horizontal mode displays and includes the B Miller Sweep Generator and B Sweep Logic circuitry. In addition to providing the B Sweep sawtooth waveform, signals are generated which control the display switching between the A and B displays.

The intensity levels of both the A and B Sweeps are set by the front-panel A and B INTENSITY controls. These controls, along with signals from the A and B Sweep Logic circuits, determine the drive level to the Z-Axis Amplifier.

The Z-Axis drive from both the A Sweep Logic circuit and the Alternate B Sweep circuit is applied to the Z-Axis Amplifier. The output signal from the Z-Axis Amplifier circuit sets the crt intensity. When using Chop Vertical mode, a blanking signal from the Chop Oscillator circuit blanks the crt display while switching between the vertical channels.

The Dc Restorer circuit applies the output voltage of the Z-Axis Amplifier between the cathode and grid of the crt. High dc potentials on these elements prohibit direct coupling to the crt.

The Power Supply provides the necessary operating voltages for the instrument. Operating potentials are obtained from a circuit composed of the Preregulator, Inverter and Transformer, and Rectifiers and Filters. The Preregulator produces approximately +43 V dc from the ac power line which is used to drive the 20 kHz Inverter stage. The transformer secondary windings provide various ac levels that are rectified and filtered to produce the operating voltages. A high-voltage multiplier circuit produces the accelerating, focus, and cathode potentials required by the crt.

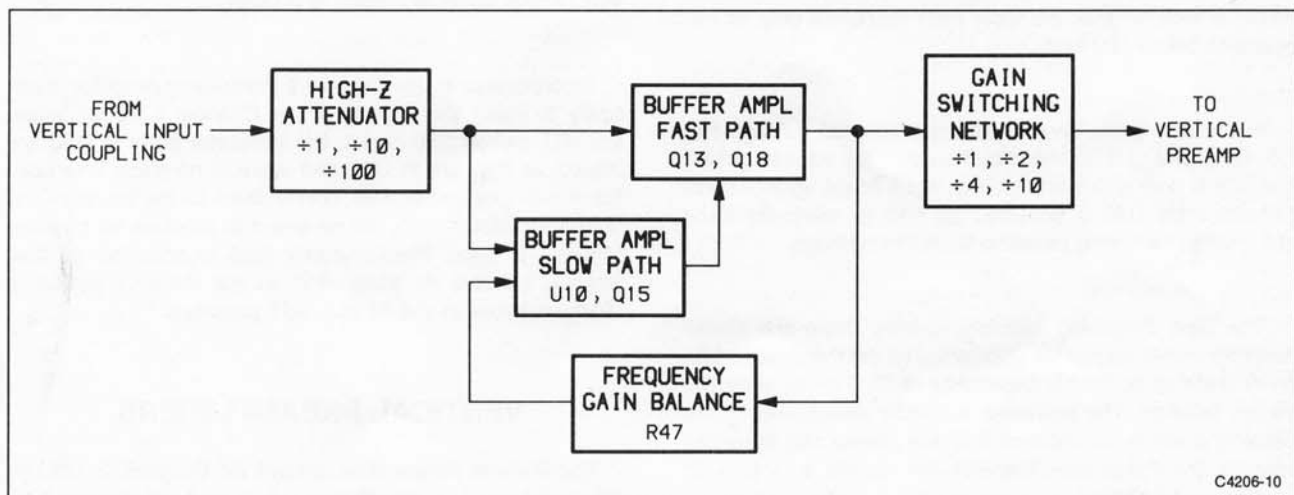
A front-panel PROBE ADJUST output is provided for use in adjusting probe compensation. The voltage at the PROBE ADJUST connector is a negative-going square wave that has a peak-to-peak amplitude of approximately 0.5 V and a repetition rate of approximately 1 kHz.

## DETAILED CIRCUIT DESCRIPTION

### VERTICAL ATTENUATORS

The Channel 1 and Channel 2 Attenuator circuits, shown on Diagram 1, are identical with the exception of the additional Invert circuitry in the Channel 2 Paraphase Amplifier. Therefore, only the Channel 1 Attenuator will be described and the Invert circuitry of Channel 2 will be discussed separately.

The Attenuator circuit (see Figure 3-1) provides control of input coupling, vertical deflection factor, and variable volts-per-division gain. Input signals for crt vertical deflection may be connected to the CH 1 OR X and the CH 2 OR Y input connectors. In the X-Y mode of operation, the signal applied to the CH 1 OR X connector provides horizontal (X-Axis) deflection for the display, and the signal applied to the CH 2 OR Y connector provides the vertical (Y-Axis) deflection for the display.



C4206-10

Figure 3-1. Block diagram of the Vertical Attenuators.



### Input Coupling

The signal applied to the CH 1 OR X input connector can be ac coupled, dc coupled, or disconnected from the input of the High-Impedance Input Attenuator circuit. Signals applied to the CH 1 OR X input connector are routed through resistor R9100 to Input Coupling switch S1. When S1 is set for dc coupling, the Channel 1 signal is applied directly to the input of the High-Impedance Attenuator stage. When ac coupled, the input signal passes through dc-blocking capacitor C2. The blocking capacitor prevents the dc component of the input signal from being applied to the Attenuator circuit. When switched into the signal path, attenuators AT1 and AT2 attenuate the input signal by factors of 100 and 10 respectively. When S1 is set to GND, the direct signal path is opened and the input of the Buffer Amplifier is connected to ground. This provides a ground reference without the need to disconnect the applied signal from the input connector. The coupling capacitor precharges through R4 to prevent large trace shifts when switching from GND to AC.

### Buffer Amplifier and Gain Switching Network

The Buffer Amplifier presents a high-impedance, low-capacitance load to the signal from the High-Impedance Attenuator and a low output impedance to the Gain Switching Network. A dual-path amplifier is used to combine high-dc stability with high-speed performance.

In the slow path, the input signal is applied to both the gate of source-follower Q13 and the inverting input of U10 through the divide-by-two network composed of R3 and R5. Transistor Q13 and emitter-follower Q18 isolate the input signal from the loading of the Gain Switching Network. The divider network at the output of the Amplifier (R46, R47, and R48) is connected to the other input of U10. Amplifier U10 compares the two divider voltages and changes the conduction level of current-source transistor Q15 to correct for any error at the source of Q13. Capacitor C10 limits the bandwidth of U10 so that the slow path responds only to frequencies below 100 kHz.

In the fast path, input signals are coupled through R6, C6, Q13, and Q18 to the circuit output. By adjusting R47, the gain in both paths is matched. Input offset voltage compensation for U10 is provided by R10 to eliminate trace shifts when switching between Volts/Div settings.

The Gain Switching Network divides down the Buffer Amplifier output signal for application to the Paraphase Amplifier and has an output impedance of 75  $\Omega$  for all Volts/Div switch settings. The particular Volts/Div switch setting will determine which contacts of S10 are closed and therefore whether the Paraphase Amplifier will receive a  $\div 1$ ,  $\div 2$ ,  $\div 4$ , or  $\div 10$  signal.

### Paraphase Amplifier

The Paraphase Amplifier converts the single-ended signal from the Gain Switching Network into a differential signal for application to the Vertical Preamp. Included in the circuitry is switching that provides extra gain for the 2 mV position of the VOLTS/DIV switch, adjustments for amplifier dc balance, and circuitry for the Variable Volts/Div function. Additionally, the Channel 2 Paraphase Amplifier contains circuitry to invert the Channel 2 display.

The signal from the Gain Switching Network is applied to the base of one transistor in U30. The other input transistor is biased by the divider network composed of R30, R31, and R33 to a level that will produce a null between the outputs of U30 (no trace shift on the crt screen) when the VOLTS/DIV control is switched between 5 mV and 2 mV. Emitter current for the two input transistors is supplied by R21, R22, R23, and R25, with R29 serving as the gain-setting resistor between the two emitters. In the 2 mV position, amplifier gain is increased by closing contact 15 of S10 to shunt R29 with R26.

The collector current through the two input transistors serves as emitter current for the two differential output transistor pairs. Base-bias voltages for the two pairs are derived from the divider network composed of R39, R41, R42, and R43. Monolithic IC U30 has matched transistor characteristics, so the ratio of currents in the two diodes connected to pin 11 determines the current ratios in the output transistor pairs. As VOLTS/DIV Variable potentiometer R43 is rotated from the calibrated to uncalibrated position, the conduction level of the transistors connected to R35 will increase. Since the transistor pair outputs are cross-wired, this increased conduction will subtract from the signal produced by the transistors connected to R38 and the overall gain of the Amplifier will decrease. Potentiometer R25 adjusts the balance of the Amplifier so there is minimal dc trace shift as the VOLTS/DIV Variable control is rotated.

Incorporated in the Channel 2 Paraphase Amplifier is circuitry to invert the polarity of the Channel 2 signal. When INVERT switch S90 is out, the transistor pairs in U80 are biased as they are in U30 and there is no trace inversion. For the IN position of S90, connections to the bases of the output transistor pairs are reversed to produce an inverted Channel 2 trace. Potentiometer R75 is adjusted so that there is minimal dc trace shift as the INVERT button is changed between the IN and OUT positions.

## VERTICAL PREAMPLIFIERS

The Vertical Preamp, shown on Diagram 2, utilizes differential signal current from the Paraphase Amplifier to

produce differential output current to drive the Delay Line Driver. Internal trigger signals for the Trigger circuitry are picked-off and channel selection for crt display is controlled by the Channel Switch circuitry.

Common-base transistors Q102 and Q103 convert differential current from the Paraphase Amplifier into level-shifted voltages that drive the bases of the input transistors of U130 and the Internal Trigger circuitry. Emitter current for the input transistors is supplied by Q114 and Q115, and the base bias is adjusted by R111. The collector current of each input transistor of U130 serves as emitter current for two differential output transistor pairs. One of the collectors of each output pair is grounded and the other provides output drive to the Delay Line Driver. The base voltages of the transistors with grounded collectors are held at ground potential by R136. The base voltages of the other transistors are controlled by the Channel Switch and Trigger View circuitry.

When Channel 1 is selected to drive the Delay Line Driver, the Q output of U540A is HI. The transistors with the ungrounded collectors will then be forward-biased and the Channel 1 signal will be conducted through to the Delay Line Driver. If Channel 1 is not selected, then the Q output of U540A is LO. The transistors with the ungrounded collectors are then reverse-biased and the output signals will be conducted to ground by the other transistor pair. The gain of the Preamplifier is set by adjusting R145 to determine how much signal current will be shunted between the two differential outputs.

## CHANNEL SWITCH AND VERTICAL OUTPUT

The Channel Switch circuitry, shown on Diagram 2, utilizes the front-panel VERTICAL MODE switches to select the crt display format. See Figure 3-2 for a block diagram of the circuit.

When any display mode other than X-Y is selected, the XY line connected to S550 is at ground potential. VERTICAL MODE switches S545 and S550 control the connection between the XY line and the  $\bar{S}$  and  $\bar{R}$  inputs of U540A to obtain the various display formats described below.

**CHANNEL 1 DISPLAY ONLY.** The CH 1 position of S550 grounds the  $\bar{S}$  input of U540A while the  $\bar{R}$  input is held HI by R539. This will produce a HI and a LO on the Q and  $\bar{Q}$  outputs respectively, and the Channel 1 Preamplifier signal will drive the Delay Line Driver as described in the "Vertical Preamplifier" section. The Channel 2 Preamplifier will be disabled.

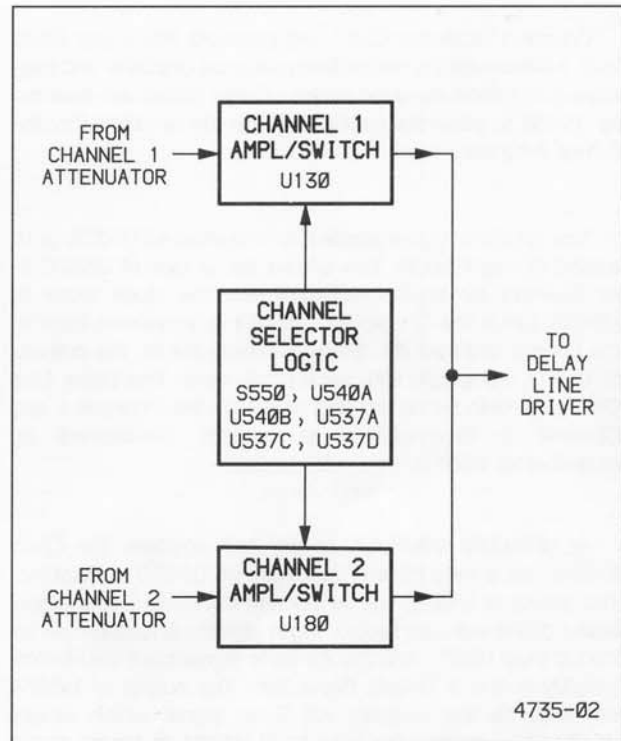


Figure 3-2. Block diagram of the Channel Switching circuitry.

**CHANNEL 2 DISPLAY ONLY.** The CH 2 position of S550 holds the  $\bar{R}$  input of U540A LO through CR538 and the  $\bar{S}$  input is held HI by R538. The outputs will then be Q LO and  $\bar{Q}$  HI to enable the Channel 2 Preamplifier signal to drive the Delay Line Driver while the Channel 1 Preamplifier is disabled.

To display the ADD, ALT, or CHOP formats, S550 must be in the BOTH position to ground the A, C, and F pins of S545.

**ADD DISPLAY.** In the ADD position of S545, both the  $\bar{S}$  and  $\bar{R}$  inputs of U540A are held LO by CR534 and CR537. The Q and  $\bar{Q}$  outputs are then both HI and signal currents from the Channel 1 and Channel 2 Preamplifiers add together to drive the Delay Line Driver.

**CHOP DISPLAY.** In the CHOP position, the Chop Enable line is held LO keeping the Q output of U540B HI. This enables multivibrator U537D to run at a frequency that is determined by R544, R545, and C545. The output of U537C, the inverted output of the multivibrator, is used to drive U537A and U537B.



## Theory of Operation—2215A Service

Coupling capacitor C547 and resistors R547 and R548 form a differentiating circuit that produces positive- and negative-going short-duration pulses. These pulses are inverted by U537B to generate the Chop Blank signal utilized by the Z-Axis Amplifier.

The Alt Sync signal applied to one input of U537A is HI except during Holdoff. This allows the output of U537C to be inverted by U537A which drives the clock input of U540A. Since the  $\overline{Q}$  output of U540A is connected back to the D input and both the  $\overline{S}$  and  $\overline{R}$  inputs are HI, the outputs of U540A will toggle with each clock input. The Delay Line Driver will then be driven alternately by the Channel 1 and Channel 2 Preamplifiers at a rate determined by multivibrator U537D.

**ALTERNATE DISPLAY.** In the ALT position, the  $\overline{\text{Chop Enable}}$  line is held HI and multivibrator U537D is disabled. The output of U537C will be LO and the Chop Blank signal from U537B will also be LO. Input signals to U537A will be the LO from U537C and the Alt Sync signal from the Holdoff circuitry in the A Sweep Generator. The output of U537A will then be the inverted Alt Sync signal which clocks U540A. This causes the outputs of U540A to toggle at the end of each sweep so that the Channel 1 and Channel 2 Preamplifier signals will alternately drive the Delay Line Driver.

### Delay Line Driver

The Delay Line Driver converts the signal current from the Vertical Preamplifiers or the Trigger View circuitry into a signal voltage for input to the Delay Line. Transistors Q202, Q203, Q206, and Q207 form a differential shunt-feedback amplifier with the gain controlled by R216 and R217. Amplifier compensation is provided by C210 and R210 and output common-mode dc stabilization by U225. Should the voltage at the junction of R222 and R223 deviate from zero, U225 will sink or source base current to Q202 and Q203 through R202 and R203. This will return the outputs of the Delay Line Driver to an average dc value of zero volts. Delay Line DL210 provides a vertical signal delay of about 90 ns so that the Sweep Generator has sufficient time to produce a sweep before the vertical signal that triggered the sweep reaches the crt deflection plates. This permits viewing the leading edge of the internal signal that originated the trigger pulse.

### Vertical Output Amplifier

The Vertical Output Amplifier provides final amplification of the input signals for application to the vertical deflection plates of the crt. Signals from the Delay Line are applied to a

differential amplifier composed of Q230 and Q231 with low- and high-frequency compensation provided by the RC networks connected between the emitters. Thermal compensation is provided by RT236, and overall gain is set by R233. The output stage of the Amplifier utilizes two totem-pole transistor pairs, Q254-Q256 and Q255-Q257, that convert the collector currents of Q230 and Q231 to proportional output voltages. Resistors R256, R258, R257, and R259 serve as feedback elements and also as divider networks so that each transistor in a pair drops half the final output voltage. The Amplifier output signals are applied to the vertical deflection plates of the crt to produce deflection of the crt beam.

BW LIMIT switch S226, C228 and C229, and a diode bridge consisting of CR226, CR227, CR228, and CR229, are utilized to reduce the bandwidth of the Amplifier if desired. With the bandwidth limit off, R226 is grounded and the nonconducting diode bridge isolates C228 and C229. With bandwidth limit on, R226 is connected to the +8.6 V supply and the diode bridge conducts. The two capacitors are no longer isolated and will attenuate high-frequency signals.

BEAM FIND switch S390 adjusts output-amplifier biasing to limit the voltage swing at the crt plates. This keeps the vertical trace within the graticule area for locating off-screen traces. With the switch in the normal out position, the -8.6 V supply provides emitter current to the Amplifier output stage through R261. When the BEAM FIND switch is in, the direct -8.6 V supply to R261 is removed and emitter current is now supplied through R261 and R262 in series. This reduces the amount of available emitter current and limits the Amplifier dynamic range.

### A/B Sweep Separation Circuit

The circuit composed of Q283, Q284, Q285, and associated components provides a means of vertically positioning the B trace with respect to the A trace during Alt Horizontal Mode displays. During the B Sweep interval, the  $\overline{\text{Sep}}$  signal from the Alternate Display Switching circuit is LO and Q283 is biased off. This allows A/B SWP SEP potentiometer R280 to affect the bias on one side of a differential current source composed of Q284 and Q285. This supplies a dc offset current to the Vertical Output Amplifier and changes the position of the B trace on the crt screen.

During the A Sweep interval, the  $\overline{\text{Sep}}$  signal is HI and Q283 is turned on. The base voltages of Q284 and Q285 are then the same, and equal current is supplied to both sides of the Vertical Output Amplifier so that no offset of the A trace occurs.

## TRIGGER AMPLIFIERS AND SWITCHING

The Trigger Amplifiers, shown on Diagram 3, provide signals to the A Trigger Generator circuit from either the Vertical Preamplifiers, the EXT INPUT connector, or the power line. The A&B INT switch selects either Channel 1 or Channel 2 as the trigger source, and the A SOURCE switch selects between internal, line, or external trigger sources.

### Internal Trigger

Signals from the Vertical Preamplifiers drive the Internal Trigger Amplifier with channel selection determined by the VERTICAL and HORIZONTAL MODE switches.

Trigger pickoff from the Preamplifiers is accomplished by Q302 and Q303 for Channel 1, and Q327 and Q328 for Channel 2. The circuitry associated with Channel 2 is the same as that for Channel 1 except that it does not have a trigger offset adjustment.

Signals from the Channel 1 Preamplifier are applied to Q302 and Q303. These emitter-follower transistors each drive one input transistor in U310, and the collectors of the U310 input transistors in turn supply emitter current to two current-steering transistors. The compensation and biasing network connected to the emitters of the input transistors in U310 is fixed for Channel 2 but not for Channel 1. Potentiometer R309 adjusts the emitter bias levels of the two input transistors so that dc offsets between channels can be matched.

The base bias voltages of one transistor in each output differential amplifier pair is fixed by the divider network composed of R321 and R322. The other base voltage is controlled by the  $\overline{\text{Ch 1 Trig}}$  line from the Trigger Channel Switch. When the  $\overline{\text{Ch 1 Trig}}$  signal is HI, the transistors in each output pair with the collectors connected together are biased on and the other transistors are off. The collector signal currents are equal in magnitude but opposite in polarity and signal cancellation occurs. If the  $\overline{\text{Ch 1 Trig}}$  signal is LO, the other transistors in each pair will be biased on and an output signal will be developed across R314 and R315 to drive the Internal Trigger Amplifier.

Internal trigger channels are chosen by the A&B INT switch with the A SOURCE switch set to INT. The INT position of S392 reverse biases CR393 and CR399 to prevent external trigger signals or the line trigger signal from reaching the A Trigger Generator. Signals from the Internal Trigger Amplifier are passed to the A Trigger Generator through forward-biased CR372.

**CHANNEL 1.** For triggering from Channel 1, the A&B INT switch is set to CH 1. The XY line connected to S555 will be at ground potential and one input of U555B will be held LO by CR556. The output of U555B will then also be LO and the Channel 1 signal path through U310 will be enabled. The Channel 2 signal path is disabled by the outputs of both U555C and U565B being HI.

**CHANNEL 2.** For triggering from Channel 2, the A&B INT switch is set to CH 2. One input each of U555C and U555D will be LO and force both gate outputs LO. The LO from U555C will enable the Channel 2 signal path through U335 and the HI outputs of U555B and U565C will disable the Channel 1 path.

**VERT MODE.** When the A&B INT switch is set to VERT MODE, trigger source selection is determined by the two VERTICAL MODE switches. For all VERTICAL MODE switch combinations except BOTH-CHOP, the  $\overline{\text{V Mode T}}$  line is HI. The inputs and outputs of U555B, U555C, and U555D will all be HI, and triggering selection will then be determined by the inputs of U565B and U565C that are controlled by U540A in the Channel Switch circuit.

When Channel 1 is selected (VERTICAL MODE switch set to CH 1), the input to U565C will be HI. The gate output will be LO and the Channel 1 signal will be selected. The LO from the other output of U540A is applied to U565B and causes the Ch 2 Trig line to go HI and the Channel 2 Trigger signal is disabled.

When Channel 2 is selected (VERTICAL MODE switch set to CH 2), the outputs of U540A, U565B, and U565C will be the reverse of the states described for Channel 1 selection. The Channel 2 signal will be selected and the Channel 1 Trigger signal disabled.

When selecting ALT VERTICAL MODE, the inputs of U565B and U565C will toggle with each sweep. The outputs of the two gates will also toggle and the Trigger signal source will alternate with the displayed channel.

In the ADD VERTICAL MODE position, both inputs to U565B and U565C will be HI and the gate outputs will be LO. Both Channel 1 and Channel 2 signal paths will be enabled and their output current will be summed at the inputs of the Internal Trigger Amplifier to produce the internal trigger signal.

## Theory of Operation—2215A Service

The CHOP VERTICAL MODE position grounds the V Mode T line and places a LO on an input of both U555B and U555C. The outputs of these two gates will then be LO and the signal to the Internal Trigger Amplifier will be the same as for the ADD mode.

### Internal Trigger Amplifier

The Internal Trigger Amplifier converts the differential trigger signals from the Vertical Preamplifiers into a single-ended signal that drives the X-Axis Amplifier and the A and B Trigger Generators.

Signal current is applied to the emitters of U350D and U350E. The collector current of U350D is converted to a voltage across feedback resistor R357. The opposite-phase collector current of U350E causes a voltage drop across R359 which adds to the voltage at the collector of U350C. This voltage appears at the base of U350A which buffers and level shifts the signal back to 0 V. The emitter signal of U350A drives the X-Axis Amplifier, the B Trigger Generator, and the base of U350B. The emitter signal of U350B in turn drives the A Trigger Generator whenever CR372 is forward biased.

### A External Trigger Amplifier

The A External Trigger Amplifier buffers signals applied to the EXT INPUT connector to drive the A Trigger Generator. Input signal coupling is determined by A EXT COUPLING switch S380 which selects AC, DC, or DC  $\div$  10 coupling.

When S380 is in the AC position, the input signal is ac-coupled through C376. In the DC position, the input signal is connected directly to the Amplifier. The DC  $\div$  10 position attenuates the input signal by a factor of 10 through the compensated divider composed of R377, R378, C380, and C381.

The signal is then applied to the gate of Q382A. This source-follower drives emitter-follower transistor Q384 which lowers the Amplifier output impedance. The two FETs are a matched pair, and since the gate and source of Q382B are connected together, Q382B will supply source current for Q382A such that there will be no voltage drop across the gate-source junction of Q382A. Protection-diode CR381 clamps the signal at the gate of Q382A to about  $-9$  V. The Amplifier output will drive the A Trigger Generator through forward-biased CR393 whenever the A SOURCE switch is set to EXT. When the A SOURCE switch is not set to EXT, the base-emitter junction of Q384 will be reverse biased and the Amplifier will be disabled.

### Line Trigger Amplifier

The Line Trigger Amplifier supplies a line-frequency trigger signal to the A Trigger Generator when the A SOURCE switch is in the LINE position.

Transformer T390 in the Power Supply provides a line-frequency signal through R397 to Q397. Diode CR399 is forward biased when S392 is in the LINE position, and the emitter signals of Q397 will drive the A Trigger Generator.

## A TRIGGER GENERATOR

The A Trigger Generator, shown on Diagram 3, supplies trigger signals to the A Sweep Generator. Included in the A Trigger Generator circuit are the P-P Auto Trigger, Auto Baseline, and TV Triggering circuitry.

### A Trigger Level Circuit

The A Trigger Level Circuit establishes voltages at the ends of the A TRIGGER LEVEL potentiometer as a function of the A TRIGGER push button selection and trigger signals selected by the A SOURCE switch.

In the P-P Auto and TV Field modes, Q413 is off and CR414 and CR415 are reverse biased. Trigger signals selected by the A SOURCE switch are applied to peak detectors consisting of Q420-Q422 and Q421-Q423. These peak detectors track dc levels and have a high voltage transfer efficiency. The positive- and negative-peak signal levels stored by C414 and C415 are near the peak levels of the trigger signal. Amplifiers U426A and U426B are configured as voltage followers with transistors Q428 and Q429 in the feedback loops. These transistors thermally compensate for Q420 and Q421 and level shift the amplifier outputs back to the original dc levels of the input trigger signals. The output of U426A will be the positive peak voltage of the input trigger signal and the output of U426B will be the negative peak voltage. Potentiometers R434 and R435 adjust for dc offsets in the trigger circuitry.

In the Norm mode,  $+8.6$  V is applied to the junction of R411 and R414. Diode CR414 is forward biased, turning on Q413 which forward biases CR415. Input transistors Q420 and Q421 are then biased off and no trigger signals will reach the A Trigger Level circuit. The inputs and outputs of U426A and U426B will then be fixed voltages and independent of trigger-signal amplitude.

### A Trigger Level Comparator

The A Trigger Level Comparator compares signals selected by the A TRIGGER SOURCE switch to a voltage set

by the A TRIGGER LEVEL control. Positive or negative slope triggering is selected by the A TRIGGER SLOPE switch.

Transistors U460B and U460E compare the wiper voltage on the A TRIGGER LEVEL control to the input trigger signal, and the transistor with the higher base voltage will conduct more of the available emitter current. The output collector currents supply emitter current to two transistor pairs which serve as cross-wired switches that are biased on or off by the A TRIGGER SLOPE switch. When S464 is set to the positive slope position, U460C and U460F are biased on and U460A and U460D are biased off. For the negative slope position, the transistors reverse states to invert the comparator output polarity.

### A Schmitt Trigger and TV Trigger Circuit

This circuitry generates a signal that drives the A Trigger Logic as a function of the Trigger Level Comparator output signal and the A TRIGGER Mode switches.

The output signals from the A Trigger Level Comparator drive Q460 and Q463. These transistors are configured as a current mirror that converts the differential output to a single-ended current to drive amplifier U480C. Slope Balance potentiometer R471D corrects for dc offsets between positive and negative slope. Shunt-feedback amplifier U480C converts a current input to a voltage output to drive the input of the Schmitt Trigger, U480D, through R469. Positive feedback for the Schmitt Trigger is provided by potentiometer R479, and C479 reduces trigger jitter by increasing positive feedback at higher frequencies. The setting of R479 determines the circuit hysteresis.

When TV Field is not selected, the TV Trig Enable line connected to R402 and R473 is LO. Transistors Q402 and Q403 are biased off and a LO is placed on one input of U480A by R474. This LO input will cause U480A to invert the output from U480D. With Q403 off, a LO will be placed on one input of U480B by R405 and U480B will also act as an inverter. The A Trigger signal at the output of U480B is therefore the same as the input signal to U480A.

When TV Field is selected, the TV Trig Enable line is HI. The outputs of U480D will determine the conduction states of Q402 and Q403, and the input of U480A connected to R473 will be HI. The output of U480A will be LO and U480B will invert the signal at its other input. Signals at the collector of Q403 are filtered by C408, R405, and C405 to reject TV video information and average the TV horizontal-sync pulses. Setting the trigger-level threshold near the center of the horizontal-sync-pulse swing establishes the untriggered level. When the TV vertical-sync block occurs, the output of the filter applied to U480B pin 7 rises to a level that will cause the Schmitt Trigger circuit to switch. Precise TV field synchronization is obtained as a result of this filtering action. The A Trigger signal output will be the inverse of the filtered signal appearing at U480B pin 7.

### A SWEEP GENERATOR AND LOGIC

The A Sweep Generator and Logic circuitry, shown on Diagram 4, produces a linear voltage ramp that is amplified by the Horizontal Amplifier to provide horizontal deflection of the crt beam. The Sweep Generator circuits also produce signals that are used to generate correct timing of the crt unblanking and intensity levels used for viewing the display. See Figure 3-3 for the block diagram of the A Sweep Generator and Logic circuitry.

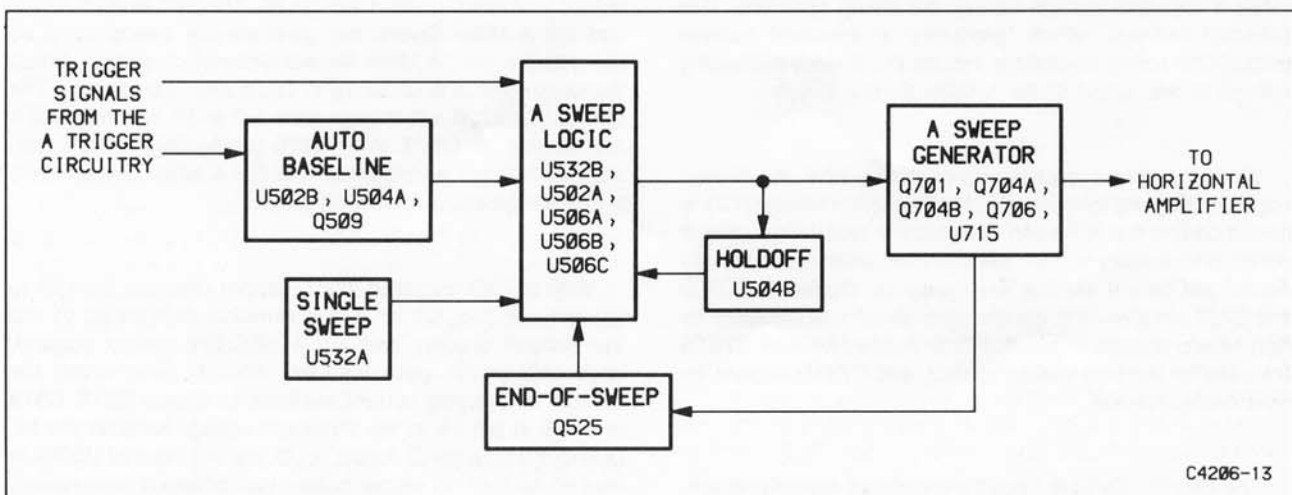


Figure 3-3. Block diagram of the A Sweep Generator and Logic circuitry.



## Theory of Operation—2215A Service

The Sweep Logic circuitry controls the holdoff time, starts the sweep upon reception of a trigger signal, and terminates the sweep at the proper sweep level. When using P-P Auto or TV Field triggering, the Sweep Logic circuitry will cause the Sweep Generator to free run, producing a baseline trace if a trigger signal is not received within a predetermined time period.

### A Miller Sweep Generator

The A Miller Sweep Generator produces a linear voltage ramp that drives the Horizontal Amplifier. It produces this ramp by maintaining a constant current through timing capacitors to obtain a linearly increasing voltage.

Field-effect transistors Q704A and Q704B are matched devices with Q704B sourcing current for Q704A. Since the gate and source of Q704B are connected together, the source current of Q704A will be of a magnitude such that there is no voltage drop across its gate-source junction.

When the sweep is not running, Q701 is biased on to hold the timing capacitors in a discharged state. The low impedance of Q701 in the feedback path holds the A Miller Sweep output near ground potential. The voltage across Q701, in addition to the base-emitter voltage of Q706, prevents saturation of the output device.

A sweep ramp is initiated when Q576 is biased off. This will bias off Q701 and the timing capacitors can charge at a rate determined by timing resistors R701 and R702 and the position of A SEC/DIV switch S701. One end of timing resistor R701 is connected to the wiper of R721 and the other end is connected to the input of the Miller integrator. Due to feedback from the circuit output through the timing capacitors, the integrator input voltage remains fixed and establishes a constant voltage across the timing resistors. This constant voltage, which produces a constant current through the timing capacitors, results in a linearly increasing voltage at the output of the A Miller Sweep circuit.

When the output reaches approximately 12 V, the Sweep Logic circuitry will initiate the holdoff period in which Q701 is turned on and the A Sweep Generator is reset. This holdoff period is necessary so that the timing capacitors can be fully discharged before another sweep starts. Capacitors C702 and C703 are always in the charging circuit and are used for high sweep speeds. Capacitor C701A in series with C701B are used for medium sweep speeds, and C701B is used for slow sweep speeds.

The Sec/Div Variable circuitry utilizes an operational amplifier to maintain a constant reference voltage at one end of R721 independent of the circuit load. The voltage applied to

the timing resistors varies with the rotational position of R721, the SEC/DIV Variable control. A fixed dc voltage is applied to the noninverting input of the operational amplifier and feedback resistors R717 and R718 establish double that voltage at the anode of VR720.

### A Sweep Logic

The A Sweep Logic circuitry controls sweep generation, as a function of incoming trigger signals and the A Trigger mode selected.

Incoming trigger signals from the output of U480B will clock U502, a one-shot multivibrator, and cause the Q output to go from LO to HI. If another trigger signal is not received by U502 within a time period determined by the time constant of R503 and C501, the Q output will return LO. Whenever trigger signals are being received, the  $\bar{Q}$  output of U502 will bias on Q509 and illuminate TRIG'D LED DS518. The output state of U502 is used in the Auto Baseline circuit as described in the "P-P AUTO and TV FIELD" section.

**NORM.** When NORM Trigger mode is selected, input pin 12 of U532D is held HI by S401B, causing the gate output to also be HI. The output of U532C will then be LO and U506A will not be held reset. Input pin 4 of U532A is held HI by S401C, causing the output to be LO which places a LO on the D input of U506A. Trigger signals received at the clock input of U506A will then clock this LO to the Q output.

During the previous holdoff period, U506A had been set by U532B so that the  $\bar{Q}$  output went LO. This biased on Q576 and the A Miller Sweep was prevented from running. Whenever U506A is clocked following holdoff by a trigger signal, the LO on the D input will be transferred to the Q output and the  $\bar{Q}$  output will go HI. This will bias off Q576 and the A Miller Sweep will generate the sweep ramp as described in the "A Miller Sweep Generator" section. When the ramp voltage is about 12 V, Q525 will be biased on. The output of U532B will change from LO to HI, setting U506A and biasing on Q576. With Q576 conducting, holdoff one-shot U504B will be triggered and the A Miller Sweep Generator will be reset to turn off Q525.

With U504B triggered, the  $\bar{Q}$  output changes from HI to LO and will stay LO for a time duration determined by the Var Holdoff circuitry and the A SEC/DIV switch position. VAR HOLDOFF potentiometer R9521 determines the amount of charging current available to charge C518, C519 or C520 at pin 15 to the threshold voltage level on pin 14. During the time the  $\bar{Q}$  output is LO, the set input of U506A is held HI so that no trigger pulses can initiate a new sweep. When pin 15 of U504B reaches the threshold voltage on pin 14, the  $\bar{Q}$  output goes HI to end the holdoff period and re-

lease U506A from the set condition. The circuit is then enabled to generate another sweep once a trigger signal is again applied to the clock input of U506A.

**P-P AUTO and TV FIELD.** When P-P Auto or TV Field is selected, the Auto Baseline configuration is enabled. Pin 12 of U532D is held LO by R569 and the output will follow the signal provided by the Q output of U502. If trigger signals are being received by U502, the output of U532D will be HI and cause the output of U532C to be LO. Flip-flop U506A will respond to trigger signals as described in the "NORM" section. If trigger signals are not being received by U502, the output of U532D will be LO. The output of U532C will then be the inverse of the input signal applied to pin 11 so that U506A will be reset when holdoff ends, causing a sweep to be generated. With no new trigger pulses being applied to the circuitry, U506A will be continuously set and then reset in this manner to generate sweeps.

**SGL SWP.** In the Sgl Swp mode, both the P-P AUTO and NORM buttons are out. This results in a LO at the output of U532C so that U506A is not held reset. A LO is also on input pin 4 of U532A.

During the previous holdoff period, U532B had reset U506B to cause the Q output to be LO. The D input of U506A will therefore be HI and clock signals to the gate will keep the  $\bar{Q}$  output LO and the sweep disabled. When the SGL SWP button is pushed in, the  $\bar{Q}$  output of U504A will go LO for a time period determined by the time constant of R504 and C504 and then return HI. This HI will then clock through the HI on the D input of U506B to the Q output. Consequently the output of U532A will go LO and CR514 will be reverse biased to bias on Q511 and light the READY LED. The next trigger pulse applied to the clock input of U506A will then initiate a sweep as described previously. At the end of the sweep, U506B will again be reset, causing the TRIG'D LED to go out and place a HI on the D input of U506A. A new sweep will not be initiated until the SGL SWP button is again pushed.

**X-Y.** In the X-Y mode of operation, the  $\bar{X}\bar{Y}$  line is LO which holds the input of U532B LO through CR518. The output of U532B will hold U506A set and no sweeps can be initiated.

## ALTERNATE B SWEEP

The Alternate B Sweep circuitry, shown on Diagram 5, produces a linear voltage ramp that is amplified by the Horizontal Amplifier to provide the B Sweep horizontal deflection on the crt. The Alternate B Sweep circuitry also produces the sweep-switching signals that control the display of the A and B Sweeps, and the gate signals used by

the Intensity and Z-Axis circuits to establish the crt unblanking and intensity levels needed for producing both the A Intensified and B Sweep displays.

The B Sweep ramp is enabled by the B Sweep Logic circuit either immediately after the end of the established delay time (Runs After Delay) or upon receipt of the first trigger signal after the delay time has elapsed. This delay time is a function of the B Delay Time Position Comparator circuit and the A sweep.

## B Miller Sweep Generator

The B Miller Sweep Generator is composed of Q709, Q710A, Q710B, Q712, and associated timing components. This circuit produces the B Sweep and functions in the same manner as the A Miller Sweep Generator; see the "A Miller Sweep Generator" section for a description of circuitry operation. The output at the collector of Q712 drives the Horizontal Amplifier and Q643.

## B Trigger Level Comparator

The B Trigger Level Comparator is composed of transistor array U605, U625C, Q619, and Q620. This circuit determines both the trigger level and slope at which the B triggering signal is produced. It functions in the same manner as the A Trigger Level Comparator with the exclusion of the TV Trigger and Trigger View circuitry. See the "A Trigger Level Comparator" section for a description of the circuit operation. Buffering of the inverting and noninverting outputs of U625D is provided by U625A and U625B, and Q630 and Q631 level shift the signals to TTL levels. The circuit output at the collector of Q630 supplies trigger signals to clock U670A.

## Runs After Delay

The Runs After Delay circuit allows the B Sweep Logic to generate a B Sweep independently of any B Trigger signals. In the Runs After Delay mode, B TRIGGER LEVEL control R602 is rotated fully clockwise. This biases off Q637 and places a LO on the collector. Inverter U660D will then have a HI output with resistor R640 providing positive feedback. The output of U660A will therefore be LO and U670A will be held set with the  $\bar{Q}$  output LO.

If the B TRIGGER LEVEL control is not fully clockwise, Q637 is biased on and the B Sweep is in the triggered mode. The output of U660D will be LO, the output of U660A will be HI, and U670A will no longer be held set.

Operation of the B Sweep Logic circuitry under both of these conditions is described in the "B Sweep Logic" discussion.

### B Delay Time Position Comparator

The B Delay Time Position Comparator circuit compares the amplitude of the A Sweep sawtooth output voltage to the dc voltage level set by B DELAY TIME POSITION potentiometer R6440. The output of the comparator is used to initiate a B Sweep and to control the B Z-Axis Logic circuit switching.

The inputs to the comparator, U655, are the wiper voltage of R9644 and the A Sweep voltage from the divider network composed of R651, R652, and R653. Input voltage ranges to the comparator are determined by VR645 and R646 for the noninverting input and by R652 for the inverting input. Delay Start potentiometer R646 is adjusted in conjunction with potentiometer R652 to set the B DELAY TIME POSITION dial calibration.

The output of the comparator is enabled or disabled by the strobe signal connected to pin 6. When the  $\overline{A\ Only}$  signal is HI, the comparator is enabled. When  $\overline{A\ Only}$  is LO, the output of the comparator is a high impedance and therefore

### B Sweep Logic

The B Sweep Logic circuitry utilizes signals from the associated B Sweep circuitry to generate control signals for both the B Miller Sweep and the B Z-Axis Switching Logic circuits.

In the Runs After Delay mode, U660A places a LO on the  $\overline{S}$  input of U670A. During the previous holdoff period, U680D pin 13 strobed LO. The output of the flip-flop composed of U680C and U680D went HI and the output of U660F went LO. With both the  $\overline{S}$  and  $\overline{R}$  inputs of U670A LO, the  $\overline{Q}$  output is HI to bias on Q709 and prevent the B Miller Sweep from running. Once the A Sweep voltage at U655 pin 3 exceeds the voltage at pin 2, the comparator output will go LO. The flip flop composed of U680C and U680D will change output states and cause the  $\overline{R}$  input of U670A to be HI. The LO on the  $\overline{S}$  input will then cause the  $\overline{Q}$  output of U670A to go LO. This will shut off Q709 and the B Miller Sweep Generator will produce a linear ramp. If the ramp voltage reaches about 12 V, sweep-end comparator Q643 will turn on and cause the output of U665D to go HI. The B Miller Sweep Generator will continue to run, but the trace will be blanked because the  $\overline{B\ Gate}$  line is HI which reverse biases CR817. Once the ramp is at approximately 13 V, VR712 will conduct and prevent the voltage from increasing further.

The B Sweep Generator will be reset for another sweep by one of two means. If the A Sweep doesn't end before the B Sweep, the Generator will not be reset until the Alt Sync

line goes from HI to LO to change the U680C-U680D flip-flop output states. The  $\overline{R}$  input of U670A will then be LO, causing the  $\overline{Q}$  output to be HI and reset the Generator. Depending on the settings of the A and B SEC/DIV switches, the A Sweep may end before the B Sweep. If this occurs, the Alt Sync line will go LO at the end of the A Sweep and cause an immediate resetting of the Generator. In either case, a new sweep will be initiated the next time the A Sweep voltage at U655 pin 3 exceeds the voltage at pin 2.

When not in the Runs After Delay mode, the output of U660A is HI and U670A has a HI on both the  $\overline{S}$  and  $\overline{D}$  inputs. The circuitry connected to the  $\overline{R}$  input of U670A functions as described above. When the output of U660F goes HI, U670A is no longer held reset and the first B trigger signal from the collector of Q630 will clock through the HI on the  $\overline{D}$  input. The  $\overline{Q}$  output of U670A will then go LO and a B Sweep will be initiated.

### Alternate Display Switching Logic

THE HORIZONTAL Amplifier Sweep Switching and the B Z-Axis Logic switching.

HORIZONTAL MODE switch S648 selects the input logic levels that are applied to the circuitry. In the A Horizontal Mode, the  $\overline{S}$  input of U670B is LO and the  $\overline{R}$  input is HI. This holds U670B set and allows only the A Sweep to be passed to the Horizontal Amplifier. In the B Horizontal mode, the set input of U670B is HI and the reset input is LO to hold U670B reset and allow only the B Sweep to reach the Horizontal Amplifier.

With S648 set to ALT, and for all settings of the VERTICAL MODE switches except BOTH-ALT, the  $\overline{V\ alt}$  signal applied to U660E and the  $\overline{S}$  and  $\overline{R}$  inputs of U670B are all HI. The LO output of U660E causes the output of U680B to be HI, and whenever the Alt Sync signal applied to pin 1 goes LO, the gate output will change from LO to HI and clock U670B. The outputs of U670B will therefore toggle with each Alt Sync signal transition to alternately enable the A and B Sweeps to reach the Horizontal Amplifier. Whenever the B Sweep is selected for the Horizontal Amplifier, the  $\overline{Q}$  output of U670B will be HI. This HI is applied to U665C pin 9, and since pin 10 is also HI, the  $\overline{Sep}$  signal from U665C will be LO to enable the A/B Sweep Separation circuitry.

When the CH 1-BOTH-CH 2 VERTICAL MODE switch is set to BOTH, the ADD-ALT-CHOP switch becomes functional. In the ALT VERTICAL MODE position, the  $\overline{V\ alt}$  signal is LO, the Halt signal is HI, and the CH 1 Selected signal is a TTL square wave that switches states at the end of the A Sweep. Input pin 4 of U680B will be HI and the gate output will be the inverse of the CH 1 Selected signal. This output



signal is NANDed with the Alt Sync signal by U680A to clock U670B. Whenever the Alt Sync signal goes LO at the end of a sweep and the Ch 1 Selected signal switches from LO to HI, U670B will be clocked. Since only positive transitions on the clock input will cause the flip-flop to change output states, two A Sweeps are required to cause the flip-flop output levels to switch. With this switching arrangement, the crt will first display the two A Intensified Sweeps and then the two Alternate B Sweeps.

### B Z-Axis Logic

The B Z-Axis Logic circuitry switches signal current levels to drive the Z-Axis Amplifier for both the B and the A Intensified Sweep displays. The current supplied is summed with the other signal inputs on the Z-Drive line.

When the HORIZONTAL MODE switch is in the ALT position, pin 5 of U665B is HI. The outputs of U670B and the B Gate signal from the output of U665D together with the INTENSITY controls determine the intensity of the A and B Sweeps.

When the A Sweep is displayed, the Q output of U670B is HI and the  $\bar{Q}$  output is LO. These output levels will bias on Q680 and bias off Q685. The emitter voltage of Q680 will reverse bias CR817 to prevent Z-Axis drive current from flowing through the diode. With Q685 off, additional Z-Axis drive current to intensify the A Sweep will be supplied whenever CR685 is biased off. Since input pin 5 of U665B is HI, the gate output and therefore the conduction state of CR685 is determined by U665B pin 4. Whenever the B Sweep is running, the output of U665D will be LO. This will cause the output of U665B to also be LO and CR685 will be biased off. If the B Sweep is not running, the output of U665B will be HI and CR685 will be biased on. This will bias off CR816 and the A Sweep will not be intensified.

If the outputs of U670B are set to display the B Sweep (Q LO and Q HI), Q680 will be biased off and Q685 will be biased on. The emitter voltage of Q685 will reverse bias CR816 to prevent Z-Axis drive current from flowing through the diode. With Q680 off, the B Sweep will be displayed if CR680 is reverse biased. Whenever the B Sweep is running, the output of U665D is LO. Diode CR680 will then be reverse biased and Z-Axis drive current will flow through CR817. If the B Sweep is not running, the output of U665D is HI, forward biasing CR680 and therefore reverse biasing CR817. No Z-Axis drive current can then flow through CR817.

## HORIZONTAL

The Horizontal Amplifier circuit, shown on Diagram 6, provides the output signals that drive the horizontal crt de-

flection plates. Signals applied to the Horizontal Preamplicifier can come from either the A or the B Miller Sweep Generator (for sweep deflection) or from the XY Amplifier (when X-Y display mode is selected). Sweep switching is under control of the Alternate Display Switching Logic circuit. See Figure 3-4 for the block diagram of the Horizontal Amplifier.

The Horizontal POSITION control, X10 Magnifier circuitry, and the horizontal portion of the Beam Find circuitry are also contained in the Horizontal Amplifier circuit.

### Horizontal Preamplicifier

The Horizontal Preamplicifier selects display modes and amplifies input signals for application to the Horizontal Output Amplifier.

The A and B Sweeps, selected by U670B in the Alternate Sweep circuitry, are applied to the emitters of Q742 and Q732 respectively through gain potentiometers R740 and R730. The transistors are biased into the active or cutoff regions by the control voltage applied at the cathodes of CR732 and CR742. Switching between the A and B Sweeps occurs within U760, with a negative input at pin 10 or 9 disconnecting the respective sweep from the rest of the amplifier. The Horizontal POSITION control adjusts the crt trace position through pin 14. Output bias current levels are set by R751 at pin 5 and frequency compensation for X-Axis signals is provided by C751 connected to pin 13.

Horizontal X10 Gain is set by the resistor network connected between pins 3 and 6. When the X10 Magnifier is on, S721 is closed and the timing adjustment is made using R754. Magnifier registration is adjusted by R749 so that there is no horizontal trace shift when switching between the X10 Magnifier on and off positions.

### X-Y Amplifier

The X-Y Amplifier amplifies the Channel 1 signal from the Internal Trigger circuitry for application to the Horizontal Preamplicifier.

When the X-Y mode is selected, Q737 is biased on to establish a HI on U760 pin 12 so that the A and B Sweeps are disconnected from the Preamplicifier outputs. The  $\bar{XY}$  signal line will be LO and Q756 will be biased off to enable the X-Axis signal to drive the noninverting input of U758. The output of U758 will then be a function of the X-Axis signal and the Horizontal POSITION control wiper voltage. The X-Axis signal gain is adjusted by R760 and the input voltage from the Horizontal POSITION control at pin 14 is disconnected within U760 so that it does not affect the Preamplicifier output. The input signal at pin 11 from U758 will be

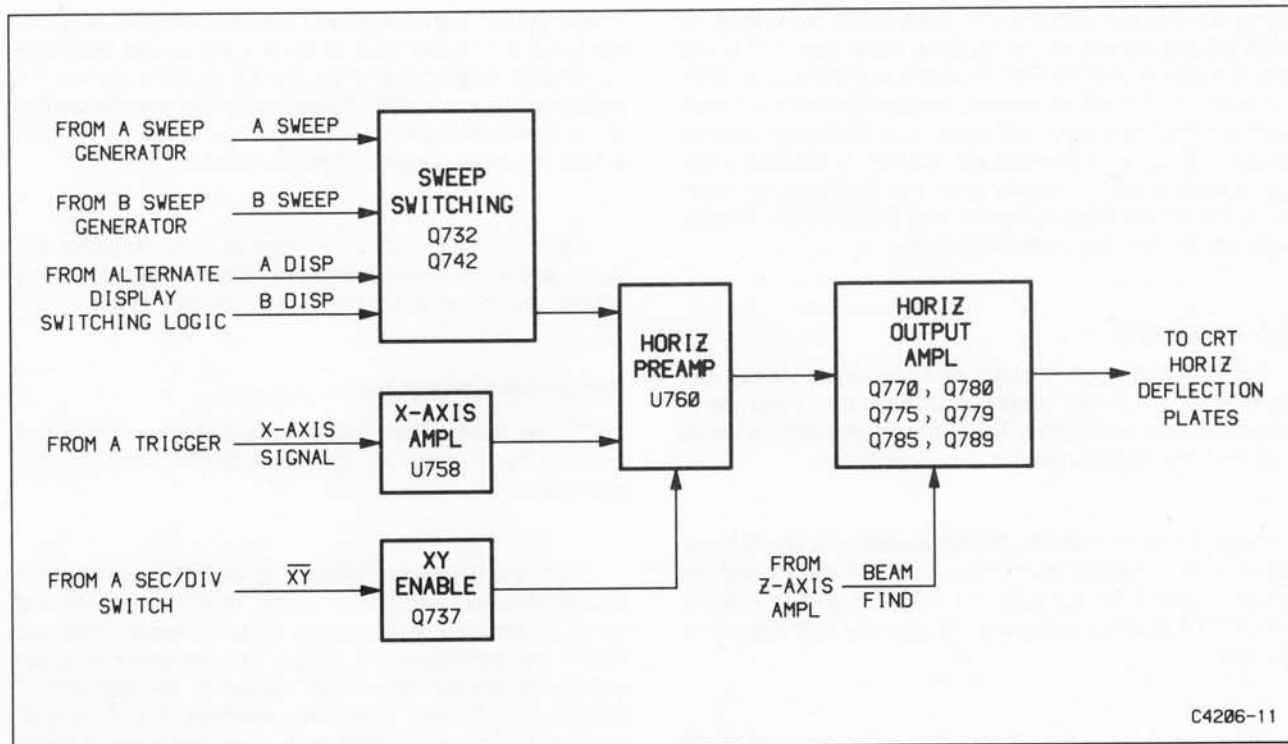


Figure 3-4. Block diagram of the Horizontal Amplifier.

converted to a differential output signal and applied to the Horizontal Output Amplifier.

When the X-Y mode is not selected, Q756 is biased on and the X-Axis signal is shunted to ground.

### Horizontal Output Amplifier

The Horizontal Output Amplifier provides final amplification of the horizontal signal to drive the horizontal crt deflection plates.

Signals from the (+) and (-) sweep outputs of U760 are used to drive two shunt-feedback amplifiers. Due to the feedback, the input impedance of these amplifiers is low. The base voltages of Q770 and Q780 are at nearly the same dc level due to forward-biased diodes CR765 and CR768 between the two emitters.

Transistors Q770, Q775, and Q779 form a cascode-feedback amplifier for driving the right crt horizontal deflection plate with R775 setting amplifier gain and C775 providing high-frequency compensation. For low-speed signals, Q779 serves as a current source for Q775, and at high sweep rates, the ramp is coupled through C779 to the emitter of Q779. This provides additional pull-up output current to

drive the crt at high sweep rates. The amplifier consisting of Q780, Q785, and Q789 drives the left crt horizontal deflection plate in the same manner as described above with zener diode VR782 level shifting the collector signal of Q780.

The BEAM FIND function is implemented when S390 is pushed in to disconnect the cathode of CR764 from the -8.6 V supply. The voltage on the cathode of VR764 goes positive, causing CR780 and CR770 to be forward biased. Current from R764 causes the output common-mode voltage of the two shunt-feedback amplifiers to be shifted negative to reduce the available voltage swing at the crt plates. This prevents the trace from being deflected off-screen horizontally.

### Z-AXIS AMPLIFIER

The Z-Axis Amplifier, shown on Diagram 7, controls the crt intensity level via several input-signal sources. The effect of these input signals is either to increase or decrease trace intensity or to completely blank portions of the display. The Z-Drive signal current as determined by the A and B Z Axis Switching Logic and the input current from the EXT Z AXIS INPUT connector (if in use) are summed at the emitter of common-base amplifier Q825 and thereby determine the collector current of the stage. This transistor provides a low-

impedance termination for the input signals and isolates the signal sources from following stages of the Z-Axis Amplifier.

Common-base transistor Q829 establishes a constant current through R832. This current is divided between Q825 and Q829 with the portion through Q829 driving the shunt-feedback output amplifier consisting of Q835, Q840, and Q845. The bias level of Q825 therefore determines the amount of emitter current available to Q829. Feedback-resistor R841 establishes the transresistance gain which converts the input current to output voltage. Emitter-follower Q835 is dc coupled to Q840, and for low-speed signals Q845 acts as a current source. Fast transitions couple through C845, providing additional current gain through Q845 for fast voltage swings at the output of the Amplifier.

External Z-Axis input voltages establish proportional input currents through R822 and R823, and Amplifier sensitivity is determined by the transresistance gain of the shunt-feedback amplifier. Diode CR823 protects the Z-Axis Amplifier if excessive signal levels are applied to the EXT Z AXIS INPUT connector.

The intensity of the crt display in the A, B, and Alt Horizontal modes is determined by the INTENSITY controls and associated circuitry. The A INTENSITY potentiometer controls the base voltage of Q804 to determine the amount of emitter current that will flow through the transistor and therefore the level of the Z-Axis signal. Likewise the B INTENSITY potentiometer will control the base voltage of Q814 and the intensity of the B and Alt Sweep displays.

When only the A Sweep is displayed, Q586 and CR583 are biased off. The current through R818, as set by the A INTENSITY potentiometer, will flow through CR818 and Q825 to fix the voltage level at the Z-Axis Amplifier output. For a B-only display, Q586 is biased on to reverse bias CR818 and prevent A-intensity current from reaching Q825. Current determined by the base voltage of Q814 will flow through CR817 to Q825 and determine the B Sweep intensity. For an alternating A and B display, Q586 will be biased off when the A Sweep is displayed. During the portion of the A Sweep in which the B Sweep runs, current from R816 is allowed to flow through CR816 by the B Z-Axis Logic circuit to provide an intensified zone.

When CHOP VERTICAL MODE is selected, the Chop Blank signal is applied to the collector of Q825 through CR824 during the display-switching time. Signal current is shunted away from CR825, and the forward bias of Q829 increases to the blanking level. When blanked, the output of the Z-Axis Amplifier drops to a level that reduces the crt beam current below viewing intensity during the chop-switching transition.

For an X-Y display, CR818, CR817, and CR816 are reverse biased. The  $\bar{X}\bar{Y}$  signal is LO to reverse bias CR551 and allow current in R820 to flow through CR820. The crt intensity is then controlled by the A INTENSITY potentiometer which sets the current in R820 through Q804.

BEAM FIND switch S390 controls the base bias voltages of Q825 and Q829. When the BEAM FIND button is out,  $-8.6$  V is supplied to a base-biasing network. When the button is pushed in, the  $-8.6$  V supply is removed and the voltage at the anode of VR828 rises to about  $-5.6$  V. This turns off Q829 so that the amplifier output voltage is determined by R835, R846 and the voltage at the BEAM FIND switch, as set by other parts of the Beam Find circuitry. The output voltage of Q835 will then be at a level such that the beam is visible regardless of Z-Drive signals, or the setting of the INTENSITY control.

### Dc Restorer

The Dc Restorer circuit produces the crt control-grid bias and couples both dc and ac components of the Z-Axis Amplifier output to the crt control grid. Direct coupling of the Z-Axis Amplifier output to the crt control grid is not employed due to the high potential differences involved. Refer to Figure 3-5 during the following discussion.

Ac drive to the Dc Restorer circuit is obtained from pin 16 of T948. The drive voltage has a peak amplitude of about  $\pm 100$  V, a frequency of about 20 kHz, and is coupled into the Dc Restorer circuit through C853 and R853. The cathode of CR851 is biased by the voltage applied from the wiper of Grid Bias potentiometer R851, and the ac-drive voltage will be clamped whenever the positive peaks reach a level that forward biases CR851.

The Z-Axis Amplifier output voltage, which varies between  $+10$  V and  $+75$  V, is applied to the Dc Restorer at the anode of CR853. The ac-drive voltage will hold CR853 reverse biased until the voltage falls below the Z-Axis Amplifier output voltage level. At that point, CR853 becomes forward biased and clamps the junction of CR851, CR853, and R854 to the Z-Axis output level. Thus, the ac-drive voltage is clamped at two levels to produce a square-wave signal with a positive dc-offset level.

The Dc Restorer is referenced to the  $-2$  kV crt cathode voltage through R858 and CR854. Initially, both C855 and C854 will charge up to a level determined by the difference between the Z-Axis output voltage and the crt cathode voltage. Capacitor C855 charges from the Z-Axis output through R858, CR854, and CR855, to the crt cathode. Capacitor C854 charges through R858, CR854, R854, and CR853 to the crt cathode.

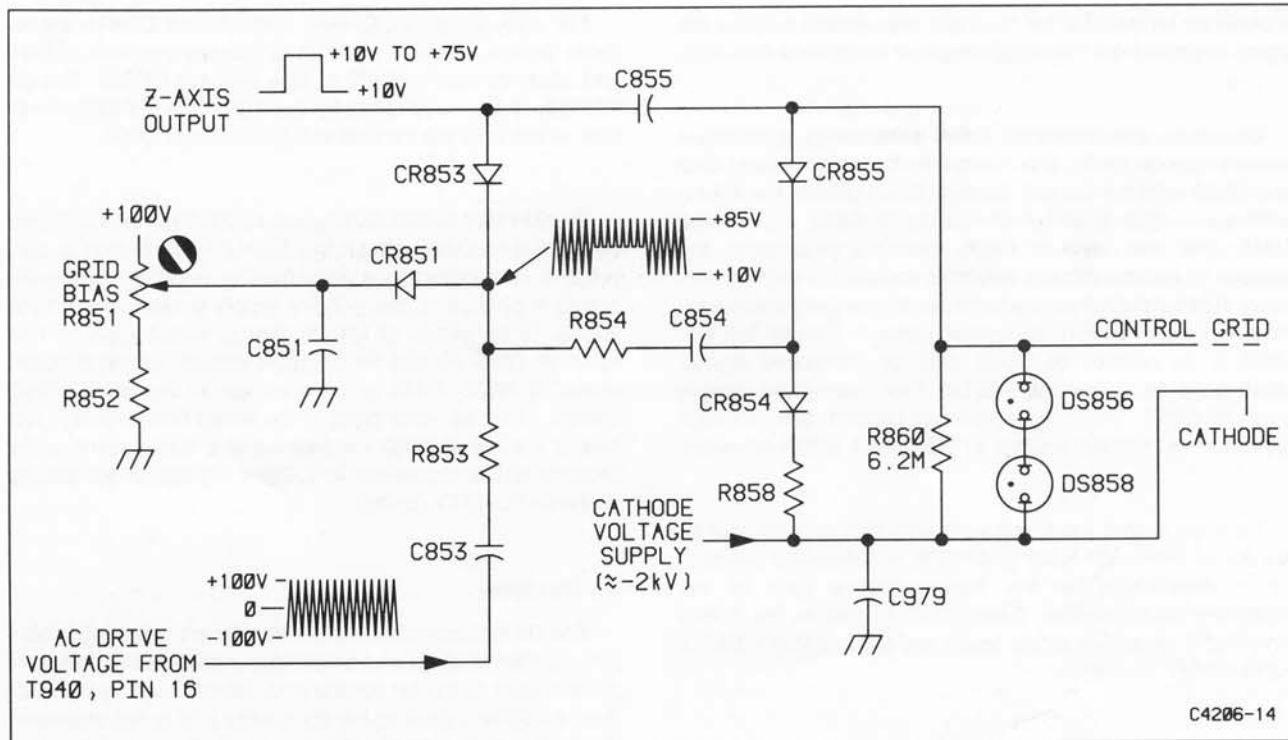


Figure 3-5. Simplified diagram of the Dc Restorer circuitry.

During the positive transitions of the ac drive, from the lower clamped level toward the higher clamped level, the charge on C854 increases due to the rising voltage. The voltage increase across C854 is equal to the amplitude of the positive transition. The negative transition is coupled through C854 to reverse bias CR854 and to forward bias CR855. The increased charge of C854 is then transferred to C855 as C854 discharges toward the Z-Axis output level. Successive cycles of the ac input to the Dc Restorer will charge C855 to a voltage equal to the initial level plus the amplitude of the clamped square-wave input.

The added charge on C855 determines the control-grid bias voltage. If more charge is added to that already present on C855, the control grid becomes more negative and less crt writing-beam current will flow. Conversely, if less charge is added, the control-grid voltage level will be closer to the cathode-voltage level and more crt writing-beam current flows.

During periods that C854 is charging, the crt control-grid voltage is held constant by the long time-constant discharge path of C855 through R860.

Fast-rise and fast-fall transitions of the Z-Axis output signal are coupled to the crt control grid through C855 to start

the crt writing-beam current toward the new intensity level. The Dc Restorer output level then follows the Z-Axis output-voltage level to set the new bias voltage for the crt control grid.

Neon lamps DS858 and DS856 protect the crt from excessive grid-to-cathode voltage if the potential on either the control grid or the cathode is lost for any reason.

### POWER SUPPLY AND PROBE ADJUST

The Power Supply circuitry converts the ac power-line voltage into the voltages needed for instrument operation. It consists of the Power Input, Preregulator, and Inverter circuits (which drive the primary of the power transformer) and secondary circuits (which produce the necessary supply voltages for the instrument).

#### Power Input

The Power Input circuit converts the ac power-line voltage to filtered dc for use by the Preregulator.

POWER switch S901 connects the ac power line through fuse F9001 to the bridge rectifier composed of CR901,



CR902, CR903, and CR904. The bridge full-wave rectifies the source voltage, and the output is filtered by C906. Input surge current at the time of instrument power-up is limited by thermistor RT901. The thermistor resistance is moderately high when the power is first turned on, but decreases as the input current warms the device. The instrument is protected from large voltage transients by suppressor VR901. Conducted interference originating within the power supply is attenuated by common-mode transformer T901, differential-mode transformer T903, line filter FL9001, and capacitors C900, C901, and C902.

### Preregulator

The Preregulator provides a regulated dc output voltage for use by the Inverter circuitry.

When the instrument is turned on, the voltage developed across C906 will charge C925 through R926. When the voltage has risen to a level high enough that U930 can reliably drive Q9070, U930 will receive operating supply voltage through Q930. This level is set by zener diode VR925 in the emitter of Q928 and by the voltage divider consisting of R925 and R927. The zener diode will keep Q928 off until the base voltage reaches approximately 6.9 V. Then Q928 will be biased into conduction and the resulting collector current will cause a voltage drop across R929. This voltage drop will bias on Q930, and the positive feedback through R930 will reinforce the turn-on of Q928. Thus Q930 and Q928 will drive each other into saturation very quickly. Once Q930 is on, U930 will begin to function.

Pulse-width modulator U930 controls the output voltage of the Preregulator by regulating the duty cycle of the pulse applied to the gate of Q9070. It utilizes an oscillator with the frequency determined by R919 and C919 (approximately 60 kHz) and with a sawtooth output voltage at pin 5. This sawtooth voltage is compared internally with the output voltage produced by the two error amplifiers. Whenever the sawtooth voltage is greater than the error amplifier output voltage, Q9070 is biased on to supply current to both C940 and the rest of the circuitry. The two error amplifiers maintain a constant output voltage and monitor the output current of the Preregulator. One input of each amplifier is connected through a divider network to the IC internal +5-V reference. The output voltage of the Preregulator is monitored by the voltage divider at pin 2. The voltage drop across R907, produced by the Preregulator output current, is applied to the current limit amplifier at pin 16.

When the instrument is first turned on, the current limit amplifier controls the conduction time of Q9070. While Q9070 is conducting, the output current increases until a sufficiently large voltage drop is developed across R907 to invoke the current-limit mode. The current limit amplifier holds the output current below the current-limit threshold of

approximately 1 A. When the voltage across C940 reaches approximately 43 V, the voltage amplifier starts controlling the duty cycle of Q9070 and the Preregulator will not limit current unless there is excessive current demand.

With Q9070 off, C907 charges to the output voltage of the Power Input circuit. When Q9070 turns on, current through the FET will come from the winding connected to pins 1 and 2 of T906 and from C907. Current to C907 is supplied by the winding connected to pins 4 and 5 of T906. When U930 shuts off Q9070, the collapsing magnetic field will raise the voltage at the anode of CR907. This diode then becomes forward biased and passes the currents supplied by C907 and the winding connected to pins 4 and 5 of T906. For this part of the cycle, current to C907 will be supplied by the winding connected to pins 1 and 2 of T906. This process will continue for each period of the oscillator, and the duty cycle controlling the conduction period of Q9070 will be altered as necessary to maintain 43 V across C940. To shut off Q9070 during each oscillator period, Q908 is used to discharge the gate-drain capacitance. Pin 10 of U930 goes LO, reverse biasing CR908 and turning on Q908 to shut off the FET.

Once the supply is running, power to U930 will be supplied from the winding connected to pins 6 and 7 of T906. Diode CR920 half-wave rectifies the voltage across pins 6 and 7 to keep filter capacitor C925 charged and to maintain supply voltage to U930 through Q930.

Instrument protection from excessive output voltage is supplied by silicon-controlled rectifier Q935. Should the Preregulator output voltage exceed 51 V, zener diode VR935 will conduct, causing Q935 to also conduct. The Preregulator output current will then be shunted through Q935, and the output voltage will very quickly go to zero. With the supply voltage of U930 no longer being provided by the winding connected to pins 6 and 7 of T906, the Preregulator will shut down and Q935 will be reset. The supply will then attempt to power up, but may again shut down if the overvoltage condition is again reached. This sequence continues until the overvoltage condition is corrected.

### Inverter

The Inverter circuit changes the dc voltage from the Preregulator to ac for use by the supplies that are connected to the secondaries of T948.

The output of the Preregulator circuit is applied to the center tap of T948. Power-switching transistors Q946 and Q947 alternate conducting current from the Preregulator output through the primary windings of T948. The transistor switching action is controlled by T944, a saturating base-drive transformer.

## Theory of Operation—2215A Service

When the instrument is first turned on, one of the switching transistors will start to conduct and its collector voltage will drop toward the common voltage level. This will induce a positive voltage from the lead of T944 which is connected to the base of the conducting transistor and reinforce conduction. Eventually T944 will saturate, and as the voltage across T944 (and T948) begins to reverse, the conducting transistor will cut off because of the drop in base drive. The other transistor will not start conduction until the voltage on the leads of T944 reverse enough to bias it on. This process will continue, and the saturation time of T944 plus the transistor-switching time will determine the frequency of Inverter operation (typically 20 kHz). After the initial Inverter start up, the switching transistors do not saturate; they remain in the active region during switching.

Diodes CR946 and CR947 serve as a negative-peak detector to generate a voltage for controlling the output of the error amplifier. Capacitor C943 charges to a voltage equal to the negative peak voltage at the collectors of Q946 and Q947, referenced to the Preregulator input voltage. This voltage level is applied to the divider composed of R937, R938, and R939. The error amplifier, composed of Q938 and Q939, is a differential amplifier that compares the reference voltage of VR943 with the voltage on the wiper of potentiometer R938. The current through Q939 will set the base drive of Q944 and thereby control the voltage on C944. This voltage will bias Q946 and Q947 to a level that will maintain the peak-to-peak input voltage of T948. The amplitude of the voltage across the transformer primary winding, and thus that of the secondary voltages of T948, is set by adjusting  $-8.6$  V Adj potentiometer R938.

At turn on, Q938 is biased off and Q939 is biased on. All the current of the error amplifier will then go through Q939 to bias on Q944. Diode CR945 allows the base of Q944 to go positive enough to initially turn on Q946 or Q947. The current through Q944 controls the base drive for Q946 and Q947. Base current provided by base-drive transformer T944 will charge C944 negative with respect to the Inverter circuit floating ground (common) level.

### Crt Supply

High-voltage multiplier U975 utilizes the 2-kV winding of T948 to generate 12 kV to drive the crt anode. It also uses an internal half-wave rectifier diode to produce  $-2$  kV for

the crt cathode. The  $-2$  kV supply is filtered by a low-pass filter composed of C975, C976, R976, R978, and C979. Neon lamp DS870 protects against excessive voltage between the crt heater and crt cathode by conducting if the voltage exceeds approximately 75 V.

### Focus Circuit

Focus voltage is also developed from the  $-2$  kV supply via a voltage divider composed of R894, R892, FOCUS potentiometer R893, R891, R890, R889, R888, and Q885. The focus voltage tracks the A-intensity level through the action of Q885. The emitter voltage of Q804, set by the A INTENSITY control, is applied to the emitter of Q885 through R885. When the emitter voltage of Q804 changes, the current through Q885 changes proportionally and alters the voltage at one end of FOCUS control R893.

### Low-Voltage Supplies

The low-voltage supplies utilize center-tapped secondary windings of T948. The  $+100$  V supply uses CR954 and CR955 for rectification and C954 for filtering. Diodes CR956 and CR957 rectify ac from taps on the 100 V winding, and C956 filters the output to produce  $+30$  V dc. The diode bridge consisting of CR960, CR961, CR962, and CR963 produces the  $+8.6$  V and  $-8.6$  V supplies. Filtering of the  $+8.6$  V is accomplished by C960, C962, and L960; filtering of the  $-8.6$  V is done by C961, C963, and L961. The  $+5.2$  V supply is produced by CR967, CR970, C968, R971, and C970.

### Probe Adjust

The Probe Adjust circuitry, shown on diagram 6, utilizes a square-wave generator and a diode switching network to produce a negative-going square-wave signal at PROBE ADJUST connector J9900. Amplifier U985 is configured as a multivibrator with the time constant of R987 and C987 determining the oscillation period. When the output of the multivibrator is at the positive supply voltage, CR988 is forward biased. This reverse biases CR989 and the PROBE ADJUST connector signal is held at ground potential by R990. When the multivibrator output switches states and is at the negative supply voltage, CR988 is reverse biased. Diode CR989 will now be forward biased and the circuit output signal be approximately  $-0.5$  V.

# PERFORMANCE CHECK PROCEDURE

## INTRODUCTION

### PURPOSE

The "Performance Check Procedure" is used to verify the Performance Requirement statements listed in Table 1-1. It is the recommended acceptance check procedure for new instruments.

Instrument performance should be checked after every 2000 hours of operation or once each year, if used infrequently. A more frequent interval may be necessary, if your instrument is subjected to harsh environments or severe usage. The results of these periodic checks will determine the need for readjustment.

Selected procedures may also be used as preliminary troubleshooting aids or to verify instrument performance after repair or component replacement.

### STRUCTURE

This procedure is structured into four major subsections, each of which can be performed independently, to permit checking individual portions of the instrument. At the beginning of each subsection there is an equipment-required list showing only the test equipment necessary for performing the steps in that subsection. In this list, the Item number that follows each piece of equipment corresponds to the Item number listed in Table 4-1.

Also at the beginning of each subsection is a list of all the front-panel control settings required to prepare the instrument for performing Step 1 in that subsection. Each succeeding step within a particular subsection should then be performed, both in the sequence presented and in its entirety, to ensure that control-setting changes will be correct for ensuing steps.

### TEST EQUIPMENT

The test equipment listed in Table 4-1 is a complete list of the equipment required to accomplish both the "Performance Check Procedure" in this section and the "Adjustment Procedure" in Section 5. To assure accurate measurements, it is important that test equipment used for making these checks meet or exceed the specifications described in Table 4-1. When considering use of equipment other than that recommended, utilize the "Minimum Specification" column to determine whether available test equipment will suffice.

Each procedure in this section is written using the control and connector nomenclature imprinted on the "recommended" test equipment. When substitute equipment is used, control settings stated in the test setup and in the procedure itself may need to be altered.

Detailed operating instructions for test equipment are not given in this procedure. If more operating information is required, refer to the appropriate test-equipment instruction manual.

### LIMITS AND TOLERANCES

The tolerances given in this procedure are valid for an instrument that is operating in and has been previously calibrated in an ambient temperature between +20°C and +30°C. The instrument also must have had at least a 20-minute warm-up period. Refer to Table 1-1 for tolerances applicable to an instrument that is operating outside this temperature range. All tolerances specified are for the instrument only and do not include test-equipment error.



## PREPARATION FOR CHECKS

It is not necessary to remove the instrument cover to accomplish any subsection in the "Performance Check Procedure", since all checks are made using operator-accessible front- and rear-panel controls and connectors.

Test equipment items 1 through 8 in Table 4-1 are required to accomplish the complete Performance Check Procedure.

Before performing any procedure in this section, set the POWER switch to ON and allow a 20-minute warm-up period.

The most accurate display adjustments are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the INTENSITY, FOCUS, and TRIGGER LEVEL controls as needed to view the display.

**Table 4-1**  
**Test Equipment Required**

| Item No. and Description       | Minimum Specification   | Purpose  | Examples of Suitable Test Equipment                        |
|--------------------------------|---|--|--|
| 1. Calibration Generator       | Standard-amplitude signal levels: 10 mV to 50 V.<br>Accuracy: $\pm 0.3\%$ .<br><br>High-amplitude signal levels: 1 V to 60 V.<br>Repetition rate: 1 kHz.<br><br>Fast-rise signal level: 1V.<br>Repetition rate: 1 MHz.<br>Rise time: 1 ns or less.<br>Flatness: $\pm 0.5\%$ . | Vertical and horizontal checks and adjustments.  | TEKTRONIX PG 506 Calibration Generator. <sup>a</sup>       |
| 2. Leveled Sine-Wave Generator | Frequency: 250 kHz to above 70 MHz. Output amplitude: variable from 10 mV to 5 V p-p. Output impedance: 50 $\Omega$ . Reference frequency: 50 kHz. Amplitude accuracy: constant within 3% of reference frequency as output frequency changes.                                 | Vertical, horizontal, and triggering checks and adjustments.<br>Display adjustment and Z-Axis check. | TEKTRONIX SG 503 Leveled Sine-Wave Generator. <sup>a</sup> |
| 3. Time-Mark Generator         | Marker outputs: 10 ns to 0.5 s. Marker accuracy: $\pm 0.1\%$ . Trigger output: 1 ms to 0.1 $\mu$ s, time-coincident with markers.   | Horizontal checks and adjustments.<br>Display adjustment.  | TEKTRONIX TG 501 Time-Mark Generator. <sup>a</sup>         |
| 4. Cable (2 required)          | Impedance: 50 $\Omega$ . Length: 42 in. Connectors: BNC.  | Signal interconnection.  | Tektronix Part Number 012-0057-01.                         |
| 5. Termination (2 required)    | Impedance: 50 $\Omega$ . Connectors: BNC.   | Signal termination.  | Tektronix Part Number 011-0049-01.                         |

<sup>a</sup>Requires a TM 500-series power-module mainframe.

Table 4-1 (cont)

| Item No. and Description                      | Minimum Specification  | Purpose  | Examples of Suitable Test Equipment                   |
|---|--|--|---|
| 6. Dual-Input Coupler                         | Connectors: BNC-Female-to-Dual-BNC male.                                     | Vertical checks and adjustments                          | Tektronix Part Number 067-0525-01.                    |
| 7. 10X Attenuator                             | Ratio: 10X. Impedance: 50 Ω. Connectors: BNC.                                | Vertical compensation and triggering checks.             | Tektronix Part Number 011-0059-02.                    |
| 8. T-Connector                                | Connectors: BNC.   | Signal interconnection.                                  | Tektronix Part Number 103-0030-00.                    |
| 9. Adapter                                    | Connectors: BNC-Male-to-Miniature Probe Tip.                                 | Signal interconnection.                                  | Tektronix Part Number 013-0084-02.                    |
| 10. Digital Voltmeter                         | Range: 0 to 140 V. Dc voltage accuracy: ±0.15%. 4 1/2-digit display.         | Power supply checks and adjustment. Vertical adjustment. | TEKTRONIX DM 501A Digital Multimeter. <sup>a</sup>    |
| 11. Test Oscilloscope with included 10X Probe | Bandwidth: dc to 10 MHz. Minimum deflection factor: 5 mV/div. Accuracy: ±3%. | Holdoff check and general troubleshooting.               | TEKTRONIX 2213A Oscilloscope.                         |
| 12. DC Voltmeter                              | Range: 0 to 2500 V, calibrated to 1% accuracy at -2000 V.                    | High-voltage power supply check.                         | Triplet Model 630-NA.                                 |
| 13. Screwdriver                               | Length: 3-in shaft. Bit Size: 3/32 in.                                       | Adjust variable resistors.                               | Xcelite R-3323.                                       |
| 14. Low-Capacitance Alignment Tool            | Length: 1-in shaft. Bit size: 3/32 in.                                       | Adjust variable capacitors.                              | J.F.D. Electronics Corp. Adjustment Tool Number 5284. |

<sup>a</sup>Requires a TM 500-series power-module mainframe.

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# VERTICAL

**Equipment Required (see Table 4-1):**

- |                                      |                               |
|--------------------------------------|-------------------------------|
| Calibration Generator (Item 1)       | 50-Ω BNC Termination (Item 5) |
| Leveled Sine-Wave Generator (Item 2) | Dual-Input Coupler (Item 6)   |
| 50-Ω BNC Cable (Item 4)              | 10X Attenuator (Item 7)       |

## INITIAL CONTROL SETTINGS

### Vertical (Both Channels)

- |                    |                  |
|--------------------|------------------|
| POSITION           | Midrange         |
| VERTICAL MODE      | CH 1             |
| BW LIMIT           | On (button in)   |
| VOLTS/DIV          | 2 mV             |
| VOLTS/DIV Variable | CAL detent       |
| INVERT             | Off (button out) |
| Input Coupling     | DC               |

### Horizontal

- |                  |               |
|------------------|---------------|
| POSITION         | Midrange      |
| HORIZONTAL MODE  | A             |
| A SEC/DIV        | 0.2 ms        |
| SEC/DIV Variable | CAL detent    |
| X10 Magnifier    | Off (knob in) |

### A TRIGGER

- |                |           |
|----------------|-----------|
| VAR HOLDOFF    | NORM      |
| Mode           | P-P AUTO  |
| SLOPE          | OUT       |
| LEVEL          | Midrange  |
| A&B INT        | VERT MODE |
| A SOURCE       | INT       |
| A EXT COUPLING | AC        |

## PROCEDURE STEPS

### 1. Check Deflection Accuracy and Variable Range

a. Connect the standard-amplitude generator output via a 50-Ω cable to the CH 1 OR X input connector.

b. CHECK—Deflection accuracy is within the limits given in Table 4-2 for each CH 1 VOLTS/DIV switch setting and corresponding standard-amplitude signal. When at the 20-mV VOLTS/DIV switch setting, rotate the CH 1 VOLTS/DIV Variable control fully counterclockwise and CHECK that the display decreases to 2 divisions or less. Then return the CH

1 VOLTS/DIV Variable control to the CAL detent and continue with the 50-mV check.

c. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

**Table 4-2**  
**Deflection Accuracy Limits**

| VOLTS/DIV Switch Setting | Standard Amplitude Signal | Vertical Deflection (Divisions) | Accuracy Limits (Divisions) |
|--------------------------|---------------------------|---------------------------------|-----------------------------|
| 2 mV                     | 10 mV                     | 5                               | 4.85 to 5.15                |
| 5 mV                     | 20 mV                     | 4                               | 3.88 to 4.12                |
| 10 mV                    | 50 mV                     | 5                               | 4.85 to 5.15                |
| 20 mV                    | 0.1 V                     | 5                               | 4.85 to 5.15                |
| 50 mV                    | 0.2 V                     | 4                               | 3.88 to 4.12                |
| 0.1 V                    | 0.5 V                     | 5                               | 4.85 to 5.15                |
| 0.2 V                    | 1 V                       | 5                               | 4.85 to 5.15                |
| 0.5 V                    | 2 V                       | 4                               | 3.88 to 4.12                |
| 1 V                      | 5 V                       | 5                               | 4.85 to 5.15                |
| 2 V                      | 10 V                      | 5                               | 4.85 to 5.15                |
| 5 V                      | 20 V                      | 4                               | 3.88 to 4.12                |

d. Repeat part b using the Channel 2 controls.

### 2. Check Bandwidth

- a. Set:
- |                  |        |
|------------------|--------|
| BANDWIDTH Full   | (OUT.) |
| VOLTS/DIV (both) | 2 mV   |
| A SEC/DIV        | 20 μs  |

b. Connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 2 OR Y input connector.

c. Set the generator to produce a 50-kHz, 6-division display.

d. CHECK—Display amplitude is 4.2 divisions or greater as the generator output frequency is increased up to the value shown in Table 4-3 for the corresponding VOLTS/DIV switch setting.

**Table 4-3**  
**Settings for Bandwidth Checks**

| VOLTS/DIV<br>Switch Setting | Generator<br>Output Frequency |
|-----------------------------|-------------------------------|
| 2 mV                        | 50 MHz                        |
| 5 mV to 5 V                 | 60 MHz                        |

e. Repeat parts c and d for all indicated CH 2 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.

f. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set the VERTICAL MODE switch to CH 1.

g. Repeat parts c and d for all indicated CH 1 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.

### 3. Check Bandwidth Limit Operation

a. Set:

|                |                |
|----------------|----------------|
| BW LIMIT       | On (button in) |
| CH 1 VOLTS/DIV | 10 mV          |
| A SEC/DIV      | 20 μs          |

b. Set the generator to produce a 50-kHz, 6-division display.

c. Increase the generator output frequency until the display amplitude decreases to 4.2 divisions.

d. CHECK—Generator output frequency is between 8.5 and 11.5 MHz.

e. Disconnect the test equipment from the instrument.

### 4. Check Common-Mode Rejection Ratio

a. Set:

|                |                  |
|----------------|------------------|
| BW LIMIT       | Off (button out) |
| CH 2 VOLTS/DIV | 10 mV            |
| INVERT         | On (button in)   |

b. Connect the leveled sine-wave generator output via a 50-Ω cable, a 50-Ω termination, and a dual-input coupler to the CH 1 OR X and the CH 2 OR Y input connectors.

c. Set the generator to produce a 25-MHz, 6-division display.

d. Vertically center the display using the Channel 1 POSITION control. Then set the VERTICAL MODE switch to CH 2 and vertically center the display using the Channel 2 POSITION control.

e. Set the VERTICAL MODE switches to BOTH and ADD.

f. CHECK—Display amplitude is 0.6 division or less.

g. If the check in part f meets the requirement, skip to part p. If it does not, continue with part h.

h. Set the VERTICAL MODE switch to CH 1.

i. Set the generator to produce a 50-kHz, 6-division display.

j. Set the VERTICAL MODE switch to BOTH.

k. Adjust the CH 1 or CH 2 VOLTS/DIV Variable control for minimum display amplitude.

l. Set the VERTICAL MODE switch to CH 1.

m. Set the generator to produce a 25-MHz, 6-division display.

n. Set the VERTICAL MODE switch to BOTH.

## Performance Check Procedure—2215A Service

- o. CHECK—Display amplitude is 0.6 division or less.
- p. Disconnect the test equipment from the instrument.

### 5. Check Channel Isolation

a. Set:

|                           |                  |
|---------------------------|------------------|
| VERTICAL MODE             | CH 1             |
| VOLTS/DIV (both)          | 1 V              |
| VOLTS/DIV Variable (both) | CAL detent       |
| INVERT                    | Off (button out) |
| Channel 2 Input Coupling  | GND              |
| A SEC/DIV                 | 0.1 $\mu$ s      |

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

c. Set the generator to produce a 25-MHz, 5-division display.

d. Set the VERTICAL MODE switch to CH 2.

e. CHECK—Display amplitude is 0.05 division or less.

f. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

g. Set:

|                          |      |
|--------------------------|------|
| VERTICAL MODE            | CH 1 |
| Channel 1 Input Coupling | GND  |
| Channel 2 Input Coupling | DC   |

h. CHECK—Display amplitude is 0.05 division or less.

i. Disconnect the test equipment from the instrument.



# HORIZONTAL

## Equipment Required (see Table 4-1):

|                                      |                                       |
|--------------------------------------|---------------------------------------|
| Calibration Generator (Item 1)       | 50- $\Omega$ BNC Cable (Item 4)       |
| Leveled Sine-Wave Generator (Item 2) | 50- $\Omega$ BNC Termination (Item 5) |
| Time-Mark Generator (Item 3)         |                                       |

## INITIAL CONTROL SETTINGS

### Vertical

|                            |                  |
|----------------------------|------------------|
| POSITION (both)            | Midrange         |
| VERTICAL MODE              | CH 1             |
| BW LIMIT                   | Off (button out) |
| CH 1 VOLTS/DIV             | 0.5 V            |
| CH 1 VOLTS/DIV<br>Variable | CAL detent       |
| Channel 1 Input Coupling   | DC               |

### Horizontal

|                       |                        |
|-----------------------|------------------------|
| POSITION              | Midrange               |
| HORIZONTAL MODE       | A                      |
| A SEC/DIV             | 0.05 $\mu$ s           |
| SEC/DIV Variable      | CAL detent             |
| X10 Magnifier         | Off (knob in)          |
| B DELAY TIME POSITION | Fully counterclockwise |

### B TRIGGER

|       |                 |
|-------|-----------------|
| SLOPE | OUT             |
| LEVEL | Fully clockwise |

### A TRIGGER

|             |      |
|-------------|------|
| VAR HOLDOFF | NORM |
| Mode        | NORM |
| SLOPE       | OUT  |

|                |              |
|----------------|--------------|
| LEVEL          | Midrange     |
| A&B INT        | VERT MODE    |
| A SOURCE       | INT          |
| A EXT COUPLING | DC $\div$ 10 |

## PROCEDURE STEPS

### 1. Check Timing Accuracy and Linearity

a. Connect the time-mark generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

b. Select 50-ns time markers from the time-marker generator.

c. Adjust the A TRIGGER LEVEL control for a stable, triggered display.

d. Use the Horizontal POSITION control to align the second time marker with the second vertical graticule line.

e. CHECK—Timing accuracy is within 3% (0.24 division at the 10th vertical graticule line), and linearity is within 7% (0.14 division over any 2 of the center 8 divisions).

**Table 4-4**  
**Settings for Timing Accuracy Checks**

| SEC/DIV<br>Switch Setting | Time-Mark Generator Setting |               |
|---------------------------|-----------------------------|---------------|
|                           | Normal                      | X10 Magnified |
| 0.05 $\mu$ s              | 50 ns                       | 10 ns         |
| 0.1 $\mu$ s               | 0.1 $\mu$ s                 | 10 ns         |
| 0.2 $\mu$ s               | 0.2 $\mu$ s                 | 20 ns         |
| 0.5 $\mu$ s               | 0.5 $\mu$ s                 | 50 ns         |
| 1 $\mu$ s                 | 1 $\mu$ s                   | 0.1 $\mu$ s   |
| 2 $\mu$ s                 | 2 $\mu$ s                   | 0.2 $\mu$ s   |
| 5 $\mu$ s                 | 5 $\mu$ s                   | 0.5 $\mu$ s   |
| 10 $\mu$ s                | 10 $\mu$ s                  | 1 $\mu$ s     |
| 20 $\mu$ s                | 20 $\mu$ s                  | 2 $\mu$ s     |
| 50 $\mu$ s                | 50 $\mu$ s                  | 5 $\mu$ s     |
| 0.1 ms                    | 0.1 ms                      | 10 $\mu$ s    |
| 0.2 ms                    | 0.2 ms                      | 20 $\mu$ s    |
| 0.5 ms                    | 0.5 ms                      | 50 $\mu$ s    |
| 1 ms                      | 1 ms                        | 0.1 ms        |
| 2 ms                      | 2 ms                        | 0.2 ms        |
| 5 ms                      | 5 ms                        | 0.5 ms        |
| 10 ms                     | 10 ms                       | 1 ms          |
| 20 ms                     | 20 ms                       | 2 ms          |
| 50 ms                     | 50 ms                       | 5 ms          |
| A Sweep Only              |                             |               |
| 0.1 s                     | 0.1 s                       | 10 ms         |
| 0.2 s                     | 0.2 s                       | 20 ms         |
| 0.5 s                     | 0.5 s                       | 50 ms         |

**NOTE**

*For checking the timing accuracy of the A SEC/DIV switch settings from 50 ms to 0.5 s, watch the time marker tips only at the 2nd and 10th vertical graticule lines while adjusting the Horizontal POSITION control.*

f. Repeat parts c through e for the remaining A SEC/DIV and time-mark generator setting combinations shown in Table 4-4 under the "Normal" column.

g. Set:

A SEC/DIV                      0.05  $\mu$ s  
X10 Magnifier                On (knob out)

h. Select 10-ns time markers from the time-mark generator.

i. Use the Horizontal POSITION control to align the first time marker that is 25 ns beyond the start of the sweep with the second vertical graticule line.

j. CHECK—Timing accuracy is within 4% (0.32 division at the 10th vertical graticule line), and linearity is within 7% (0.14 division over any 2 of the center 8 divisions). Exclude any portion of the sweep past the 100th magnified division.

k. Repeat parts i and j for the remaining A SEC/DIV and time-mark generator setting combinations shown in Table 4-4 under the "X10 Magnified" column.

l. Set:

HORIZONTAL MODE        B  
A SEC/DIV                    0.1  $\mu$ s  
B SEC/DIV                    0.05  $\mu$ s  
X10 Magnifier                Off (knob in)

m. Repeat parts b through k for the B Sweep. Keep the A SEC/DIV switch one setting slower than the B SEC/DIV switch.

**2. Check Variable Range**

a. Set:

HORIZONTAL MODE        A  
A and B SEC/DIV            0.2 ms  
SEC/DIV Variable            Fully counterclockwise  
X10 Magnifier                Off (knob in)  
A TRIGGER Mode             P-P AUTO

b. Select 0.5-ms time markers from the time-mark generator.

c. CHECK—Time markers are 1 division or less apart.

**3. Check Delay Time Dial Range and Accuracy**

a. Set:

Channel 1 Input Coupling    GND  
SEC/DIV Variable            CAL detent  
HORIZONTAL MODE            ALT

b. Set the B DELAY TIME POSITION dial fully counterclockwise.

c. Align the start of the A Sweep with the 1st vertical graticule line using the Horizontal POSITION control.

d. CHECK—Intensified portion of the trace starts within 0.5 division of the start of the sweep.

e. Rotate the B DELAY TIME POSITION control fully clockwise.

f. CHECK—Intensified portion of the trace is past the 11th vertical graticule line.

g. Set:

A and B SEC/DIV            0.5  $\mu$ s  
 B DELAY TIME POSITION    Fully counterclockwise

h. Align the start of the A Sweep with the 1st vertical graticule line using the Horizontal POSITION control.

i. CHECK—Intensified portion of the trace starts within 1.1 divisions of the start of the sweep.

j. Repeat parts d and e.

k. Set:

Channel 1 Input Coupling    DC  
 HORIZONTAL MODE            B  
 A SEC/DIV                      0.5  $\mu$ s  
 B SEC/DIV                      0.05  $\mu$ s  
 B DELAY TIME POSITION    1.00

l. Select 5- $\mu$ s time markers from the time-mark generator.

m. Adjust the Horizontal POSITION control so that the top of the first fully displayed time marker is aligned with the center vertical graticule line.

n. Without changing the Horizontal POSITION control setting, set the B DELAY TIME POSITION dial to 9.00. Slightly readjust the B DELAY TIME POSITION dial to align the top of the time marker with the center vertical graticule line.

o. CHECK—The B DELAY TIME POSITION dial setting is between 8.905 and 9.095.

p. Repeat parts l through n for the remaining A and B SEC/DIV and time-mark generator setting combinations shown in Table 4-5.

Table 4-5  
 Settings for Delay Time Accuracy Checks

| A SEC/DIV<br>Switch Setting | B SEC/DIV<br>Switch Setting | Time-Mark<br>Generator Setting |
|-----------------------------|-----------------------------|--------------------------------|
| 0.5 $\mu$ s                 | 0.05 $\mu$ s                | 0.5 $\mu$ s                    |
| 5 $\mu$ s                   | 0.5 $\mu$ s                 | 5 $\mu$ s                      |
| 0.5 ms                      | 50 $\mu$ s                  | 0.5 ms                         |
| 5 ms                        | 0.5 ms                      | 5 ms                           |
| 0.5 s                       | 50 ms                       | 0.5 s                          |

q. Set:

A SEC/DIV                      0.5 ms  
 B SEC/DIV                      50  $\mu$ s  
 B DELAY TIME POSITION    1.00

r. Select 0.5-ms time markers from the time-mark generator.

s. Adjust the Horizontal POSITION control so that the rising edge of the displayed time marker is aligned with the center vertical graticule line.

t. Without changing the Horizontal POSITION control setting, turn the B DELAY TIME POSITION dial clockwise to position the next time marker leading edge to the center vertical graticule line.

u. CHECK—The B DELAY TIME POSITION dial setting is 0.975 to 1.025 greater than the previous setting.

v. Set the B DELAY TIME POSITION dial to the exact integer setting.

w. Repeat parts r through u for each successive time marker up to the marker corresponding to the B DELAY TIME POSITION dial setting of 10.00.

#### 4. Check Delay Jitter

a. Set:

A SEC/DIV                      0.5 ms  
 B SEC/DIV                      0.5  $\mu$ s  
 B DELAY TIME POSITION    10.00

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b. Select 50- $\mu$ s time markers from the time-mark generator.

c. Rotate the B DELAY TIME POSITION control counterclockwise to position a time marker within the graticule area for each major dial division and CHECK that the jitter on the leading edge of the time marker does not exceed 0.5 division. Disregard slow drift.

### 5. Check Position Range

a. Set:

|                 |            |
|-----------------|------------|
| HORIZONTAL MODE | A          |
| A SEC/DIV       | 10 $\mu$ s |

b. Select 10- $\mu$ s time markers from the time-mark generator.

c. CHECK—Start of the sweep can be positioned to the right of the center vertical graticule line by rotating the Horizontal POSITION control fully clockwise.

d. CHECK—The 11th time marker can be positioned to the left of the center vertical graticule line by rotating the Horizontal POSITION control fully counterclockwise.

e. Select 50- $\mu$ s time markers from the time-mark generator.

f. Align the 3rd time marker with the center vertical graticule line using the Horizontal POSITION control.

g. Set the X10 Magnifier knob to On (knob out).

h. CHECK—Magnified time marker can be positioned to the left of the center vertical graticule line by rotating the Horizontal POSITION control fully counterclockwise.

i. CHECK—Start of the sweep can be positioned to the right of the center vertical graticule line by rotating the Horizontal POSITION control fully clockwise.

j. Disconnect the test equipment from the instrument.

### 6. Check X Gain

a. Set:

|                     |               |
|---------------------|---------------|
| CH 1 VOLTS/DIV      | 10 mV         |
| Horizontal POSITION | Midrange      |
| A SEC/DIV           | X-Y           |
| X10 Magnifier       | Off (knob in) |

b. Connect the standard-amplitude generator output via a 50- $\Omega$  cable to the CH 1 OR X input connector.

c. Set the generator to produce a 50-mV signal. Vertically center the trace using the Channel 1 POSITION control.

d. CHECK—Display is 4.8 to 5.2 horizontal divisions.

e. Disconnect the test equipment from the instrument.

### 7. Check X Bandwidth

a. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

b. Set the generator to produce a 5-division horizontal display at an output frequency of 50 kHz.

c. Increase the generator output frequency to 3 MHz.

d. CHECK—Display is at least 3.5 horizontal divisions.

e. Disconnect the test equipment from the instrument.

# TRIGGER

## Equipment Required (see Table 4-1):

Leveled Sine-Wave Generator (Item 2)

50- $\Omega$  BNC Termination (Item 5)

50- $\Omega$  BNC Cable (Item 4)

## INITIAL CONTROL SETTINGS

### Vertical

|                           |                  |
|---------------------------|------------------|
| POSITION (both)           | Midrange         |
| VERTICAL MODE             | CH 1             |
| BW LIMIT                  | Off (button out) |
| CH 1 VOLTS/DIV            | 5 mV             |
| CH 2 VOLTS/DIV            | 50 mV            |
| VOLTS/DIV Variable (both) | CAL detent       |
| INVERT                    | Off (button out) |
| Input Coupling (both)     | DC               |

### Horizontal

|                       |                        |
|-----------------------|------------------------|
| POSITION              | Midrange               |
| HORIZONTAL MODE       | A                      |
| A and B SEC/DIV       | 0.2 $\mu$ s            |
| SEC/DIV Variable      | CAL detent             |
| X10 Magnifier         | Off (knob in)          |
| B DELAY TIME POSITION | Fully counterclockwise |

### B TRIGGER

|       |          |
|-------|----------|
| SLOPE | OUT      |
| LEVEL | Midrange |

### A TRIGGER

|                |          |
|----------------|----------|
| VAR HOLDOFF    | NORM     |
| Mode           | P-P AUTO |
| SLOPE          | OUT      |
| LEVEL          | Midrange |
| A&B INT        | CH 1     |
| A SOURCE       | INT      |
| A EXT COUPLING | DC       |

## PROCEDURE STEPS

### 1. Check Internal Triggering

a. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

b. Set the generator to produce a 5-MHz, 3-division display.

c. Set the CH 1 VOLTS/DIV switch to 50 mV.

d. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6.

**Table 4-6**  
Switch Combinations for A Triggering Checks

| A TRIGGER Mode | A TRIGGER SLOPE |
|----------------|-----------------|
| NORM           | OUT             |
| NORM           | IN              |
| P-P AUTO       | IN              |
| P-P AUTO       | OUT             |

e. Set the HORIZONTAL MODE switch to B.

f. CHECK—Stable display can be obtained by adjusting the B TRIGGER LEVEL control in a position other than the B RUNS AFTER DLY position for both the OUT and IN positions of the B TRIGGER SLOPE switch.

g. Set:

|                 |      |
|-----------------|------|
| VERTICAL MODE   | CH 2 |
| HORIZONTAL MODE | A    |
| A&B INT         | CH 2 |

h. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.



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i. Repeat parts d through f.

j. Set:

|                 |               |
|-----------------|---------------|
| HORIZONTAL MODE | A             |
| A SEC/DIV       | 0.1 $\mu$ s   |
| X10 Magnifier   | On (knob out) |

k. Set the generator to produce a 60-MHz, 1.0-division display.

l. Repeat parts d through f.

m. Set:

|                 |           |
|-----------------|-----------|
| VERTICAL MODE   | CH 1      |
| HORIZONTAL MODE | A         |
| A&B INT         | VERT MODE |

n. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector.

o. Repeat parts d through f.

p. Disconnect the test equipment from the instrument.

### 2. Check External Triggering

a. Set:

|                 |               |
|-----------------|---------------|
| VERTICAL MODE   | CH 1          |
| CH 1 VOLTS/DIV  | 5 mV          |
| HORIZONTAL MODE | A             |
| A SEC/DIV       | 0.1 $\mu$ s   |
| X10 Magnifier   | Off (knob in) |
| A SOURCE        | EXT           |

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable, a 50- $\Omega$  termination, and a dual-input coupler to both the CH 1 or X and EXT INPUT connectors.

c. Set the leveled sine-wave generator output voltage to 40 mV and the frequency to 5 MHz.

d. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6.

e. Set CH 1 VOLTS/DIV switch to 50 mV.

f. Set the leveled sine-wave generator output voltage to 150 mV and the frequency to 60 MHz. Set the X10 Magnifier to On (knob out).

g. Repeat part d.

### 3. Check External Trigger Ranges

a. Set:

|                |               |
|----------------|---------------|
| CH 1 VOLTS/DIV | 0.5 V         |
| A SEC/DIV      | 20 $\mu$ s    |
| X10 Magnifier  | Off (knob in) |
| A TRIGGER Mode | NORM          |

b. Set the generator to produce a 50-kHz, 6.4-division display.

c. CHECK—Display is triggered along the entire positive slope of the waveform as the A TRIGGER LEVEL control is rotated.

d. CHECK—Display is not triggered (no trace) at either extreme of rotation.

e. Set the A TRIGGER SLOPE button to IN.

f. CHECK—Display is triggered along the entire negative slope of the waveform as the A TRIGGER LEVEL control is rotated.

g. CHECK—Display is not triggered (no trace) at either extreme of rotation.

### 4. Check Single Sweep Operation

a. Adjust the A TRIGGER LEVEL control to obtain a stable display.

b. Set:

|                          |     |
|--------------------------|-----|
| Channel 1 Input Coupling | GND |
| A SOURCE                 | INT |

## Performance Check Procedure—2215A Service

c. Press in the SGL SWP RESET button. The READY LED should illuminate and remain on.

f. Press in the SGL SWP RESET button several times.

d. Set the Channel 1 Input Coupling switch to DC.

e. CHECK—READY LED goes out and a single sweep occurs.

g. CHECK—Single-sweep trace occurs, and the READY LED illuminates briefly every time the SGL SWP RESET button is pressed in and released.

### NOTE

*The A INTENSITY control may require adjustment to observe the single-sweep trace.*

h. Disconnect the test equipment from the instrument.

## EXTERNAL Z-AXIS AND PROBE ADJUST

### Equipment Required (see Table 4-1):

|                                       |                                      |
|---------------------------------------|--------------------------------------|
| Leveled Sine-Wave Generator (Item 2)  | BNC T-Connector (Item 8)             |
| Two 50- $\Omega$ BNC Cables (Item 4)  | 10X Probe (provided with instrument) |
| 50- $\Omega$ BNC Termination (Item 5) |                                      |

### INITIAL CONTROL SETTINGS

#### Vertical

|                            |                  |
|----------------------------|------------------|
| Channel 1 POSITION         | Midrange         |
| VERTICAL MODE              | CH 1             |
| BW LIMIT                   | Off (button out) |
| CH 1 VOLTS/DIV             | 1 V              |
| CH 1 VOLTS/DIV<br>Variable | CAL detent       |
| Channel 1 Input Coupling   | DC               |

#### Horizontal

|                  |               |
|------------------|---------------|
| POSITION         | Midrange      |
| HORIZONTAL MODE  | A             |
| A SEC/DIV        | 20 $\mu$ s    |
| SEC/DIV Variable | CAL detent    |
| X10 Magnifier    | Off (knob in) |

#### A TRIGGER

|             |           |
|-------------|-----------|
| VAR HOLDOFF | NORM      |
| Mode        | P-P AUTO  |
| SLOPE       | OUT       |
| LEVEL       | Midrange  |
| A&B INT     | VERT MODE |
| A SOURCE    | INT       |

connector. Then connect a 50- $\Omega$  cable and a 50- $\Omega$  termination from the T-connector to the EXT Z AXIS INPUT connector on the rear panel.

b. Set the generator to produce a 5-V, 50-kHz signal.

c. CHECK—For noticeable intensity modulation. The positive part of the sine wave should be of lower intensity than the negative part.

d. Disconnect the test equipment from the instrument.

### 2. Check Probe Adjust Operation

a. Set:

|                |        |
|----------------|--------|
| CH 1 VOLTS/DIV | 10 mV  |
| A SEC/DIV      | 0.5 ms |

b. Connect the 10X Probe to the CH 1 OR X input connector and insert the probe tip into the PROBE ADJUST jack on the instrument front panel. If necessary, adjust the probe compensation for a flat-topped square-wave display.

c. CHECK—Display amplitude is 4.75 to 5.25 divisions.

d. Disconnect the probe from the instrument.

### PROCEDURE STEPS

#### 1. Check External Z-Axis Operation

a. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a T-connector to the CH 1 OR X input con-

# ADJUSTMENT PROCEDURE

## INTRODUCTION

### PURPOSE

The "Adjustment Procedure" is a set of logically sequenced instructions intended to return the instrument to conformance with the Performance Requirement statements listed in Table 1-1. Adjustments contained in this procedure should only be performed after checks from the "Performance Check Procedure" (Section 4) have indicated a need for readjustment or after repairs have been made to the instrument.

### STRUCTURE

This procedure is structured into four major subsections, each of which can be performed independently to permit adjustment of individual sections of the instrument. For example, if only the Vertical section fails to meet the Performance Requirements or has had repairs made, it can be readjusted with little or no effect on other sections of the instrument.

The Power Supply section, however, affects all other sections of the instrument. Therefore, if repairs or readjustments have been made that change the absolute value of any of the supply voltages, the entire Adjustment Procedure should be performed.

At the beginning of each subsection is a list of all the front-panel control settings required to prepare the instrument for performing Step 1 in that subsection. Each succeeding step within a subsection should be performed in sequence and in its entirety to ensure that control settings will be correct for ensuing steps. All steps within a subsection should be completed.

### TEST EQUIPMENT

The test equipment listed in Table 4-1 is a complete list of the equipment required to accomplish both the "Performance Check Procedure" in section 4 and the "Adjustment Procedure" in this section. To assure accurate measure-

ments, it is important that test equipment used for making these checks meet or exceed the specifications described in Table 4-1. When considering use of equipment other than that recommended, utilize the "Minimum Specification" column to determine whether available test equipment will suffice.

Detailed operating instructions for test equipment are not given in this procedure. If more operating information is required, refer to the appropriate test-equipment instruction manual.

### LIMITS AND TOLERANCES

The limits and tolerances stated in this procedure are instrument specifications only if they are listed in the "Performance Requirements" column of Table 1-1. Tolerances given are applicable only to the instrument undergoing adjustment and do not include test equipment error. Adjustment of the instrument must be accomplished at an ambient temperature between +20°C and +30°C, and the instrument must have had a warm-up period of at least 20 minutes.

### ADJUSTMENT INTERACTION

Some adjustments interact with and affect other adjustment settings. Table 5-1 identifies these interaction areas. Refer to this table if a partial procedure is performed or if a circuit requires readjustment due to a component replacement. To use Table 5-1, first find the adjustment that was made (extreme left column). Then move to the right, across the row, until you come to a darkened square. From the darkened square, move up the column to find the interactive adjustment. Check the accuracy and, if necessary, readjust the adjustment.

### PREPARATION FOR ADJUSTMENT

The instrument cabinet must be removed to perform the Adjustment Procedure. See the "Cabinet" remove and re-

## Adjustment Procedure—2215A Service

place instructions located in the "Maintenance" section of the manual.

All test equipment items listed in Table 4-1 are required to accomplish a complete Adjustment Procedure. At the beginning of each subsection there is an equipment-required list showing only the test equipment necessary for performing the steps in that subsection. In this list, the item number following each piece of equipment corresponds to the item number listed in Table 4-1.

Before performing this procedure, do not preset any internal adjustments and do not change the  $-8.6\text{-V}$  power-supply adjustment. Altering this adjustment may necessitate a complete readjustment of the instrument, whereas only a

partial adjustment might otherwise be required. Only change an internal adjustment setting if a Performance Characteristic cannot be met with the original setting. If it is necessary to change the setting of an internal adjustment, check Table 5-1 for possible adjustment interactions.

Before performing any procedure in this section, set the POWER switch to ON and allow a 20-minute warm-up period.

The most accurate display adjustments are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the INTENSITY, FOCUS, and TRIGGER LEVEL controls as needed to view the display.

**Table 5-1**  
**Adjustment Interactions**

| Adjustments or Replacements Made | Adjustments Affected |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
|----------------------------------|----------------------|----------|------------------|------------------|----------------------------|---------------|-----------------|-----------------|----------------------|------------|----------------|------------------------|-------------------|-------------------|--------------------------|----------------|---------------------|---------------|----------------------------|
|                                  | TRACE ALIGNMENT      | GEOMETRY | 2/5mV DC BALANCE | CH 1 VAR BALANCE | MF/LF GAIN BAL & FREQ COMP | VERTICAL GAIN | ATTENUATOR COMP | DELAY LINE COMP | CH 2 HIGH FREQ MATCH | HORIZ GAIN | HORIZ X10 GAIN | MAGNIFIER REGISTRATION | DELAY DIAL TIMING | HIGH-SPEED TIMING | 5ns TIMING AND LINEARITY | TRIGGER OFFSET | TRIGGER SENSITIVITY | SLOPE BALANCE | P-P AUTO TRIGGER CENTERING |
| -8.6V POWER SUPPLY               |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| TRACE ALIGNMENT                  |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| GEOMETRY                         |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| 2/5mV DC BALANCE                 |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| CH 1 VAR BALANCE                 |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| MF/LF GAIN BAL & FREQ COMP       |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| VERTICAL GAIN                    |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| ATTENUATOR COMP                  |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| DELAY LINE COMP                  |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| CH 2 HIGH FREQ MATCH             |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| HORIZ GAIN                       |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| HORIZ X10 GAIN                   |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| MAGNIFIER REGISTRATION           |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| DELAY DIAL TIMING                |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| HIGH-SPEED TIMING                |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| 5ns TIMING AND LINEARITY         |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| TRIGGER OFFSET                   |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| TRIGGER SENSITIVITY              |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| SLOPE BALANCE                    |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| P-P AUTO TRIGGER CENTERING       |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |
| CRT REPLACEMENT                  |                      |          |                  |                  |                            |               |                 |                 |                      |            |                |                        |                   |                   |                          |                |                     |               |                            |

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**Vertical**

|   |      |
|---|------|
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## POWER SUPPLY AND CRT DISPLAY

**Equipment Required (See Table 4-1):**

|                                      |                             |
|--------------------------------------|-----------------------------|
| Leveled Sine-Wave Generator (Item 2) | Digital Voltmeter (Item 10) |
| Time-Mark Generator (Item 3)         | DC Voltmeter (Item 12)      |
| 50-Ω BNC Cable (Item 4)              | Screwdriver (Item 13)       |
| 50-Ω BNC Termination (Item 5)        |                             |

See **ADJUSTMENT LOCATIONS 1**

*at the back of this manual for location of test points and adjustments.*

### INITIAL CONTROL SETTINGS

**Vertical**

|                          |            |
|--------------------------|------------|
| POSITION (both)          | Midrange   |
| VERTICAL MODE            | CH 1       |
| CH 1 VOLTS/DIV           | 10 mV      |
| CH 1 VOLTS/DIV Variable  | CAL detent |
| Channel 1 Input Coupling | GND        |

**Horizontal**

|                  |               |
|------------------|---------------|
| POSITION         | Midrange      |
| HORIZONTAL MODE  | A             |
| A SEC/DIV        | X-Y           |
| SEC/DIV Variable | CAL detent    |
| X10 Magnifier    | Off (knob in) |

**A TRIGGER**

|             |           |
|-------------|-----------|
| VAR HOLDOFF | NORM      |
| Mode        | P-P AUTO  |
| SLOPE       | OUT       |
| LEVEL       | Midrange  |
| A&B INT     | VERT MODE |
| A SOURCE    | INT       |

a. Connect the digital voltmeter low lead to chassis ground and connect the volts lead to the  $-8.6\text{-V}$  supply (TP961).

b. CHECK—Voltmeter reading is  $-8.56$  to  $-8.64$  V. If the reading is within these limits, skip to part d.

c. ADJUST—The  $-8.6$  V Adj potentiometer (R938) for a voltmeter reading of  $-8.60$  V.

d. CHECK—Voltage levels of the remaining power supplies listed in Table 5-2 are within the specified limits.

**Table 5-2  
Power Supply Limits**

| Power Supply | Test Point | Reading (Volts)     |
|--------------|------------|---------------------|
| $-8.6$ V     | TP961      | $-8.56$ to $-8.64$  |
| $+5.2$ V     | W968       | $+5.04$ to $+5.36$  |
| $+8.6$ V     | W960       | $+8.43$ to $+8.77$  |
| $+30$ V      | W956       | $+29.1$ to $+30.9$  |
| $+100$ V     | W954       | $+97.0$ to $+103.0$ |

### PROCEDURE STEPS

**1. Check/Adjust Power Supply DC Levels (R938)**

**NOTE**

*Review the information at the beginning of the Adjustment Procedure before starting this step.*

e. Disconnect the test equipment from the instrument.

## 2. Check High-Voltage Supply

**WARNING**

*Instrument must be turned off when removing or replacing the crt cover and cap.*

a. Remove the crt cover and cap and connect a dc voltmeter capable of measuring at least  $-2500$  V between pin 2 of the crt socket and chassis ground. Pin 2 of the crt is negative with respect to the chassis.

b. CHECK—Voltmeter reading is between  $-1900$  V and  $-2100$  V.

c. Disconnect the voltmeter leads and replace the crt cap and cover.

## 3. Adjust CRT Grid Bias (R851)

a. Connect a  $50\text{-}\Omega$  termination to the EXT Z AXIS INPUT connector located on the rear panel.

b. Adjust the front-panel FOCUS control to produce a well-defined dot.

c. Rotate the A INTENSITY control fully counterclockwise.

d. ADJUST—Grid Bias (R851) for a visible dot. Then back off the Grid Bias potentiometer until the dot just disappears.

e. Disconnect the  $50\text{-}\Omega$  termination from the EXT Z AXIS INPUT connector.

## 4. Adjust Astigmatism (R874)

a. Set:

|                          |                  |
|--------------------------|------------------|
| A INTENSITY              | Visible display  |
| Channel 1 Input Coupling | DC               |
| A SEC/DIV                | $5\ \mu\text{s}$ |

b. Connect the leveled sine-wave generator output via a  $50\text{-}\Omega$  cable and a  $50\text{-}\Omega$  termination to the CH 1 OR X input connector.

c. Set the generator to produce a 50-kHz, 4-division display.

d. ADJUST—Astig (R874) and the front-panel FOCUS control for the best defined waveform.

e. Disconnect the test equipment from the instrument.

## 5. Adjust Trace Alignment

a. Set the Channel 1 Input Coupling switch to GND and position the trace to the center horizontal graticule line.

b. ADJUST—The front-panel TRACE ROTATION control for optimum alignment of the trace with the center horizontal graticule line.

## 6. Adjust Geometry (R870)

a. Set:

|                     |        |
|---------------------|--------|
| CH 1 VOLTS/DIV      | 50 mV  |
| CH 1 Input Coupling | DC     |
| A SEC/DIV           | 0.1 ms |

b. Connect  $20\text{-}\mu\text{s}$  time markers from the time-mark generator via a  $50\text{-}\Omega$  cable and a  $50\text{-}\Omega$  termination to the CH 1 OR X input connector.

c. Adjust the Channel 1 POSITION control fully counterclockwise to position the baseline part of the display below the bottom horizontal graticule line.

d. ADJUST—Geom (R870) for minimum curvature of the time markers at the left and right edges of the graticule.

e. Set the Channel 1 Input Coupling switch to GND.

f. ADJUST—Geom (R870) for minimum curvature of the baseline trace when positioned at the top and bottom horizontal graticule lines using the Channel 1 POSITION control.

g. Set the Channel 1 Input Coupling switch to DC.

h. Repeat parts d through g for optimum compromise between the vertical and horizontal displays.

i. Disconnect the test equipment from the instrument.

# VERTICAL

## Equipment Required (See Table 4-1):

|                                      |  |
|--------------------------------------|--|
| Calibration Generator (Item 1)       | 10X Attenuator (Item 7)                  |
| Leveled Sine-Wave Generator (Item 2) | Adapter (Item 9)                         |
| 50-Ω BNC Cable (Item 4)              | Screwdriver (Item 13)                    |
| 50-Ω BNC Termination (Item 5)        | Low-Capacitance Alignment Tool (Item 14) |
| Dual-Input Coupler (Item 6)          | 10X Probe (included with instrument)     |

See **ADJUSTMENT LOCATIONS 1** and **ADJUSTMENT LOCATIONS 2**

at the back of this manual for locations of test points and adjustments.

## INITIAL CONTROL SETTINGS

### Vertical (Both Channels)

|                    |                  |
|--------------------|------------------|
| POSITION           | Midrange         |
| VERTICAL MODE      | CH 1             |
| BW LIMIT           | On (button in)   |
| VOLTS/DIV          | 5 mV             |
| VOLTS/DIV Variable | CAL detent       |
| INVERT             | Off (button out) |
| Input Coupling     | GND              |

### Horizontal

|                  |               |
|------------------|---------------|
| POSITION         | Midrange      |
| HORIZONTAL MODE  | A             |
| A SEC/DIV        | 0.5 ms        |
| SEC/DIV Variable | CAL detent    |
| X10 Magnifier    | Off (knob in) |

### A TRIGGER

|                |           |
|----------------|-----------|
| VAR HOLDOFF    | NORM      |
| Mode           | P-P AUTO  |
| SLOPE          | OUT       |
| LEVEL          | Midrange  |
| A&B INT        | VERT MODE |
| A SOURCE       | INT       |
| A EXT COUPLING | AC        |

## PROCEDURE STEPS

### 1. Adjust Attenuator Step Balance (R10 and R60)

a. Position the trace on the center horizontal graticule line using the Channel 1 POSITION control.

b. ADJUST—Ch 1 Step Bal (R10) to set the trace on the center horizontal graticule line.

c. Set the CH 1 VOLTS/DIV switch to 50 mV.

d. Repeat parts a through c until there is no trace shift when changing the CH 1 VOLTS/DIV switch from 50 mV to 5 mV.

e. Set the VERTICAL MODE switch to CH 2.

f. Repeats parts a through d for Channel 2, adjusting Ch 2 Step Bal (R60) in part b.

### 2. Adjust 2/5 mV DC Balance (R33 and R83)

a. Set the CH 2 VOLTS/DIV switch to 5 mV.

b. Position the trace on the center horizontal graticule line using the Channel 2 POSITION control.

c. Set the CH 2 VOLTS/DIV switch to 2 mV.

d. ADJUST—Ch 2 2/5 mV Dc Bal (R83) to set the trace on the center horizontal graticule line.

e. Repeat parts a through d until there is no trace shift when changing the CH 2 VOLTS/DIV switch from 5 mV to 2 mV.

f. Set the VERTICAL MODE switch to CH 1.

g. Repeat parts a through e for Channel 1, adjusting Ch 1 2/5 mV Dc Bal (R33) in part d.

### 3. Adjust Channel 1 Variable Balance (R25)

a. Set both VOLTS/DIV switches to 10 mV.

b. Rotate the CH 1 VOLTS/DIV Variable control fully counterclockwise.

c. Position the trace on the center horizontal graticule line using the Channel 1 POSITION control.

d. Rotate the CH 1 VOLTS/DIV Variable control clockwise to the CAL detent.

e. ADJUST—Ch 1 Var Bal (R25) to set the trace to the center horizontal graticule line.

f. Repeat parts b through e until there is no trace shift between the fully clockwise and the fully counterclockwise positions of the CH 1 VOLTS/DIV Variable control.

g. Return the CH 1 VOLTS/DIV Variable control to the CAL detent.

### 4. Adjust Channel 2 Invert Balance (R75)

a. Set the VERTICAL MODE switch to CH 2.

b. Position the trace on the center horizontal graticule line using the Channel 2 POSITION control.

c. Set the INVERT button to On (button in).

d. ADJUST—Ch 2 Invert Bal (R75) to set the trace to the center horizontal graticule line.

e. Set the INVERT button to Off (button out).

f. Repeat parts b through e until there is no trace shift when switching the INVERT button between the On and Off positions.

g. Repeat Steps 2 and 3 for Channel 1 until no further improvement is noted.

h. Repeat Steps 2 and 4 for Channel 2 until no further improvement is noted.

### 5. Adjust MF/LF Compensation and Gain Balance (C53, R97, C3, and R47).

a. Set:

|                       |            |
|-----------------------|------------|
| VERTICAL MODE         | CH 2       |
| VOLTS/DIV (both)      | 10 mV      |
| Input Coupling (both) | DC         |
| A SEC/DIV             | 20 $\mu$ s |

b. Connect the high-amplitude square wave output via a 50- $\Omega$  cable, a 10X attenuator, and a 50- $\Omega$  termination to the CH 2 OR Y input connector.

c. Set the generator to produce a 10-kHz, 5-division display.

d. Set the top of the display on the center horizontal graticule line using the Channel 2 POSITION control.

e. ADJUST—Ch 2 MF/LF Comp (C53) and Ch 2 MF/LF Gain Bal (R97) for the best front corner and flat top.

f. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set the VERTICAL MODE switch to CH 1.

g. Set the top of the display on the center horizontal graticule line using the Channel 1 POSITION control.



## Adjustment Procedure—2215A Service

h. ADJUST—Ch 1 MF/LF Comp (C3) and Ch 1 MF/LF Gain Bal (R47) for the best front corner and flat top.

i. Disconnect the test equipment from the instrument.

### 6. Adjust Vertical Gain (R145, R195, R76, and R26)

a. Connect a 50-mV standard-amplitude signal via a 50- $\Omega$  cable to the CH 1 OR X input connector.

b. Set the A SEC/DIV switch to 0.2 ms.

c. ADJUST—Ch 1 Gain (R145) for an exact 5-division display.

d. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

e. ADJUST—Ch 2 Gain (R195) for an exact 5-division display.

f. Change the generator output to 10 mV and set both VOLTS/DIV switches to 2 mV.

g. ADJUST—Ch 2 2-mV Gain (R76) for an exact 5-division display.

h. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set the VERTICAL MODE switch to CH 1.

i. ADJUST—Ch 1 2-mV Gain (R26) for an exact 5-division display.

j. Set both Input Coupling switches to GND.

k. CHECK—That no trace shift occurs when switching between the 5 mV and 2 mV positions of the CH 1 VOLTS/DIV switch. If trace shift is observed, repeat Step 2 of this procedure.

l. Set the VERTICAL MODE switch to CH 2.

m. CHECK—That no trace shift occurs when switching between the 5 mV and 2 mV positions of the CH 2

VOLTS/DIV switch. If trace shift is observed, repeat Step 2 of this procedure.

### 7. Check Deflection Accuracy and Variable Range

a. Set:

|                       |      |
|-----------------------|------|
| VERTICAL MODE         | CH 1 |
| Input Coupling (both) | DC   |

b. CHECK—Deflection accuracy is within the limits given in Table 5-3 for each CH 1 VOLTS/DIV switch setting and corresponding standard-amplitude signal. When at the 20-mV VOLTS/DIV switch setting, rotate the CH 1 VOLTS/DIV Variable control fully counterclockwise and CHECK that the display decreases to 2 divisions or less. Then return the CH 1 VOLTS/DIV Variable control to the CAL detent and continue with the 50-mV check.

**Table 5-3**  
Deflection Accuracy Limits

| VOLTS/DIV Switch Setting | Standard Amplitude Signal | Vertical Deflection (Divisions) | Accuracy Limits (Divisions) |
|--------------------------|---------------------------|---------------------------------|-----------------------------|
| 2 mV                     | 10 mV                     | 5                               | 4.85 to 5.15                |
| 5 mV                     | 20 mV                     | 4                               | 3.88 to 4.12                |
| 10 mV                    | 50 mV                     | 5                               | 4.85 to 5.15                |
| 20 mV                    | 0.1 V                     | 5                               | 4.85 to 5.15                |
| 50 mV                    | 0.2 V                     | 4                               | 3.88 to 4.12                |
| 0.1 V                    | 0.5 V                     | 5                               | 4.85 to 5.15                |
| 0.2 V                    | 1 V                       | 5                               | 4.85 to 5.15                |
| 0.5 V                    | 2 V                       | 4                               | 3.88 to 4.12                |
| 1 V                      | 5 V                       | 5                               | 4.85 to 5.15                |
| 2 V                      | 10 V                      | 5                               | 4.85 to 5.15                |
| 5 V                      | 20 V                      | 4                               | 3.85 to 4.12                |

c. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

d. Repeat part b using the Channel 2 controls.

### 8. Check Input Coupling

a. Set both VOLTS/DIV switches to 10 mV.

b. Set the calibration generator to produce a 20-mV signal.

c. Set the bottom of the signal on the center horizontal graticule line using the Channel 2 POSITION control.

d. Set the Channel 2 Input Coupling switch to AC.

e. CHECK—Display is centered about the center horizontal graticule line.

f. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set the VERTICAL MODE switch to CH 1.

g. Repeat parts c through e using the Channel 1 controls.

h. Disconnect the test equipment from the instrument.

**9. Adjust Attenuator Compensation (C12, C11, C5, C4, C62, C61, C55, and C54)**

a. Set:

|                       |            |
|-----------------------|------------|
| VOLTS/DIV (both)      | 0.1 V      |
| Input Coupling (both) | DC         |
| A SEC/DIV             | 20 $\mu$ s |

b. Connect the high-amplitude square wave output via a 50- $\Omega$  cable and a 50- $\Omega$  terminator to the CH 1 OR X input connector.

c. Set the generator to produce a 10-kHz, 5-division display.

**NOTE**

*Use Table 5-4 to identify the correct capacitor for each channel adjustment.*

d. ADJUST—The 10X LF Comp capacitor for best front corner.

e. Set the CH 1 VOLTS/DIV switch to 1 V.

f. Set the generator to produce a 5-division display.

**Table 5-4  
Attenuator Compensation Adjustments**

| Adjustment   | Channel 1 | Channel 2 |
|--------------|-----------|-----------|
| 10X LF Comp  | C12       | C62       |
| 10X Input C  | C11       | C61       |
| 100X LF Comp | C5        | C55       |
| 100X Input C | C4        | C54       |

g. ADJUST—The 100X LF Comp capacitor for best front corner.

h. Replace the 50- $\Omega$  cable and 50- $\Omega$  termination with the 10X probe (supplied with the instrument).

i. Set the CH 1 VOLTS/DIV switch to 10 mV and the A SEC/DIV switch to 0.2 ms.

j. Insert the tip of the X10 probe into the PROBE ADJUST output jack.

k. Adjust the X10 probe compensation for a flat top on the waveform. Refer to the instructions supplied with the probe for details of compensation adjustment.

l. Set the CH 1 VOLTS/DIV switch to 0.1 V or 1 V (10X PROBE).

m. Connect the X10 probe tip to the high amplitude generator via a probe-tip-to-BNC connector.

n. Set the generator to produce a 1 kHz, 5-division display.

o. ADJUST—The 10X Input C capacitor for best flat top.

p. Set the CH 1 VOLTS/DIV switch to 1 V or 10 V (X10 PROBE) and set the generator to produce a 5-division display.

q. ADJUST—The 100X Input C Capacitor for the best flat top.

r. Set the VERTICAL MODE switch to CH 2.

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s. Repeat parts c through q for Channel 2.

t. Disconnect the test equipment from the instrument.

### 10. Check Alternation Operation

a. Set:

|                       |              |
|-----------------------|--------------|
| VERTICAL MODE         | BOTH and ALT |
| Input Coupling (both) | GND          |
| A and B SEC/DIV       | 50 ms        |
| A&B INT               | CH 1         |

b. Position the Channel 1 and Channel 2 traces about 2 divisions apart using the Channel 1 and Channel 2 POSITION controls.

c. CHECK—Sweeps alternate for all the A SEC/DIV switch settings.

#### NOTE

*At sweep speeds of 2 ms per division or faster, the trace alternations occur too rapidly to be observed.*

### 11. Check Chop Operation

a. Set:

|               |               |
|---------------|---------------|
| VERTICAL MODE | BOTH and CHOP |
| A SEC/DIV     | 1 $\mu$ s     |
| A&B INT       | VERT MODE     |
| A SOURCE      | EXT           |

b. Connect the 10X probe to the EXT INPUT connector.

c. Connect the 10X probe tip to TP537.

d. CHECK—Period of one complete square-wave cycle is between 1.6 and 2.6 horizontal divisions.

e. Disconnect the 10X probe from TP537 and the EXT INPUT connector.

f. CHECK—Two traces are visible for all A SEC/DIV switch settings.

### 12. Adjust High-Frequency Compensation (C237) and Delay Line Compensation (R240 and R241)

a. Set:

|                       |                  |
|-----------------------|------------------|
| VERTICAL MODE         | CH 1             |
| BW LIMIT              | Off (button out) |
| VOLTS/DIV (both)      | 10 mV            |
| Input Coupling (both) | DC               |
| A SEC/DIV             | 0.05 $\mu$ s     |
| A SOURCE              | INT              |

b. Connect the positive-going fast-rise square wave output via a 50- $\Omega$  cable, a 10X attenuator, and a 50- $\Omega$  termination to the CH 1 OR X input connector.

c. Set the generator to produce a 1-MHz, 5-division display.

d. Set the top of the display to the center horizontal graticule line using the Channel 1 POSITION control.

e. ADJUST—HF Peak Comp (C237) for 2% overshoot (0.1 division) on the displayed signal.

f. ADJUST—DL Comp 1 (R240) and DL Comp 2 (R241) for best flat top on the front corner.

g. Repeat parts e and f until no further improvement is noted.

h. Set the CH 1 VOLTS/DIV switch to 5 mV.

i. Set the generator to produce a 5-division display.

j. CHECK—Display peak-to-peak aberrations are within  $\pm 4\%$  (0.2 division or less).

k. Repeat part j for each of the following CH 1 VOLTS/DIV switch settings: 5 mV through 0.5 V. Adjust the generator output and add or remove the 10X attenuator as necessary to maintain a 5-division display at each VOLTS/DIV switch setting.

l. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

- m. Set the CH 2 VOLTS/DIV switch to 5 mV.
- n. Repeat parts i through k for Channel 2.
- o. Disconnect the test equipment from the instrument.

**NOTE**

*Install the instrument cabinet for the remaining vertical checks and allow a 20-minute warm-up period before continuing with the Adjustment Procedure. See the "Cabinet" remove and replace instructions located in the "Maintenance" section of the manual.*

**13. Check Bandwidth Limit Operation**

a. Set:

|                           |                |
|---------------------------|----------------|
| VERTICAL MODE             | CH 1           |
| Vertical POSITION (both)  | Midrange       |
| BW LIMIT                  | On (button in) |
| VOLTS/DIV Variable (both) | CAL detent     |
| Input Coupling (both)     | DC             |
| A SEC/DIV                 | 20 $\mu$ s     |

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

c. Set the generator to produce a 50-kHz, 6-division display.

d. Increase the generator output frequency until the display amplitude decreases to 4.2 divisions.

e. CHECK—Generator output frequency is between 8.5 MHz and 11.5 MHz.

**14. Check Bandwidth**

a. Set:

|                  |                  |
|------------------|------------------|
| BW LIMIT         | Off (button out) |
| VOLTS/DIV (both) | 2 mV             |

b. Set the generator to produce a 50-kHz, 6-division display.

c. CHECK—Display amplitude is 4.2 divisions or greater as the generator output frequency is increased up to the value shown in Table 5-5 for the corresponding VOLTS/DIV switch setting.

**Table 5-5  
Settings for Bandwidth Checks**

| VOLTS/DIV<br>Switch Setting | Generator<br>Output Frequency |
|-----------------------------|-------------------------------|
| 2 mV                        | 50 MHz                        |
| 5 mV to 5 V                 | 60 MHz                        |

d. Repeat parts b and c for all indicated CH 1 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.

e. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

f. Repeat parts b and c for all indicated CH 2 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.

**15. Check Channel Isolation**

a. Set:

|                          |             |
|--------------------------|-------------|
| VOLTS/DIV (both)         | 1 V         |
| Channel 1 Input Coupling | GND         |
| A SEC/DIV                | 0.1 $\mu$ s |

b. Set the generator to produce a 25-MHz, 5-division display.

c. Set the VERTICAL MODE switch to CH 1.

d. CHECK—Display amplitude is 0.05 division or less.

e. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector.

f. Set:

|                          |      |
|--------------------------|------|
| VERTICAL MODE            | CH 2 |
| Channel 1 Input Coupling | DC   |
| Channel 2 Input Coupling | GND  |

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- g. CHECK—Display amplitude is 0.05 division or less.
- h. Disconnect the test equipment from the instrument.

### 16. Check Common-Mode Rejection Ratio

a. Set:

|                          |                |
|--------------------------|----------------|
| VOLTS/DIV (both)         | 10 mV          |
| INVERT                   | On (button in) |
| Channel 2 Input Coupling | DC             |

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable, a 50- $\Omega$  termination, and a dual-input coupler to the CH 1 OR X and CH 2 OR Y input connectors.

c. Set the generator to produce a 25-MHz, 6-division display.

d. Vertically center the display using the Channel 2 POSITION control. Then set the VERTICAL MODE switch to CH 1 and vertically center the display using the Channel 1 POSITION control.

e. Set the VERTICAL MODE switches to BOTH and ADD.

f. CHECK—Display amplitude is 0.6 division or less.

g. If the check in part f meets the requirement, skip to part p. If it does not, continue with part h.

h. Set the VERTICAL MODE switch to CH 1.

i. Set the generator to produce a 50-kHz, 6-division display.

j. Set the VERTICAL MODE switch to BOTH.

k. Adjust the CH 1 or CH 2 VOLTS/DIV Variable control for minimum display amplitude.

l. Set the VERTICAL MODE switch to CH 1.

m. Set the generator to produce a 25-MHz, 6-division display.

n. Set the VERTICAL MODE switch to BOTH.

o. CHECK—Display amplitude is 0.6 division or less.

p. Disconnect the test equipment from the instrument.

### 17. Check Input Gate Current

a. Set:

|                           |            |
|---------------------------|------------|
| VERTICAL MODE             | CH 1       |
| VOLTS/DIV (both)          | 2 mV       |
| VOLTS/DIV Variable (both) | CAL detent |
| Input Coupling (both)     | GND        |

b. Position the trace on the center horizontal graticule line using the Channel 1 POSITION control.

c. CHECK—For 0.1 division or less trace shift while alternating the Channel 1 Input Coupling switch between the AC and GND positions.

d. Set the VERTICAL MODE switch to CH 2.

e. Repeat parts b and c using the Channel 2 controls.

#### NOTE

*To continue with the Adjustment Procedure, remove the instrument cabinet and allow a 20-minute time period to elapse before continuing with the Adjustment Procedure. See the "Cabinet" removal instructions located in the "Maintenance" section of the manual.*



# HORIZONTAL

## Equipment Required (see Table 4-1):

|                                      |  |
|--------------------------------------|--|
| Calibration Generator (Item 1)       | 50- $\Omega$ BNC Termination (Item 5)    |
| Leveled Sine-Wave Generator (Item 2) | Test Oscilloscope (Item 11)              |
| Time-Mark Generator (Item 3)         | Screwdriver (Item 13)                    |
| 50- $\Omega$ Cable (Item 4)          | Low-Capacitance Alignment Tool (Item 14) |

See **ADJUSTMENT LOCATIONS 1** and **ADJUSTMENT LOCATIONS 3**

at the back of the manual for test points and adjustments locations.

## INITIAL CONTROL SETTINGS

### Vertical

|                          |                  |
|--------------------------|------------------|
| POSITION (both)          | Midrange         |
| VERTICAL MODE            | CH 1             |
| BW LIMIT                 | Off (button out) |
| CH 1 VOLTS/DIV           | 0.5 V            |
| CH 1 VOLTS/DIV Variable  | CAL detent       |
| Channel 1 Input Coupling | DC               |

### Horizontal

|                       |                        |
|-----------------------|------------------------|
| POSITION              | Midrange               |
| HORIZONTAL MODE       | A                      |
| A and B SEC/DIV       | 0.1 ms                 |
| SEC/DIV Variable      | CAL detent             |
| X10 Magnifier         | Off (knob in)          |
| B DELAY TIME POSITION | Fully counterclockwise |

### B TRIGGER

|       |                 |
|-------|-----------------|
| SLOPE | OUT             |
| LEVEL | Fully clockwise |

### A TRIGGER

|             |           |
|-------------|-----------|
| VAR HOLDOFF | NORM      |
| Mode        | P-P AUTO  |
| SLOPE       | OUT       |
| LEVEL       | Midrange  |
| A&B INT     | VERT MODE |
| A SOURCE    | INT       |

## PROCEDURE STEPS

### 1. Adjust Horizontal Amplifier Gain (R740 and R730)

a. Connect 0.1-ms time markers from the time-mark generator via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

b. Align the first time marker with the first (extreme left) vertical graticule line using the Horizontal POSITION control.

c. ADJUST—A Sweep Gain (R740) for 1 time marker per division over the center 8 divisions.

### NOTE

*When making timing measurements, use as a reference the tips of the time markers positioned at the center horizontal graticule line.*

d. Set the HORIZONTAL MODE switch to B.

e. ADJUST—B Sweep Gain (R730) for 1 time marker per division.

## Adjustment Procedure—2215A Service

### 2. Adjust X10 Horizontal Amplifier Gain (R754)

a. Set:

|                 |               |
|-----------------|---------------|
| HORIZONTAL MODE | A             |
| X10 Magnifier   | On (knob out) |

b. Select 10- $\mu$ s time markers from the time-mark generator.

c. Align the nearest time marker to the first vertical graticule line with the first graticule line.

d. ADJUST—X10 Gain (R754) for 1 time marker per division.

### 3. Adjust Magnifier Registration (R749)

a. Select 0.5-ms time markers from the time-mark generator.

b. Position the middle time marker to the center vertical graticule line using the Horizontal POSITION control.

c. Set the X10 Magnifier to Off (knob in).

d. ADJUST—Mag Regis (R749) to position the middle time marker to the center vertical graticule line.

e. Set the X10 Magnifier to On (knob out) and CHECK for no horizontal shift in the time marker.

f. Repeat parts c through e until no further improvement is noted.

### 4. Check Position Range

a. Set:

|                          |            |
|--------------------------|------------|
| Channel 1 Input Coupling | DC         |
| A SEC/DIV                | 10 $\mu$ s |

b. Select 10- $\mu$ s time markers from the time-mark generator.

c. CHECK—Start of the sweep can be positioned to the right of the center vertical graticule line by rotating the Horizontal POSITION control fully clockwise.

d. CHECK—The 11th time marker can be positioned to the left of the center vertical graticule line by rotating the Horizontal POSITION control fully counterclockwise.

e. Select 50- $\mu$ s time markers from the time-mark generator.

f. Align the 3rd time marker with the center vertical graticule line using the Horizontal POSITION control.

g. Set the X10 Magnifier to On (knob out).

h. CHECK—Magnified time marker can be positioned to the left of the center vertical graticule line by rotating the Horizontal POSITION control fully counterclockwise.

i. CHECK—Start of the sweep can be positioned to the right of the center vertical graticule line by rotating the Horizontal POSITION control fully clockwise.

### 5. Check Variable Range

a. Set:

|                     |                        |
|---------------------|------------------------|
| Horizontal POSITION | Midrange               |
| A SEC/DIV           | 0.2 ms                 |
| SEC/DIV Variable    | Fully counterclockwise |
| X10 Magnifier       | Off (knob in)          |

b. Select 0.5-ms time markers from the time-mark generator.

c. CHECK—Time markers are 1 division or less apart.

### 6. Adjust Delay Dial Timing (R646 and R652)

a. Set:

|                       |            |
|-----------------------|------------|
| HORIZONTAL MODE       | ALT        |
| A SEC/DIV             | 0.1 ms     |
| B SEC/DIV             | 1 $\mu$ s  |
| SEC/DIV Variable      | CAL detent |
| B DELAY TIME POSITION | 1.00       |

b. Select 0.1-ms time markers from the time-mark generator.

c. Adjust the A/B SWP SEP control to separate the A and B Sweeps.

## Adjustment Procedure—2215A Service

d. ADJUST—Delay Start (R646) so that the 2nd A-Sweep time marker is intensified and the B-Sweep time marker's rising edge starts at the beginning of the B Sweep.

e. Set the B DELAY TIME POSITION dial to 9.00.

f. ADJUST—Delay End (R652) so that the 10th A-Sweep time marker is intensified and the B-Sweep time marker's rising edge starts at the beginning of the B Sweep.

g. Set the B DELAY TIME POSITION dial to 1.00.

h. Repeat parts d through g until no further improvement is noted.

### 7. Adjust High-Speed Timing (C703 and C713)

a. Set:

|                 |             |
|-----------------|-------------|
| HORIZONTAL MODE | A           |
| A SEC/DIV       | 0.1 $\mu$ S |

b. Select 0.1- $\mu$ S time markers from the time-mark generator.

c. ADJUST—A High Speed Timing (C703) for 1 time marker per division over the center 8 divisions.

d. Set:

|                 |             |
|-----------------|-------------|
| HORIZONTAL MODE | B           |
| A SEC/DIV       | 0.2 $\mu$ S |
| B SEC/DIV       | 0.1 $\mu$ S |

e. ADJUST—B High Speed Timing (C713) for 1 time marker per division over the center 8 divisions.

### 8. Adjust 5-ns Timing and Linearity (C775)

a. Set:

|                 |       |
|-----------------|-------|
| CH 1 VOLTS/DIV  | 0.2 V |
| HORIZONTAL MODE | A     |

|               |               |
|---------------|---------------|
| A SEC/DIV     | 0.05 $\mu$ S  |
| X10 Magnifier | On (knob out) |

b. Select 10-ns time markers from the time-mark generator.

c. Align the time markers with the vertical graticule lines using the Horizontal POSITION control.

d. ADJUST—5-ns Timing (C775) for one time marker every 2 divisions over the center 8 divisions of the magnified sweep.

e. CHECK—Time markers between the 2nd and 4th vertical graticule lines should be aligned within 0.14 division. If not, a slight compromise between timing and linearity should be made by readjusting the 5-ns Timing capacitor (C775).

### 9. Check Timing Accuracy and Linearity

a. Set:

|                |               |
|----------------|---------------|
| CH 1 VOLTS/DIV | 0.5 V         |
| X10 Magnifier  | Off (knob in) |
| A TRIGGER Mode | NORM          |

b. Select 50-ns time markers from the time-mark generator.

c. Adjust the A TRIGGER LEVEL control for a stable, triggered display.

d. Use the Horizontal POSITION control to align the second time marker with the second vertical graticule line.

e. CHECK—Timing accuracy is within 3% (0.24 division at the 10th vertical graticule line), and linearity is within 7% (0.14 division over any 2 of the center 8 divisions).

**Table 5-6**  
**Settings for Timing Accuracy Checks**

| SEC/DIV<br>Switch Setting | Time-Mark Generator Setting |               |
|---------------------------|-----------------------------|---------------|
|                           | Normal                      | X10 Magnified |
| 0.05 $\mu$ s              | 50 ns                       | 10 ns         |
| 0.1 $\mu$ s               | 0.1 $\mu$ s                 | 10 ns         |
| 0.2 $\mu$ s               | 0.2 $\mu$ s                 | 20 ns         |
| 0.5 $\mu$ s               | 0.5 $\mu$ s                 | 50 ns         |
| 1 $\mu$ s                 | 1 $\mu$ s                   | 0.1 $\mu$ s   |
| 2 $\mu$ s                 | 2 $\mu$ s                   | 0.2 $\mu$ s   |
| 5 $\mu$ s                 | 5 $\mu$ s                   | 0.5 $\mu$ s   |
| 10 $\mu$ s                | 10 $\mu$ s                  | 1 $\mu$ s     |
| 20 $\mu$ s                | 20 $\mu$ s                  | 2 $\mu$ s     |
| 50 $\mu$ s                | 50 $\mu$ s                  | 5 $\mu$ s     |
| 0.1 ms                    | 0.1 ms                      | 10 $\mu$ s    |
| 0.2 ms                    | 0.2 ms                      | 20 $\mu$ s    |
| 0.5 ms                    | 0.5 ms                      | 50 $\mu$ s    |
| 1 ms                      | 1 ms                        | 0.1 ms        |
| 2 ms                      | 2 ms                        | 0.2 ms        |
| 5 ms                      | 5 ms                        | 0.5 ms        |
| 10 ms                     | 10 ms                       | 1 ms          |
| 20 ms                     | 20 ms                       | 2 ms          |
| 50 ms                     | 50 ms                       | 5 ms          |
| A Sweep Only              |                             |               |
| 0.1 s                     | 0.1 s                       | 10 ms         |
| 0.2 s                     | 0.2 s                       | 20 ms         |
| 0.5 s                     | 0.5 s                       | 50 ms         |

**NOTE**

*For checking the timing accuracy of the A SEC/DIV switch settings from 50 ms to 0.5 s, watch the time marker tips only at the 2nd and 10th vertical graticule lines while adjusting the Horizontal POSITION control.*

f. Repeat parts c through e for the remaining A SEC/DIV and time-mark generator setting combinations shown in Table 5-6 under the "Normal" column.

g. Set the X10 Magnifier to On (knob out).

h. Select 50-ms time markers from the time-mark generator when checking the A Sweep and 5-ms time markers when checking the B Sweep.

i. Use the Horizontal POSITION control to align the first time marker that is 25 ns beyond the start of the sweep with the second vertical graticule line.

j. CHECK—Timing accuracy is within 4% (0.32 division at the 10th vertical graticule line), and linearity is within 7% (0.14 division over any 2 of the center 8 divisions). Exclude any portion of the sweep past the 100th magnified division.

k. Repeat parts i and j for the remaining A SEC/DIV and time-mark generator setting combinations shown in Table 5-6 under the "X10 Magnified" column.

l. Set:

|                 |               |
|-----------------|---------------|
| HORIZONTAL MODE | B             |
| A SEC/DIV       | 0.1 $\mu$ s   |
| B SEC/DIV       | 0.05 $\mu$ s  |
| X10 Magnifier   | Off (knob in) |

m. Repeat parts b through k for the B Sweep. Keep the A SEC/DIV switch one setting slower than the B SEC/DIV switch.

**10. Check Delay Time Dial Range and Accuracy**

a. Set:

|                          |                        |
|--------------------------|------------------------|
| Channel 1 Input Coupling | GND                    |
| HORIZONTAL MODE          | ALT                    |
| A and B SEC/DIV          | 0.2 ms                 |
| X10 Magnifier            | Off (knob in)          |
| B DELAY TIME POSITION    | Fully counterclockwise |
| A TRIGGER Mode           | P-P AUTO               |

b. Align the start of the A Sweep with the 1st vertical graticule line using the Horizontal POSITION control.

c. CHECK—Intensified portion of the trace starts within 0.5 division of the start of the sweep.

d. Rotate the B DELAY TIME POSITION control fully clockwise.

e. CHECK—Intensified portion of the trace is past the 11th vertical graticule line.

f. Set:

|                       |                        |
|-----------------------|------------------------|
| A and B SEC/DIV       | 0.5 $\mu$ s            |
| B DELAY TIME POSITION | Fully counterclockwise |

g. Align the start of the A Sweep with the 1st vertical graticule line using the Horizontal POSITION control.

h. CHECK—Intensified portion of the trace starts within 1.1 divisions of the start of the sweep.

i. Repeat parts d and e.

j. Set:

Channel 1 Input Coupling DC  
 HORIZONTAL MODE B  
 A SEC/DIV 0.5  $\mu$ s  
 B SEC/DIV 0.05  $\mu$ s  
 B DELAY TIME POSITION 1.00

k. Select 0.5- $\mu$ s time markers from the time-mark generator.

l. Adjust the Horizontal POSITION control so that the top of the first fully displayed time marker is aligned with the center vertical graticule line.

m. Without changing the Horizontal POSITION control setting, set the B DELAY TIME POSITION dial to 9.00. Slightly readjust the B DELAY TIME POSITION dial to align the top of the time marker with the center vertical graticule line.

n. CHECK—The B DELAY TIME POSITION dial setting is between 8.905 and 9.095.

o. Repeat parts l through n for the remaining A and B SEC/DIV and time-mark generator setting combinations shown in Table 5-7.

Table 5-7  
 Settings for Delay Time Accuracy Checks

| A SEC/DIV<br>Switch Setting | B SEC/DIV<br>Switch Setting | Time-Mark<br>Generator Setting |
|-----------------------------|-----------------------------|--------------------------------|
| 0.5 $\mu$ s                 | 0.05 $\mu$ s                | 0.5 $\mu$ s                    |
| 5 $\mu$ s                   | 0.5 $\mu$ s                 | 5 $\mu$ s                      |
| 0.5 ms                      | 50 $\mu$ s                  | 0.5 ms                         |
| 5 ms                        | 0.5 ms                      | 5 ms                           |
| 0.5 s                       | 50 ms                       | 0.5 s                          |

p. Set:

A SEC/DIV 5  $\mu$ s  
 B SEC/DIV 0.5  $\mu$ s  
 B DELAY TIME POSITION 1.00

q. Select 5- $\mu$ s time markers from the time-mark generator.

r. Adjust the Horizontal POSITION control so that the rising edge of the displayed time marker is aligned with the center vertical graticule line.

s. Without changing the Horizontal POSITION control setting, turn the B DELAY TIME POSITION dial clockwise to position the next time marker leading edge to the center vertical graticule line.

t. CHECK—The B DELAY TIME POSITION dial setting is 0.975 to 1.025 greater than the previous setting.

u. Set the B DELAY TIME POSITION dial to the exact integer setting.

v. Repeat parts r through u for each successive time marker up to the marker corresponding to the B DELAY TIME POSITION dial setting of 10.00.

## 11. Check Delay Jitter

a. Set:

A SEC/DIV 0.5 ms  
 B SEC/DIV 0.5  $\mu$ s  
 B DELAY TIME POSITION 10.00

b. Select 50- $\mu$ s time markers from the time-mark generator.

c. Rotate the B DELAY TIME POSITION dial counter-clockwise to position a time marker within the graticule area for each major dial division and CHECK that the jitter on the leading edge does not exceed 0.5 division. Disregard slow drift.

d. Disconnect the test equipment from the instrument.



## Adjustment Procedure—2215A Service

### 12. Adjust X Gain (R760)

a. Set:

|                |       |
|----------------|-------|
| CH 1 VOLTS/DIV | 10 mV |
| A SEC/DIV      | X-Y   |

b. Connect a 50-mV standard-amplitude signal via a 50- $\Omega$  cable to the CH 1 OR X input connector.

c. ADJUST—X Gain (R760) for exactly 5-divisions of horizontal deflection.

d. Disconnect the test equipment from the instrument.

### 13. Check X Bandwidth

a. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

b. Set the generator to produce a 5-division horizontal display at an output frequency of 50 kHz.

c. Increase the generator output frequency to 2 MHz.

d. CHECK—Display is at least 3.5 horizontal divisions.

e. Disconnect the test equipment from the instrument.

### 14. Check A-Sweep Holdoff

a. Set:

|                 |      |
|-----------------|------|
| HORIZONTAL MODE | A    |
| A SEC/DIV       | 1 ms |
| VAR HOLDOFF     | NORM |

b. Connect the test oscilloscope and its 10X probe tip to the front end of R707 (toward the front panel) which is located on the Timing circuit board.

c. CHECK—The A-Sweep holdoff is greater than 3 ms but less than 7 ms.

d. Rotate the VAR HOLDOFF control to the maximum clockwise position (MAX).

e. CHECK—The A-Sweep holdoff has increased by a factor of 10 or more.

f. Disconnect the test oscilloscope 10X probe from R707.

# TRIGGER

## Equipment Required (see Table 4-1):

|                                      |                             |
|--------------------------------------|-----------------------------|
| Leveled Sine-Wave Generator (Item 2) | 10X Attenuator (Item 7)     |
| 50-Ω BNC Cable (Item 4)              | Digital Voltmeter (Item 12) |
| 50-Ω BNC Termination (Item 5)        | Screwdriver (Item 13)       |
| Dual-Input Coupler (Item 6)          |                             |

See **ADJUSTMENT LOCATIONS 1**

at the back of this manual for test points and adjustment locations.

## INITIAL CONTROL SETTINGS

### Vertical (Both Channels)

|                    |                  |
|--------------------|------------------|
| POSITION           | Midrange         |
| VERTICAL MODE      | BOTH-ALT         |
| BW LIMIT           | Off (button out) |
| VOLTS/DIV          | 0.5 V            |
| VOLTS/DIV Variable | CAL detent       |
| INVERT             | Off (button out) |
| Input Coupling     | GND              |

### Horizontal

|                       |                        |
|-----------------------|------------------------|
| POSITION              | Midrange               |
| HORIZONTAL MODE       | A                      |
| A and B SEC/DIV       | 1 ms                   |
| SEC/DIV Variable      | CAL detent             |
| X10 Magnifier         | Off (knob in)          |
| B DELAY TIME POSITION | Fully counterclockwise |

### B TRIGGER

|       |          |
|-------|----------|
| SLOPE | OUT      |
| LEVEL | Midrange |

### A TRIGGER

|                |          |
|----------------|----------|
| VAR HOLDOFF    | NORM     |
| Mode           | P-P AUTO |
| SLOPE          | OUT      |
| LEVEL          | Midrange |
| A&B INT        | CH 2     |
| A SOURCE       | INT      |
| A EXT COUPLING | DC       |

## PROCEDURE STEPS

### 1. Adjust Trigger Offset (R309)

a. Set the Channel 1 trace and the Channel 2 trace to the center horizontal graticule line using the Channel 1 and Channel 2 POSITION controls.

b. Connect the digital voltmeter low lead to chassis ground and the high (volts) lead to W4000-1 (Alt Sweep Logic circuit board connector to the Main circuit board).

c. CHECK—The offset voltage reading is less than 80 mV. Note the reading for use in part e.

d. Set the A&B INT switch to CH 1.

e. ADJUST—Trigger Offset (R309) so that the voltage reading is the same as that obtained in part c.

f. Set the A&B INT switch to CH 2.

g. Repeat parts c through f until there is 1 mV or less difference in the voltmeter readings between the CH 1 and CH 2 positions of the A&B INT switch.

### 2. Adjust Trigger Sensitivity (R479) and (R627)

a. Set:

|                  |       |
|------------------|-------|
| VERTICAL MODE    | CH 1  |
| CH 1 VOLTS/DIV   | 0.1 V |
| AC-GND-DC (both) | AC    |
| A and B SEC/DIV  | 10 μs |

**Adjustment Procedure—2215A Service**

b. Connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 1 OR X input connector.

c. Set the generator to produce a 50-kHz, 2.2-division display.

d. Set the CH 1 VOLTS/DIV switch to 1 V.

e. ADJUST—A Trigger Sensitivity (R479) while rotating the A TRIGGER LEVEL control slowly so that the A Trigger is just able to be maintained.

f. Adjust the A TRIGGER LEVEL control for a stable display.

g. Set the HORIZONTAL MODE switch to B.

h. ADJUST—B Trigger Sensitivity (R627) while rotating the B TRIGGER LEVEL control slowly so that the B Trigger is just able to be maintained.

i. Return the HORIZONTAL MODE switch to A.

**3. Adjust Slope Balance (R471)**

a. Set:

CH 1 VOLTS/DIV            50 mV  
HORIZONTAL MODE        A

b. Set the generator to produce a 4-division display.

c. ADJUST—Slope Bal (R471) for a downward vertical shift of 0.22 division at the start of the sweep when changing the A TRIGGER SLOPE switch between the OUT and IN positions.

**4. Adjust P-P Auto Trigger Centering (R434 and R435)**

a. Set:

A TRIGGER SLOPE        OUT  
A TRIGGER LEVEL        Fully clockwise

b. Set the generator to produce a 50-kHz, 5-division display.

c. Set the CH 1 VOLTS/DIV switch to 0.5 V.

d. ADJUST—(+) Auto (R434) so that the vertical display just solidly triggers on the positive peak of the signal.

e. Set:

A TRIGGER SLOPE        IN  
A TRIGGER LEVEL        Fully counterclockwise

f. ADJUST—(-) Auto (R435) so that the display just solidly triggers on the negative peak of the signal.

**5. Check Internal Triggering**

a. Set:

CH 1 VOLTS/DIV            5 mV  
CH 2 VOLTS/DIV            50 mV  
A and B SEC/DIV            0.2 μs  
A&B INT                      CH 1

b. Set the generator to produce a 5-MHz, 3-division display.

c. Set the CH 1 VOLTS/DIV switch to 50 mV.

d. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 5-8.

**Table 5-8**  
**Switch Combinations for A Triggering Checks**

| A TRIGGER Mode | A TRIGGER SLOPE |
|----------------|-----------------|
| NORM           | OUT             |
| NORM           | IN              |
| P-P AUTO       | IN              |
| P-P AUTO       | OUT             |

e. Set the HORIZONTAL MODE switch to B.

f. CHECK—Stable display can be obtained by adjusting the B TRIGGER LEVEL control in a position other than the B RUNS AFTER DLY position for both the OUT and IN positions of the B TRIGGER SLOPE switch.

g. Set:

|                 |      |
|-----------------|------|
| VERTICAL MODE   | CH 2 |
| HORIZONTAL MODE | A    |
| A&B INT         | CH 2 |

h. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

i. Repeat parts d through f.

j. Set:

|                 |               |
|-----------------|---------------|
| HORIZONTAL MODE | A             |
| A SEC/DIV       | 0.1 $\mu$ s   |
| X10 Magnifier   | On (knob out) |

k. Set the generator to produce a 60-MHz, 1.0-division display.

l. Repeat parts d through f.

m. Set:

|                 |           |
|-----------------|-----------|
| VERTICAL MODE   | CH 1      |
| HORIZONTAL MODE | A         |
| A&B INT         | VERT MODE |

n. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector.

o. Repeat parts d through f.

p. Disconnect the test equipment from the instrument.

## 6. Check External Triggering

a. Set:

|                 |               |
|-----------------|---------------|
| VERTICAL MODE   | CH 1          |
| CH 1 VOLT/DIV   | 20 mV         |
| HORIZONTAL MODE | A             |
| A SEC/DIV       | 0.1 $\mu$ s   |
| X10 Magnifier   | Off (knob in) |
| A SOURCE        | EXT           |

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable, a 50- $\Omega$  termination, and a dual-input coupler to both the CH 1 OR X and EXT INPUT connectors.

c. Set the leveled sine-wave generator output voltage to 40 mV and the frequency to 5 MHz.

d. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6.

e. Set CH 1 VOLTS/DIV switch to 50 mV.

f. Set the leveled sine-wave generator output voltage to 150 mV and the frequency to 60 MHz. Set the X10 Magnifier to On (knob out).

g. Repeat part d.

## 7. Check External Trigger Ranges

a. Set:

|                |               |
|----------------|---------------|
| CH 1 VOLTS/DIV | 0.5 V         |
| A SEC/DIV      | 20 $\mu$ s    |
| X10 Magnifier  | Off (knob in) |
| A TRIGGER Mode | NORM          |

b. Set the generator to produce a 50-kHz, 6.4-division display.

c. CHECK—Display is triggered along the entire positive slope of the waveform as the A TRIGGER LEVEL control is rotated.

d. CHECK—Display is not triggered (no trace) at either extreme of rotation.

e. Set the A TRIGGER SLOPE button to IN.

f. CHECK—Display is triggered along the entire negative slope of the waveform as the A TRIGGER LEVEL control is rotated.

g. CHECK—Display is not triggered (no trace) at either extreme of rotation.

## Adjustment Procedure—2215A Service

### 8. Check Single Sweep Operation

a. Adjust the A TRIGGER LEVEL control to obtain a stable display.

b. Set:

|                          |     |
|--------------------------|-----|
| Channel 1 Input Coupling | GND |
| A SOURCE                 | INT |

c. Press in the SGL SWP RESET button. The READY LED should illuminate and remain on.

d. Set the Channel 1 Input Coupling switch to DC.

e. CHECK—READY LED goes out and a single sweep occurs.

#### NOTE

*The A INTENSITY control may require adjustment to observe the single-sweep trace.*

f. Press in the SGL SWP RESET button several times.

g. CHECK—Single-sweep trace occurs, and the READY LED illuminates briefly every time the SGL SWP RESET button is pressed in and released.

h. Disconnect the test equipment from the instrument.



# EXTERNAL Z-AXIS AND PROBE ADJUST

## Equipment Required (see Table 4-1):

|                                       |                                      |
|---------------------------------------|--------------------------------------|
| Leveled Sine-Wave Generator (Item 2)  | BNC T-Connector (Item 8)             |
| Two 50- $\Omega$ BNC Cables (Item 4)  | 10X Probe (provided with instrument) |
| 50- $\Omega$ BNC Termination (Item 5) |                                      |

## INITIAL CONTROL SETTINGS

### Vertical

|                          |                  |
|--------------------------|------------------|
| Channel 1 POSITION       | Midrange         |
| VERTICAL MODE            | CH 1             |
| BW LIMIT                 | Off (button out) |
| CH 1 VOLTS/DIV           | 1 V              |
| CH 1 VOLTS/DIV Variable  | CAL detent       |
| Channel 1 Input Coupling | DC               |

### Horizontal

|                  |               |
|------------------|---------------|
| POSITION         | Midrange      |
| HORIZONTAL MODE  | A             |
| A SEC/DIV        | 20 $\mu$ s    |
| SEC/DIV Variable | CAL detent    |
| X10 Magnifier    | Off (knob in) |

### A TRIGGER

|             |           |
|-------------|-----------|
| VAR HOLDOFF | NORM      |
| Mode        | P-P AUTO  |
| SLOPE       | OUT       |
| LEVEL       | Midrange  |
| A&B INT     | VERT MODE |
| A SOURCE    | INT       |

## PROCEDURE STEPS

### 1. Check External Z-Axis Operation

a. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a T-connector to the CH 1 OR X input connector. Then connect a 50- $\Omega$  cable and a 50- $\Omega$  termination from the T-connector to the EXT Z AXIS INPUT connector on the rear panel.

b. Set the generator to produce a 5-V, 50-kHz signal.

c. CHECK—For noticeable intensity modulation. The positive part of the sine wave should be of lower intensity than the negative part.

d. Disconnect the test equipment from the instrument.

### 2. Check Probe Adjust Operation

a. Set:

|                |        |
|----------------|--------|
| CH 1 VOLTS/DIV | 10 mV  |
| A SEC/DIV      | 0.5 ms |

b. Connect the 10X Probe to the CH 1 OR X input connector and insert the probe tip into the PROBE ADJUST jack on the instrument front panel. If necessary, adjust the probe compensation for a flat-topped square-wave display.

c. CHECK—Display amplitude is 4.75 to 5.25 divisions.

d. Disconnect the probe from the instrument.

# MAINTENANCE

This section of the manual contains information for conducting preventive maintenance, troubleshooting, and corrective maintenance on the 2215A Oscilloscope.

## STATIC-SENSITIVE COMPONENTS

The following precautions are applicable when performing any maintenance involving internal access to the instrument.



*Static discharge can damage any semiconductor component in this instrument.*

This instrument contains electrical components that are susceptible to damage from static discharge. Table 6-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

When performing maintenance observe the following precautions to avoid component damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers or on a metal rail. Label any package that contains static-sensitive components or assemblies.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these components. Servicing static-sensitive components or assemblies should be performed only at a static-free work station by qualified service personnel.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Keep the component leads shorted together whenever possible.

6. Pick up components by their bodies, never by their leads.

**Table 6-1**  
**Susceptibility**  
**to Static Discharge Damage**

| Semiconductor Classes   | Relative Susceptibility Levels <sup>a</sup> |
|---|---|
| MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs. (Most Sensitive) | 1   |
| ECL   | 2   |
| Schottky signal diodes  | 3   |
| Schottky TTL  | 4   |
| High-frequency bipolar transistors  | 5   |
| JFETs   | 6   |
| Linear microcircuits  | 7   |
| Low-power Schottky TTL  | 8   |
| TTL (Least Sensitive)   | 9   |

<sup>a</sup>Voltage equivalent for levels: (Voltage discharged from a 100 pF capacitor through a resistance of 100 Ω.)

1 = 100 to 500 V    4 = 500 V    7 = 400 to 1000 V(est.)  
 2 = 200 to 500 V    5 = 400 to 600 V    8 = 900 V  
 3 = 250 V    6 = 600 to 800 V    9 = 1200 V

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only approved antistatic, vacuum-type desoldering tools for component removal.

## PREVENTIVE MAINTENANCE

### INTRODUCTION

Preventive maintenance consists of cleaning, visual inspection, lubrication, and checking instrument performance. When accomplished regularly, it may prevent instrument malfunction and enhance instrument reliability. The severity of the environment in which the instrument is used determines the required frequency of maintenance. An appropriate time to accomplish preventive maintenance is just before instrument adjustment.

### GENERAL CARE

The cabinet minimizes accumulation of dust inside the instrument and should normally be in place when operating the oscilloscope. The optional front-panel cover provides both dust and damage protection for the front panel and crt face, and it should be in place whenever the instrument is stored or is being transported.

### INSPECTION AND CLEANING

The instrument should be visually inspected and 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, preventing efficient heat dissipation. It also provides an electrical conduction path that could result in instrument failure, especially under high-humidity conditions.

#### CAUTION

*Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Use a nonresidue-type cleaner, preferably isopropyl alcohol, denatured ethyl alcohol, or a solution of 5% mild detergent with 95% water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.*

### Exterior

**INSPECTION.** Inspect the external portion of the instrument for damage, wear, and missing parts; use Table 6-2 as a guide. Instruments that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Deficiencies found that could cause personal injury or could lead to further damage to the instrument should be repaired immediately.

#### CAUTION

*To prevent getting moisture inside the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.*

**CLEANING.** Loose dust on the outside of the instrument can be removed with a soft cloth or small soft-bristle brush. The brush is particularly useful for dislodging dirt on and around the controls and connectors. Dirt that remains can be removed with a soft cloth dampened in a mild detergent-and-water solution. Do not use abrasive cleaners. Clean the light filter and the crt face with a soft lint-free cloth dampened with either denatured alcohol or a mild detergent-and-water solution.

### Interior

To gain access to internal portions of the instrument for inspection and cleaning, refer to the "Removal and Replacement Instructions" in the "Corrective Maintenance" part of this section.

**INSPECTION.** Inspect the internal portions of the instrument for damage and wear, using Table 6-3 as a guide. Deficiencies found should be repaired immediately. 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 more important that the cause of overheating be corrected to prevent recurrence of the damage.

**Table 6-2**  
**External Inspection Checklist**

| Item                    | Inspect For  | Repair Action   |
|-------------------------|--|---|
| Cabinet and Front Panel | Cracks, scratches, deformations, and damaged hardware or gaskets.                            | Touch up paint and replace defective parts.                           |
| Front-panel Controls    | Missing, damaged, or loose knobs, buttons, and controls.                                     | Repair or replace missing or defective items.                         |
| Connectors              | Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.                | Replace defective parts. Clean or wash out dirt.                      |
| Carrying Handle         | Correct operation.   | Replace defective parts.  |
| Accessories             | Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors. | Replace damaged or missing items, frayed cables, and defective parts. |

**Table 6-3**  
**Internal Inspection Checklist**

| Item               | Inspect For   | Repair Action  |
|--------------------|---|--|
| Circuit Boards     | Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating. | Clean solder corrosion with an eraser and flush with isopropyl alcohol. Resolder defective connections. Determine cause of burned items and repair. Repair defective circuit runs. |
| Resistors          | Burned, cracked, broken, or blistered.  | Replace defective resistors. Check for cause of burned component and repair as necessary.  |
| Solder Connections | Cold solder or rosin joints.  | Resolder joint and clean with isopropyl alcohol.   |
| Capacitors         | Damaged or leaking cases. Corroded solder on leads or terminals.  | Replace defective capacitors. Clean solder connections and flush with isopropyl alcohol.   |
| Wiring and Cables  | Loose plugs or connectors. Burned, broken, or frayed wiring.  | Firmly seat connectors. Repair or replace defective wires or cables.   |
| Chassis            | Dents, deformations, and damaged hardware.  | Straighten, repair, or replace defective hardware.   |

If any electrical component is replaced, conduct a Performance Check of the affected circuit and of other closely related circuit (see Section 4). If repair or replacement work is done on any of the power supplies, conduct a complete Performance Check and, if so indicated, an instrument readjustment (see Section 5).



*To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument.*

## Maintenance—2215A Service

**CLEANING.** To clean the interior, blow off dust with dry, low-pressure air (approximately 9 psi). Remove any remaining dust with a soft brush or a cloth dampened with a solution of mild detergent and water. A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.

If these methods do not remove all the dust or dirt, the instrument may be spray washed using a solution of 5% mild detergent and 95% water as follows:

1. Gain access to the parts to be cleaned (see "Removal and Replacement Instructions").
2. Spray wash dirty parts with the detergent-and-water solution; then use clean water to thoroughly rinse them.
3. Dry all parts with low-pressure air.

**SWITCH CONTACTS.** The VOLTS/DIV and the SEC/DIV Switches are mounted circuit-boards within the instrument. Care must be exercised to preserve the high-frequency characteristics of these switches. Switch maintenance is seldom necessary, but if it is required, observe the following precautions.

1. The VOLTS/DIV switches contain cam-actuated contacts.



*Most spray-type circuit coolants contain Freon 12 as a propellant. Because many Freons adversely affect switch contacts, do not use a spray-type coolants.*

*The only recommended circuit coolants for the volts-division attenuators are dry ice (CO<sub>2</sub>) and isopropyl alcohol.*

- a. Use only isopropyl alcohol as a cleaning solution, especially in the area of the vertical Attenuator circuit board. Carbon-based solvents will damage the board material.
  - b. Apply the alcohol with a small, camel-hair brush. Do not use cotton-tipped applicators when cleaning contacts.
2. The SEC/DIV switch is comprised of rotary-activated contacts.

### CAUTION

*Use only hot deionized or distilled water, 55° C (131° F), to clean the timing switch in this instrument. Tap water contains impurities which are left as residuals after evaporation.*

- a. Spray hot water into the slots at the top of each switch housing while rotating the switch control knob. Spray only for approximately five seconds, using an atomizing spray device.
- b. Dry both the switch and the circuit board on which it is mounted, using dry low-pressure air.
- c. Bake the switch and the circuit board in an oven at 75° C (167° F) for 15 minutes to eliminate all moisture.
- d. Spray a very small amount (only about a 1/2-second squirt) of a recommended lubricant, such as No Noise, into the slots at the top of the switch housing.
- e. Rotate the switch control knob about 180° and again spray a very small amount of lubricant into each slot.

## LUBRICATION

Most of the potentiometers used in this instrument are permanently sealed and generally do not require periodic lubrication. All switches, both rotary- and lever-type, are installed with proper lubrication applied where necessary and will rarely require any additional lubrication. Therefore, a regular periodic lubrication program for the instrument is not recommended.

## SEMICONDUCTOR CHECKS

Periodic checks of the transistors and other semiconductors in the oscilloscope are not recommended. The best check of semi-conductor performance is actual operation in the instrument.

## PERIODIC READJUSTMENT

To ensure accurate measurements, check the performance of this instrument after every 2000 hours of operation, or if used infrequently, once each year. In addition, replacement of components may necessitate readjustment of the affected circuits.



Complete Performance Check and Adjustment instructions are given in Sections 4 and 5. The Performance Check Procedure can also be helpful in localizing certain trouble in the instrument. In some cases, minor problems may be re-

vealed or corrected by readjustment. If only a partial adjustment is performed, see the interaction chart, Table 5-1, for possible adjustment interactions with other circuits.

## TROUBLESHOOTING

### INTRODUCTION

Preventive maintenance performed on a regular basis should reveal most potential problems before an instrument malfunctions. However, should troubleshooting be required, the following information is provided to facilitate location of a fault. In addition, the material presented in the "Theory of Operation" and the "Diagrams" sections of this manual may be helpful while troubleshooting.

### TROUBLESHOOTING AIDS

#### Schematic Diagrams

Complete schematic diagrams are located on tabbed foldout pages in the "Diagrams" section. The portions of circuitry that are mounted on each circuit board are enclosed within heavy black lines. Also within the black lines, near either the top or the bottom edge, are the assembly number and name of the circuit board.

Component numbers and electrical values of components in this instrument are shown on the schematic diagrams. Refer to the first page of the "Diagrams" section for definitions of the reference designators and symbols used to identify components.

#### Circuit Board Illustrations

Circuit board illustrations (showing the physical location of each component) are provided for use in conjunction with each schematic diagram. Each board illustration can be found on the back side of a foldout page, preceding the schematic diagram(s) to which it relates. If more than one schematic diagram is associated with a particular circuit board, the board illustration is located on a left-hand page preceding the diagram with which the board is first associated.

Also provided in the "Diagrams" section is an illustration of the bottom side of the Main circuit board. This drawing facilitates troubleshooting by showing the connection pads and the location of components that are mounted on the top side of the board. Probing of Main board component signals that are inaccessible from the top side can be achieved with-

out the necessity of disassembling portions of the instrument.

Waveform test-point locations are also identified on the circuit board illustration by hexagonal-outlined numbers that correspond to the waveform numbers appearing on both the schematic diagram and the waveform illustration.

#### Circuit Board Locations

An illustration depicting the location of a circuit board within the instrument is shown on the foldout page adjacent to the circuit board illustration.

#### Circuit Board Interconnection Diagram

A circuit board cable distribution diagram and connector-pin locator table is also provided in the "Diagrams" section to aid in tracing a signal path or power source between boards. All wires, plug and jack numbers are shown along with wire or pin numbers.

#### Power Distribution Diagram

A Power Distribution diagram 8 is provided to aid in troubleshooting power-supply problems. This diagram shows service jumpers used to remove power from the various circuit boards. Excessive loading on a power supply by a circuit board can be isolated to the faulty board by disconnecting appropriate service jumpers.

#### Grid Coordinate System

Each schematic diagram and circuit board illustration has a grid border along its left and top edges. A table located adjacent to each schematic diagram lists the grid coordinates of each component shown on that schematic. To aid in physically locating a component on the respective circuit board, this table also lists the circuit-board grid coordinate of each component.

Adjacent to each circuit board illustration is an alphanumeric listing of every component mounted on that board. A second column in this listing identifies the schematic dia-

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gram in which each component can be found. These component-locator tables are especially useful when more than one schematic diagram is associated with a particular circuit board.

### Troubleshooting Charts

The troubleshooting charts contained in the "Diagrams" section are to be used as an aid in locating malfunctioning circuitry. To use the charts, begin with the Troubleshooting Guide. This chart will help identify a particular problem area for further troubleshooting.

Note that some troubleshooting-procedure boxes on each chart contain numbers along their lower edges. These numbers identify the applicable schematic diagram(s) to be used when performing the action specified in the box.

Both General and Specific notes may be called out in the troubleshooting-chart boxes. These notes are located on the inner panels of the foldout pages. Specific Notes contain procedures or additional information to be used in performing the particular troubleshooting step called for in that box. General Notes contain information that pertains to the overall troubleshooting procedure.

Some malfunctions, especially those involving multiple simultaneous failures, may require more elaborate troubleshooting approaches with references to circuit descriptions in the "Theory or Operation" section of this manual.

### Component Color Coding

Information regarding color codes and markings of resistors and capacitors is located in the color-coding illustration (Figure 9-1) at the beginning of the "Diagrams" section.

**RESISTOR COLOR CODE.** Resistors used in this instrument are carbon-film, composition, or precision metal-film types. They are color coded with the EIA color code; however, some metal-film resistors may have the value printed on the body. The color code is interpreted by starting with the strip that is nearest to one end of the resistor. Composition resistors have four stripes; these represent two significant figures, a multiplier, and a tolerance value. Metal-film resistors have five stripes which represent three significant figures, a multiplier, and a tolerance value.

**CAPACITOR MARKINGS.** Capacitance values of common disc capacitors and small electrolytics are marked on the side of the capacitor body. White ceramic capacitors are color code in picofarads, using a modified EIA code.

Dipped tantalum capacitors are color coded in microfarads. The color dot indicates both the positive lead and the voltage rating. Since these capacitors are easily destroyed by reversed or excessive voltage, be careful to observe the polarity and voltage rating.

**DIODE COLOR CODE.** The cathode end of each glass-encased diode is indicated by either a stripe, a series of stripes, or a dot. For most silicon or germanium diodes marked with a series of stripes, the color combination of the stripes identifies three digits of the Tektronix Part Number, using the resistor color-code system (e.g., a diode having either a pink or a blue strip at the cathode end, then a brown-gray-green stripe combination, indicates Tektronix Part Number 152-0185-00). The cathode and anode ends of a metal-encased diode can be identified by the diode symbol marked on its body.

### Semiconductor Lead Configurations

Figure 9-2 in the "Diagrams" section shows the lead configurations for semiconductor devices used in the instrument. These lead configurations and case styles are typical of those available at completion of the design of the instrument. Vendor changes and performance improvement changes may result in changes of case styles or lead configurations. If the device in question does not appear to match the configuration in Figure 9-2, examine the associated circuitry or consult a semiconductor manufacturer's data sheet.

### Multipin Connectors

Multipin connector orientation is indicated by two triangles: one on the holder and one on the circuit board. Slot numbers are usually molded into the holder. When a connection is made to circuit-board pins, ensure that the triangle on the holder and the triangle on the circuit board are aligned with each other (see Figure 6-1).

## TROUBLESHOOTING EQUIPMENT

The equipment listed in Table 4-1, or equivalent equipment, may be useful when troubleshooting this instrument.

## TROUBLESHOOTING TECHNIQUES

The following procedure is arranged in an order that enables checking simple trouble possibilities before requiring more extensive troubleshooting. The first four checks ensure proper control settings, connections, operation, and adjustment. If the trouble is not located by these checks, the remaining steps will aid in locating the defective component.

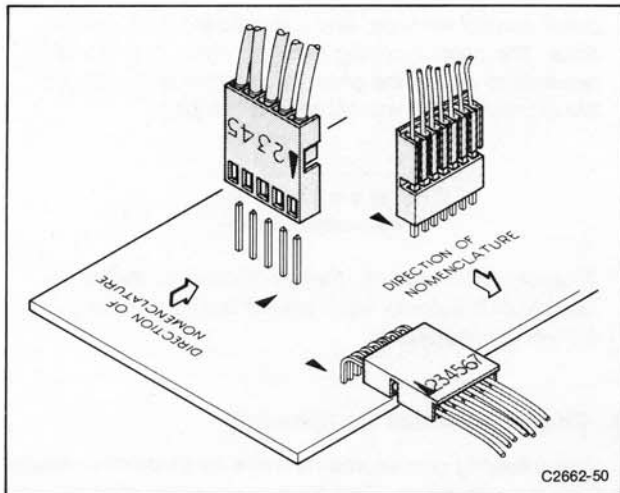


Figure 6-1. Multi-connector holder orientation.

When the defective component is located, replace it, using the appropriate replacement procedure given under "Corrective Maintenance" in this section.

### CAUTION

*Before using any test equipment to make measurements on static-sensitive, current-sensitive, or voltage-sensitive components or assemblies, ensure that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.*

## 1. Check Control Settings

Incorrect control settings can give a false indication of instrument malfunction. If there is any question about the correct function or operation of any control, refer to either the "Operating Instructions" (Section 2) in this manual or to the instrument Operators Manual.

## 2. Check Associated Equipment

Before proceeding, ensure that any equipment used with this instrument is operating correctly. Verify that input signals are properly connected and that the interconnecting cables are not defective. Check the power-input-source voltages.

### WARNING

*To avoid electrical shock, disconnect the instrument from the power-input source before performing visual inspection.*

## 3. Visual Check

Perform a visual inspection. This check may reveal broken connections or wires, damaged components, semi-conductors not firmly mounted, damaged circuit boards, or other clues.

### WARNING

*Dangerous potentials exist at several points throughout this instrument. If it is operated with the cabinet removed, do not touch exposed connections or components.*

## 4. Check Instrument Performance and Adjustment

Check the performance of either those circuits where trouble appears to exist or the entire instrument. The apparent trouble may only be the result of misadjustment. Complete performance check and adjustment instructions are given in Sections 4 and 5 of this manual.

## 5. Isolate Trouble to a Circuit

To isolate problems to a particular area, use the trouble symptom to help identify the circuit in which the trouble is located. Refer to the troubleshooting charts in the "Diagrams" section as an aid in locating a faulty circuit.

## 6. Check Power Supplies

### WARNING

*For safety reasons an isolation transformer must be connected whenever troubleshooting is done in the Preregulator and the Inverter Power Supply sections.*

Check the power supplies whenever trouble symptoms appear in more than one circuit. The correct output voltage and ripple for each supply should be measured between the supply test point and chassis ground test point (see Table 6-4). Voltages may be measured with a DMM, while the ripple measurements are accomplished with an oscilloscope. Before checking power-supply circuitry set the A INTENSITY control to minimum brightness and the A SEC/DIV switch to X-Y mode.

When measuring ripple, use a 1X probe with a bayonet signal tip attached to the probe tip to minimize stray pickup. Insert the bayonet signal tip to the first test point indicated in Table 6-4 and touch the bayonet ground tip to the chassis ground near the test point. The ripple values listed in Table

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6-4 are based on a system limited in bandwidth to 30 kHz (greater bandwidth will result in higher readings).

If power supply voltages and ripple are within the listed ranges, the supply can be assumed to be operating correctly. If any are outside these ranges, the supply may be either misadjusted or operating incorrectly. Use the "Power Supply and CRT Display" part of the "Adjustment Procedure" section to adjust the  $-8.6$  V supply.

A defective component elsewhere in the instrument can create the appearance of a power-supply problem and may also affect the operation of other circuits.

**Table 6-4**  
**Power Supply Limits and Ripple**

| Power Supply | Test Point | Reading (Volts)     | P-P Ripple (mV) |
|--------------|------------|---------------------|-----------------|
| $-8.6$ V     | TP961      | $-8.56$ to $-8.64$  | 1.5             |
| $+5.2$ V     | W968       | $+5.04$ to $+5.36$  | 3.0             |
| $+8.6$ V     | W960       | $+8.43$ to $+8.77$  | 1.5             |
| $+30$ V      | W956       | $+29.1$ to $+30.9$  | 20.0            |
| $+100$ V     | W954       | $+97.0$ to $+103.0$ | 40.0            |

### 7. Check Circuit Board Interconnections

After the trouble has been isolated to a particular circuit, again check for loose or broken connections and heat-damaged components.

### 8. Check Voltages and Waveforms

Often the defective component can be located by checking the appropriate voltage or waveform in the circuit. Typical voltages are listed on the schematic diagrams. Waveforms are shown adjacent to the schematics, and waveform test points are indicated on both the schematics and circuit board illustrations by hexagonal-outlined numbers.

#### NOTE

*Voltages and waveforms given on the schematic diagrams are not absolute and may vary slightly between instruments. To establish operating conditions similar to those used to obtain these readings, see the "Voltage and Waveform Setup" conditions in the "Diagrams" section for the preliminary equipment setup. Note the recommended test equipment, initial front-*

*panel control settings, and cable-connection instructions. The control-setting changes (from initial setup) required to obtain the given waveforms and voltages are located on the waveform-diagram page.*

#### WARNING

*To avoid electric shock, always disconnect the instrument from the power input source before removing or replacing components.*

### 9. Check Individual Components

The following procedures describe methods of checking individual components. Two-lead components that are soldered in place are most accurately checked by first disconnecting one end from the circuit board. This isolates the measurement from the effects of surrounding circuitry. See Figure 9-1 for value identification or Figure 9-2 for typical semiconductor lead configuration.

#### CAUTION

*When checking semiconductors, observe the static-sensitive precautions located at the beginning of this section.*

**TRANSISTORS.** A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a known good component. However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

When troubleshooting transistors in the circuit with a voltmeter, measure both the emitter-to-base and emitter-to-collector voltages to determine whether they are consistent with normal circuit voltages. Voltages across a transistor may vary with the type of device and its circuit function.

Some of these voltages are predictable. The emitter-to-base voltage for a conducting silicon transistor will normally range from  $0.6$  to  $0.8$  V. The emitter-to-collector voltage for a saturated transistor is about  $0.2$  V. Because these values are small, the best way to check them is by connecting a sensitive voltmeter across the junction rather than comparing two voltages taken with respect to ground. If the former method is used, both leads of the voltmeter must be isolated from ground.



If values less than these are obtained, either the device is shorted or no current is flowing in the external circuit. If values exceed the emitter-to-base values given, either the junction is reverse biased or the device is defective. Voltages exceeding those given for typical emitter-to-collector values could indicate either a nonsaturated device operating normally or a defective (open-circuited) transistor. If the device is conducting, voltage will be developed across the resistors in series with it; if it is open, no voltage will be developed across the resistors in series with it, unless current is being supplied by a parallel path.

**CAUTION**

*When checking emitter-to-base junctions, do not use an ohmmeter range that has either a high internal current or voltage. High current or high voltage can damage the transistor. Reverse biasing the emitter-to-base junction with a high current may degrade the transistor's current-transfer ratio (Beta).*

A transistor emitter-to-base junction also can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R X 1 k $\Omega$  range. The junction resistance should be very high in one direction and very low when the meter leads are reversed.

When troubleshooting a field-effect transistor, the voltage across its elements can be checked in the same manner as previously described for other transistors. However, remember that in the normal depletion mode of operation, the gate-to-source junction is reverse biased; in the enhanced mode, the junction is forward biased.

**INTEGRATED CIRCUITS.** An integrated circuit (IC) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is essential to troubleshooting a circuit having an IC. Use care when checking voltages and waveforms around the IC so that adjacent leads are not shorted together. The grabber tip or an IC test clip provides a convenient means of clipping a test probe to an IC.

**CAUTION**

*When checking a diode, do not use an ohmmeter range that has a high internal current. High current can damage the diode. Checks on diodes can be performed in much the same manner as on transistor emitter-to-base junctions; use a dynamic tester, such as the TEKTRONIX 576 Curve Tracer.*

**DIODES.** A diode can be checked for either an open or a shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R X 1 k $\Omega$  range. The diode resistance should be very high in one direction and very low when the meter leads are reversed.

When conducting, silicon diodes should have 0.6 to 0.8 V across their junctions, and schottky diodes should have 0.2 to 0.4 V across their junctions. Higher readings indicate that they are either reverse biased or defective, depending on polarity.

**RESISTORS.** Check resistors with an ohmmeter. Refer to the "Replaceable Electrical parts" list for the tolerances of resistors used in this instrument. A resistor normally does not require replacement unless its measured value varies widely from its specified value and tolerance.

**INDUCTORS.** Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit.

**CAPACITORS.** A leaky or shorted capacitor can best be detected by checking resistance with an ohmmeter set to one of the highest ranges. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after the capacitor is charged to the output voltage of the ohmmeter. An open capacitor can be detected with a capacitance meter or by checking whether the capacitor passes ac signals.

## 10. Repair and Adjust the Circuit

If any defective parts are located, follow the replacement procedures given under "Corrective Maintenance" in this section. After any electrical component has been replaced, the performance for that particular circuit should be checked, as well as the performance of other closely related circuits. Since the power supplies affect all circuits, performance of the entire instrument should be checked if work has been done in any of the power supplies or if the power transformer has been replaced. Readjustment of the affected circuitry may be necessary. Refer to the "Performance Check Procedure" and "Adjustment Procedure" (Sections 4 and 5) and to Table 5-1 (Adjustment Interactions).



# CORRECTIVE MAINTENANCE

## INTRODUCTION

Corrective maintenance consists of component replacement and instrument repair. This part of the manual describes special techniques and procedures required to replace components in this instrument. If it is necessary to ship your instrument to a Tektronix Service Center for repair or service, refer to the "Repackaging for Shipment" instructions at the end of this section.

## MAINTENANCE PRECAUTIONS

To reduce the possibility of personal injury or instrument damage, observe the following precautions.

1. Disconnect the instrument from the ac power input source before removing or installing components.
2. Use care not to interconnect instrument grounds which may be at difference potentials (cross grounding).

## OBTAINING REPLACEMENT PARTS

Most electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can usually be obtained from a local commercial source. Before purchasing or ordering a part from a source other than Tektronix, Inc., please check the "Replaceable Electrical Parts" list (Section 8) for the proper value, rating, tolerance, and description.

### NOTE

*Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade instrument performance.*

### Special Parts

In addition to the standard electronic components, some special parts are used in this instrument. These parts are

manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with our specifications. The various manufacturers can be identified by referring to the "Cross Index-Mfr Code Number to Manufacturer" at the beginning of the "Replaceable Electrical Parts" list. Most of the mechanical parts used in this instrument were 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., be sure to include all of the following information:

1. Instrument type (include modification or option numbers).
2. Instrument serial number.
3. A description of the part (if electrical, include its component number).
4. Tektronix part number.

## MAINTENANCE AIDS

The maintenance aids listed in Table 6-5 include items required for performing most of the maintenance procedures on this instrument. Equivalent product may be substituted for the examples given, provided their characteristics are similar.

## INTERCONNECTIONS

Pin connectors are used to connect wires to the interconnecting pins. They are grouped together and mounted in a plastic holder and should be removed, reinstalled, or replaced as a unit. If an individual wire or connector in the assembly is faulty, the entire cable assembly should be replaced. To provide correct orientation of this multipin connector when it is reconnected to its mating pins, an arrow is stamped on the circuit board, and a matching arrow is molded into the plastic housing of the multipin connector. Be sure these arrows are aligned with each other when the multipin connector is reinstalled.

**Table 6-5**  
**Maintenance Aids**

| Description                 | Specifications                                | Usage   | Example   |
|-----------------------------|---|---|---|
| 1. Soldering Iron           | 15 to 25 W.                                   | General soldering and unsoldering.                      | Antex Precision Model C.  |
| 2. Torx Screwdrivers        | Torx tips #T7, #T9, #T10, #T15 and #T20.      | Assembly and disassembly.                               | Tektronix Part Numbers<br>(#T7) 003-1293-00<br>(#T9) 003-0965-00<br>(#T10) 003-0814-00<br>(#T15) 003-0966-00<br>(#T20) 003-0866-00. |
| 3. Nutdrivers               | 1/4 inch, 5/16 inch, 1/2 inch, and 9/16 inch. | Assembly and disassembly.                               | Xcelite #8, #10, #16, and #18.  |
| 4. Open-end Wrench          | 9/16 inch.                                    | Assembly and disassembly.                               |   |
| 5. Hex Wrenches             | 0.050 inch and 1/16 inch.                     | Assembly and disassembly.                               | Allen Wrenches.   |
| 6. Long-nose Pliers         |   | Component removal and replacement.                      |   |
| 7. Diagonal Cutters         |   | Component removal and replacement.                      |   |
| 8. Vacuum Solder Extractor  | No static charge retention.                   | Unsoldering components.                                 | Pace Model PC-10.   |
| 9. Lubricant                | No-Noise.                                     | Switch lubrication.                                     | Tektronix Part Number 006-0442-02.  |
| 10. Pin-replacement Kit     |   | Replace circuit board connector pins.                   | Tektronix Part Number 040-0542-00.  |
| 11. Isolation Transformer   |   | Isolate the instrument from the ac-power-source outlet. | Tektronix Part Number 006-5953-00.  |
| 12. 1X Probe                |   | Power supply ripple check.                              | TEKTRONIX P6101 Probe (1X). Part Number 010-6101-03.  |
| 13. Bayonet Ground Assembly |   | Signal interconnection.                                 | Tektronix Part Number 013-0085-00.  |

## TRANSISTORS AND INTEGRATED CIRCUITS

Transistors and integrated circuits should not be replaced unless they are actually defective. If unsoldered from the circuit board during routine maintenance, return them to their original board locations. Unnecessary replacement or transposing of semiconductor devices may affect the adjustment of the instrument. When a semiconductor is replaced, check the performance of any instrument circuit that may be affected.

Any replacement components should be of the original type or a direct replacement. Bend transistor leads to fit their circuit board holes and cut the leads to the same length as the original component. See Figure 9-2 for typical lead-configuration illustrations.

To remove a soldered dual-in-line packaged (DIP) IC, do not heat adjacent conductors consecutively. Apply heat to pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

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The heat-sink-mounted power supply transistors are insulated from the heat sink. In addition, a heat-sink compound is used to increase heat transfer capabilities. Reinstall the insulators and replace the heat-sink compound when replacing these transistors. The compound should be applied to both sides of the insulators and should be applied to the bottom side of the transistor where it comes in contact with the insulator.

### NOTE

*After replacing a power transistor, check that the collector is not shorted to the heat sink before applying power to the instrument.*

## SOLDERING TECHNIQUES

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used to remove or replace parts. General soldering techniques, which apply to maintenance of any precision electronic equipment, should be used when working on this instrument.

### WARNING

*To avoid an electric-shock hazard, observe the following precautions before attempting any soldering: turn the instrument off, disconnect it from the ac power source, and allow approximately three minutes for the power-supply capacitors to discharge.*

Use rosin-core wire solder containing 63% tin and 37% lead. Contact your local Tektronix Field Office or representative to obtain the names of approved solder types.

When soldering on circuit boards or small insulated wires, use only a 15- to 25-watt, pencil-type soldering iron. A higher wattage soldering iron can cause etched circuit conductors to separate from the board base material and melt the insulation on small wires. Always keep the soldering-iron tip properly tinned to ensure best heat transfer from the iron tip to the solder joint. To protect heat-sensitive components, either hold the component lead with long-nose pliers or place a heat block between the component body and the solder joint. Apply only enough solder to make a firm joint. After soldering, clean the area around the solder connection with an approved flux-removing solvent (such as isopropyl alcohol) and allow it to air dry.

### CAUTION

*Attempts to unsolder, remove, and resolder leads from the component side of a circuit board may cause damage to the reverse side of the circuit board.*

The following techniques should be used to replace a component on any of the circuit boards:

1. Touch the vacuum desoldering tool to the lead at the solder connection. Never place the iron directly on the board; doing this may damage the board.

### NOTE

*Some components are difficult to remove from the circuit board due to a bend placed in each lead during machine insertion of the component. The purpose of the bent leads is to hold the component in place during a solder-flow manufacturing process that solders all the components at once. To make removal of machine-inserted components easier, straighten the component leads on the reverse side of the circuit board with a small screwdriver or pliers. It may be necessary to remove the circuit board to gain access to the component leads on the reverse side of the circuit board. Circuit-board removal and reinstallation procedures are discussed later in this section.*

2. When removing a multipin component, especially an IC, do not heat adjacent pins consecutively. Apply heat to pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

### CAUTION

*Excessive heat can cause the etched circuit conductors to separate from the circuit board. Never allow the solder extractor tip to remain at one place on the board for more than three seconds. Solder wick, spring-actuated or squeeze-bulb solder suckers, and heat blocks (for desoldering multipin components) must not be used. Damage caused by poor soldering techniques can void the instrument warranty.*

3. To replace the component, bend the leads of the replacement item to fit the holes in the circuit board. If the

component is replaced while the board is installed in the instrument, cut the leads so they protrude only a small amount through the reverse side of the circuit board. Excess lead length may cause shorting to other conductive parts.

4. Insert the leads into the holes of the board so that the replacement component is positioned the same as the original component. Most components should be firmly seated against the circuit board.

5. Touch the soldering iron to the connection and apply enough solder to make a firm solder joint. Do not move the component while the solder hardens.

6. Cut off any excess lead protruding through the circuit board (if not clipped to size in step 3).

7. Clean the area around the solder connection with an approved flux-removing solvent. Be careful not to remove any of the printed information from the circuit board.

## REMOVAL AND REPLACEMENT INSTRUCTIONS

The exploded view drawings in the "Replaceable Mechanical Parts" list (Section 10) may be helpful during the removal and reinstallation of individual subassemblies or components. Circuit board and component locations are shown in the "Diagrams" section.

### WARNING

*To avoid electric shock, disconnect the instrument from the ac-power-input source before removing or replacing any component or assembly.*

### Cabinet

To remove the instrument cabinet, perform the following steps:

1. Disconnect the power cord from the instrument.
2. Remove the screw from the right-rear side of the cabinet and two screws from the rear panel. Then remove the rear panel.

3. Pull the front panel and attached chassis forward and out of the cabinet.

To reinstall the cabinet, perform the following steps:

4. Slide the chassis frame into the cabinet from the front until the cabinet is fully into the front-panel groove and the rear of the cabinet is flush with the rear of the chassis.

5. Align the rear-panel and the side mounting holes with the screw holes in the chassis frame and reinstall the three screws removed in step 2.

### CAUTION

*To ensure that the cabinet is grounded to the instrument chassis, the screw at the right rear side of the cabinet must be tightly secured.*

6. Reconnect the power cord.

### Cathode-Ray Tube

### WARNING

*Use care when handling a crt. Breakage of the crt may cause high-velocity scattering of glass fragments (implosion). Protective clothing and safety glasses should be worn. Avoid striking the crt on any object which may cause it to crack or implode. When storing a crt, either place it in a protective carton or set it face down on a smooth surface in a protected location with a soft mat under the faceplate.*

To remove the crt, perform the following steps:

1. Disconnect four deflection-plate wires at the middle of the crt neck and unplug the Trace Rotation connector (P9006) from the Front-Panel circuit board (note the connection locations and wire colors for reinstallation reference).

### WARNING

*The crt anode lead and the High-Voltage Multiplier output lead retain a high-voltage charge after the instrument is turned off. To avoid electrical shock, disconnect the High-Voltage Multiplier lead from the crt anode lead and ground both leads to the main instrument chassis.*

## Maintenance—2215A Service

2. Unplug the crt anode lead connector from the High-Voltage Multiplier lead located on left side of Power-Supply shield and discharge it to the chassis.

3. Remove two front panel screws that retain the plastic crt frame and light filter to the front panel. Remove the crt frame and light filter from the instrument.

4. With the rear of the instrument facing you, place the fingers of both hands over the front edge of the front subpanel. Then, using both thumbs press forward gently on the crt funnel near the front of the crt. When the crt base pins disengage from the socket, remove the crt and the crt shield through the instrument front subpanel. Place the crt in a safe place until it is ready to reinstall. If the plastic crt corner pads fall out, save them for reinstallation.

5. Remove the crt socket cover and cap from the rear of the crt socket for reinstallation.

To reinstall the crt, perform the following steps:

6. Reinstall any plastic crt corner pads that are out of place. Insert the crt, crt shield, anode lead, and Trace Rotation leads through the front-panel opening. Make sure all pins are straight and that the indexing keys on the crt base, socket, and shield are aligned. Make sure that the ground clip makes contact only with the outside of the crt shield.

7. Push the crt base into the socket. Verify that the crt base and socket are flush together as viewed from the rear and that the crt is seated properly in the front-panel opening.

8. Reinstall the crt socket cap and cover to the rear of the crt socket (removed in step 5).

9. Reinstall the crt frame and light filter; then secure them with two front panel screws (removed in step 3).

10. Reconnect the crt anode lead to the High-Voltage Multiplier (disconnected in step 2).

11. Reconnect the four deflection-plate wires and the Trace Rotation connector (disconnected in step 1).

### Power-Supply Shield

To remove the Power-Supply shield, perform the following steps:

1. Remove the screw from the plastic power-supply cover on the bottom section of the Main circuit board. Press gently on the rear of the cover and slide it forward.

2. Remove the screw securing the Power-Supply shield to the Main circuit board (located at the bottom of the circuit board near the middle right side of the frame).

3. Remove three screws securing the Power-Supply shield to the back of the chassis frame (two located at the left rear of the shield and one located at the upper right rear corner of the shield).

4. Remove the crt anode lead from the anode clip on the side of the Power-Supply shield.

5. Remove the screw from the front upper right-hand corner of the Power-Supply shield.

6. Lift the shield up and out of the chassis frame by removing the right rear corner first.

To reinstall the Power-Supply shield, perform the following steps:

7. Insert the shield into the chassis frame. Make sure that the shield's right and back edges are in their chassis frame guides, that the crt socket-wire assembly is in its cut-out, and that the Alt Sweep board is in its plastic holder.

8. Reinstall the screw at the upper right-hand corner of the shield (removed in step 5).

9. Reinstall the crt anode lead into the anode clip on the side of the Power-Supply shield (removed in step 4).

10. Reinstall three screws securing the shield to the back of the chassis frame (removed in step 3).

11. Reinstall the screw holding the shield to the Main circuit board at the right side of the frame (removed in step 2).

12. Reinstall the plastic power-supply cover on the bottom of the Main circuit board and secure both the shield and the cover with one screw (removed in step 1).



### Filter Circuit Board

To remove the Filter circuit board, perform the following steps:

1. Remove the Power-Supply shield (see the "Power-Supply Shield" removal procedure).

2. Remove the five wires to the Filter circuit board by unsoldering two wires from the Main circuit board, two from the line filter, and one wire from the fuse holder (pull the protective cap completely off the fuse holder before unsoldering).

3. Remove two screws securing the Filter circuit board to the back of the chassis frame. Lift the Filter circuit board out of the instrument.

To reinstall the Filter circuit board, perform the following steps:

4. Reinstall two screws securing the Filter circuit board to the back of the chassis frame (removed in step 3).

5. Resolder the five wires from the Filter circuit board to the Main circuit board, line filter, and fuse holder (unsoldered in step 2).

6. Reinstall the Power-Supply shield (see the "Power-Supply Shield" reinstallation procedure).

### Alt Sweep Circuit Board

To remove the Alt Sweep circuit board, perform the following steps:

1. Use a vacuum-desoldering tool to unsolder the 27 pins (between the Alt Sweep circuit board and the Main circuit board) from the Main circuit board.

2. Remove the Alt Sweep circuit board from the instrument by unclipping it from the plastic holder attached to the Power-Supply shield.

To reinstall the Alt Sweep circuit board, perform the following steps:

3. Insert the 27 pins of the Alt Sweep circuit board into the Main circuit board.

4. Reinstall the Alt Sweep circuit board into the plastic holder attached to the Power-Supply shield.

5. Resolder the 27 pins to the Main circuit board (unsoldered in step 1).

### Attenuator Circuit Board

To remove the Attenuator circuit board, perform the following steps:

1. Use a 1/16-inch Hex-key wrench to loosen the set screws on both the CH 1 and the CH 2 VOLTS/DIV Variable knobs and remove the knobs.

2. Set the CH 1 and the CH 2 VOLTS/DIV switches to the same position. Note switch positions for reinstallation reference; then remove the knobs by pulling them straight out from the front panel.

3. Place the instrument on its side and unsolder the resistors from the CH 1 and CH 2 input connectors.

4. Remove two screws securing the Attenuator board to the subpanel (located underneath the CH 1 and CH 2 input connectors).

5. Remove the following connectors from the Attenuator circuit board, noting their locations for reinstallation reference:

- a. P9103, a four-wire connector located behind the CH 1 VOLTS/DIV switch assembly.
- b. P9108, a four-wire connector located behind the CH 2 VOLTS/DIV switch assembly.
- c. P9091, a three-wire connector located between the Channel 1 and Channel 2 Variable potentiometers at the rear of the Attenuator circuit board.

6. Remove four screws securing the Top shield to both the Attenuator circuit board and the bottom shield.

7. Remove two screws and the ground strap from the rear of the Attenuator circuit board.

8. Pull the Attenuator board straight back from the front of the instrument until the circuit board interconnecting pins are disengaged and the switch shafts are clear of both the Front-Panel circuit board and the two Input Coupling switch shafts (located between the front-panel and the subpanel).



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To reinstall the Attenuator circuit board, perform the following steps:

9. Insert the two VOLTS/DIV switch shafts and the Input Coupling switch shafts into the front panel holes. Ensure that the interconnecting pins are aligned with the Front-Panel circuit board connectors and that the two resistors (soldered to the bottom of the Attenuator circuit board) do not touch the Front-Panel circuit board. Push the Attenuator circuit board forward and, at the same time press the front end of the board down slightly. Align the two Input Coupling switch shafts with the front-panel holes by moving either the Channel 1 or the Channel 2 Input Coupling switch knob.

10. Reinstall two screws and ground strap to the rear of the Attenuator circuit board (removed in step 7).

11. Replace the top shield and reinstall the four screws and ground strap from the rear of the attenuator board to the top shield (removed in step 6).

12. Reconnect three connectors to the Attenuator circuit board disconnected in step 5.

13. Place the instrument on its side and reinstall two screws to the subpanel (removed in step 4).

14. Resolder the resistors to the CH 1 and CH 2 input connectors (disconnected in step 3).

15. Reinstall the two VOLTS/DIV knobs at the positions noted in step 2.

16. Rotate the two Variable control shafts fully clockwise to their calibrated detent positions.

17. Reinstall the Variable knobs onto their shafts (with lettering horizontal and right-side up) and tighten the set screws.

### Timing Circuit Board

To remove the Timing circuit board, perform the following steps.

1. Use a 1/16-inch Hex-key wrench to loosen the set screw of the SEC/DIV Variable knob.

2. Lock the A and B SEC/DIV knobs together and note the position for reinstallation reference. Use a 1/4-inch nut driver to remove the nut securing the B SEC/DIV knob; pull off the knob and collet from the shaft assembly.

3. Use a 1/16-inch Hex-key wrench to loosen two set screws securing the A SEC/DIV dial to the shaft assembly.

4. Remove the following connectors from the Timing circuit board.

a. P9705, an eight-wire connector located at the rear of the Timing circuit board.

b. P9700, a 10-wire connector located on the right edge of the Timing circuit board.

5. Remove one screw at the rear of the Attenuator circuit board (securing both the Attenuator and the Timing circuit boards to the Bottom shield).

6. Remove the remaining three screws securing the Timing circuit board to the Bottom shield.

7. Pull the Timing circuit board straight back from the front of the instrument until the circuit board interconnecting pins are disengaged and the switch shaft is clear of the Front-Panel circuit board.

To reinstall the Timing circuit board, perform the following steps:

8. Insert the SEC/DIV switch shaft through the hole in the Front-Panel circuit board, ensuring that the interconnecting pins are aligned with the Front-Panel connectors. Push the Timing circuit board forward into position.

9. Reinstall three screws securing the Timing circuit board to the bottom shield (removed in step 6).

10. Reinstall the remaining screw at the rear of the Attenuator circuit board securing both the Attenuator and the Timing circuit boards to the bottom shield (removed in step 5).

11. Reconnect two connectors to the Timing circuit board (disconnected in step 4).

12. Reinstall the A SEC/DIV dial in the position noted in step 3 and secure it with two set screws.

13. Reinstall the collet and the B SEC/DIV knob at the position noted in step 2 and secure it with the nut.

14. Reinstall the SEC/DIV Variable knob onto its shaft (with lettering horizontal and right-side up) and tighten the set screw.

### Bottom Shield, Attenuator and Timing Circuit-Board Module

Removal of the module consisting of the Bottom shield and the Attenuator and Timing circuit boards is accomplished by the following steps:

1. Perform steps 1 through 5 under the "Attenuator Circuit Board" removal procedure.

2. Perform steps 1 through 4 under the "Timing Circuit Board" removal.

3. Place the instrument on its side and remove four screws holding the Bottom shield to the Main circuit board.

4. Pull the Bottom shield, along with the Attenuator and Timing circuit boards straight back from the front of the instrument until the interconnecting pins on both circuit boards are disengaged and the switch shafts are clear of the holes in the Front-Panel circuit board; then lift out the entire assembly through the top of the instrument.

5. If accessibility to the bottom of either the Attenuator or the Timing circuit board is desired, refer to steps 6 and 7 of the "Attenuator Circuit Board" removal procedure and to steps 5 and 6 of the "Timing Circuit Board" removal procedure.

To reinstall the Bottom shield-Attenuator-Timing assembly, perform the following steps:

6. If one or both of the circuit boards was removed, reinstall the circuit board(s) to the Bottom shield by referring to steps 10 and 11 of the "Attenuator Circuit Board" reinstallation procedure and to steps 9 and 10 of the "Timing Circuit Board" reinstallation procedure.

7. Insert the three switch shafts through the holes in both the Front-Panel circuit board and the front panel (refer to the "Attenuator Circuit Board" and the "Timing Circuit Board" reinstallation procedures).

8. Reinstall the four screws holding the Bottom shield to the Main circuit board (removed in step 3).

9. Complete reinstallation of the module by performing steps 12 through 17 of the "Attenuator Circuit Board" reinstallation procedure and steps 11 through 14 of the "Timing Circuit Board" reinstallation procedure.

### Front-Panel Circuit Board

1. Remove the crt (see the "Cathode-Ray Tube" removal procedure).

2. Remove the Bottom shield, Attenuator, and Timing circuit-board module (see the preceding removal procedure).

3. Remove the knobs from the following control shafts by pulling them straight out from the front panel:

- a. Channel 1 and Channel 2 POSITION,
- b. A/B SWP SEP,
- c. Horizontal POSITION,
- d. A TRIGGER LEVEL,
- e. B TRIGGER LEVEL.

4. Unsolder both the resistor to the EXT INPUT center connector and the wire strap to the EXT INPUT ground lug.

5. Unsolder the single wire from the PROBE ADJUST connector and the two wires from the VAR HOLDOFF control (leading to the Front-Panel circuit board).

6. Remove the following screws:

- a. Three screws securing the upper part of the Front-Panel circuit board to the front panel.
- b. Two recessed frame-securing screws at the left-rear corner of the chassis frame.
- c. Two screws holding the Main circuit board to the chassis frame.
- d. One screw securing the delay line to the chassis frame on the left side of the instrument.
- e. Two recessed frame-securing screws at the right front corner.

7. Pull the front-left frame assembly apart from the rear-right frame assembly.

**NOTE**

*At this point, any component on the Front-Panel circuit board may be accessed for removal and replacement. Skip to step 11 of this procedure after component replacement. If circuit board replacement is intended, continue with the remaining disassembly steps.*

8. Use a vacuum-desoldering tool to unsolder the 39 wire straps from the Main circuit board (connecting to the Front-Panel circuit board).

9. Remove the Front-Panel circuit board from the instrument and clean the wire-strap holes on the Main circuit board of any remaining solder.

**NOTE**

*If a vacuum-desoldering tool is not available, lift each strap out of the Main circuit board as the joint is heated.*

To reinstall the Front-Panel circuit board, perform the following steps:

10. Insert and resolder the 39 wire straps on the Front-Panel circuit board into their corresponding holes in the Main circuit board (unsoldered in step 8).

11. Align the two chassis frame assemblies disassembled in step 7, making sure the POWER switch extension-shaft button is properly placed in the front panel.

12. Reinstall four chassis-frame securing screws, two screws securing the Main circuit board to the chassis frame, and one screw securing the delay line to the chassis frame (removed in step 6, parts b through e).

13. Push the Front-Panel circuit board forward and insert the control shafts, push buttons, and three-position slide switches into their corresponding front-panel holes.

14. Reinstall three screws securing the Front-Panel circuit board to the front-panel (removed in step 6, part a).

15. Resolder the single wire to the PROBE ADJUST connector and the two wires to the VAR HOLDOFF control (unsoldered in step 5).

16. Resolder the resistor to the EXT INPUT center connector and the wire strap to the EXT INPUT ground lug (unsoldered in step 4).

17. Replace the front-panel knobs (removed in step 3).

18. Reinstall the Bottom shield, Attenuator, and Timing circuit-board module (see the preceding reinstallation procedure).

19. Reinstall the crt (see the "Cathode-Ray Tube" reinstallation procedure).

**Main Circuit Board**

All components on the Main circuit board are accessible either directly or by removing either the crt, the Bottom shield, Attenuator, Timing circuit-board module, or the Power-Supply shield. Removal of the Main circuit board is required only when it is necessary to replace the board with a new one.

To remove the Main circuit board, perform the following steps:

1. Disconnect the three-wire B DELAY TIME POSITION potentiometer connector (P4644) from the Main circuit board (located in front of the Power-Supply shield).

2. Remove the Alt Sweep circuit board (see "Alt Sweep Circuit Board" removal procedure).

3. Remove the Power-Supply shield and plastic power-supply cover (see "Power-Supply Shield" removal procedure).

4. Unsolder five wires from the Filter circuit board (leading to the Main circuit board).

5. Remove connectors from the Attenuator and Timing circuit boards, noting their locations for reinstallation reference.

6. Remove the FOCUS control shaft assembly by pulling it straight out from the front panel.

7. Remove the POWER switch extension-shaft assembly by first pressing in the POWER button to the ON position. Then insert a scribe (or similar tool) into the notch between the end of the switch shaft and the end of the extension shaft and gently pry the connection apart. Push the extension shaft forward, then sideways, to clear the switch shaft. Finally, pull the extension shaft back and out of the instrument.

8. Disconnect P9001 and P9002 from the rear of the Main circuit board near the fuse holder.

9. Unsolder the rear-panel EXT Z AXIS connector wire from the Main circuit board.

10. Remove two screws securing the power-supply transistor heat-sink assembly (at the right side of the chassis frame).

**WARNING**

*The crt anode lead and the output terminal to the High-Voltage Multiplier will retain a high-voltage charge after the instrument is turned off. To avoid electrical shock, ground the crt side of the anode lead to the main instrument chassis.*

11. Disconnect the crt anode lead from the High-Voltage Multiplier anode lead by carefully pulling the anode plug out of the jack. Discharge the plug tip to the chassis.

12. Unsolder two sets of crt socket wires from the Main circuit board, noting wire color and position for reinstallation reference.

13. Unsolder two sets of delay-line wires from the Main circuit board, noting wire color and position for reinstallation reference.

14. Remove three screws securing the Bottom shield to the Main circuit board.

15. Remove three screws securing the Main circuit board to the instrument chassis frame (one under the EXT Z AXIS connector and two along the left side of the Main circuit board).

16. Use a vacuum-desoldering tool to unsolder the 39 wire straps (connecting the Main circuit board to the Front-Panel circuit board) from the Main circuit board.

**NOTE**

*If a vacuum-desoldering tool is not available, lift each wire strap out of the Main circuit board as the joint is heated. Use care to maintain, as nearly as possible, the original shape and spacing of the wire straps to facilitate replacing the circuit board.*

17. Push the wire-strap connection end of the Main circuit board down until it is clear of all wire strap ends; then remove it through the bottom of the instrument frame. Ensure that the wire straps are not bent out of place.

To replace the Main circuit board, use the following procedure:

18. Place the Main circuit board into the chassis frame, ensuring that the board is in the guides at the rear and right side of the frame and that the 39 wire straps from the Front-Panel circuit board are inserted into their corresponding holes.

19. Reinstall three screws securing the Main circuit board to the chassis frame (removed in step 15).

20. Resolder 39 wire straps to the Main circuit board.

21. Reinstall three screws holding the bottom shield to the Main circuit board (removed in step 14).

22. Resolder two sets of delay-line wires at the locations noted in step 13.

23. Resolder two sets of crt socket wires at the locations noted in step 12.

24. Reconnect the crt anode lead to the High-Voltage Multiplier anode lead (disconnect in step 11).

25. Reinstall two securing screws in the power-supply transistor heat sink assembly (removed in step 10).

26. Insert and resolder the EXT Z AXIS connector wire into the Main circuit board (removed in step 9).

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27. Reconnect P9001 and P9002 to the Main circuit board (removed in step 8).

28. Insert the POWER switch extension-shaft assembly into the front panel (from the rear). Push the POWER switch to the ON lock position and align the extension shaft with the switch shaft. Press them together gently until they snap into place.

29. Reinstall the FOCUS control shaft assembly (removed in step 6).

30. Reconnect the connectors to the Attenuator and Timing circuit boards (removed in step 5).

31. Resolder five wires from the Filter circuit board to the Main circuit board (unsoldered in step 4).

32. Reinstall the Power-Supply shield and plastic power-supply cover (see "Power-Supply Shield" reinstallation procedure).

33. Reinstall the Alt Sweep circuit board (see "Alt Sweep Circuit Board" reinstallation procedure).

34. Reconnect the B DELAY TIME POSITION potentiometer connector (P9644) to the Main circuit board (disconnected in step 1).

## REPACKAGING FOR SHIPMENT

If the instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm

that can be contacted. Include complete instrument serial number and a description of the service required.

Save and reuse 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 its finish. Obtain a carton of corrugated cardboard having a carton test strength of 275 pounds 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.

## SELECTABLE COMPONENTS

If desired, the trigger-system bandwidth of the oscilloscope may be reduced from the normal 10 MHz to frequencies shown in Table 6-6. To alter the bandwidth, remove C419 (component number A1C419 on Diagram 3) from the Main Circuit Board using the steps in the "Soldering Techniques" part of the "Maintenance" section. The capacitor should be replaced with a non-polarized type such as a disc-ceramic or equivalent.

Table 6-6  
Trigger Bandwidth Alteration

| Trigger Bandwidth | Capacitor Value |
|-------------------|-----------------|
| 10 MHz            | 390 pF          |
| 5 MHz             | 750 pF          |
| 1 MHz             | 3300 pF         |
| 50 kHz            | 0.068 $\mu$ F   |
| 10 kHz            | 0.33 $\mu$ F    |



# OPTIONS

There are currently no options for the 2215A, except the optional power cords previously described in Section 2.

# 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.

### LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

### CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

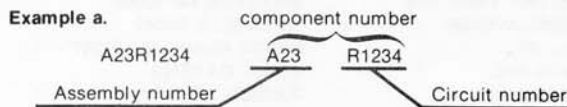
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

### ABBREVIATIONS

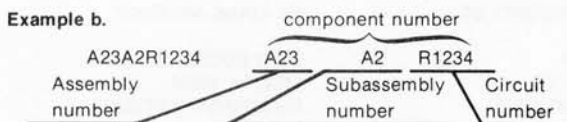
Abbreviations conform to American National Standard Y1.1.

### COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



**Read: Resistor 1234 of Assembly 23**



**Read: Resistor 1234 of Subassembly 2 of Assembly 23**

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

### TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

### SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

### NAME & DESCRIPTION (column five of the Electrical Parts List)

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.

### MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

### MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer   | Address                                   | City, State, Zip                           |
|-----------|--|---|--|
| 000FG     | RIFA WORLD PRODUCTS INC.   | 7625 BUSH LAKE RD<br>P.O. BOX 35263       | MINNEAPOLIS, MN 55435                      |
| 000LI     | TOPTRON CORP   |   | TOKYO, JAPAN                               |
| 00779     | AMP, INC.  | P.O. BOX 3608                             | HARRISBURG, PA 17105                       |
| 00853     | SANGAMO ELECTRIC CO., S. CAROLINA DIV.   | P.O. BOX 128                              | PICKENS, SC 29671                          |
| 01121     | ALLEN-BRADLEY COMPANY  | 1201 2ND STREET SOUTH                     | MILWAUKEE, WI 53204                        |
| 01281     | TRW ELECTRONIC COMPONENTS, SEMICONDUCTOR OPERATIONS                            |   |  |
| 01295     | TEXAS INSTRUMENTS, INC.<br>SEMICONDUCTOR GROUP                                 | 14520 AVIATION BLVD.<br><br>P.O. BOX 5012 | LAWNDALE, CA 90260<br><br>DALLAS, TX 75222 |
| 02113     | COILCRAFT INC.   | 1102 SILVER LAKE RD.                      | CARY, IL 60013                             |
| 02114     | FERROXCUBE CORPORATION   | PO BOX 359, MARION ROAD                   | SAUGERTIES, NY 12477                       |
| 02735     | RCA CORPORATION, SOLID STATE DIVISION  | ROUTE 202                                 | SOMERVILLE, NY 08876                       |
| 03508     | GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT                   | ELECTRONICS PARK                          | SYRACUSE, NY 13201                         |
| 04222     | AVX CERAMICS, DIVISION OF AVX CORP.  | P O BOX 867                               | 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                    |
| 07716     | TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, BURLINGTON DIV.                | 2850 MT. PLEASANT<br>230 ADRIAN RD.       | BURLINGTON, IA 52601<br>MILLBRAE, CA 94030 |
| 08057     | MAGNETICS DIV OF SPANG INDST. INC.   | LOWER WASHINGTON STREET                   | DOVER, NH 03820                            |
| 12697     | CLAROSTAT MFG. CO., INC.   | 580 PLEASANT STREET                       | WATERTOWN, MA 02172                        |
| 12969     | UNITRODE CORPORATION   |   | LOS GATOS, CA 95030                        |
| 13511     | AMPHENOL CARDRE DIV., BUNKER RAMO CORP.  |   |  |
| 14433     | ITT SEMICONDUCTORS   | 3301 ELECTRONICS WAY<br>P O BOX 3049      | WEST PALM BEACH, FL 33402                  |
| 14552     | MICRO SEMICONDUCTOR CORP.  | 2830 E FAIRVIEW ST.                       | SANTA ANA, CA 92704                        |
| 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. |   |  |
| 15454     | RODAN INDUSTRIES, INC.   | P.O. BOX 168, 500 BROADWAY                | LAWRENCE, MA 01841                         |
| 18324     | SIGNETICS CORP.  | 2905 BLUE STAR ST.                        | ANAHEIM, CA 92806                          |
| 19396     | ILLINOIS TOOL WORKS, INC. PAKTRON DIV.   | 811 E. ARQUES                             | SUNNYVALE, CA 94086                        |
| 20462     | PREM ENTERPRISES, INC.   | 900 FOLLIN LANE, SE                       | VIENNA, VA 22180                           |
| 22229     | SOLITRON DEVICES, INC., SEMICONDUCTOR GROUP                                    | 3519 N. CHAPEL HILL                       | MCHENRY, IL 60050                          |
| 22526     | BERG ELECTRONICS, INC.   | 8808 BALBOA AVENUE                        | SAN DIEGO OPERS, CA 92123                  |
| 24546     | CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION                            | YOUK EXPRESSWAY                           | NEW CUMBERLAND, PA 17070                   |
| 27014     | NATIONAL SEMICONDUCTOR CORP.   | 550 HIGH STREET                           | BRADFORD, PA 16701                         |
| 32997     | BOURNS, INC., TRIMPOT PRODUCTS DIV.  | 2900 SEMICONDUCTOR DR.                    | SANTA CLARA, CA 95051                      |
| 50157     | MIDWEST COMPONENTS INC.  | 1200 COLUMBIA AVE.<br>P. O. BOX 787       | RIVERSIDE, CA 92507                        |
| 51984     | NEC AMERICA INC. RADIO AND TRANSMISSION DIV.                                   | 1981 PORT CITY BLVD.                      | MUSKEGON, MI 49443                         |
| 53184     | XCITON CORPORATION   | 2990 TELESTAR CT. SUITE 212               | FALLS CHURCH, VA 22042                     |
| 54473     | MATSUSHITA ELECTRIC, CORP. OF AMERICA  | 5 HEMLOCK STREET                          | LATHAM, NY 12110                           |
| 54583     | TDK ELECTRONICS CORP.  | 1 PANASONIC WAY                           | SECAUCUS, NJ 07094                         |
| 54937     | DEYOUNG MFG., INC.   | 755 EASTGATE BLVD.                        | GARDEN CITY, NY 11530                      |
| 55680     | NICHICON/AMERICA/CORP.   | PO BOX 1806, 1517 130TH AVE.              | BELLEVUE, WA 98009                         |
| 56289     | SPRAGUE ELECTRIC CO.   | 6435 N PROESEL AVENUE                     | CHICAGO, IL 60645                          |
| 57668     | R-OHM CORP.  | 87 MARSHALL ST.                           | NORTH ADAMS, MA 01247                      |
| 59660     | TUSONIX INC.   | 16931 MILLIKEN AVE.                       | IRVINE, CA 92713                           |
| 59821     | CENTRALAB INC<br>SUB NORTH AMERICAN PHILIPS CORP                               | 2155 N FORBES BLVD                        | TUCSON, AZ 85705                           |
| 71279     | CAMBRIDGE THERMIONIC CORP.   | 7158 MERCHANT AVE                         | EL PASO, TX 79915                          |
| 71400     | BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.                                    | 445 CONCORD AVE.                          | CAMBRIDGE, MA 02138                        |
| 71590     | CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.                               | 2536 W. UNIVERSITY ST.                    | ST. LOUIS, MO 63107                        |
| 72982     | ERIE TECHNOLOGICAL PRODUCTS, INC.  | P O BOX 858                               | FORT DODGE, IA 50501                       |
| 73138     | BECKMAN INSTRUMENTS, INC., HELIPOT DIV.  | 644 W. 12TH ST.                           | ERIE, PA 16512                             |
| 75042     | TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION          | 2500 HARBOR BLVD.                         | FULLERTON, CA 92634                        |
| 77820     | BENDIX CORP., THE, ELECTRICAL COMPONENTS DIVISION                              | 401 N. BROAD ST.                          | PHILADELPHIA, PA 19108                     |
| 80009     | TEKTRONIX, INC.  | SHERMAN AVE.<br>P O BOX 500               | SIDNEY, NY 13838<br>BEAVERTON, OR 97077    |

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer  | Address                                    | City, State, Zip            |
|-----------|---|--|-----------------------------|
| 80031     | ELECTRA-MIDLAND CORP., MEPCO DIV.                             | 22 COLUMBIA ROAD                           | MORRISTOWN, NJ 07960        |
| 82104     | STANDARD GRIGSBY CO., DIV. OF SUN<br>CHEMICAL CORPORATION     | 920 RATHBONE AVENUE                        | AURORA, IL 60507            |
| 82389     | SWITCHCRAFT, INC.   | 5555 N. ELSTON AVE.                        | CHICAGO, IL 60630           |
| 90201     | MALLORY CAPACITOR CO., DIV. OF<br>P. R. MALLORY AND CO., INC. | 3029 E. WASHINGTON STREET<br>P. O. BOX 372 | INDIANAPOLIS, IN 46206      |
| 91637     | DALE ELECTRONICS, INC.  | P. O. BOX 609                              | COLUMBUS, NE 68601          |
| 96733     | SAN FERNANDO ELECTRIC MFG CO                                  | 1501 FIRST ST                              | SAN FERNANDO, CA 91341      |
| D5243     | ROEDERSTEIN E SPEZIALFABRIK FUER<br>KONDENSTATOREN GMBH       | LUDMILLA STRASSE 23-25                     | 8300 LANDSHUT, GERMANY      |
| S4431     | MURATA MFG. CO. LTD.  | 16 KAIJEN NISHIJM CHO                      | NAGAOKAYO KYOTO, JAPAN      |
| T0020     | UNITED CHEMI-CON INC.   | 1128 LEXINGTON AVE.                        | ROCHESTER, NY 14606         |
| T1339     | COMPONENT WEST PREM MAGNETICS INC.                            | 3521 N CHAPEL SPACE HILL RD.               | MCHENRY, IL 60050           |
| T1394     | MURATA ERIE NORTH AMERICAN INC                                | 1148 FRANKLIN RD SE                        | MARIETTA, GA 30067          |
| T1442     | TAIYO-YUDEN (USA) INC ARLINGTON CENTER                        | 714 W ALGONQUIN                            | ARLINGTON HEIGHTS, IL 60005 |
| T1557     | TEKA PRODUCTS, INC.   | 45 SALEM ST.                               | PROVIDENCE, RI 02907        |

# Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. |         | Name & Description                   | Mfr Code | Mfr Part Number  |
|---------------|--------------------|------------------|---------|--------------------------------------|----------|------------------|
|               |                    | Eff              | Dscont  |                                      |          |                  |
| ASSEMBLIES    |                    |                  |         |                                      |          |                  |
| A1            | 670-8284-00        | B010100          | B011899 | CKT BOARD ASSY:MAIN                  | 80009    | 670-8284-00      |
| A1            | 670-8284-01        | B011900          |         | CKT BOARD ASSY:MAIN                  | 80009    | 670-8284-01      |
| A2            | 672-0086-00        |                  |         | CKT BOARD ASSY:ATTENUATOR            | 80009    | 672-0086-00      |
| A2A1          | 670-8267-XX        |                  |         | CKT BOARD ASSY:ATTENUATOR            |          |                  |
|               |                    |                  |         | (NOT REPLACEABLE,USE A2)             |          |                  |
| A3            | 670-8286-00        |                  |         | CKT BOARD ASSY:FRONT PANEL           | 80009    | 670-8286-00      |
| A4            | 670-8285-00        |                  |         | CKT BOARD ASSY:TIMING                | 80009    | 670-8285-00      |
| A5            | 670-8287-00        |                  |         | CKT BOARD ASSY:ALTERNATE SWEEP       | 80009    | 670-8287-00      |
| A6            | 670-7615-00        |                  |         | CKT BOARD ASSY:EMI FILTER BOARD      | 80009    | 670-7615-00      |
| A1 MAIN       |                    |                  |         |                                      |          |                  |
| A1            | 670-8284-00        | B010100          | B011899 | CKT BOARD ASSY:MAIN                  | 80009    | 670-8284-00      |
|               | 670-8284-01        | B011900          |         | CKT BOARD ASSY:MAIN                  | 80009    | 670-8284-01      |
| A1C114        | 281-0767-00        |                  |         | CAP.,FXD,CER DI:330PF,20%,100V       | 12969    | CGB331MEN        |
| A1C115        | 281-0767-00        |                  |         | CAP.,FXD,CER DI:330PF,20%,100V       | 12969    | CGB331MEN        |
| A1C116        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C125        | 281-0772-00        |                  |         | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C126        | 283-0114-00        |                  |         | CAP.,FXD,CER DI:0.0015UF,5%,200V     | 59660    | 805534Y5D0152J   |
| A1C130        | 283-0642-00        |                  |         | CAP.,FXD,MICA D:33PF,+/-0.5PF,300V   | 00853    | D10-5E330G       |
| A1C133        | 281-0785-00        |                  |         | CAP.,FXD,CER DI:68PF,10%,100V        | 04222    | GC101A680K       |
| A1C164        | 281-0767-00        |                  |         | CAP.,FXD,CER DI:330PF,20%,100V       | 12969    | CGB331MEN        |
| A1C165        | 281-0767-00        |                  |         | CAP.,FXD,CER DI:330PF,20%,100V       | 12969    | CGB331MEN        |
| A1C175        | 281-0772-00        |                  |         | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C176        | 283-0114-00        |                  |         | CAP.,FXD,CER DI:0.0015UF,5%,200V     | 59660    | 805534Y5D0152J   |
| A1C180        | 283-0642-00        |                  |         | CAP.,FXD,MICA D:33PF,+/-0.5PF,300V   | 00853    | D10-5E330G       |
| A1C200        | 290-0136-00        |                  |         | CAP.,FXD,ELCTLT:2.2UF,20%,20V        | 56289    | 162D225X0020CD2  |
| A1C201        | 290-0136-00        |                  |         | CAP.,FXD,ELCTLT:2.2UF,20%,20V        | 56289    | 162D225X0020CD2  |
| A1C210        | 281-0511-00        |                  |         | CAP.,FXD,CER DI:22PF,+/-2.2PF,500V   | 59660    | 301-000C0G0220K  |
| A1C215        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C220        | 281-0772-00        |                  |         | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C225        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C226        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C228        | 281-0630-00        |                  |         | CAP.,FXD,CER DI:390PF,5%,500V        | 72982    | 630000Y5D391J    |
| A1C229        | 281-0630-00        |                  |         | CAP.,FXD,CER DI:390PF,5%,500V        | 72982    | 630000Y5D391J    |
| A1C237        | 281-0140-00        |                  |         | CAP.,VAR,CER DI:5-25PF,100V          | 59660    | 518-023A 5-25    |
| A1C239        | 281-0776-00        |                  |         | CAP.,FXD,CER DI:120PF,5%,500V        | 04222    | SA101A121JAA     |
| A1C240        | 283-0331-00        |                  |         | CAP.,FXD,CER DI:43PF,2%,100V         | 59660    | 0805536C0G0-430G |
| A1C241        | 281-0816-00        |                  |         | CAP.,FXD,CER DI:82PF,5%,100V         | 96733    | R3247            |
| A1C242        | 281-0812-00        |                  |         | CAP.,FXD,CER DI:1000PF,10%,100V      | 04222    | MA101C102KAA     |
| A1C250        | 281-0768-00        |                  |         | CAP.,FXD,CER DI:470PF,20%,100V       | 56289    | 292CC0G471M100B  |
| A1C251        | 281-0768-00        |                  |         | CAP.,FXD,CER DI:470PF,20%,100V       | 56289    | 292CC0G471M100B  |
| A1C255        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C262        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C274        | 281-0773-00        |                  |         | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C281        | 281-0775-00        |                  |         | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C292        | 290-0776-00        |                  |         | CAP.,FXD,ELCTLT:22UF,+50-10%,10V     | 55680    | ULA1A220TEA      |
| A1C312        | 281-0895-00        |                  |         | CAP.,FXD,CER DI:6.8PF,100W VDC       | 04222    | MA101A6R8DAA     |
| A1C337        | 281-0895-00        |                  |         | CAP.,FXD,CER DI:6.8PF,100W VDC       | 04222    | MA101A6R8DAA     |
| A1C363        | 281-0862-00        |                  |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |



Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                   | Mfr Code | Mfr Part Number  |
|---------------|--------------------|-----------------------------|--------------------------------------|----------|------------------|
| A1C369        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C381        | 283-0663-00        |                             | CAP.,FXD,MICA D:16.8PF,+/-0.5PF,500V | 00853    | D155C16R8D0      |
| A1C389        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C390        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C392        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C396        | 283-0203-00        |                             | CAP.,FXD,CER DI:0.47UF,20%,50V       | 04222    | 5R305SE474MAA    |
| A1C397        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C405        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C408        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C414        | 290-0246-00        |                             | CAP.,FXD,ELCTLT:3.3UF,10%,15V        | 56289    | 173D335X9015V    |
| A1C415        | 290-0246-00        |                             | CAP.,FXD,ELCTLT:3.3UF,10%,15V        | 56289    | 173D335X9015V    |
| A1C418        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C419        | 281-0768-00        |                             | CAP.,FXD,CER DI:470PF,20%,100V       | 56289    | 292CC0G471M100B  |
| A1C420        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C421        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C451        | 281-0772-00        |                             | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C453        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C459        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C473        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C479        | 281-0895-00        |                             | CAP.,FXD,CER DI:6.8PF,100V VDC       | 04222    | MA101A6R8DAA     |
| A1C480        | 281-0772-00        |                             | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C494        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C499        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C500        | 281-0893-00        |                             | CAP.,FXD,CER DI:4.7PF,+/-0.5PF,100V  | 04222    | MA101A4R7DAA     |
| A1C501        | 290-0246-00        |                             | CAP.,FXD,ELCTLT:3.3UF,10%,15V        | 56289    | 173D335X9015V    |
| A1C502        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C503        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C504        | 290-0246-00        |                             | CAP.,FXD,ELCTLT:3.3UF,10%,15V        | 56289    | 173D335X9015V    |
| A1C505        | 290-0183-00        |                             | CAP.,FXD,ELCTLT:1UF,10%,35V          | 90201    | TAC105K035P02    |
| A1C506        | 281-0772-00        |                             | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C507        | 290-0776-00        |                             | CAP.,FXD,ELCTLT:22UF,+50-10%,10V     | 55680    | ULA1A220TEA      |
| A1C517        | 281-0772-00        |                             | CAP.,FXD,CER DI:0.0047UF,10%,100V    | 04222    | GC701C472K       |
| A1C518        | 281-0852-00        |                             | CAP.,FXD,CER DI:1800PF,10%,100VDC    | 04222    | GC101C182KAA.    |
| A1C519        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C520        | 290-0246-00        |                             | CAP.,FXD,ELCTLT:3.3UF,10%,15V        | 56289    | 173D335X9015V    |
| A1C525        | 281-0895-00        |                             | CAP.,FXD,CER DI:6.8PF,100V VDC       | 04222    | MA101A6R8DAA     |
| A1C527        | 281-0797-00        |                             | CAP.,FXD,CER DI:15PF,10%,100V        | 72982    | 8035D9AADC0G150K |
| A1C529        | 281-0785-00        |                             | CAP.,FXD,CER DI:68PF,10%,100V        | 04222    | GC101A680K       |
| A1C531        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C537        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C538        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C539        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C540        | 290-0776-00        |                             | CAP.,FXD,ELCTLT:22UF,+50-10%,10V     | 55680    | ULA1A220TEA      |
| A1C545        | 283-0119-00        |                             | CAP.,FXD,CER DI:2200PF,5%,200V       | 59660    | 855-536Y5E0222J  |
| A1C547        | 281-0767-00        |                             | CAP.,FXD,CER DI:330PF,20%,100V       | 12969    | CGB331MEN        |
| A1C553        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C561        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C565        | 281-0768-00        |                             | CAP.,FXD,CER DI:470PF,20%,100V       | 56289    | 292CC0G471M100B  |
| A1C590        | 290-0136-00        |                             | CAP.,FXD,ELCTLT:2.2UF,20%,20V        | 56289    | 162D225X0020CD2  |
| A1C603        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C627        | 281-0895-00        |                             | CAP.,FXD,CER DI:6.8PF,100V VDC       | 04222    | MA101A6R8DAA     |
| A1C635        | 281-0826-00        |                             | CAP.,FXD,CER DI:2200PF,5%,100V       | 12969    | CGB222KEX        |
| A1C646        | 290-0776-00        |                             | CAP.,FXD,ELCTLT:22UF,+50-10%,10V     | 55680    | ULA1A220TEA      |
| A1C647        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |

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| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                   | Mfr Code | Mfr Part Number  |
|---------------|--------------------|-----------------------------|--------------------------------------|----------|------------------|
| A1C648        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C649        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V | 04222    | GC70-1E102M      |
| A1C673        | 281-0797-00        |                             | CAP.,FXD,CER DI:15PF,10%,100V        | 72982    | 8035D9AADC0G150K |
| A1C764        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C770        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C775        | 281-0214-00        |                             | CAP.,VAR,CER DI:0.5-3PF,400V         | 80031    | 2502A0R503VP02F0 |
| A1C777        | 281-0771-00        |                             | CAP.,FXD,CER DI:0.0022UF,20%,200V    | 56289    | 292C Z5U222M200B |
| A1C779        | 285-1101-00        |                             | CAP.,FXD,PLSTC:0.022UF,10%,200V      | 19396    | 223K02PT485      |
| A1C780        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C782        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C785        | 281-0661-00        |                             | CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V  | 04222    | 7001-COK-OR8B    |
| A1C787        | 281-0771-00        |                             | CAP.,FXD,CER DI:0.0022UF,20%,200V    | 56289    | 292C Z5U222M200B |
| A1C789        | 285-1101-00        |                             | CAP.,FXD,PLSTC:0.022UF,10%,200V      | 19396    | 223K02PT485      |
| A1C796        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C797        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C799        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C824        | 281-0785-00        |                             | CAP.,FXD,CER DI:68PF,10%,100V        | 04222    | GC101A680K       |
| A1C825        | 281-0767-00        |                             | CAP.,FXD,CER DI:330PF,20%,100V       | 12969    | CGB331MEN        |
| A1C828        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C832        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C835        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C845        | 281-0771-00        |                             | CAP.,FXD,CER DI:0.0022UF,20%,200V    | 56289    | 292C Z5U222M200B |
| A1C847        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C849        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C851        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C853        | 281-0791-00        |                             | CAP.,FXD,CER DI:270PF,10%,100V       | 04222    | MA101A271KAA     |
| A1C854        | 283-0279-00        |                             | CAP.,FXD,CER DI:0.001UF,20%,3000V    | 59660    | 878-521-S-Y5S-10 |
| A1C855        | 285-1255-00        |                             | CAP.,FXD,PLASTI:0.01UF,20%,3KV       | 56289    | 430P582          |
| A1C871        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C873        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C875        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C877        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C879        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C893        | 283-0279-00        |                             | CAP.,FXD,CER DI:0.001UF,20%,3000V    | 59660    | 878-521-S-Y5S-10 |
| A1C904        | 285-1192-00        |                             | CAP.,FXD,PPR DI:0.0022UF,20%,250VAC  | 000FG    | PME271Y422       |
| A1C906        | 290-0978-00        |                             | CAP.,FXD,ELCTLT:75UF,+50-10%,450V    | 56289    | 17D1149          |
| A1C907        | 285-0932-00        |                             | CAP.,FXD,PLSTC:1UF,10%,400V          | 14752    | 230B1E105K       |
| A1C908        | 283-0481-00        |                             | CAP.,FXD,CER DI:220PF,10%,250 VAC    | T1394    | DE7090B221KVA1-K |
| A1C917        | 281-0812-00        |                             | CAP.,FXD,CER DI:1000PF,10%,100V      | 04222    | MA101C102KAA     |
| A1C919        | 281-0852-00        |                             | CAP.,FXD,CER DI:1800PF,10%,100VDC    | 04222    | GC101C182KAA.    |
| A1C922        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C925        | 290-0973-00        |                             | CAP.,FXD,ELCTLT:100UF,20%,25VDC      | T0020    | SM25VB100M       |
| A1C940        | 290-0922-00        |                             | CAP.,FXD,ELCTLT:1000UF,+50-10%,50V   | 55680    | ULB1E102TFAANA   |
| A1C941        | 283-0057-00        |                             | CAP.,FXD,CER DI:0.1UF,+80-20%,200V   | 56289    | 2C20Z5U104Z200B  |
| A1C942        | 290-0768-00        |                             | CAP.,FXD,ELCTLT:10UF,+50-10%,100V    | 54473    | ECE-A100V10L     |
| A1C943        | 290-0768-00        |                             | CAP.,FXD,ELCTLT:10UF,+50-10%,100V    | 54473    | ECE-A100V10L     |
| A1C944        | 290-0183-00        |                             | CAP.,FXD,ELCTLT:1UF,10%,35V          | 90201    | TAC105K035P02    |
| A1C945        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V        | 04222    | MA205E104MAA     |
| A1C954        | 290-0947-00        |                             | CAP.,FXD,ELCTLT:33UF,+50-10%,160V    | 55680    | UHC2C330TFA      |
| A1C956        | 290-0946-00        |                             | CAP.,FXD,ELCTLT:270UF,10+100%,40V    | 90201    | VPR271N040E1E1C  |
| A1C960        | 290-0945-00        |                             | CAP.,FXD,ELCTLT:840UF,10+100%,12V    | 90201    | VPR841N012E1E1C  |
| A1C961        | 290-0945-00        |                             | CAP.,FXD,ELCTLT:840UF,10+100%,12V    | 90201    | VPR841N012E1E1C  |
| A1C962        | 290-0945-00        |                             | CAP.,FXD,ELCTLT:840UF,10+100%,12V    | 90201    | VPR841N012E1E1C  |
| A1C963        | 290-0945-00        |                             | CAP.,FXD,ELCTLT:840UF,10+100%,12V    | 90201    | VPR841N012E1E1C  |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                     | Mfr Code | Mfr Part Number |
|---------------|--------------------|-----------------------------|--|----------|-----------------|
| A1C968        | 290-0945-00        |                             | CAP.,FXD,ELCTLT:840UF,10+100%,12V      | 90201    | VPR841N012E1E1C |
| A1C970        | 290-0945-00        |                             | CAP.,FXD,ELCTLT:840UF,10+100%,12V      | 90201    | VPR841N012E1E1C |
| A1C975        | 285-1255-00        |                             | CAP.,FXD,PLASTI:0.01UF,20%,3KV         | 56289    | 430P582         |
| A1C976        | 285-1255-00        |                             | CAP.,FXD,PLASTI:0.01UF,20%,3KV         | 56289    | 430P582         |
| A1C979        | 285-1255-00        |                             | CAP.,FXD,PLASTI:0.01UF,20%,3KV         | 56289    | 430P582         |
| A1CR133       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR183       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR226       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR227       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR228       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR229       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR372       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR381       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR393       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR399       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR414       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR415       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR503       | 152-0075-00        |                             | SEMICONV DEVICE:SW,GE,22V,40MA         | 14433    | G866            |
| A1CR508       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR509       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR514       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR518       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR529       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR551       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR556       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR583       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR712       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR764       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR765       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR768       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR770       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR780       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR805       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR818       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR820       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR823       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR824       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR825       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR829       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR840       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR845       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR851       | 152-0242-00        |                             | SEMICONV DEVICE:SILICON,225V,200MA     | 07263    | FDH5004         |
| A1CR853       | 152-0242-00        |                             | SEMICONV DEVICE:SILICON,225V,200MA     | 07263    | FDH5004         |
| A1CR854       | 152-0242-00        |                             | SEMICONV DEVICE:SILICON,225V,200MA     | 07263    | FDH5004         |
| A1CR855       | 152-0242-00        |                             | SEMICONV DEVICE:SILICON,225V,200MA     | 07263    | FDH5004         |
| A1CR879       | 152-0413-00        |                             | SEMICONV DEVICE:SILICON,400V,750MA     | 12969    | UTR307          |
| A1CR901       | 152-0040-00        |                             | SEMICONV DEVICE:SILICON,600V,1A        | 15238    | LG109           |
| A1CR902       | 152-0040-00        |                             | SEMICONV DEVICE:SILICON,600V,1A        | 15238    | LG109           |
| A1CR903       | 152-0040-00        |                             | SEMICONV DEVICE:SILICON,600V,1A        | 15238    | LG109           |
| A1CR904       | 152-0040-00        |                             | SEMICONV DEVICE:SILICON,600V,1A        | 15238    | LG109           |
| A1CR907       | 152-0808-00        |                             | SEMICONV DVC,DI:RECTIFIER,SI,400V,1.0A | 01281    | DSR3400X        |
| A1CR908       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA      | 01295    | 1N4152R         |
| A1CR920       | 152-0061-00        |                             | SEMICONV DEVICE:SILICON,175V,100MA     | 07263    | FDH2161         |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscnt | Name & Description                       | Mfr Code | Mfr Part Number  |
|---------------|--------------------|----------------------------|--|----------|------------------|
| A1CR946       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR947       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR954       | 152-0413-00        |                            | SEMICONV DEVICE:SILICON,400V,750MA       | 12969    | UTR307           |
| A1CR955       | 152-0413-00        |                            | SEMICONV DEVICE:SILICON,400V,750MA       | 12969    | UTR307           |
| A1CR956       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR957       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR960       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR961       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR962       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR963       | 152-0414-00        |                            | SEMICONV DEVICE:SILICON,200V,0.75A       | 12969    | UTR308           |
| A1CR967       | 152-0581-00        |                            | SEMICONV DEVICE:SILICON,20V,1A           | 04713    | 1N5817           |
| A1CR970       | 152-0581-00        |                            | SEMICONV DEVICE:SILICON,20V,1A           | 04713    | 1N5817           |
| A1DS856       | 150-0035-00        |                            | LAMP,GLOW:90V,0.3MA,AID-T,WIRE LD        | 000LI    | JH005/3011JA     |
| A1DS858       | 150-0035-00        |                            | LAMP,GLOW:90V,0.3MA,AID-T,WIRE LD        | 000LI    | JH005/3011JA     |
| A1DS870       | 150-0035-00        |                            | LAMP,GLOW:90V,0.3MA,AID-T,WIRE LD        | 000LI    | JH005/3011JA     |
| A1DS9150      | 150-1071-01        |                            | LT EMITTING DIO:GREEN,565NM,20MA MAX     | 80009    | 150-1071-01      |
| A1E200        | 276-0752-00        |                            | CORE,EM:FERRITE                          | T1442    | BP53-BH3.5X10X4. |
| A1E201        | 276-0752-00        |                            | CORE,EM:FERRITE                          | T1442    | BP53-BH3.5X10X4. |
| A1E272        | 276-0532-00        |                            | SHIELDING BEAD.:                         | 02114    | 56-590-65/4A6    |
| A1E590        | 276-0752-00        |                            | CORE,EM:FERRITE                          | T1442    | BP53-BH3.5X10X4. |
| A1E907        | 276-0635-00        |                            | CORE,EM:TOROID,FERRITE                   | 08057    | 7J-41405-TC      |
| A1L960        | 108-1058-00        |                            | COIL,RF:FIXED,10UH                       | 02113    | B8724            |
| A1L961        | 108-1058-00        |                            | COIL,RF:FIXED,10UH                       | 02113    | B8724            |
| A1P9000       | 131-3148-00        |                            | CONN,RCPT,ELEC:HEADER,1 X 36,0.1 SPACING | T1557    | 082-3640-SS40-RA |
| A1P9100       | 131-3148-00        |                            | CONN,RCPT,ELEC:HEADER,1 X 36,0.1 SPACING | T1557    | 082-3640-SS40-RA |
| A1P9644       | 131-0608-00        |                            | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD | 22526    | 48283-036        |
| A1P9644       | -----              |                            | (QUANTITY OF 3)                          |          |                  |
| A1P9802       | 131-0589-00        |                            | TERMINAL,PIN:0.46 L X 0.025 SQ           | 22526    | 48283-029        |
| A1P9802       | -----              |                            | (QUANTITY OF 5)                          |          |                  |
| A1Q102        | 151-0712-00        |                            | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8223          |
| A1Q103        | 151-0712-00        |                            | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8223          |
| A1Q114        | 151-0190-00        |                            | TRANSISTOR:SILICON,NPN                   | 07263    | S032677          |
| A1Q115        | 151-0190-00        |                            | TRANSISTOR:SILICON,NPN                   | 07263    | S032677          |
| A1Q152        | 151-0712-00        |                            | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8223          |
| A1Q153        | 151-0712-00        |                            | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8223          |
| A1Q164        | 151-0190-00        |                            | TRANSISTOR:SILICON,NPN                   | 07263    | S032677          |
| A1Q165        | 151-0190-00        |                            | TRANSISTOR:SILICON,NPN                   | 07263    | S032677          |
| A1Q202        | 151-0471-00        |                            | TRANSISTOR:SILICON,NPN                   | 07263    | S39875           |
| A1Q203        | 151-0471-00        |                            | TRANSISTOR:SILICON,NPN                   | 07263    | S39875           |
| A1Q206        | 151-0221-02        |                            | TRANSISTOR:SILICON,PNP                   | 07263    | S42530           |
| A1Q207        | 151-0221-02        |                            | TRANSISTOR:SILICON,PNP                   | 07263    | S42530           |
| A1Q230        | 151-0221-02        |                            | TRANSISTOR:SILICON,PNP                   | 07263    | S42530           |
| A1Q231        | 151-0221-02        |                            | TRANSISTOR:SILICON,PNP                   | 07263    | S42530           |
| A1Q254        | 151-0752-00        |                            | TRANSISTOR:SILICON,NPN                   | 01281    | LT4403           |
| A1Q255        | 151-0752-00        |                            | TRANSISTOR:SILICON,NPN                   | 01281    | LT4403           |
| A1Q256        | 151-0752-00        |                            | TRANSISTOR:SILICON,NPN                   | 01281    | LT4403           |
| A1Q257        | 151-0752-00        |                            | TRANSISTOR:SILICON,NPN                   | 01281    | LT4403           |
| A1Q283        | 151-0736-00        |                            | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8317          |
| A1Q284        | 151-0712-00        |                            | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8223          |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                     | Mfr Code | Mfr Part Number |
|---------------|--------------------|-----------------------------|--|----------|-----------------|
| A1Q285        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8223         |
| A1Q302        | 151-0711-01        |                             | TRANSISTOR:NPN,SI,TO-92                | 04713    | SPS8608M        |
| A1Q303        | 151-0711-01        |                             | TRANSISTOR:NPN,SI,TO-92                | 04713    | SPS8608M        |
| A1Q327        | 151-0711-01        |                             | TRANSISTOR:NPN,SI,TO-92                | 04713    | SPS8608M        |
| A1Q328        | 151-0711-01        |                             | TRANSISTOR:NPN,SI,TO-92                | 04713    | SPS8608M        |
| A1Q382        | 151-1042-00        |                             | SEMICONDC DVC SE:MATCHED PAIR FET      | 22229    | S2089           |
| A1Q384        | 151-0711-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8224         |
| A1Q397        | 151-0190-00        |                             | TRANSISTOR:SILICON,NPN                 | 07263    | S032677         |
| A1Q402        | 151-0276-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | 2N5087          |
| A1Q403        | 151-0276-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | 2N5087          |
| A1Q413        | 151-0190-00        |                             | TRANSISTOR:SILICON,NPN                 | 07263    | S032677         |
| A1Q419        | 151-0711-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8224         |
| A1Q420        | 151-0711-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8224         |
| A1Q421        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8223         |
| A1Q422        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6866K        |
| A1Q423        | 151-0424-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8246         |
| A1Q428        | 151-0711-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8224         |
| A1Q429        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8223         |
| A1Q460        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8223         |
| A1Q463        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8223         |
| A1Q509        | 151-0188-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6868         |
| A1Q511        | 151-0188-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6868         |
| A1Q525        | 151-0190-00        |                             | TRANSISTOR:SILICON,NPN                 | 07263    | S032677         |
| A1Q576        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6866K        |
| A1Q578        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6866K        |
| A1Q586        | 151-0198-00        |                             | TRANSISTOR:SILICON,NPN,SEL FROM MPS918 | 04713    | SPS8802-1       |
| A1Q756        | 151-0432-00        |                             | TRANSISTOR:SILICON,NPN                 | 27014    | T07391E2        |
| A1Q770        | 151-0188-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6868         |
| A1Q775        | 151-0347-00        |                             | TRANSISTOR:SILICON,NPN                 | 56289    | 2N5551          |
| A1Q779        | 151-0350-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6700         |
| A1Q780        | 151-0190-00        |                             | TRANSISTOR:SILICON,NPN                 | 07263    | S032677         |
| A1Q785        | 151-0347-00        |                             | TRANSISTOR:SILICON,NPN                 | 56289    | 2N5551          |
| A1Q789        | 151-0350-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6700         |
| A1Q804        | 151-0188-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6868         |
| A1Q814        | 151-0188-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6868         |
| A1Q825        | 151-0424-00        |                             | TRANSISTOR:SILICON,NPN                 | 04713    | SPS8246         |
| A1Q829        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6866K        |
| A1Q835        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6866K        |
| A1Q840        | 151-0347-00        |                             | TRANSISTOR:SILICON,NPN                 | 56289    | 2N5551          |
| A1Q845        | 151-0350-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS6700         |
| A1Q885        | 151-0443-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | SPS7950         |
| A1Q908        | 151-0164-00        |                             | TRANSISTOR:PNP,SI,TO-92                | 04713    | 2N2907A         |
| A1Q928        | 151-0432-00        |                             | TRANSISTOR:SILICON,NPN                 | 27014    | T07391E2        |
| A1Q930        | 151-0164-00        |                             | TRANSISTOR:PNP,SI,TO-92                | 04713    | 2N2907A         |
| A1Q935        | 151-0506-00        |                             | SCR:SILICON                            | 03508    | C106B2X283      |
| A1Q938        | 151-0276-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | 2N5087          |
| A1Q939        | 151-0276-00        |                             | TRANSISTOR:SILICON,PNP                 | 04713    | 2N5087          |
| A1Q944        | 151-0432-00        |                             | TRANSISTOR:SILICON,NPN                 | 27014    | T07391E2        |
| A1Q946        | 151-0476-02        |                             | TRANSISTOR:SILICON,NPN,SEL             | 04713    | ORD BY DESCR    |
| A1Q947        | 151-0476-02        |                             | TRANSISTOR:SILICON,NPN,SEL             | 04713    | ORD BY DESCR    |
| A1Q9070       | 151-1151-00        |                             | TRANSISTOR:MOSFE,N-CHANNEL,SI,TO-220   | 04713    | MPT3N40         |
| A1R100        | 315-0430-00        |                             | RES.,FXD,CMPSN:43 OHM,5%,0.25W         | 01121    | CB4305          |
| A1R101        | 315-0430-00        |                             | RES.,FXD,CMPSN:43 OHM,5%,0.25W         | 01121    | CB4305          |



## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                | Mfr Code | Mfr Part Number |
|---------------|--------------------|-----------------------------|-----------------------------------|----------|-----------------|
| A1R102        | 321-0155-00        |                             | RES.,FXD,FILM:402 OHM,1%,0.125W   | 91637    | MFF1816G402R0F  |
| A1R103        | 321-0155-00        |                             | RES.,FXD,FILM:402 OHM,1%,0.125W   | 91637    | MFF1816G402R0F  |
| A1R104        | 321-0101-00        |                             | RES.,FXD,FILM:110 OHM,1%,0.125W   | 91637    | MFF1816G110R0F  |
| A1R105        | 321-0101-00        |                             | RES.,FXD,FILM:110 OHM,1%,0.125W   | 91637    | MFF1816G110R0F  |
| A1R106        | 321-0161-00        |                             | RES.,FXD,FILM:464 OHM,1%,0.125W   | 91637    | MFF1816G464R0F  |
| A1R108        | 321-0223-00        |                             | RES.,FXD,FILM:2.05K OHM,1%,0.125W | 91637    | MFF1816G20500F  |
| A1R109        | 321-0221-00        |                             | RES.,FXD,FILM:1.96K OHM,1%,0.125W | 91637    | CMF55116G19600F |
| A1R114        | 321-0225-00        |                             | RES.,FXD,FILM:2.15K OHM,1%,0.125W | 91637    | MFF1816G21500F  |
| A1R115        | 321-0225-00        |                             | RES.,FXD,FILM:2.15K OHM,1%,0.125W | 91637    | MFF1816G21500F  |
| A1R120        | 321-0123-00        |                             | RES.,FXD,FILM:187 OHM,1%,0.125W   | 91637    | MFF1816G187R0F  |
| A1R121        | 321-0123-00        |                             | RES.,FXD,FILM:187 OHM,1%,0.125W   | 91637    | MFF1816G187R0F  |
| A1R122        | 315-0820-00        |                             | RES.,FXD,CMPSN:82 OHM,5%,0.25W    | 01121    | CB8205          |
| A1R125        | 315-0242-00        |                             | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W  | 01121    | CB2425          |
| A1R126        | 315-0182-00        |                             | RES.,FXD,CMPSN:1.8K OHM,5%,0.25W  | 01121    | CB1825          |
| A1R130        | 315-0510-00        |                             | RES.,FXD,CMPSN:51 OHM,5%,0.25W    | 01121    | CB5105          |
| A1R131        | 315-0510-00        |                             | RES.,FXD,CMPSN:51 OHM,5%,0.25W    | 01121    | CB5105          |
| A1R132        | 315-0511-00        |                             | RES.,FXD,CMPSN:510 OHM,5%,0.25W   | 01121    | CB5115          |
| A1R133        | 315-0111-00        |                             | RES.,FXD,CMPSN:110 OHM,5%,0.25W   | 01121    | CB1115          |
| A1R135        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R136        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R139        | 315-0302-00        |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W    | 01121    | CB3025          |
| A1R142        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R143        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R144        | 315-0471-00        |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W   | 01121    | CB4715          |
| A1R145        | 311-1238-00        |                             | RES.,VAR, NONWIR:5K OHM,10%,0.50W | 73138    | 72-27-0         |
| A1R150        | 315-0430-00        |                             | RES.,FXD,CMPSN:43 OHM,5%,0.25W    | 01121    | CB4305          |
| A1R151        | 315-0430-00        |                             | RES.,FXD,CMPSN:43 OHM,5%,0.25W    | 01121    | CB4305          |
| A1R152        | 321-0155-00        |                             | RES.,FXD,FILM:402 OHM,1%,0.125W   | 91637    | MFF1816G402R0F  |
| A1R153        | 321-0155-00        |                             | RES.,FXD,FILM:402 OHM,1%,0.125W   | 91637    | MFF1816G402R0F  |
| A1R154        | 321-0101-00        |                             | RES.,FXD,FILM:110 OHM,1%,0.125W   | 91637    | MFF1816G110R0F  |
| A1R155        | 321-0101-00        |                             | RES.,FXD,FILM:110 OHM,1%,0.125W   | 91637    | MFF1816G110R0F  |
| A1R156        | 321-0161-00        |                             | RES.,FXD,FILM:464 OHM,1%,0.125W   | 91637    | MFF1816G464R0F  |
| A1R158        | 321-0223-00        |                             | RES.,FXD,FILM:2.05K OHM,1%,0.125W | 91637    | MFF1816G20500F  |
| A1R159        | 321-0221-00        |                             | RES.,FXD,FILM:1.96K OHM,1%,0.125W | 91637    | CMF55116G19600F |
| A1R164        | 321-0225-00        |                             | RES.,FXD,FILM:2.15K OHM,1%,0.125W | 91637    | MFF1816G21500F  |
| A1R165        | 321-0225-00        |                             | RES.,FXD,FILM:2.15K OHM,1%,0.125W | 91637    | MFF1816G21500F  |
| A1R170        | 321-0123-00        |                             | RES.,FXD,FILM:187 OHM,1%,0.125W   | 91637    | MFF1816G187R0F  |
| A1R171        | 321-0123-00        |                             | RES.,FXD,FILM:187 OHM,1%,0.125W   | 91637    | MFF1816G187R0F  |
| A1R172        | 315-0820-00        |                             | RES.,FXD,CMPSN:82 OHM,5%,0.25W    | 01121    | CB8205          |
| A1R175        | 315-0242-00        |                             | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W  | 01121    | CB2425          |
| A1R176        | 315-0182-00        |                             | RES.,FXD,CMPSN:1.8K OHM,5%,0.25W  | 01121    | CB1825          |
| A1R180        | 315-0510-00        |                             | RES.,FXD,CMPSN:51 OHM,5%,0.25W    | 01121    | CB5105          |
| A1R181        | 315-0510-00        |                             | RES.,FXD,CMPSN:51 OHM,5%,0.25W    | 01121    | CB5105          |
| A1R182        | 315-0511-00        |                             | RES.,FXD,CMPSN:510 OHM,5%,0.25W   | 01121    | CB5115          |
| A1R183        | 315-0111-00        |                             | RES.,FXD,CMPSN:110 OHM,5%,0.25W   | 01121    | CB1115          |
| A1R185        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R186        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R189        | 315-0302-00        |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W    | 01121    | CB3025          |
| A1R192        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R193        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R194        | 315-0471-00        |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W   | 01121    | CB4715          |
| A1R195        | 311-1238-00        |                             | RES.,VAR, NONWIR:5K OHM,10%,0.50W | 73138    | 72-27-0         |
| A1R202        | 321-0178-00        |                             | RES.,FXD,FILM:698 OHM,1%,0.125W   | 91637    | MFF1816G698R0F  |
| A1R203        | 321-0178-00        |                             | RES.,FXD,FILM:698 OHM,1%,0.125W   | 91637    | MFF1816G698R0F  |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                   | Mfr Code | Mfr Part Number  |
|---------------|--------------------|-----------------------------|--------------------------------------|----------|------------------|
| A1R204        | 321-0089-00        |                             | RES.,FXD,FILM:82.5 OHM,1%,0.125W     | 91637    | MFF1816G82R50F   |
| A1R206        | 321-0139-00        |                             | RES.,FXD,FILM:274 OHM,1%,0.125W      | 91637    | MFF1816G274R0F   |
| A1R207        | 321-0139-00        |                             | RES.,FXD,FILM:274 OHM,1%,0.125W      | 91637    | MFF1816G274R0F   |
| A1R210        | 315-0331-00        |                             | RES.,FXD,CMPSN:330 OHM,5%,0.25W      | 01121    | CB3315           |
| A1R212        | 321-0086-00        |                             | RES.,FXD,FILM:76.8 OHM,1%,0.125W     | 91637    | MFF1816G76R80F   |
| A1R213        | 321-0086-00        |                             | RES.,FXD,FILM:76.8 OHM,1%,0.125W     | 91637    | MFF1816G76R80F   |
| A1R215        | 321-0135-00        |                             | RES.,FXD,FILM:249 OHM,1%,0.125W      | 91637    | MFF1816G249R0F   |
| A1R216        | 321-0163-00        |                             | RES.,FXD,FILM:487 OHM,1%,0.125W      | 91637    | MFF1816G487R0F   |
| A1R217        | 321-0163-00        |                             | RES.,FXD,FILM:487 OHM,1%,0.125W      | 91637    | MFF1816G487R0F   |
| A1R218        | 321-0102-00        |                             | RES.,FXD,FILM:113 OHM,1%,0.125W      | 91637    | MFF1816G113R0F   |
| A1R219        | 321-0102-00        |                             | RES.,FXD,FILM:113 OHM,1%,0.125W      | 91637    | MFF1816G113R0F   |
| A1R220        | 307-0104-00        |                             | RES.,FXD,CMPSN:3.3 OHM,5%,0.25W      | 01121    | CB33G5           |
| A1R222        | 321-0318-00        |                             | RES.,FXD,FILM:20K OHM,1%,0.125W      | 91637    | MFF1816G20001F   |
| A1R223        | 321-0318-00        |                             | RES.,FXD,FILM:20K OHM,1%,0.125W      | 91637    | MFF1816G20001F   |
| A1R225        | 315-0103-00        |                             | RES.,FXD,CMPSN:10K OHM,5%,0.25W      | 01121    | CB1035           |
| A1R226        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W      | 01121    | CB2215           |
| A1R227        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W      | 01121    | CB2215           |
| A1R230        | 321-0086-00        |                             | RES.,FXD,FILM:76.8 OHM,1%,0.125W     | 91637    | MFF1816G76R80F   |
| A1R231        | 321-0086-00        |                             | RES.,FXD,FILM:76.8 OHM,1%,0.125W     | 91637    | MFF1816G76R80F   |
| A1R233        | 321-0085-00        |                             | RES.,FXD,FILM:75 OHM,1%,0.125W       | 91637    | MFF1816G75R00F   |
| A1R234        | 315-0390-00        |                             | RES.,FXD,CMPSN:39 OHM,5%,0.25W       | 01121    | CB3905           |
| A1R235        | 315-0390-00        |                             | RES.,FXD,CMPSN:39 OHM,5%,0.25W       | 01121    | CB3905           |
| A1R236        | 315-0621-00        |                             | RES.,FXD,CMPSN:620 OHM,5%,0.25W      | 01121    | CB6215           |
| A1R239        | 315-0392-00        |                             | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W     | 01121    | CB3925           |
| A1R240        | 311-1248-00        |                             | RES.,VAR, NONWIR:500 OHM,10%,0.50W   | 73138    | 72-23-0          |
| A1R241        | 311-1237-00        |                             | RES.,VAR, NONWIR:1K OHM,10%,0.50W    | 32997    | 3386X-T07-102    |
| A1R242        | 315-0273-00        |                             | RES.,FXD,CMPSN:27K OHM,5%,0.25W      | 01121    | CB2735           |
| A1R244        | 321-0172-00        |                             | RES.,FXD,FILM:604 OHM,1%,0.125W      | 91637    | MFF1816G604R0F   |
| A1R245        | 321-0172-00        |                             | RES.,FXD,FILM:604 OHM,1%,0.125W      | 91637    | MFF1816G604R0F   |
| A1R250        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W      | 01121    | CB2215           |
| A1R251        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W      | 01121    | CB2215           |
| A1R254        | 321-0110-00        |                             | RES.,FXD,FILM:137 OHM,1%,0.125W      | 91637    | MFF1816G137R0F   |
| A1R255        | 321-0110-00        |                             | RES.,FXD,FILM:137 OHM,1%,0.125W      | 91637    | MFF1816G137R0F   |
| A1R256        | 322-0175-00        |                             | RES.,FXD,FILM:649 OHM,1%,0.25W       | 75042    | CEBT0-6490F      |
| A1R257        | 322-0175-00        |                             | RES.,FXD,FILM:649 OHM,1%,0.25W       | 75042    | CEBT0-6490F      |
| A1R258        | 322-0180-00        |                             | RES.,FXD,FILM:732 OHM,1%,0.25W       | 75042    | CEBT0-7320F      |
| A1R259        | 322-0180-00        |                             | RES.,FXD,FILM:732 OHM,1%,0.25W       | 75042    | CEBT0-7320F      |
| A1R261        | 323-0058-00        |                             | RES.,FXD,FILM:39.2 OHM,1%,0.5W,TC=TO | 07716    | CEC39.2OHM1PERCE |
| A1R262        | 315-0151-00        |                             | RES.,FXD,CMPSN:150 OHM,5%,0.25W      | 01121    | CB1515           |
| A1R266        | 323-0114-00        |                             | RES.,FXD,FILM:150 OHM,1%,0.50W       | 75042    | CECT0-1500F      |
| A1R267        | 323-0114-00        |                             | RES.,FXD,FILM:150 OHM,1%,0.50W       | 75042    | CECT0-1500F      |
| A1R268        | 323-0114-00        |                             | RES.,FXD,FILM:150 OHM,1%,0.50W       | 75042    | CECT0-1500F      |
| A1R269        | 323-0114-00        |                             | RES.,FXD,FILM:150 OHM,1%,0.50W       | 75042    | CECT0-1500F      |
| A1R270        | 323-0114-00        |                             | RES.,FXD,FILM:150 OHM,1%,0.50W       | 75042    | CECT0-1500F      |
| A1R271        | 323-0114-00        |                             | RES.,FXD,FILM:150 OHM,1%,0.50W       | 75042    | CECT0-1500F      |
| A1R279        | 315-0223-00        |                             | RES.,FXD,CMPSN:22K OHM,5%,0.25W      | 01121    | CB2235           |
| A1R281        | 315-0821-00        |                             | RES.,FXD,CMPSN:820 OHM,5%,0.25W      | 01121    | CB8215           |
| A1R282        | 315-0752-00        |                             | RES.,FXD,CMPSN:7.5K OHM,5%,0.25W     | 01121    | CB7525           |
| A1R283        | 315-0471-00        |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W      | 01121    | CB4715           |
| A1R284        | 315-0621-00        |                             | RES.,FXD,CMPSN:620 OHM,5%,0.25W      | 01121    | CB6215           |
| A1R285        | 315-0561-00        |                             | RES.,FXD,CMPSN:560 OHM,5%,0.25W      | 01121    | CB5615           |
| A1R286        | 321-0068-00        |                             | RES.,FXD,FILM:49.9 OHM,1%,0.125W     | 91637    | MFF1816G49R90F   |
| A1R287        | 321-0068-00        |                             | RES.,FXD,FILM:49.9 OHM,1%,0.125W     | 91637    | MFF1816G49R90F   |
| A1R288        | 315-0431-00        |                             | RES.,FXD,CMPSN:430 OHM,5%,0.25W      | 01121    | CB4315           |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                | Mfr Code | Mfr Part Number |
|---------------|--------------------|-----------------------------|-----------------------------------|----------|-----------------|
| A1R289        | 315-0431-00        |                             | RES.,FXD,CMPSN:430 OHM,5%,0.25W   | 01121    | CB4315          |
| A1R292        | 321-0179-00        |                             | RES.,FXD,FILM:715 OHM,1%,0.125W   | 91637    | MFF1816G715R0F  |
| A1R293        | 315-0620-00        |                             | RES.,FXD,CMPSN:62 OHM,5%,0.25W    | 01121    | CB6205          |
| A1R301        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W   | 01121    | CB2215          |
| A1R302        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W   | 01121    | CB2215          |
| A1R303        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W   | 01121    | CB2215          |
| A1R304        | 315-0152-00        |                             | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W  | 01121    | CB1525          |
| A1R305        | 315-0152-00        |                             | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W  | 01121    | CB1525          |
| A1R306        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R307        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R309        | 311-1564-00        |                             | RES.,VAR,NONWIR:TRMR,500 OHM,0.5W | 73138    | 91-86-0         |
| A1R310        | 321-0194-00        |                             | RES.,FXD,FILM:1.02K OHM,1%,0.125W | 91637    | MFF1816G10200F  |
| A1R311        | 321-0194-00        |                             | RES.,FXD,FILM:1.02K OHM,1%,0.125W | 91637    | MFF1816G10200F  |
| A1R312        | 321-0098-00        |                             | RES.,FXD,FILM:102 OHM,1%,0.125W   | 91637    | MFF1816G102R0F  |
| A1R314        | 321-0170-00        |                             | RES.,FXD,FILM:576 OHM,1%,0.125W   | 91637    | MFF1816G576R0F  |
| A1R315        | 321-0170-00        |                             | RES.,FXD,FILM:576 OHM,1%,0.125W   | 91637    | MFF1816G576R0F  |
| A1R317        | 321-0218-00        |                             | RES.,FXD,FILM:1.82K OHM,1%,0.125W | 91637    | MFF1816G18200F  |
| A1R318        | 321-0193-00        |                             | RES.,FXD,FILM:1K OHM,1%,0.125W    | 01121    | ORD BY DESCR    |
| A1R319        | 321-0212-00        |                             | RES.,FXD,FILM:1.58K OHM,1%,0.125W | 91637    | MFF1816G15800F  |
| A1R321        | 321-0208-00        |                             | RES.,FXD,FILM:1.43K OHM,1%,0.125W | 91637    | MFF1816G14300F  |
| A1R322        | 321-0238-00        |                             | RES.,FXD,FILM:2.94K OHM,1%,0.125W | 91637    | MFF1816G29400F  |
| A1R324        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R326        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W   | 01121    | CB2215          |
| A1R327        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W   | 01121    | CB2215          |
| A1R328        | 315-0221-00        |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W   | 01121    | CB2215          |
| A1R329        | 315-0152-00        |                             | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W  | 01121    | CB1525          |
| A1R330        | 315-0152-00        |                             | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W  | 01121    | CB1525          |
| A1R331        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R332        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R335        | 321-0203-00        |                             | RES.,FXD,FILM:1.27K OHM,1%,0.125W | 91637    | MFF1816G12700F  |
| A1R336        | 321-0203-00        |                             | RES.,FXD,FILM:1.27K OHM,1%,0.125W | 91637    | MFF1816G12700F  |
| A1R337        | 321-0098-00        |                             | RES.,FXD,FILM:102 OHM,1%,0.125W   | 91637    | MFF1816G102R0F  |
| A1R339        | 321-0170-00        |                             | RES.,FXD,FILM:576 OHM,1%,0.125W   | 91637    | MFF1816G576R0F  |
| A1R340        | 321-0170-00        |                             | RES.,FXD,FILM:576 OHM,1%,0.125W   | 91637    | MFF1816G576R0F  |
| A1R342        | 321-0218-00        |                             | RES.,FXD,FILM:1.82K OHM,1%,0.125W | 91637    | MFF1816G18200F  |
| A1R343        | 321-0193-00        |                             | RES.,FXD,FILM:1K OHM,1%,0.125W    | 01121    | ORD BY DESCR    |
| A1R344        | 321-0212-00        |                             | RES.,FXD,FILM:1.58K OHM,1%,0.125W | 91637    | MFF1816G15800F  |
| A1R346        | 321-0208-00        |                             | RES.,FXD,FILM:1.43K OHM,1%,0.125W | 91637    | MFF1816G14300F  |
| A1R347        | 321-0238-00        |                             | RES.,FXD,FILM:2.94K OHM,1%,0.125W | 91637    | MFF1816G29400F  |
| A1R349        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R350        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R351        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R352        | 321-0274-00        |                             | RES.,FXD,FILM:6.98K OHM,1%,0.125W | 91637    | CMF55116G69800F |
| A1R353        | 321-0274-00        |                             | RES.,FXD,FILM:6.98K OHM,1%,0.125W | 91637    | CMF55116G69800F |
| A1R354        | 315-0272-00        |                             | RES.,FXD,CMPSN:2.7K OHM,5%,0.25W  | 01121    | CB2725          |
| A1R356        | 315-0622-00        |                             | RES.,FXD,CMPSN:6.2K OHM,5%,0.25W  | 01121    | CB6225          |
| A1R357        | 321-0149-00        |                             | RES.,FXD,FILM:348 OHM,1%,0.125W   | 91637    | MFF1816G348R0F  |
| A1R358        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R359        | 321-0148-00        |                             | RES.,FXD,FILM:340 OHM,1%,0.125W   | 91637    | MFF1816G340R0F  |
| A1R360        | 321-0156-00        |                             | RES.,FXD,FILM:412 OHM,1%,0.125W   | 91637    | MFF1816G412R0F  |
| A1R361        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R363        | 315-0331-00        |                             | RES.,FXD,CMPSN:330 OHM,5%,0.25W   | 01121    | CB3315          |
| A1R365        | 315-0620-00        |                             | RES.,FXD,CMPSN:62 OHM,5%,0.25W    | 01121    | CB6205          |
| A1R366        | 315-0202-00        |                             | RES.,FXD,CMPSN:2K OHM,5%,0.25W    | 01121    | CB2025          |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscnt | Name & Description                | Mfr Code | Mfr Part Number |
|---------------|--------------------|----------------------------|-----------------------------------|----------|-----------------|
| A1R367        | 315-0911-00        |                            | RES.,FXD,CMPSN:910 OHM,5%,0.25W   | 01121    | CB9115          |
| A1R369        | 315-0751-00        |                            | RES.,FXD,CMPSN:750 OHM,5%,0.25W   | 01121    | CB7515          |
| A1R372        | 315-0220-00        |                            | RES.,FXD,CMPSN:22 OHM,5%,0.25W    | 01121    | CB2205          |
| A1R374        | 315-0202-00        |                            | RES.,FXD,CMPSN:2K OHM,5%,0.25W    | 01121    | CB2025          |
| A1R381        | 321-0444-00        |                            | RES.,FXD,FILM:412K OHM,1%,0.125W  | 91637    | MFF1816G41202F  |
| A1R382        | 315-0470-00        |                            | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R384        | 315-0121-00        |                            | RES.,FXD,CMPSN:120 OHM,5%,0.25W   | 01121    | CB1215          |
| A1R385        | 315-0130-00        |                            | RES.,FXD,CMPSN:13 OHM,5%,0.25W    | 01121    | CB1305          |
| A1R386        | 315-0911-00        |                            | RES.,FXD,CMPSN:910 OHM,5%,0.25W   | 01121    | CB9115          |
| A1R389        | 315-0100-00        |                            | RES.,FXD,CMPSN:10 OHM,5%,0.25W    | 01121    | CB1005          |
| A1R390        | 315-0101-00        |                            | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R392        | 315-0751-00        |                            | RES.,FXD,CMPSN:750 OHM,5%,0.25W   | 01121    | CB7515          |
| A1R393        | 315-0240-00        |                            | RES.,FXD,CMPSN:24 OHM,5%,0.25W    | 01121    | CB2405          |
| A1R395        | 315-0911-00        |                            | RES.,FXD,CMPSN:910 OHM,5%,0.25W   | 01121    | CB9115          |
| A1R397        | 315-0200-00        |                            | RES.,FXD,CMPSN:20 OHM,5%,0.25W    | 01121    | CB2005          |
| A1R398        | 315-0201-00        |                            | RES.,FXD,CMPSN:200 OHM,5%,0.25W   | 01121    | CB2015          |
| A1R399        | 315-0751-00        |                            | RES.,FXD,CMPSN:750 OHM,5%,0.25W   | 01121    | CB7515          |
| A1R402        | 315-0182-00        |                            | RES.,FXD,CMPSN:1.8K OHM,5%,0.25W  | 01121    | CB1825          |
| A1R405        | 315-0752-00        |                            | RES.,FXD,CMPSN:7.5K OHM,5%,0.25W  | 01121    | CB7525          |
| A1R407        | 315-0752-00        |                            | RES.,FXD,CMPSN:7.5K OHM,5%,0.25W  | 01121    | CB7525          |
| A1R408        | 315-0392-00        |                            | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W  | 01121    | CB3925          |
| A1R411        | 315-0103-00        |                            | RES.,FXD,CMPSN:10K OHM,5%,0.25W   | 01121    | CB1035          |
| A1R412        | 315-0102-00        |                            | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R413        | 315-0113-00        |                            | RES.,FXD,CMPSN:11K OHM,5%,0.25W   | 01121    | CB1135          |
| A1R414        | 315-0244-00        |                            | RES.,FXD,CMPSN:240K OHM,5%,0.25W  | 01121    | CB2445          |
| A1R415        | 315-0244-00        |                            | RES.,FXD,CMPSN:240K OHM,5%,0.25W  | 01121    | CB2445          |
| A1R416        | 315-0473-00        |                            | RES.,FXD,CMPSN:47K OHM,5%,0.25W   | 01121    | CB4735          |
| A1R417        | 315-0473-00        |                            | RES.,FXD,CMPSN:47K OHM,5%,0.25W   | 01121    | CB4735          |
| A1R419        | 315-0182-00        |                            | RES.,FXD,CMPSN:1.8K OHM,5%,0.25W  | 01121    | CB1825          |
| A1R420        | 315-0101-00        |                            | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R421        | 315-0203-00        |                            | RES.,FXD,CMPSN:20K OHM,5%,0.25W   | 01121    | CB2035          |
| A1R422        | 315-0100-00        |                            | RES.,FXD,CMPSN:10 OHM,5%,0.25W    | 01121    | CB1005          |
| A1R423        | 315-0100-00        |                            | RES.,FXD,CMPSN:10 OHM,5%,0.25W    | 01121    | CB1005          |
| A1R424        | 315-0203-00        |                            | RES.,FXD,CMPSN:20K OHM,5%,0.25W   | 01121    | CB2035          |
| A1R426        | 315-0434-00        |                            | RES.,FXD,CMPSN:430K OHM,5%,0.25W  | 01121    | CB4345          |
| A1R427        | 315-0434-00        |                            | RES.,FXD,CMPSN:430K OHM,5%,0.25W  | 01121    | CB4345          |
| A1R428        | 315-0102-00        |                            | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R429        | 315-0102-00        |                            | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R432        | 315-0823-00        |                            | RES.,FXD,CMPSN:82K OHM,5%,0.25W   | 01121    | CB8235          |
| A1R433        | 315-0823-00        |                            | RES.,FXD,CMPSN:82K OHM,5%,0.25W   | 01121    | CB8235          |
| A1R434        | 311-1646-00        |                            | RES.,VAR,NONWIR:TRMR,2M OHM,0.5W  | 01121    | E4A205          |
| A1R435        | 311-1646-00        |                            | RES.,VAR,NONWIR:TRMR,2M OHM,0.5W  | 01121    | E4A205          |
| A1R446        | 315-0224-00        |                            | RES.,FXD,CMPSN:220K OHM,5%,0.25W  | 01121    | CB2245          |
| A1R451        | 315-0100-00        |                            | RES.,FXD,CMPSN:10 OHM,5%,0.25W    | 01121    | CB1005          |
| A1R452        | 315-0272-00        |                            | RES.,FXD,CMPSN:2.7K OHM,5%,0.25W  | 01121    | CB2725          |
| A1R453        | 315-0470-00        |                            | RES.,FXD,CMPSN:47 OHM,5%,0.25W    | 01121    | CB4705          |
| A1R455        | 315-0100-00        |                            | RES.,FXD,CMPSN:10 OHM,5%,0.25W    | 01121    | CB1005          |
| A1R457        | 321-0207-00        |                            | RES.,FXD,FILM:1.4K OHM,1%,0.125W  | 91637    | MFF1816G14000F  |
| A1R458        | 321-0197-00        |                            | RES.,FXD,FILM:1.1K OHM,1%,0.125W  | 91637    | MFF1816G11000F  |
| A1R459        | 315-0242-00        |                            | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W  | 01121    | CB2425          |
| A1R460        | 321-0091-00        |                            | RES.,FXD,FILM:86.6 OHM,1%,0.125W  | 91637    | MFF1816G86R60F  |
| A1R461        | 321-0203-00        |                            | RES.,FXD,FILM:1.27K OHM,1%,0.125W | 91637    | MFF1816G12700F  |
| A1R462        | 321-0201-00        |                            | RES.,FXD,FILM:1.21K OHM,1%,0.125W | 91637    | MFF1816G12100F  |
| A1R463        | 321-0090-00        |                            | RES.,FXD,FILM:84.5 OHM,1%,0.125W  | 91637    | MFF1816G84R50F  |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix   | Serial/Model No. |        | Name & Description                | Mfr Code | Mfr Part Number |
|---------------|-------------|------------------|--------|-----------------------------------|----------|-----------------|
|               | Part No.    | Eff              | Dscont |                                   |          |                 |
| A1R464        | 315-0271-00 |                  |        | RES.,FXD,CMPSN:270 OHM,5%,0.25W   | 01121    | CB2715          |
| A1R465        | 315-0431-00 |                  |        | RES.,FXD,CMPSN:430 OHM,5%,0.25W   | 01121    | CB4315          |
| A1R469        | 315-0820-00 |                  |        | RES.,FXD,CMPSN:82 OHM,5%,0.25W    | 01121    | CB8205          |
| A1R470        | 315-0113-00 |                  |        | RES.,FXD,CMPSN:11K OHM,5%,0.25W   | 01121    | CB1135          |
| A1R471        | 311-1245-00 |                  |        | RES.,VAR,NONWIR:10K OHM,10%,0.50W | 73138    | 72-28-0         |
| A1R473        | 315-0392-00 |                  |        | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W  | 01121    | CB3925          |
| A1R474        | 315-0432-00 |                  |        | RES.,FXD,CMPSN:4.3K OHM,5%,0.25W  | 01121    | CB4325          |
| A1R478        | 315-0222-00 |                  |        | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W  | 01121    | CB2225          |
| A1R479        | 311-1236-00 |                  |        | RES.,VAR,NONWIR:250 OHM,10%,0.50W | 73138    | 72-22-0         |
| A1R483        | 315-0391-00 |                  |        | RES.,FXD,CMPSN:390 OHM,5%,0.25W   | 01121    | CB3915          |
| A1R486        | 315-0431-00 |                  |        | RES.,FXD,CMPSN:430 OHM,5%,0.25W   | 01121    | CB4315          |
| A1R487        | 315-0471-00 |                  |        | RES.,FXD,CMPSN:470 OHM,5%,0.25W   | 01121    | CB4715          |
| A1R494        | 307-0104-00 |                  |        | RES.,FXD,CMPSN:3.3 OHM,5%,0.25W   | 01121    | CB33G5          |
| A1R499        | 307-0104-00 |                  |        | RES.,FXD,CMPSN:3.3 OHM,5%,0.25W   | 01121    | CB33G5          |
| A1R500        | 315-0101-00 |                  |        | RES.,FXD,CMPSN:100 OHM,5%,0.25W   | 01121    | CB1015          |
| A1R501        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R502        | 315-0911-00 |                  |        | RES.,FXD,CMPSN:910 OHM,5%,0.25W   | 01121    | CB9115          |
| A1R503        | 315-0473-00 |                  |        | RES.,FXD,CMPSN:47K OHM,5%,0.25W   | 01121    | CB4735          |
| A1R504        | 315-0124-00 |                  |        | RES.,FXD,CMPSN:120K OHM,5%,0.25W  | 01121    | CB1245          |
| A1R505        | 315-0473-00 |                  |        | RES.,FXD,CMPSN:47K OHM,5%,0.25W   | 01121    | CB4735          |
| A1R507        | 315-0391-00 |                  |        | RES.,FXD,CMPSN:390 OHM,5%,0.25W   | 01121    | CB3915          |
| A1R509        | 315-0222-00 |                  |        | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W  | 01121    | CB2225          |
| A1R510        | 315-0471-00 |                  |        | RES.,FXD,CMPSN:470 OHM,5%,0.25W   | 01121    | CB4715          |
| A1R511        | 315-0392-00 |                  |        | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W  | 01121    | CB3925          |
| A1R512        | 315-0432-00 |                  |        | RES.,FXD,CMPSN:4.3K OHM,5%,0.25W  | 01121    | CB4325          |
| A1R513        | 315-0391-00 |                  |        | RES.,FXD,CMPSN:390 OHM,5%,0.25W   | 01121    | CB3915          |
| A1R514        | 315-0471-00 |                  |        | RES.,FXD,CMPSN:470 OHM,5%,0.25W   | 01121    | CB4715          |
| A1R516        | 315-0392-00 |                  |        | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W  | 01121    | CB3925          |
| A1R517        | 315-0432-00 |                  |        | RES.,FXD,CMPSN:4.3K OHM,5%,0.25W  | 01121    | CB4325          |
| A1R518        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R523        | 315-0153-00 |                  |        | RES.,FXD,CMPSN:15K OHM,5%,0.25W   | 01121    | CB1535          |
| A1R524        | 321-0318-00 |                  |        | RES.,FXD,FILM:20K OHM,1%,0.125W   | 91637    | MFF1816G20001F  |
| A1R525        | 321-0322-00 |                  |        | RES.,FXD,FILM:22.1K OHM,1%,0.125W | 91637    | MFF1816G22101F  |
| A1R526        | 315-0152-00 |                  |        | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W  | 01121    | CB1525          |
| A1R527        | 315-0392-00 |                  |        | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W  | 01121    | CB3925          |
| A1R528        | 315-0911-00 |                  |        | RES.,FXD,CMPSN:910 OHM,5%,0.25W   | 01121    | CB9115          |
| A1R529        | 315-0392-00 |                  |        | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W  | 01121    | CB3925          |
| A1R538        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R539        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R540        | 315-0511-00 |                  |        | RES.,FXD,CMPSN:510 OHM,5%,0.25W   | 01121    | CB5115          |
| A1R541        | 315-0511-00 |                  |        | RES.,FXD,CMPSN:510 OHM,5%,0.25W   | 01121    | CB5115          |
| A1R544        | 315-0431-00 |                  |        | RES.,FXD,CMPSN:430 OHM,5%,0.25W   | 01121    | CB4315          |
| A1R545        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R547        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R548        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W    | 01121    | CB1025          |
| A1R549        | 315-0681-00 |                  |        | RES.,FXD,CMPSN:680 OHM,5%,0.25W   | 01121    | CB6815          |
| A1R555        | 315-0821-00 |                  |        | RES.,FXD,CMPSN:820 OHM,5%,0.25W   | 01121    | CB8215          |
| A1R556        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R558        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R560        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R561        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R562        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W  | 01121    | CB5125          |
| A1R564        | 315-0202-00 |                  |        | RES.,FXD,CMPSN:2K OHM,5%,0.25W    | 01121    | CB2025          |
| A1R565        | 315-0301-00 |                  |        | RES.,FXD,CMPSN:300 OHM,5%,0.25W   | 01121    | CB3015          |



Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix   | Serial/Model No. |        | Name & Description                      | Mfr   | Mfr Part Number |
|---------------|-------------|------------------|--------|---|-------|-----------------|
|               | Part No.    | Eff              | Dscont |   | Code  |                 |
| A1R566        | 315-0511-00 |                  |        | RES.,FXD,CMPSN:510 OHM,5%,0.25W         | 01121 | CB5115          |
| A1R568        | 315-0332-00 |                  |        | RES.,FXD,CMPSN:3.3K OHM,5%,0.25W        | 01121 | CB3325          |
| A1R569        | 315-0432-00 |                  |        | RES.,FXD,CMPSN:4.3K OHM,5%,0.25W        | 01121 | CB4325          |
| A1R571        | 315-0222-00 |                  |        | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W        | 01121 | CB2225          |
| A1R572        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W          | 01121 | CB1025          |
| A1R573        | 315-0222-00 |                  |        | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W        | 01121 | CB2225          |
| A1R574        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W          | 01121 | CB1025          |
| A1R576        | 315-0561-00 |                  |        | RES.,FXD,CMPSN:560 OHM,5%,0.25W         | 01121 | CB5615          |
| A1R577        | 315-0221-00 |                  |        | RES.,FXD,CMPSN:220 OHM,5%,0.25W         | 01121 | CB2215          |
| A1R578        | 315-0561-00 |                  |        | RES.,FXD,CMPSN:560 OHM,5%,0.25W         | 01121 | CB5615          |
| A1R580        | 315-0181-00 |                  |        | RES.,FXD,CMPSN:180 OHM,5%,0.25W         | 01121 | CB1815          |
| A1R586        | 315-0101-00 |                  |        | RES.,FXD,CMPSN:100 OHM,5%,0.25W         | 01121 | CB1015          |
| A1R645        | 315-0201-00 |                  |        | RES.,FXD,CMPSN:200 OHM,5%,0.25W         | 01121 | CB2015          |
| A1R646        | 311-1563-00 |                  |        | RES.,VAR,NONWIR:1K OHM,20%,0.50W        | 73138 | 91-85-0         |
| A1R647        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W          | 01121 | CB1025          |
| A1R648        | 315-0512-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W        | 01121 | CB5125          |
| A1R649        | 321-0343-00 |                  |        | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W        | 01121 | CB5125          |
| A1R673        | 315-0472-00 |                  |        | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W        | 01121 | CB4725          |
| A1R676        | 315-0471-00 |                  |        | RES.,FXD,CMPSN:470 OHM,5%,0.25W         | 01121 | CB4715          |
| A1R715        | 321-0309-00 |                  |        | RES.,FXD,FILM:16.2K OHM,1%,0.125W,TC=TO | 91637 | CMF55116G16201F |
| A1R756        | 315-0912-00 |                  |        | RES.,FXD,CMPSN:9.1K OHM,5%,0.25W        | 01121 | CB9125          |
| A1R757        | 315-0561-00 |                  |        | RES.,FXD,CMPSN:560 OHM,5%,0.25W         | 01121 | CB5615          |
| A1R758        | 321-0343-00 |                  |        | RES.,FXD,FILM:36.5K OHM,1%,0.125W       | 91637 | MFF1816G36501F  |
| A1R759        | 321-0267-00 |                  |        | RES.,FXD,FILM:5.9K OHM,1%,0.125W        | 91637 | MFF1816G59000F  |
| A1R760        | 311-1565-00 |                  |        | RES.,VAR,NONWIR:250 OHM,20%,0.50W       | 73138 | 91-87-0         |
| A1R761        | 321-0210-00 |                  |        | RES.,FXD,FILM:1.5K OHM,1%,0.125W        | 91637 | MFF1816G15000F  |
| A1R764        | 315-0221-00 |                  |        | RES.,FXD,CMPSN:220 OHM,5%,0.25W         | 01121 | CB2215          |
| A1R766        | 321-0109-00 |                  |        | RES.,FXD,FILM:133 OHM,1%,0.125W         | 91637 | MFF1816G133R0F  |
| A1R768        | 321-0158-00 |                  |        | RES.,FXD,FILM:432 OHM,1%,0.125W         | 91637 | MFF1816G432R0F  |
| A1R770        | 315-0470-00 |                  |        | RES.,FXD,CMPSN:47 OHM,5%,0.25W          | 01121 | CB4705          |
| A1R773        | 321-0182-00 |                  |        | RES.,FXD,FILM:768 OHM,1%,0.125W         | 91637 | MFF1816G768R0F  |
| A1R775        | 323-0310-00 |                  |        | RES.,FXD,FILM:16.5K OHM,1%,0.50W        | 75042 | CECT0-1652F     |
| A1R776        | 321-0205-00 |                  |        | RES.,FXD,FILM:1.33K OHM,1%,0.125W       | 91637 | MFF1816G13300F  |
| A1R777        | 315-0470-00 |                  |        | RES.,FXD,CMPSN:47 OHM,5%,0.25W          | 01121 | CB4705          |
| A1R778        | 315-0101-00 |                  |        | RES.,FXD,CMPSN:100 OHM,5%,0.25W         | 01121 | CB1015          |
| A1R779        | 315-0243-00 |                  |        | RES.,FXD,CMPSN:24K OHM,5%,0.25W         | 01121 | CB2435          |
| A1R780        | 315-0470-00 |                  |        | RES.,FXD,CMPSN:47 OHM,5%,0.25W          | 01121 | CB4705          |
| A1R782        | 321-0209-00 |                  |        | RES.,FXD,FILM:1.47K OHM,1%,0.125W       | 91637 | MFF1816G14700F  |
| A1R783        | 321-0201-00 |                  |        | RES.,FXD,FILM:1.21K OHM,1%,0.125W       | 91637 | MFF1816G12100F  |
| A1R785        | 323-0310-00 |                  |        | RES.,FXD,FILM:16.5K OHM,1%,0.50W        | 75042 | CECT0-1652F     |
| A1R786        | 321-0205-00 |                  |        | RES.,FXD,FILM:1.33K OHM,1%,0.125W       | 91637 | MFF1816G13300F  |
| A1R787        | 315-0470-00 |                  |        | RES.,FXD,CMPSN:47 OHM,5%,0.25W          | 01121 | CB4705          |
| A1R788        | 315-0101-00 |                  |        | RES.,FXD,CMPSN:100 OHM,5%,0.25W         | 01121 | CB1015          |
| A1R789        | 315-0243-00 |                  |        | RES.,FXD,CMPSN:24K OHM,5%,0.25W         | 01121 | CB2435          |
| A1R792        | 321-0263-00 |                  |        | RES.,FXD,FILM:5.36K OHM,1%,0.125W       | 91637 | MFF1816G53600F  |
| A1R793        | 321-0361-00 |                  |        | RES.,FXD,FILM:56.2K OHM,1%,0.125W       | 91637 | MFF1816G56201F  |
| A1R796        | 315-0100-00 |                  |        | RES.,FXD,CMPSN:10 OHM,5%,0.25W          | 01121 | CB1005          |
| A1R797        | 315-0100-00 |                  |        | RES.,FXD,CMPSN:10 OHM,5%,0.25W          | 01121 | CB1005          |
| A1R799        | 315-0100-00 |                  |        | RES.,FXD,CMPSN:10 OHM,5%,0.25W          | 01121 | CB1005          |
| A1R800        | 315-0682-00 |                  |        | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W        | 01121 | CB6825          |
| A1R804        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W          | 01121 | CB1025          |
| A1R805        | 315-0562-00 |                  |        | RES.,FXD,CMPSN:5.6K OHM,5%,0.25W        | 01121 | CB5625          |
| A1R810        | 315-0682-00 |                  |        | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W        | 01121 | CB6825          |
| A1R814        | 315-0102-00 |                  |        | RES.,FXD,CMPSN:1K OHM,5%,0.25W          | 01121 | CB1025          |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                   | Mfr Code | Mfr Part Number |
|---------------|--------------------|-----------------------------|--------------------------------------|----------|-----------------|
| A1R818        | 315-0302-00        |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W       | 01121    | CB3025          |
| A1R820        | 315-0332-00        |                             | RES.,FXD,CMPSN:3.3K OHM,5%,0.25W     | 01121    | CB3325          |
| A1R822        | 301-0512-00        |                             | RES.,FXD,CMPSN:5.1K OHM,5%,0.50W     | 01121    | EB5125          |
| A1R823        | 301-0512-00        |                             | RES.,FXD,CMPSN:5.1K OHM,5%,0.50W     | 01121    | EB5125          |
| A1R825        | 315-0750-00        |                             | RES.,FXD,CMPSN:75 OHM,5%,0.25W       | 01121    | CB7505          |
| A1R826        | 315-0104-00        |                             | RES.,FXD,CMPSN:100K OHM,5%,0.25W     | 01121    | CB1045          |
| A1R828        | 315-0560-00        |                             | RES.,FXD,CMPSN:56 OHM,5%,0.25W       | 01121    | CB5605          |
| A1R830        | 321-0212-00        |                             | RES.,FXD,FILM:1.58K OHM,1%,0.125W    | 91637    | MFF1816G15800F  |
| A1R832        | 321-0222-00        |                             | RES.,FXD,FILM:2K OHM,1%,0.125W       | 91637    | MFF1816G20000F  |
| A1R834        | 315-0101-00        |                             | RES.,FXD,CMPSN:100 OHM,5%,0.25W      | 01121    | CB1015          |
| A1R835        | 321-0228-00        |                             | RES.,FXD,FILM:2.32K OHM,1%,0.125W    | 91637    | MFF1816G23200F  |
| A1R836        | 315-0102-00        |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W       | 01121    | CB1025          |
| A1R840        | 315-0561-00        |                             | RES.,FXD,CMPSN:560 OHM,5%,0.25W      | 01121    | CB5615          |
| A1R841        | 322-0322-00        |                             | RES.,FXD,FILM:22.1K OHM,1%,0.25W     | 24546    | NA60D2212F      |
| A1R842        | 315-0241-00        |                             | RES.,FXD,CMPSN:240 OHM,5%,0.25W      | 01121    | CB2415          |
| A1R844        | 315-0104-00        |                             | RES.,FXD,CMPSN:100K OHM,5%,0.25W     | 01121    | CB1045          |
| A1R845        | 315-0472-00        |                             | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W     | 01121    | CB4725          |
| A1R849        | 315-0102-00        |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W       | 01121    | CB1025          |
| A1R851        | 311-1558-00        |                             | RES.,VAR,NONWIR:20K OHM,20%,0.50W    | 73138    | 91-80-0         |
| A1R852        | 315-0203-00        |                             | RES.,FXD,CMPSN:20K OHM,5%,0.25W      | 01121    | CB2035          |
| A1R853        | 315-0244-00        |                             | RES.,FXD,CMPSN:240K OHM,5%,0.25W     | 01121    | CB2445          |
| A1R854        | 315-0472-00        |                             | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W     | 01121    | CB4725          |
| A1R858        | 315-0511-00        |                             | RES.,FXD,CMPSN:510 OHM,5%,0.25W      | 01121    | CB5115          |
| A1R860        | 315-0625-00        |                             | RES.,FXD,CMPSN:6.2M OHM,5%,0.25W     | 01121    | CB6255          |
| A1R870        | 311-1555-00        |                             | RES.,VAR,NONWIR:100K OHM,20%,0.5W    | 73138    | 91-77-0         |
| A1R871        | 315-0102-00        |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W       | 01121    | CB1025          |
| A1R872        | 315-0223-00        |                             | RES.,FXD,CMPSN:22K OHM,5%,0.25W      | 01121    | CB2235          |
| A1R873        | 315-0513-00        |                             | RES.,FXD,CMPSN:51K OHM,5%,0.25W      | 01121    | CB5135          |
| A1R874        | 311-1555-00        |                             | RES.,VAR,NONWIR:100K OHM,20%,0.5W    | 73138    | 91-77-0         |
| A1R875        | 315-0102-00        |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W       | 01121    | CB1025          |
| A1R877        | 315-0102-00        |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W       | 01121    | CB1025          |
| A1R879        | 315-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.25W     | 01121    | CB5145          |
| A1R885        | 315-0912-00        |                             | RES.,FXD,CMPSN:9.1K OHM,5%,0.25W     | 01121    | CB9125          |
| A1R886        | 315-0184-00        |                             | RES.,FXD,CMPSN:180K OHM,5%,0.25W     | 01121    | CB1845          |
| A1R888        | 301-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.50W     | 01121    | EB5145          |
| A1R889        | 301-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.50W     | 01121    | EB5145          |
| A1R890        | 301-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.50W     | 01121    | EB5145          |
| A1R891        | 301-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.50W     | 01121    | EB5145          |
| A1R892        | 301-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.50W     | 01121    | EB5145          |
| A1R893        | 311-1933-00        |                             | RES.,VAR,NONWIR:PNL,5M OHM,10%,0.50W | 01121    | 23M909          |
| A1R894        | 301-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.50W     | 01121    | EB5145          |
| A1R905        | 301-0823-00        |                             | RES.,FXD,CMPSN:82K OHM,5%,0.50W      | 01121    | EB8235          |
| A1R906        | 301-0823-00        |                             | RES.,FXD,CMPSN:82K OHM,5%,0.50W      | 01121    | EB8235          |
| A1R907        | 308-0843-00        |                             | RES.,FXD WW:0.2 OHM,5%,1.0W          | 91637    | RS1AR2000JT/R   |
| A1R908        | 315-0302-00        |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W       | 01121    | CB3025          |
| A1R909        | 315-0390-00        |                             | RES.,FXD,CMPSN:39 OHM,5%,0.25W       | 01121    | CB3905          |
| A1R910        | 315-0301-00        |                             | RES.,FXD,CMPSN:300 OHM,5%,0.25W      | 01121    | CB3015          |
| A1R912        | 321-0150-00        |                             | RES.,FXD,FILM:357 OHM,1%,0.125W      | 91637    | MFF1816G357R0F  |
| A1R913        | 321-0289-00        |                             | RES.,FXD,FILM:10K OHM,1%,0.125W      | 91637    | MFF1816G10001F  |
| A1R914        | 321-0378-00        |                             | RES.,FXD,FILM:84.5K OHM,1%,0.125W    | 91637    | MFF1816G84501F  |
| A1R915        | 321-0289-00        |                             | RES.,FXD,FILM:10K OHM,1%,0.125W      | 91637    | MFF1816G10001F  |
| A1R916        | 315-0514-00        |                             | RES.,FXD,CMPSN:510K OHM,5%,0.25W     | 01121    | CB5145          |
| A1R917        | 315-0303-00        |                             | RES.,FXD,CMPSN:30K OHM,5%,0.25W      | 01121    | CB3035          |
| A1R919        | 315-0113-00        |                             | RES.,FXD,CMPSN:11K OHM,5%,0.25W      | 01121    | CB1135          |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. |         | Name & Description                         | Mfr Code | Mfr Part Number |
|---------------|--------------------|------------------|---------|--|----------|-----------------|
|               |                    | Eff              | Dscont  |  |          |                 |
| A1R921        | 315-0303-00        |                  |         | RES.,FXD,CMPSN:30K OHM,5%,0.25W            | 01121    | CB3035          |
| A1R922        | 315-0203-00        |                  |         | RES.,FXD,CMPSN:20K OHM,5%,0.25W            | 01121    | CB2035          |
| A1R925        | 315-0124-00        |                  |         | RES.,FXD,CMPSN:120K OHM,5%,0.25W           | 01121    | CB1245          |
| A1R926        | 303-0154-00        |                  |         | RES.,FXD,CMPSN:150K OHM,5%,1W              | 01121    | GB1545          |
| A1R927        | 315-0104-00        |                  |         | RES.,FXD,CMPSN:100K OHM,5%,0.25W           | 01121    | CB1045          |
| A1R928        | 315-0682-00        |                  |         | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W           | 01121    | CB6825          |
| A1R929        | 315-0302-00        |                  |         | RES.,FXD,CMPSN:3K OHM,5%,0.25W             | 01121    | CB3025          |
| A1R930        | 315-0104-00        |                  |         | RES.,FXD,CMPSN:100K OHM,5%,0.25W           | 01121    | CB1045          |
| A1R934        | 308-0441-00        |                  |         | RES.,FXD,WW:3 OHM,5%,3W                    | 91637    | CW2B-3R00J      |
| A1R935        | 315-0121-00        |                  |         | RES.,FXD,CMPSN:120 OHM,5%,0.25W            | 01121    | CB1215          |
| A1R937        | 321-0234-00        |                  |         | RES.,FXD,FILM:2.67K OHM,1%,0.125W          | 91637    | MFF1816G26700F  |
| A1R938        | 311-1248-00        |                  |         | RES.,VAR,NONWIR:500 OHM,10%,0.50W          | 73138    | 72-23-0         |
| A1R939        | 321-0304-00        |                  |         | RES.,FXD,FILM:14.3K OHM,1%,0.125W          | 91637    | MFF1816G14301F  |
| A1R940        | 315-0203-00        |                  |         | RES.,FXD,CMPSN:20K OHM,5%,0.25W            | 01121    | CB2035          |
| A1R941        | 315-0102-00        |                  |         | RES.,FXD,CMPSN:1K OHM,5%,0.25W             | 01121    | CB1025          |
| A1R942        | 315-0102-00        |                  |         | RES.,FXD,CMPSN:1K OHM,5%,0.25W             | 01121    | CB1025          |
| A1R943        | 301-0472-00        |                  |         | RES.,FXD,CMPSN:4.7K OHM,5%,0.5W            | 01121    | EB4725          |
| A1R944        | 315-0102-00        |                  |         | RES.,FXD,CMPSN:1K OHM,5%,0.25W             | 01121    | CB1025          |
| A1R945        | 301-0202-00        |                  |         | RES.,FXD,CMPSN:2K OHM,5%,0.5W              | 01121    | EB2025          |
| A1R946        | 315-0470-00        |                  |         | RES.,FXD,CMPSN:47 OHM,5%,0.25W             | 01121    | CB4705          |
| A1R947        | 315-0470-00        |                  |         | RES.,FXD,CMPSN:47 OHM,5%,0.25W             | 01121    | CB4705          |
| A1R949        | 308-0677-00        |                  |         | RES.,FXD,WW:1 OHM,5%,2W                    | 75042    | BWH-1R000J      |
| A1R964        | 307-0106-00        |                  |         | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W           | 01121    | CB47G5          |
| A1R966        | 307-0106-00        |                  |         | RES.,FXD,CMPSN:4.7 OHM,5%,0.25W            | 01121    | CB47G5          |
| A1R971        | 308-0847-00        |                  |         | RES.,FXD,WW:0.62 OHM,5%,1W                 | 75042    | 8W20-0.62OHM    |
| A1R976        | 315-0512-00        |                  |         | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W           | 01121    | CB5125          |
| A1R978        | 315-0512-00        |                  |         | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W           | 01121    | CB5125          |
| A1R9272       | 301-0201-00        |                  |         | RES.,FXD,CMPSN:200 OHM,5%,0.5W             | 01121    | EB2015          |
| A1R9273       | 301-0201-00        |                  |         | RES.,FXD,CMPSN:200 OHM,5%,0.5W             | 01121    | EB2015          |
| A1RT236       | 307-0125-00        |                  |         | RES.,THERMAL:500 OHM,10%,25 DEG C          | 50157    | 2D1595          |
| A1S901        | 260-1849-03        |                  |         | SWITCH,PUSH:DPDT,4A,250VAC,W/COVER         | 80009    | 260-1849-03     |
| A1T390        | 120-1401-00        |                  |         | XFMR,TRIG:                                 | 54937    | ORD BY DESCR    |
| A1T906        | 120-1439-00        |                  |         | TRANSFORMER,RF:ENERGY STORAGE              | 20462    | ORD BY DESCR    |
| A1T944        | 120-1347-00        |                  |         | TRANSFORMER,RF:DRIVER SATURATING POT CORE  | 54583    | BDT-001         |
| A1T948        | 120-1348-01        | B010100          | B011449 | XFRM,PWR,SDN&SU:HIGH VOLTAGE               | 80009    | 120-1348-01     |
| A1T948        | 120-1348-02        | B011450          |         | XFRM,PWR,SON&SU:HIGH VOLTAGE               | 80009    | 120-1348-02     |
| A1TP940       | 131-0589-00        |                  |         | TERMINAL,PIN:0.46 L X 0.025 SQ             | 22526    | 48283-029       |
| A1TP950       | 131-0589-00        |                  |         | TERMINAL,PIN:0.46 L X 0.025 SQ             | 22526    | 48283-029       |
| A1U130        | 155-0274-00        |                  |         | MICROCIRCUIT,LI:VERTICAL PREAMP            | 80009    | 155-0274-00     |
| A1U180        | 155-0274-00        |                  |         | MICROCIRCUIT,LI:VERTICAL PREAMP            | 80009    | 155-0274-00     |
| A1U225        | 156-0067-00        |                  |         | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER      | 01295    | MICROA741CP     |
| A1U310        | 156-0534-00        |                  |         | MICROCIRCUIT,LI:DUAL DIFF AMPL,14 LD DIP   | 02735    | CA3102E-98      |
| A1U335        | 156-0534-00        |                  |         | MICROCIRCUIT,LI:DUAL DIFF AMPL,14 LD DIP   | 02735    | CA3102E-98      |
| A1U350        | 156-1294-00        |                  |         | MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY  | 02735    | CA3127E-98      |
| A1U426        | 156-0158-00        |                  |         | MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER | 18324    | MC1458N         |
| A1U460        | 156-0534-00        |                  |         | MICROCIRCUIT,LI:DUAL DIFF AMPL,14 LD DIP   | 02735    | CA3102E-98      |
| A1U480        | 156-0205-03        |                  |         | MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE,ELC  | 04713    | MC10102 L OR P  |
| A1U502        | 156-1713-00        |                  |         | MICROCIRCUIT,DI:ECL,RETRIG MONOSTABLE MV   | 04713    | MC10198(P OR L) |
| A1U504        | 156-1335-00        |                  |         | MICROCIRCUIT,DI:DUAL RETRIG RESET MONO MV  | 07263    | 96LS02          |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                          | Mfr Code | Mfr Part Number  |
|---------------|--------------------|-----------------------------|---|----------|------------------|
| A1U506        | 156-1639-00        |                             | MICROCIRCUIT,DI:ECL,DUAL D MA-SLAVE FF      | 04713    | MC10H131(P OR L) |
| A1U532        | 156-0205-03        |                             | MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE,ELC   | 04713    | MC10102 L OR P   |
| A1U537        | 156-0721-02        |                             | MICROCIRCUIT,DI:QUAD 2-IN NAND SCHMITT TRI  | 04713    | SN74LS132NDS     |
| A1U540        | 156-0388-03        |                             | MICROCIRCUIT,DI:DUAL D FLIP-FLOP            | 07263    | 74LS74A          |
| A1U555        | 156-0728-02        |                             | MICROCIRCUIT,DI:QUAD 2 INPUT STATE W/OC     | 80009    | 74LS09           |
| A1U565        | 156-0384-02        |                             | MICROCIRCUIT,DI:QUAD 2-INP NAND GATE        | 01295    | SN74LS03         |
| A1U758        | 156-1149-00        |                             | MICROCIRCUIT,LI:OPERATIONAL AMP,JFET INPUT  | 27014    | GLEA134          |
| A1U930        | 156-1627-00        |                             | MICROCIRCUIT,LI:POWER WIDTH MODULATED CONT  | 01295    | TL594CN          |
| A1U975        | 152-0806-00        |                             | SEMICON D VVC,DI:HV MULTIPLIER,4KV AC INPUT | S4431    | MSL8513          |
| A1VR645       | 152-0317-00        |                             | SEMICON D DEVICE:ZENER,0.25W,6.2V,5%        | 04713    | SZG20012         |
| A1VR712       | 152-0508-00        |                             | SEMICON D DEVICE:ZENER,0.4W,12.6V,5%        | 80009    | 152-0508-00      |
| A1VR764       | 152-0508-00        |                             | SEMICON D DEVICE:ZENER,0.4W,12.6V,5%        | 80009    | 152-0508-00      |
| A1VR782       | 152-0243-00        |                             | SEMICON D DEVICE:ZENER,0.4W,15V,5%          | 14552    | TD3810983        |
| A1VR828       | 152-0514-00        |                             | SEMICON D DEVICE:ZENER,0.4W,10V,1%          | 80009    | 152-0514-00      |
| A1VR925       | 152-0166-00        |                             | SEMICON D DEVICE:ZENER,0.4W,6.2V,5%         | 04713    | SZ11738RL        |
| A1VR935       | 152-0255-00        |                             | SEMICON D DEVICE:ZENER,0.4W,51V,5%          | 80009    | 152-0255-00      |
| A1VR943       | 152-0317-00        |                             | SEMICON D DEVICE:ZENER,0.25W,6.2V,5%        | 04713    | SZG20012         |
| A1W142        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W143        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W192        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W193        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W282        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W283        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W310        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W335        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W350        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W351        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W408        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W410        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W419        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W428        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W429        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W494        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W535        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W537        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W538        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W555        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W556        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W558        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W560        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W582        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W590        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W591        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W592        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W602        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W603        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W635        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W649        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W732        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W770        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W780        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |
| A1W885        | 131-0566-00        |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG        | 57668    | JWW-0200E0       |

Replaceable Electrical Parts—2215A Service

| Component No.  | Tektronix Part No. | Serial/Model No. |         | Name & Description                       | Mfr Code | Mfr Part Number  |
|----------------|--------------------|------------------|---------|--|----------|------------------|
|                |                    | Eff              | Dscont  |  |          |                  |
| A1W954         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W955         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W956         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W959         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W960         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W961         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W964         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W965         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W968         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W971         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W972         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W974         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W975         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W976         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W977         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W979         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W991         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W992         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W993         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W995         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W997         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W998         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W999         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG     | 57668    | JWW-0200E0       |
| A1W9000        | 131-3148-00        | B010100          | B011899 | CONN,RCPT,ELEC:HEADER,1 X 36,0.1 SPACING | T1557    | 082-3640-SS40-RA |
| A1W9000(1-21)  | 131-3228-01        | B011900          |         | CONN,RCPT,ELEC:HEADER,1 X 21,0.1 SPACING | T1557    | 082-3440-SS29    |
| A1W9000(22-40) | 131-3228-00        | B011900          |         | CONN,RCPT,ELEC:HEADER,1 X 21,0.1 SPACING | T1557    | 082-2540-SS29    |
| A1W9040        | 195-7745-00        |                  |         | LEAD,ELECTRICAL:18 AWG,3.5 L,8-04        | 80009    | 195-7745-00      |
| A1W9070        | 198-4819-00        |                  |         | WIRE SET,ELEC:POWER FET                  | 80009    | 198-4819-00      |
| A1W9103        | 175-6138-00        |                  |         | CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON    | 80009    | 175-6138-00      |
| A1W9108        | 175-6138-00        |                  |         | CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON    | 80009    | 175-6138-00      |
| A1W9190        | 195-7747-00        |                  |         | LEAD,ELECTRICAL:18 AWG,3.5 L,8-19        | 80009    | 195-7747-00      |
| A1W9700        | 175-6136-00        |                  |         | CA ASSY,SP,ELEC:10,26 AWG,7.0 L,RIBBON   | 80009    | 175-6136-00      |
| A1W9705        | 175-6137-00        |                  |         | CA ASSY,SP,ELEC:8,26 AWG,6.0 L,RIBBON    | 80009    | 175-6137-00      |
| A1W9778        | 195-7065-00        |                  |         | LEAD,ELECTRICAL:22 AWG,1.5 L,9-2         | 80009    | 195-7065-00      |
| A1W9788        | 195-7064-00        |                  |         | LEAD,ELECTRICAL:22 AWG,2.0 L,9-5         | 80009    | 195-7064-00      |
| A1W9870        | 136-0202-08        |                  |         | SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT  | 80009    | 136-0202-08      |
| A1W9991        | 175-6139-00        |                  |         | CA ASSY,SP,ELEC:3,26 AWG,4.0 L,RIBBON    | 80009    | 175-6139-00      |



Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff | Dscont  | Name & Description                         | Mfr Code | Mfr Part Number  |
|---------------|--------------------|----------------------|---------|--|----------|------------------|
| A2 ATTENUATOR |                    |                      |         |  |          |                  |
| A2            | 672-0086-00        |                      |         | CKT BOARD ASSY:ATTENUATOR                  | 80009    | 672-0086-00      |
| A2AT1         | 307-1014-06        |                      |         | ATTENUATOR,FXD:100X                        | 80009    | 307-1014-06      |
| A2AT2         | 307-1013-00        |                      |         | ATTENUATOR,FXD:10X                         | 80009    | 307-1013-00      |
| A2AT51        | 307-1014-06        |                      |         | ATTENUATOR,FXD:100X                        | 80009    | 307-1014-06      |
| A2AT52        | 307-1013-00        |                      |         | ATTENUATOR,FXD:10X                         | 80009    | 307-1013-00      |
| A2C2          | 285-1132-02        |                      |         | CAP.,FXD,PLASTI:0.019UF,10%,600V,RADIAL LD | 80009    | 285-1132-02      |
| A2C3          | 281-0182-00        | B010100              | B012199 | CAP.,VAR,PLSTC:1.8-10PF,500V               | 80031    | 2805D1R810BH02F0 |
| A2C3          | 281-0182-00        | B012200              |         | CAP.,VAR,PLSTC:1.8-10PF,500V               | 80031    | 2805D1R810BH02F0 |
| A2C6          | 283-0000-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+100-0%,500V       | 59660    | 831610Y5U0102P   |
| A2C9          | 281-0770-00        |                      |         | CAP.,FXD,CER DI:1000 PF,20%,100V           | 04222    | MA101C102MAA     |
| A2C10         | 283-0028-00        |                      |         | CAP.,FXD,CER DI:0.0022UF,20%,50V           | 59660    | 0805585Y5SO222M  |
| A2C13         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C17         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C21         | 281-0773-00        |                      |         | CAP.,FXD,CER DI:0.1UF,20%,50V              | 04222    | MA205E104MAA     |
| A2C30         | 281-0775-00        |                      |         | CAP.,FXD,CER DI:0.1UF,20%,50V              | 04222    | MA205E104MAA     |
| A2C35         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C38         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C52         | 285-1132-02        |                      |         | CAP.,FXD,PLASTI:0.019UF,10%,600V,RADIAL LD | 80009    | 285-1132-02      |
| A2C53         | 281-0182-00        | B010100              | B012199 | CAP.,VAR,PLSTC:1.8-10PF,500V               | 80031    | 2805D1R810BH02F0 |
| A2C53         | 281-0182-00        | B012200              |         | CAP.,VAR,PLSTC:1.8-10PF,500V               | 80031    | 2805D1R810BH02F0 |
| A2C56         | 283-0000-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+100-0%,500V       | 59660    | 831610Y5U0102P   |
| A2C59         | 281-0770-00        |                      |         | CAP.,FXD,CER DI:1000 PF,20%,100V           | 04222    | MA101C102MAA     |
| A2C60         | 283-0028-00        |                      |         | CAP.,FXD,CER DI:0.0022UF,20%,50V           | 59660    | 0805585Y5SO222M  |
| A2C63         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C67         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C71         | 281-0773-00        |                      |         | CAP.,FXD,CER DI:0.1UF,20%,50V              | 04222    | MA205E104MAA     |
| A2C80         | 281-0775-00        |                      |         | CAP.,FXD,CER DI:0.1UF,20%,50V              | 04222    | MA205E104MAA     |
| A2C85         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C88         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C90         | 290-0523-00        |                      |         | CAP.,FXD,ELCTLT:2.2UF,20%,20V              | 56289    | 196D225X0020HA1  |
| A2C91         | 290-0523-00        |                      |         | CAP.,FXD,ELCTLT:2.2UF,20%,20V              | 56289    | 196D225X0020HA1  |
| A2C93         | 290-0776-00        |                      |         | CAP.,FXD,ELCTLT:22UF,+50-10%,10V           | 55680    | ULA1A220TEA      |
| A2C94         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2C96         | 290-0776-00        |                      |         | CAP.,FXD,ELCTLT:22UF,+50-10%,10V           | 55680    | ULA1A220TEA      |
| A2C97         | 281-0862-00        |                      |         | CAP.,FXD,CER DI:0.001UF,+80-20%,100V       | 04222    | GC70-1E102M      |
| A2CR7         | 152-0324-00        |                      |         | SEMICONV DEVICE:SILICON,35V,100MA          | 03508    | DE103            |
| A2CR18        | 152-0141-02        |                      |         | SEMICONV DEVICE:SILICON,30V,150MA          | 01295    | 1N4152R          |
| A2CR57        | 152-0324-00        |                      |         | SEMICONV DEVICE:SILICON,35V,100MA          | 03508    | DE103            |
| A2CR68        | 152-0141-02        |                      |         | SEMICONV DEVICE:SILICON,30V,150MA          | 01295    | 1N4152R          |
| A2E90         | 276-0532-00        |                      |         | SHIELDING BEAD.:                           | 02114    | 56-590-65/4A6    |
| A2E91         | 276-0532-00        |                      |         | SHIELDING BEAD.:                           | 02114    | 56-590-65/4A6    |
| A2L93         | 120-0382-00        |                      |         | XFMR,TOROID:14 TURNS,SINGLE                | 80009    | 120-0382-00      |
| A2L96         | 120-0382-00        |                      |         | XFMR,TOROID:14 TURNS,SINGLE                | 80009    | 120-0382-00      |
| A2P9091       | 131-0608-00        |                      |         | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD   | 22526    | 48283-036        |
|               | -----              |                      |         | (QUANTITY OF 3)                            |          |                  |
| A2P9103       | 131-0608-00        |                      |         | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD   | 22526    | 48283-036        |
|               | -----              |                      |         | (QUANTITY OF 4)                            |          |                  |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. |         | Name & Description                       | Mfr Code | Mfr Part Number  |
|---------------|--------------------|------------------|---------|--|----------|------------------|
|               |                    | Eff              | Dscont  |  |          |                  |
| A2P9108       | 131-0608-00        |                  |         | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD | 22526    | 48283-036        |
|               | -----              |                  |         | (QUANTITY OF 4)                          |          |                  |
| A2P9200       | 131-0787-00        |                  |         | TERMINAL,PIN:0.64L X 0.025 SQ            | 22526    | 47359            |
|               | -----              |                  |         | (QUANTITY OF 2)                          |          |                  |
| A2Q13         | 151-1124-00        |                  |         | TRANSISTOR:JFE,N-CHAN,SI,SEL             | 22229    | F2942            |
| A2Q15         | 151-0711-00        |                  |         | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8224          |
| A2Q18         | 151-0711-00        |                  |         | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8224          |
| A2Q63         | 151-1124-00        |                  |         | TRANSISTOR:JFE,N-CHAN,SI,SEL             | 22229    | F2942            |
| A2Q65         | 151-0711-00        |                  |         | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8224          |
| A2Q68         | 151-0711-00        |                  |         | TRANSISTOR:SILICON,NPN                   | 04713    | SPS8224          |
| A2R2          | 317-0105-00        |                  |         | RES.,FXD,CMPSN:1M OHM,5%,0.125W          | 01121    | BB1055           |
| A2R3          | 321-1731-00        |                  |         | RES.,FXD,FILM: 500K OHM,1%,0.125W        | 24546    | N44D5003F        |
| A2R4          | 317-0056-00        |                  |         | RES.,FXD,CMPSN:5.6 OHM,5%,0.125W         | 01121    | BB56G5           |
| A2R5          | 321-1731-00        |                  |         | RES.,FXD,FILM: 500K OHM,1%,0.125W        | 24546    | N44D5003F        |
| A2R6          | 317-0105-00        |                  |         | RES.,FXD,CMPSN:1M OHM,5%,0.125W          | 01121    | BB1055           |
| A2R7          | 315-0160-00        |                  |         | RES.,FXD,CMPSN:16 OHM,5%,0.25W           | 01121    | CB1605           |
| A2R8          | 315-0220-01        |                  |         | RES.,FXD,CMPSN:22 OHM,5%,0.25W           | 01121    | CB2205           |
| A2R9          | 315-0112-00        |                  |         | RES.,FXD,CMPSN:1.1K OHM,5%,0.25W         | 01121    | CB1125           |
| A2R10         | 311-1559-00        |                  |         | RES.,VAR,NONWIR:10K OHM,20%,0.50W        | 73138    | 91-81-0          |
| A2R11         | 315-0153-00        |                  |         | RES.,FXD,CMPSN:15K OHM,5%,0.25W          | 01121    | CB1535           |
| A2R13         | 315-0101-00        |                  |         | RES.,FXD,CMPSN:100 OHM,5%,0.25W          | 01121    | CB1015           |
| A2R14         | 317-0161-00        |                  |         | RES.,FXD,CMPSN:160 OHM,5%,0.125W         | 01121    | BB1615           |
| A2R15         | 315-0101-00        |                  |         | RES.,FXD,CMPSN:100 OHM,5%,0.25W          | 01121    | CB1015           |
| A2R17         | 315-0201-00        |                  |         | RES.,FXD,CMPSN:200 OHM,5%,0.25W          | 01121    | CB2015           |
| A2R18         | 315-0911-00        |                  |         | RES.,FXD,CMPSN:910 OHM,5%,0.25W          | 01121    | CB9115           |
| A2R19         | 307-0843-00        |                  |         | RES,NTWK,FXD,FI:INPUT ATTENUATOR         | 80009    | 307-0843-00      |
| A2R21         | 315-0160-00        |                  |         | RES.,FXD,CMPSN:16 OHM,5%,0.25W           | 01121    | CB1605           |
| A2R22         | 321-0210-00        |                  |         | RES.,FXD,FILM:1.5K OHM,1%,0.125W         | 91637    | MFF1816G15000F   |
| A2R23         | 321-0210-00        |                  |         | RES.,FXD,FILM:1.5K OHM,1%,0.125W         | 91637    | MFF1816G15000F   |
| A2R25         | 311-1568-00        |                  |         | RES.,VAR,NONWIR:50 OHM,20%,0.50W         | 73138    | 91-90-0          |
| A2R26         | 311-0643-00        |                  |         | RES.,VAR,NONWIR:50 OHM,10%,0.50W         | 73138    | 82-33-2          |
| A2R29         | 321-0090-00        |                  |         | RES.,FXD,FILM:84.5 OHM,1%,0.125W         | 91637    | MFF1816G84R50F   |
| A2R30         | 315-0124-00        |                  |         | RES.,FXD,CMPSN:120K OHM,5%,0.25W         | 01121    | CB1245           |
| A2R31         | 315-0750-00        |                  |         | RES.,FXD,CMPSN:75 OHM,5%,0.25W           | 01121    | CB7505           |
| A2R33         | 311-1556-00        |                  |         | RES.,VAR,NONWIR:50K OHM,20%,0.50W        | 73138    | 91-78-0          |
| A2R34         | 315-0101-00        |                  |         | RES.,FXD,CMPSN:100 OHM,5%,0.25W          | 01121    | CB1015           |
| A2R35         | 321-0144-00        |                  |         | RES.,FXD,FILM:309 OHM,1%,0.125W          | 91637    | MFF1816G309R0F   |
| A2R37         | 315-0102-00        |                  |         | RES.,FXD,CMPSN:1K OHM,5%,0.25W           | 01121    | CB1025           |
| A2R38         | 321-0144-00        |                  |         | RES.,FXD,FILM:309 OHM,1%,0.125W          | 91637    | MFF1816G309R0F   |
| A2R39         | 315-0242-00        |                  |         | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W         | 01121    | CB2425           |
| A2R41         | 321-0154-00        | B010100          | B012199 | RES.,FXD,FILM:392 OHM,1%,0.125W          | 91637    | MFF1816G392R0F   |
| A2R41         | 321-0151-00        | B012200          |         | RES.,FXD,FILM:365 OHM,1%,0.125W          | 91637    | MFF1816G365R0F   |
| A2R42         | 315-0333-00        |                  |         | RES.,FXD,CMPSN:33K OHM,5%,0.25W          | 01121    | CB3335           |
| A2R43         | 311-2179-00        |                  |         | RES.,VAR,NONWWW:PNL,10K OHM,10%,0.5W     | 32997    | 91Z1D-Z07-EA0037 |
| A2R46         | 315-0472-00        |                  |         | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W         | 01121    | CB4725           |
| A2R47         | 311-1224-00        |                  |         | RES.,VAR,NONWIR:500 OHM,20%,0.50W        | 32997    | 3386F-T04-501    |
| A2R48         | 315-0512-00        |                  |         | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W         | 01121    | CB5125           |
| A2R52         | 317-0105-00        |                  |         | RES.,FXD,CMPSN:1M OHM,5%,0.125W          | 01121    | BB1055           |
| A2R53         | 321-1731-00        |                  |         | RES.,FXD,FILM: 500K OHM,1%,0.125W        | 24546    | N44D5003F        |
| A2R54         | 317-0056-00        |                  |         | RES.,FXD,CMPSN:5.6 OHM,5%,0.125W         | 01121    | BB56G5           |
| A2R55         | 321-1731-00        |                  |         | RES.,FXD,FILM: 500K OHM,1%,0.125W        | 24546    | N44D5003F        |
| A2R56         | 317-0105-00        |                  |         | RES.,FXD,CMPSN:1M OHM,5%,0.125W          | 01121    | BB1055           |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. |         | Name & Description                     | Mfr Code | Mfr Part Number  |
|---------------|--------------------|------------------|---------|--|----------|------------------|
|               |                    | Eff              | Dscont  |  |          |                  |
| A2R57         | 315-0160-00        |                  |         | RES.,FXD,CMPSN:16 OHM,5%,0.25W         | 01121    | CB1605           |
| A2R58         | 315-0220-01        |                  |         | RES.,FXD,CMPSN:22 OHM,5%,0.25W         | 01121    | CB2205           |
| A2R59         | 315-0112-00        |                  |         | RES.,FXD,CMPSN:1.1K OHM,5%,0.25W       | 01121    | CB1125           |
| A2R60         | 311-1559-00        |                  |         | RES.,VAR,NONWIR:10K OHM,20%,0.50W      | 73138    | 91-81-0          |
| A2R61         | 315-0153-00        |                  |         | RES.,FXD,CMPSN:15K OHM,5%,0.25W        | 01121    | CB1535           |
| A2R63         | 315-0101-00        |                  |         | RES.,FXD,CMPSN:100 OHM,5%,0.25W        | 01121    | CB1015           |
| A2R64         | 317-0161-00        |                  |         | RES.,FXD,CMPSN:160 OHM,5%,0.125W       | 01121    | BB1615           |
| A2R65         | 315-0101-00        |                  |         | RES.,FXD,CMPSN:100 OHM,5%,0.25W        | 01121    | CB1015           |
| A2R67         | 315-0201-00        |                  |         | RES.,FXD,CMPSN:200 OHM,5%,0.25W        | 01121    | CB2015           |
| A2R68         | 315-0911-00        |                  |         | RES.,FXD,CMPSN:910 OHM,5%,0.25W        | 01121    | CB9115           |
| A2R69         | 307-0843-00        |                  |         | RES,NTWK,FXD,FI:INPUT ATTENUATOR       | 80009    | 307-0843-00      |
| A2R71         | 315-0160-00        |                  |         | RES.,FXD,CMPSN:16 OHM,5%,0.25W         | 01121    | CB1605           |
| A2R72         | 321-0210-00        |                  |         | RES.,FXD,FILM:1.5K OHM,1%,0.125W       | 91637    | MFF1816G15000F   |
| A2R73         | 321-0210-00        |                  |         | RES.,FXD,FILM:1.5K OHM,1%,0.125W       | 91637    | MFF1816G15000F   |
| A2R75         | 311-1568-00        |                  |         | RES.,VAR,NONWIR:50 OHM,20%,0.50W       | 73138    | 91-90-0          |
| A2R76         | 311-0643-00        |                  |         | RES.,VAR,NONWIR:50 OHM,10%,0.50W       | 73138    | 82-33-2          |
| A2R79         | 321-0090-00        |                  |         | RES.,FXD,FILM:84.5 OHM,1%,0.125W       | 91637    | MFF1816G84R50F   |
| A2R80         | 315-0124-00        |                  |         | RES.,FXD,CMPSN:120K OHM,5%,0.25W       | 01121    | CB1245           |
| A2R81         | 315-0750-00        |                  |         | RES.,FXD,CMPSN:75 OHM,5%,0.25W         | 01121    | CB7505           |
| A2R83         | 311-1556-00        |                  |         | RES.,VAR,NONWIR:50K OHM,20%,0.50W      | 73138    | 91-78-0          |
| A2R84         | 315-0101-00        |                  |         | RES.,FXD,CMPSN:100 OHM,5%,0.25W        | 01121    | CB1015           |
| A2R85         | 321-0144-00        |                  |         | RES.,FXD,FILM:309 OHM,1%,0.125W        | 91637    | MFF1816G309R0F   |
| A2R87         | 315-0102-00        |                  |         | RES.,FXD,CMPSN:1K OHM,5%,0.25W         | 01121    | CB1025           |
| A2R88         | 321-0144-00        |                  |         | RES.,FXD,FILM:309 OHM,1%,0.125W        | 91637    | MFF1816G309R0F   |
| A2R91         | 321-0154-00        | B010100          | B012199 | RES.,FXD,FILM:392 OHM,1%,0.125W        | 91637    | MFF1816G392R0F   |
| A2R91         | 321-0151-00        | B012200          |         | RES.,FXD,FILM:365 OHM,1%,0.125W        | 91637    | MFF1816G365R0F   |
| A2R93         | 311-2179-00        |                  |         | RES.,VAR,NONWIR:PNL,10K OHM,10%,0.5W   | 32997    | 91Z1D-Z07-EA0037 |
| A2R96         | 315-0472-00        |                  |         | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W       | 01121    | CB4725           |
| A2R97         | 311-1224-00        |                  |         | RES.,VAR,NONWIR:500 OHM,20%,0.50W      | 32997    | 3386F-T04-501    |
| A2R98         | 315-0512-00        |                  |         | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W       | 01121    | CB5125           |
| A2S1          | 263-1040-00        |                  |         | SWITCH ASSEMBLY:CHANNEL 1 DIVISION     | 80009    | 263-1040-00      |
| A2S10         | 263-1041-00        |                  |         | SWITCH ASSEMBLY:CHANNEL 2 DIVISION     | 80009    | 263-1041-00      |
| A2S51         | 263-1040-00        |                  |         | SWITCH ASSEMBLY:CHANNEL 1 DIVISION     | 80009    | 263-1040-00      |
| A2S60         | 263-1041-00        |                  |         | SWITCH ASSEMBLY:CHANNEL 2 DIVISION     | 80009    | 263-1041-00      |
| A2U10         | 156-1134-01        |                  |         | MICROCIRCUIT,DI:OPNL AMP,MOS/FET INPUT | 02735    | CA3140AE         |
| A2U30         | 155-0273-00        |                  |         | MICROCIRCUIT,LI: ATTEN AMPLIFIER       | 80009    | 155-0273-00      |
| A2U60         | 156-1134-01        |                  |         | MICROCIRCUIT,DI:OPNL AMP,MOS/FET INPUT | 02735    | CA3140AE         |
| A2U80         | 155-0273-00        |                  |         | MICROCIRCUIT,LI: ATTEN AMPLIFIER       | 80009    | 155-0273-00      |
| A2W43         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG   | 57668    | JWW-0200E0       |
| A2W93         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG   | 57668    | JWW-0200E0       |
| A2W94         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG   | 57668    | JWW-0200E0       |
| A2W96         | 131-0566-00        |                  |         | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG   | 57668    | JWW-0200E0       |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                                    | Mfr Code | Mfr Part Number  |
|---------------|--------------------|-----------------------------|---|----------|------------------|
| A3            | 670-8286-00        |                             | A3 FRONT PANEL<br>CKT BOARD ASSY:FRONT PANEL          | 80009    | 670-8286-00      |
| A3C376        | 283-0006-00        |                             | CAP.,FXD,CER DI:0.02UF,+80-20%,500V                   | 59660    | 084154525V00203Z |
| A3C377        | 281-0576-00        |                             | CAP.,FXD,CER DI:11PF,5%,500V                          | 59660    | 301-000C0G0110J  |
| A3C379        | 283-0780-00        |                             | CAP.,FXD,MICA D:125PF,1%,500V                         | 00853    | D155F1250F0      |
| A3C380        | 281-0578-00        |                             | CAP.,FXD,CER DI:18PF,5%,500V                          | 59660    | 301-050C0G0180J  |
| A3C987        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V                         | 04222    | MA205E104MAA     |
| A3CR534       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3CR537       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3CR538       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3CR539       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3CR648       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3CR988       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3CR989       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                     | 01295    | 1N4152R          |
| A3DS518       | 150-1029-00        |                             | LT EMITTING DIO:GREEN,565NM,35MA                      | 53184    | XC209G           |
| A3J9200       | 136-0499-02        |                             | CONNECTOR,RCPT,:2 CONTACT                             | 00779    | 4-380949-2       |
| A3J9250       | 136-0499-02        |                             | CONNECTOR,RCPT,:2 CONTACT<br>(QUANTITY OF 2)          | 00779    | 4-380949-2       |
| A3P9006       | 131-0589-00        |                             | TERMINAL,PIN:0.46 L X 0.025 SQ<br><br>(QUANTITY OF 2) | 22526    | 48283-029        |
| A3R89         | 315-0242-00        |                             | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W                      | 01121    | CB2425           |
| A3R92         | 315-0333-00        |                             | RES.,FXD,CMPSN:33K OHM,5%,0.25W                       | 01121    | CB3335           |
| A3R111        | 321-0251-00        |                             | RES.,FXD,FILM:4.02K OHM,1%,0.125W                     | 91637    | MFF1816G40200F   |
| A3R112        | 311-2178-00        |                             | RES.,VAR,NONWW:PNK,500 OHM,10%,0.5W                   | 01121    | W8650A           |
| A3R161        | 321-0251-00        |                             | RES.,FXD,FILM:4.02K OHM,1%,0.125W                     | 91637    | MFF1816G40200F   |
| A3R162        | 311-2178-00        |                             | RES.,VAR,NONWW:PNK,500 OHM,10%,0.5W                   | 01121    | W8650A           |
| A3R201        | 315-0200-00        |                             | RES.,FXD,CMPSN:20 OHM,5%,0.25W                        | 01121    | CB2005           |
| A3R401        | 315-0200-00        |                             | RES.,FXD,CMPSN:20 OHM,5%,0.25W                        | 01121    | CB2005           |
| A3R280        | 311-2147-00        |                             | RES.,VAR,NONWIR:PNL,5K OHM,20%,0.50W                  | 01121    | W8615C           |
| A3R377        | 321-0807-00        |                             | RES.,FXD,FILM:900K OHM,1%,0.125W                      | 91637    | CMF55116G90000F  |
| A3R378        | 321-0617-00        |                             | RES.,FXD,FILM:111K OHM,1%,0.125W                      | 91637    | MFF1816G11102F   |
| A3R379        | 315-0220-00        |                             | RES.,FXD,CMPSN:22 OHM,5%,0.25W                        | 01121    | CB2205           |
| A3R380        | 321-0459-00        |                             | RES.,FXD,FILM:590K OHM,1%,0.125W                      | 91637    | CMF55116G59002F  |
| A3R438        | 311-2178-00        |                             | RES.,VAR,NONWW:PNK,500 OHM,10%,0.5W                   | 01121    | W8650A           |
| A3R519        | 315-0682-00        |                             | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W                      | 01121    | CB6825           |
| A3R520        | 315-0912-00        |                             | RES.,FXD,CMPSN:9.1K OHM,5%,0.25W                      | 01121    | CB9125           |
| A3R602        | 311-2147-00        |                             | RES.,VAR,NONWIR:PNL,5K OHM,20%,0.50W                  | 01121    | W8615C           |
| A3R726        | 311-2147-00        |                             | RES.,VAR,NONWIR:PNL,5K OHM,20%,0.50W                  | 01121    | W8615C           |
| A3R982        | 311-1560-00        |                             | RES.,VAR,NONWIR:5K OHM,20%,0.50W                      | 73138    | 91-82-0          |
| A3R983        | 315-0201-00        |                             | RES.,FXD,CMPSN:200 OHM,5%,0.25W                       | 01121    | CB2015           |
| A3R985        | 315-0114-00        |                             | RES.,FXD,CMPSN:110K OHM,5%,0.25W                      | 01121    | CB1145           |
| A3R986        | 315-0434-00        |                             | RES.,FXD,CMPSN:430K OHM,5%,0.25W                      | 01121    | CB4345           |
| A3R987        | 315-0124-00        |                             | RES.,FXD,CMPSN:120K OHM,5%,0.25W                      | 01121    | CB1245           |
| A3R988        | 315-0182-00        |                             | RES.,FXD,CMPSN:1.8K OHM,5%,0.25W                      | 01121    | CB1825           |
| A3R989        | 321-0239-00        |                             | RES.,FXD,FILM:3.01K OHM,1%,0.125W                     | 91637    | MFF1816G30100F   |
| A3R990        | 321-0126-00        |                             | RES.,FXD,FILM:200 OHM,1%,0.125W                       | 91637    | MFF1816G200R0F   |
| A3R9376       | 315-0510-00        |                             | RES.,FXD,CMPSN:51 OHM,5%,0.25W                        | 01121    | CB5105           |
| A3S90         | 260-1995-00        |                             | SWITCH,PUSH:DPDT,GOLD CONTACTS,SLOPE                  | 71590    | K40352AB         |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix   | Serial/Model No. |        | Name & Description                    | Mfr Code | Mfr Part Number |
|---------------|-------------|------------------|--------|---------------------------------------|----------|-----------------|
|               | Part No.    | Eff              | Dscont |                                       |          |                 |
| A3S226        | 260-2075-00 |                  |        | SWITCH,PUSH:SPDT,50VDC,500M AMP       | 80009    | 260-2075-00     |
| A3S380        | 260-2033-00 |                  |        | SWITCH,SLIDE:DPTT,125V,0.5A           | 82389    | ORD BY DESCR    |
| A3S390        | 260-2111-00 |                  |        | SWITCH,PUSH:1 BUTTON,1 POLE,BEAM FIND | 59821    | ORD BY DESCR    |
| A3S392        | 260-2033-00 |                  |        | SWITCH,SLIDE:DPTT,125V,0.5A           | 82389    | ORD BY DESCR    |
| A3S401        | 260-2110-00 |                  |        | SWITCH,PUSH:3 BUTTON,2 POLE,TRIG MODE | 59821    | ORD BY DESCR    |
| A3S460        | 260-2075-00 |                  |        | SWITCH,PUSH:SPDT,50VDC,500M AMP       | 80009    | 260-2075-00     |
| A3S545        | 260-2033-00 |                  |        | SWITCH,SLIDE:DPTT,125V,0.5A           | 82389    | ORD BY DESCR    |
| A3S550        | 260-2033-00 |                  |        | SWITCH,SLIDE:DPTT,125V,0.5A           | 82389    | ORD BY DESCR    |
| A3S555        | 260-2033-00 |                  |        | SWITCH,SLIDE:DPTT,125V,0.5A           | 82389    | ORD BY DESCR    |
| A3S602        | 260-2075-00 |                  |        | SWITCH,PUSH:SPDT,50VDC,500M AMP       | 80009    | 260-2075-00     |
| A3S648        | 260-2033-00 |                  |        | SWITCH,SLIDE:DPTT,125V,0.5A           | 82389    | ORD BY DESCR    |
| A3U985        | 156-0067-00 |                  |        | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295    | MICROA741CP     |
| A3W89         | 131-0566-00 |                  |        | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG  | 57668    | JWW-0200E0      |
| A3W515        | 131-0566-00 |                  |        | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG  | 57668    | JWW-0200E0      |
| A3W534        | 131-0566-00 |                  |        | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG  | 57668    | JWW-0200E0      |
| A3W539        | 131-0566-00 |                  |        | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG  | 57668    | JWW-0200E0      |
| A3W630        | 131-0566-00 |                  |        | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG  | 57668    | JWW-0200E0      |
| A3W9520       | 175-8548-00 |                  |        | CA ASSY,SP,ELEC:2.26 AWG,4.0 L,RIBBON | 80009    | 175-8548-00     |



Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscnt | Name & Description  | Mfr Code | Mfr Part Number  |
|---------------|--------------------|----------------------------|---|----------|------------------|
| A4            | 670-8285-00        |                            | A4 TIMING<br>CKT BOARD ASSY:TIMING  | 80009    | 670-8285-00      |
| A4C701        | 295-0194-00        |                            | CAP SET,MATCHED:2 EA 1.0UF,1.5%,50V   | 90201    | TTX 100 + 100    |
| A4C702        | 283-0674-00        |                            | CAP.,FXD,MICA D:85PF,1%,500V  | 00853    | D155F850F0       |
| A4C703        | 281-0207-00        |                            | CAP.,VAR,PLSTC:2-18PF,100V  | 80031    | 2807C00218MH02F0 |
| A4C705        | 281-0813-00        |                            | CAP.,FXD CER DI:0.047UF,20%,50V   | 04222    | GC705-E-473M     |
| A4C706        | 281-0773-00        |                            | CAP.,FXD,CER DI:0.1UF,20%,50V   | 04222    | MA205E104MAA     |
| A4C707        | 281-0773-00        |                            | CAP.,FXD,CER DI:0.1UF,20%,50V   | 04222    | MA205E104MAA     |
| A4C708        | 281-0756-00        |                            | CAP.,FXD,CER DI:2.2PF,0.5%,200V   | 12969    | CGB2R2DFN        |
| A4C710        | 281-0813-00        |                            | CAP.,FXD CER DI:0.047UF,20%,50V   | 04222    | GC705-E-473M     |
| A4C712        | 283-0674-00        |                            | CAP.,FXD,MICA D:85PF,1%,500V  | 00853    | D155F850F0       |
| A4C713        | 281-0207-00        |                            | CAP.,VAR,PLSTC:2-18PF,100V  | 80031    | 2807C00218MH02F0 |
| A4C714        | 281-0756-00        |                            | CAP.,FXD,CER DI:2.2PF,0.5%,200V   | 12969    | CGB2R2DFN        |
| A4C715        | 290-0776-00        |                            | CAP.,FXD,ELCTLT:22UF,+50-10%,10V  | 55680    | ULA1A220TEA      |
| A4C720        | 281-0775-00        |                            | CAP.,FXD,CER DI:0.1UF,20%,50V   | 04222    | MA205E104MAA     |
| A4C724        | 281-0773-00        |                            | CAP.,FXD,CER DI:0.1UF,20%,50V   | 04222    | MA205E104MAA     |
| A4C728        | 283-0203-00        |                            | CAP.,FXD,CER DI:0.47UF,20%,50V  | 04222    | 5R305SE474MAA    |
| A4C749        | 281-0775-00        |                            | CAP.,FXD,CER DI:0.1UF,20%,50V   | 04222    | MA205E104MAA     |
| A4C750        | 290-0246-00        |                            | CAP.,FXD,ELCTLT:3.3UF,10%,15V   | 56289    | 173D335X9015V    |
| A4C751        | 281-0809-00        |                            | CAP.,FXD,CER DI:200PF,5%,100V   | 04222    | GC101A201J       |
| A4C752        | 281-0775-00        |                            | CAP.,FXD,CER DI:0.1UF,20%,50V   | 04222    | MA205E104MAA     |
| A4C755        | 283-0107-00        |                            | CAP.,FXD,CER DI:51PF,5%,200V  | 96733    | R3017            |
| A4CR732       | 152-0141-02        |                            | SEMICONV DEVICE:SILICON,30V,150MA   | 01295    | 1N4152R          |
| A4CR742       | 152-0141-02        |                            | SEMICONV DEVICE:SILICON,30V,150MA   | 01295    | 1N4152R          |
| A4P9250       | 131-0787-00        |                            | TERMINAL,PIN:0.64L X 0.025 SQ<br>(QUANTITY OF 4)                                | 22526    | 47359            |
| A4P9700       | 131-0608-00        |                            | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD  | 22526    | 48283-036        |
| A4P9705       | 131-0608-00        |                            | (QUANTITY OF 10)<br>TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD<br>(QUANTITY OF 5) | 22526    | 48283-036        |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No.<br>Eff Dscnt | Name & Description                         | Mfr Code | Mfr Part Number |
|---------------|--------------------|-------------------------------|--|----------|-----------------|
| A4Q701        | 151-0424-00        |                               | TRANSISTOR:SILICON,NPN                     | 04713    | SPS8246         |
| A4Q704        | 151-1042-00        |                               | SEMICON DVC SE:MATCHED PAIR FET            | 22229    | S2089           |
| A4Q706        | 151-0736-00        |                               | TRANSISTOR:SILICON,NPN                     | 04713    | SPS8317         |
| A4Q709        | 151-0424-00        |                               | TRANSISTOR:SILICON,NPN                     | 04713    | SPS8246         |
| A4Q710        | 151-1042-00        |                               | SEMICON DVC SE:MATCHED PAIR FET            | 22229    | S2089           |
| A4Q712        | 151-0736-00        |                               | TRANSISTOR:SILICON,NPN                     | 04713    | SPS8317         |
| A4Q732        | 151-0712-00        |                               | TRANSISTOR:SILICON,NPN                     | 04713    | SPS8223         |
| A4Q737        | 151-0188-00        |                               | TRANSISTOR:SILICON,PNP                     | 04713    | SPS6868         |
| A4Q742        | 151-0712-00        |                               | TRANSISTOR:SILICON,NPN                     | 04713    | SPS8223         |
| A4R701        | 307-0780-01        |                               | RES NTWK,FXD FI:TIMING                     | 80009    | 307-0780-01     |
| A4R702        | 322-0519-01        |                               | RES.,FXD,FILM:2.49M OHM,0.5%,0.25W         | 91637    | HFF143G24903D   |
| A4R703        | 315-0100-00        |                               | RES.,FXD,CMPSN:10 OHM,5%,0.25W             | 01121    | CB1005          |
| A4R705        | 315-0151-00        |                               | RES.,FXD,CMPSN:150 OHM,5%,0.25W            | 01121    | CB1515          |
| A4R707        | 301-0202-00        |                               | RES.,FXD,CMPSN:2K OHM,5%,0.5W              | 01121    | EB2025          |
| A4R709        | 315-0100-00        |                               | RES.,FXD,CMPSN:10 OHM,5%,0.25W             | 01121    | CB1005          |
| A4R710        | 315-0151-00        |                               | RES.,FXD,CMPSN:150 OHM,5%,0.25W            | 01121    | CB1515          |
| A4R711        | 307-0780-01        |                               | RES NTWK,FXD FI:TIMING                     | 80009    | 307-0780-01     |
| A4R713        | 301-0202-00        |                               | RES.,FXD,CMPSN:2K OHM,5%,0.5W              | 01121    | EB2025          |
| A4R715        | 321-0308-00        |                               | RES.,FXD,FILM:15.8K OHM,1%,0.125W          | 91637    | MFF1816G15801F  |
| A4R716        | 321-0303-00        |                               | RES.,FXD,FILM:14K OHM,1%,0.125W            | 91637    | MFF1816G14001F  |
| A4R717        | 321-0306-00        |                               | RES.,FXD,FILM:15K OHM,1%,0.125W            | 91637    | MFF1816G15001F  |
| A4R718        | 321-0306-00        |                               | RES.,FXD,FILM:15K OHM,1%,0.125W            | 91637    | MFF1816G15001F  |
| A4R719        | 315-0330-00        |                               | RES.,FXD,CMPSN:33 OHM,5%,0.25W             | 01121    | CB3305          |
| A4R721        | 311-2151-00        |                               | RES.,VAR, NONWIR:PNL,500 OHM,20%,0.5W,DPST | 12697    | ORD BY DESCR    |
| A4R722        | 315-0201-00        |                               | RES.,FXD,CMPSN:200 OHM,5%,0.25W            | 01121    | CB2015          |
| A4R724        | 315-0200-00        |                               | RES.,FXD,CMPSN:20 OHM,5%,0.25W             | 01121    | CB2005          |
| A4R727        | 321-0246-00        |                               | RES.,FXD,FILM:3.57K OHM,1%,0.125W          | 91637    | MFF1816G35700F  |
| A4R728        | 321-0211-00        |                               | RES.,FXD,FILM:1.54K OHM,1%,0.125W          | 91637    | MFF1816G15400F  |
| A4R730        | 311-0635-00        |                               | RES.,VAR, NONWIR:1K OHM,10%,0.5%,0.5W      | 73138    | 82P-6-2-102K    |
| A4R731        | 321-0244-00        |                               | RES.,FXD,FILM:3.4K OHM,1%,0.125W           | 91637    | MFF1816G34000F  |
| A4R732        | 321-0198-00        |                               | RES.,FXD,FILM:1.13K OHM,1%,0.125W          | 91637    | MFF1816G11300F  |
| A4R733        | 321-0203-00        |                               | RES.,FXD,FILM:1.27K OHM,1%,0.125W          | 91637    | MFF1816G12700F  |
| A4R737        | 315-0392-00        |                               | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W           | 01121    | CB3925          |
| A4R738        | 315-0512-00        |                               | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W           | 01121    | CB5125          |
| A4R740        | 311-0635-00        |                               | RES.,VAR, NONWIR:1K OHM,10%,0.5%,0.5W      | 73138    | 82P-6-2-102K    |
| A4R741        | 321-0244-00        |                               | RES.,FXD,FILM:3.4K OHM,1%,0.125W           | 91637    | MFF1816G34000F  |
| A4R742        | 321-0198-00        |                               | RES.,FXD,FILM:1.13K OHM,1%,0.125W          | 91637    | MFF1816G11300F  |
| A4R743        | 321-0203-00        |                               | RES.,FXD,FILM:1.27K OHM,1%,0.125W          | 91637    | MFF1816G12700F  |
| A4R745        | 321-0177-00        |                               | RES.,FXD,FILM:681 OHM,1%,0.125W            | 91637    | MFF1816G681R0F  |
| A4R746        | 321-0184-00        |                               | RES.,FXD,FILM:806 OHM,1%,0.125W            | 91637    | MFF1816G806R0F  |
| A4R748        | 315-0113-00        |                               | RES.,FXD,CMPSN:11K OHM,5%,0.25W            | 01121    | CB1135          |
| A4R749        | 311-1560-00        |                               | RES.,VAR, NONWIR:5K OHM,20%,0.50W          | 73138    | 91-82-0         |
| A4R750        | 315-0113-00        |                               | RES.,FXD,CMPSN:11K OHM,5%,0.25W            | 01121    | CB1135          |
| A4R751        | 321-0326-00        |                               | RES.,FXD,FILM:24.3K OHM,1%,0.125W          | 91637    | CMF55116G24301F |
| A4R752        | 315-0100-00        |                               | RES.,FXD,CMPSN:10 OHM,5%,0.25W             | 01121    | CB1005          |
| A4R753        | 321-0216-00        |                               | RES.,FXD,FILM:1.74K OHM,1%,0.125W          | 91637    | MFF1816G17400F  |
| A4R754        | 311-0622-00        |                               | RES.,VAR, NONWIR:100 OHM,10%,0.50W         | 32997    | 3329H-G48-101   |
| A4R755        | 315-0121-00        |                               | RES.,FXD,CMPSN:120 OHM,5%,0.25W            | 01121    | CB1215          |
| A4S701        | 260-2023-01        |                               | SWITCH,ROTARY:A/B SWEEP                    | 82104    | ODR BY DESCR    |
| A4U715        | 156-0067-00        |                               | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER      | 01295    | MICROA741CP     |
| A4U750        | 156-1150-00        |                               | MICROCIRCUIT,LI:VOLTAGE REGULATOR,NEGATIVE | 04713    | MC79L05ACP      |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Name & Description                   | Mfr Code | Mfr Part Number |
|---------------|--------------------|----------------------|--------|--------------------------------------|----------|-----------------|
| A4U760        | 155-0124-00        |                      |        | MICROCIRCUIT,LI:HORIZONTAL PREAMPL   | 80009    | 155-0124-00     |
| A4VR720       | 152-0744-00        |                      |        | SEMICONV DEVICE:ZEN,SI,3.6V,5%,0.4W  | 04713    | 1N747A          |
| A4VR749       | 152-0744-00        |                      |        | SEMICONV DEVICE:ZEN,SI,3.6V,5%,0.4W  | 04713    | 1N747A          |
| A4W709        | 131-0566-00        |                      |        | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG | 57668    | JWW-0200E0      |

## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                                   | Mfr Code | Mfr Part Number |
|---------------|--------------------|-----------------------------|--|----------|-----------------|
| A5            | 670-8287-00        |                             | A5 ALTERNATE SWEEP<br>CKT BOARD ASSY:ALTERNATE SWEEP | 80009    | 670-8287-00     |
| A5C610        | 281-0862-00        |                             | CAP.,FXD,CER DI:0.001UF,+80-20%,100V                 | 04222    | GC70-1E102M     |
| A5C624        | 281-0826-00        |                             | CAP.,FXD,CER DI:2200PF,5%,100V                       | 12969    | CGB222KEX       |
| A5C627        | 281-0895-00        |                             | CAP.,FXD,CER DI:6.8PF,100W VDC                       | 04222    | MA101A6R8DAA    |
| A5C643        | 281-0904-00        |                             | CAP.,FXD,CER DI:12PF,10%                             | 04222    | MA101A120KAA    |
| A5C655        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V                        | 04222    | MA205E104MAA    |
| A5C659        | 281-0773-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V                        | 04222    | MA205E104MAA    |
| A5C665        | 281-0810-00        |                             | CAP.,FXD,CER DI:5.6PF,0.5%,100V                      | 04222    | GC10-1A5R6D     |
| A5C671        | 281-0851-00        |                             | CAP.,FXD,CER DI:180PF,5%,100VDC                      | 04222    | GC10-1-A-181K   |
| A5C672        | 281-0759-00        |                             | CAP.,FXD,CER DI:22PF,10%,100V                        | 96733    | R2735           |
| A5C690        | 281-0772-00        |                             | CAP.,FXD,CER DI:0.0047UF,10%,100V                    | 04222    | GC701C472K      |
| A5C693        | 290-0776-00        |                             | CAP.,FXD,ELCTLT:22UF,+50-10%,10V                     | 55680    | ULA1A220TEA     |
| A5C694        | 281-0775-00        |                             | CAP.,FXD,CER DI:0.1UF,20%,50V                        | 04222    | MA205E104MAA    |
| A5CR680       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                    | 01295    | 1N4152R         |
| A5CR685       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                    | 01295    | 1N4152R         |
| A5CR816       | 152-0153-00        |                             | SEMICONV DEVICE:SILICON,15V,50MA                     | 07263    | FD7003          |
| A5CR817       | 152-0141-02        |                             | SEMICONV DEVICE:SILICON,30V,150MA                    | 01295    | 1N4152R         |
| A5Q619        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                               | 04713    | SPS8223         |
| A5Q620        | 151-0712-00        |                             | TRANSISTOR:SILICON,NPN                               | 04713    | SPS8223         |
| A5Q630        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                               | 04713    | SPS6866K        |
| A5Q631        | 151-0199-00        |                             | TRANSISTOR:SILICON,PNP                               | 04713    | SPS6866K        |
| A5Q637        | 151-0276-00        |                             | TRANSISTOR:SILICON,PNP                               | 04713    | 2N5087          |
| A5Q643        | 151-0190-00        |                             | TRANSISTOR:SILICON,NPN                               | 07263    | S032677         |
| A5Q680        | 151-0198-00        |                             | TRANSISTOR:SILICON,NPN,SEL FROM MPS918               | 04713    | SPS8802-1       |
| A5Q685        | 151-0198-00        |                             | TRANSISTOR:SILICON,NPN,SEL FROM MPS918               | 04713    | SPS8802-1       |
| A5R604        | 315-0242-00        |                             | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W                     | 01121    | CB2425          |
| A5R605        | 321-0203-00        |                             | RES.,FXD,FILM:1.27K OHM,1%,0.125W                    | 91637    | MFF1816G12700F  |
| A5R606        | 321-0201-00        |                             | RES.,FXD,FILM:1.21K OHM,1%,0.125W                    | 91637    | MFF1816G12100F  |
| A5R609        | 315-0222-00        |                             | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W                     | 01121    | CB2225          |
| A5R610        | 315-0241-00        |                             | RES.,FXD,CMPSN:240 OHM,5%,0.25W                      | 01121    | CB2415          |
| A5R611        | 315-0470-00        |                             | RES.,FXD,CMPSN:47 OHM,5%,0.25W                       | 01121    | CB4705          |
| A5R614        | 315-0302-00        |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W                       | 01121    | CB3025          |
| A5R616        | 321-0207-00        |                             | RES.,FXD,FILM:1.4K OHM,1%,0.125W                     | 91637    | MFF1816G14000F  |
| A5R617        | 321-0197-00        |                             | RES.,FXD,FILM:1.1K OHM,1%,0.125W                     | 91637    | MFF1816G11000F  |
| A5R619        | 321-0092-00        |                             | RES.,FXD,FILM:88.7 OHM,1%,0.125W                     | 91637    | MFF1816G88R70F  |
| A5R620        | 321-0090-00        |                             | RES.,FXD,FILM:84.5 OHM,1%,0.125W                     | 91637    | MFF1816G84R50F  |
| A5R621        | 315-0271-00        |                             | RES.,FXD,CMPSN:270 OHM,5%,0.25W                      | 01121    | CB2715          |
| A5R623        | 315-0820-00        |                             | RES.,FXD,CMPSN:82 OHM,5%,0.25W                       | 01121    | CB8205          |
| A5R624        | 301-0510-00        |                             | RES.,FXD,CMPSN:51 OHM,5%,0.50W                       | 01121    | EB5105          |
| A5R625        | 315-0431-00        |                             | RES.,FXD,CMPSN:430 OHM,5%,0.25W                      | 01121    | CB4315          |
| A5R626        | 315-0431-00        |                             | RES.,FXD,CMPSN:430 OHM,5%,0.25W                      | 01121    | CB4315          |
| A5R627        | 315-0201-00        |                             | RES.,FXD,CMPSN:200 OHM,5%,0.25W                      | 01121    | CB2015          |
| A5R630        | 315-0471-00        |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W                      | 01121    | CB4715          |
| A5R631        | 315-0471-00        |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W                      | 01121    | CB4715          |
| A5R632        | 315-0181-00        |                             | RES.,FXD,CMPSN:180 OHM,5%,0.25W                      | 01121    | CB1815          |
| A5R633        | 315-0302-00        |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W                       | 01121    | CB3025          |
| A5R634        | 315-0201-00        |                             | RES.,FXD,CMPSN:200 OHM,5%,0.25W                      | 01121    | CB2015          |
| A5R637        | 315-0104-00        |                             | RES.,FXD,CMPSN:100K OHM,5%,0.25W                     | 01121    | CB1045          |
| A5R638        | 315-0102-00        |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W                       | 01121    | CB1025          |
| A5R640        | 315-0114-00        |                             | RES.,FXD,CMPSN:110K OHM,5%,0.25W                     | 01121    | CB1145          |

Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No.   | Serial/Model No. Eff Dscont | Name & Description                                 | Mfr Code | Mfr Part Number |
|---------------|----------------------|-----------------------------|--|----------|-----------------|
| A5R642        | 321-0314-00          |                             | RES.,FXD,FILM:18.2K OHM,1%,0.125W                  | 91637    | MFF1816G18201F  |
| A5R643        | 321-0322-00          |                             | RES.,FXD,FILM:22.1K OHM,1%,0.125W                  | 91637    | MFF1816G22101F  |
| A5R644        | 315-0512-00          |                             | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W                   | 01121    | CB5125          |
| A5R651        | 321-0277-00          |                             | RES.,FXD,FILM:7.5K OHM,1%,0.125W                   | 91637    | MFF1816G75000F  |
| A5R652        | 311-1238-00          |                             | RES.,VAR, NONWIR:5K OHM,10%,0.50W                  | 73138    | 72-27-0         |
| A5R653        | 321-0289-00          |                             | RES.,FXD,FILM:10K OHM,1%,0.125W                    | 91637    | MFF1816G10001F  |
| A5R657        | 315-0102-00          |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W                     | 01121    | CB1025          |
| A5R660        | 315-0471-00          |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W                    | 01121    | CB4715          |
| A5R662        | 315-0392-00          |                             | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W                   | 01121    | CB3925          |
| A5R663        | 315-0102-00          |                             | RES.,FXD,CMPSN:1K OHM,5%,0.25W                     | 01121    | CB1025          |
| A5R664        | 315-0392-00          |                             | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W                   | 01121    | CB3925          |
| A5R665        | 315-0204-00          |                             | RES.,FXD,CMPSN:200K OHM,5%,0.25W                   | 01121    | CB2045          |
| A5R666        | 315-0221-00          |                             | RES.,FXD,CMPSN:220 OHM,5%,0.25W                    | 01121    | CB2215          |
| A5R670        | 315-0512-00          |                             | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W                   | 01121    | CB5125          |
| A5R671        | 315-0681-00          |                             | RES.,FXD,CMPSN:680 OHM,5%,0.25W                    | 01121    | CB6815          |
| A5R672        | 315-0331-00          |                             | RES.,FXD,CMPSN:330 OHM,5%,0.25W                    | 01121    | CB3315          |
| A5R674        | 315-0512-00          |                             | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W                   | 01121    | CB5125          |
| A5R677        | 315-0471-00          |                             | RES.,FXD,CMPSN:470 OHM,5%,0.25W                    | 01121    | CB4715          |
| A5R690        | 315-0100-00          |                             | RES.,FXD,CMPSN:10 OHM,5%,0.25W                     | 01121    | CB1005          |
| A5R693        | 307-0106-00          |                             | RES.,FXD,CMPSN:4.7 OHM,5%,0.25W                    | 01121    | CB47G5          |
| A5R816        | 315-0562-00          |                             | RES.,FXD,CMPSN:5.6K OHM,5%,0.25W                   | 01121    | CB5625          |
| A5R817        | 315-0302-00          |                             | RES.,FXD,CMPSN:3K OHM,5%,0.25W                     | 01121    | CB3025          |
| A5U605        | 156-0534-00          |                             | MICROCIRCUIT,LI:DUAL DIFF AMPL,14 LD DIP           | 02735    | CA3102E-98      |
| A5U625        | 156-0182-03          |                             | MICROCIRCUIT,DI:TRIPLE 2-3-2 INPUT GATE            | 04713    | MC10105 P OR L  |
| A5U655        | 156-1126-00          |                             | MICROCIRCUIT,LI:VOLTAGE COMPARATOR                 | 51984    | UPC311C         |
| A5U660        | 156-0385-02          |                             | MICROCIRCUIT,DI:HEX INVERTER                       | 01295    | SN74LS04        |
| A5U665        | 156-0382-02          |                             | MICROCIRCUIT,DI:QUAD 2-INP NAND GATE               | 01295    | SN74LS00        |
| A5U670        | 156-1611-00          |                             | MICROCIRCUIT,DI:DUAL D TYPE EDGE-TRIGGERED         | 07263    | 74F74           |
| A5U680        | 156-0382-02          |                             | MICROCIRCUIT,DI:QUAD 2-INP NAND GATE               | 01295    | SN74LS00        |
| A5VR624       | 152-0195-00          |                             | SEMICONV DEVICE:ZENER,0.4W,5.1V,5%                 | 04713    | SZ11755         |
| A5VR660       | 152-0195-00          |                             | SEMICONV DEVICE:ZENER,0.4W,5.1V,5%                 | 04713    | SZ11755         |
| A5W637        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W638        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W643        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W655        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W662        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W668        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W670        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W677        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W678        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W682        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W690        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W695        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W696        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W698        | 131-0566-00          |                             | BUS CONDUCTOR:DUMMY RES,2.375,22 AWG               | 57668    | JWW-0200E0      |
| A5W9401       | 131-0589-00<br>----- |                             | TERMINAL,PIN:0.46 L X 0.025 SQ<br>(QUANTITY OF 27) | 22526    | 48283-029       |



## Replaceable Electrical Parts—2215A Service

| Component No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description                   | Mfr Code | Mfr Part Number  |
|---------------|--------------------|-----------------------------|--------------------------------------|----------|------------------|
| A6 EMI FILTER |                    |                             |                                      |          |                  |
| A6            | 670-7615-00        |                             | CKT BOARD ASSY:EMI FILTER BOARD      | 80009    | 670-7615-00      |
| A6C900        | 285-1252-00        |                             | CAP,FXD,PLASTIC:0.15UF,10%,250VAC    | D5243    | F1772-415-2000   |
| A6C902        | 285-1192-00        |                             | CAP.,FXD,PPR DI:0.0022UF,20%,250VAC  | 000FG    | PME271Y422       |
| A6C903        | 285-1192-00        |                             | CAP.,FXD,PPR DI:0.0022UF,20%,250VAC  | 000FG    | PME271Y422       |
| A6R900        | 301-0474-00        |                             | RES.,FXD,CMPSN:470K OHM,5%,0.50W     | 01121    | EB4745           |
| A6R901        | 301-0512-00        |                             | RES.,FXD,CMPSN:5.1K OHM,5%,0.50W     | 01121    | EB5125           |
| A6R903        | 301-0331-00        |                             | RES.,FXD,CMPSN:330 OHM,5%,0.5W       | 01121    | EB3315           |
| A6RT901       | 307-0863-00        |                             | RES.,THERMAL:10 OHM,10%,NTC          | 15454    | SG-135           |
| A6T901        | 120-1449-00        |                             | XFMR,COM MODE:                       | 02113    | P104             |
| A6T903        | 120-1455-00        |                             | TRANSFORMER,RF:POT CORE              | T1339    | ORD BY DESCR     |
| A6VR901       | 307-0456-00        |                             | RES,V SENSITIVE:                     | 03508    | M0V-V250LA15A    |
| A6W9011       | 196-0531-00        |                             | LEAD,ELECTRICAL:18 AWG,3.0 L,8-01    | 80009    | 196-0531-00      |
| A6W9091       | 196-0505-00        |                             | LEAD,ELECTRICAL:18 AWG,3.0 L,8-9     | 80009    | 106-0505-00      |
| CHASSIS PARTS |                    |                             |                                      |          |                  |
| DL9210        | 119-0955-00        |                             | DELAY LINE,ELEC:88NS,150 OHM         | 80009    | 119-0955-00      |
| F9001         | 159-0019-00        |                             | FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOW | 71400    | MDL1             |
| FL9001        | 119-1541-01        |                             | LINE FILTER,AS:1A,250V AC            | 80009    | 119-1541-01      |
| J9100         | 131-0126-00        |                             | CONNECTOR,RCPT,:BNC,FEMALE           | 77820    | 9663-1 NT-34     |
| J9376         | 131-0955-00        |                             | CONN,RCPT,ELEC:BNC,FEMALE            | 13511    | 31-279           |
| J9510         | 131-0126-00        |                             | CONNECTOR,RCPT,:BNC,FEMALE           | 77820    | 9663-1 NT-34     |
| J9800         | 131-0955-00        |                             | CONN,RCPT,ELEC:BNC,FEMALE            | 13511    | 31-279           |
| J9900         | 136-0387-02        |                             | JACK,TIP:BLACK                       | 71279    | 450-4252-01-0310 |
| R9100         | 315-0620-00        |                             | RES.,FXD,CMPSN:62 OHM,5%,0.25W       | 01121    | CB6205           |
| R9510         | 315-0620-00        |                             | RES.,FXD,CMPSN:62 OHM,5%,0.25W       | 01121    | CB6205           |
| R9521         | 311-2146-00        |                             | RES.,VAR,NONWIR:50 OHM,20%,0.5W      | 12697    | CM41773          |
| R9644         | 311-1183-02        |                             | RES.,VAR,WW:2K OHM,2W,W/RIBBON       | 80009    | 311-1183-02      |
| R9802         | 311-2177-01        |                             | RES.,VAR,NONWW:PNL,10K OHM,20%,0.5W  | 80009    | 311-2177-01      |
| R9812         | 311-2177-01        |                             | RES.,VAR,NONWW:PNL,10K OHM,20%,0.5W  | 80009    | 311-2177-01      |
| V9870         | 154-0861-00        |                             | ELECTRON TUBE:                       | 80009    | 154-0861-00      |

# DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

## Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it is in the low state.

Abbreviations are based on ANSI Y1.1-1972.

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

- Y14.15, 1966 Drafting Practices.
- Y14.2, 1973 Line Conventions and Lettering.
- Y10.5, 1968 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

American National Standard Institute  
1430 Broadway  
New York, New York 10018

## Component Values

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).

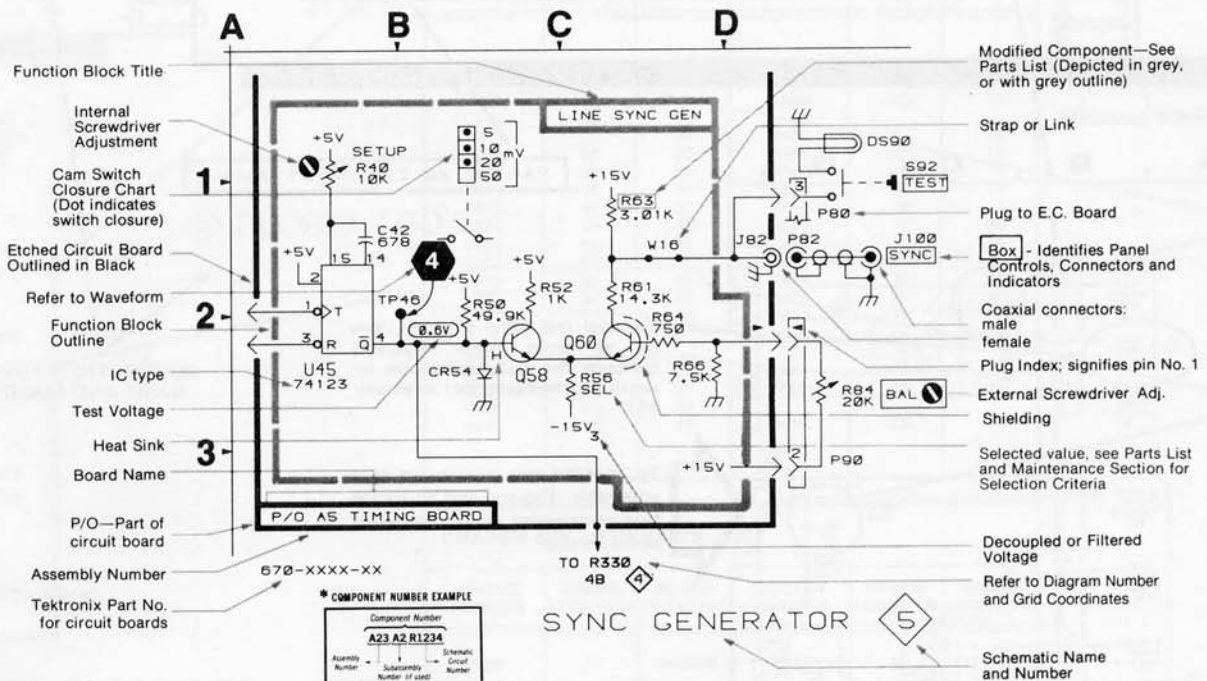
Resistors = Ohms ( $\Omega$ ).

————— The information and special symbols below may appear in this manual. —————

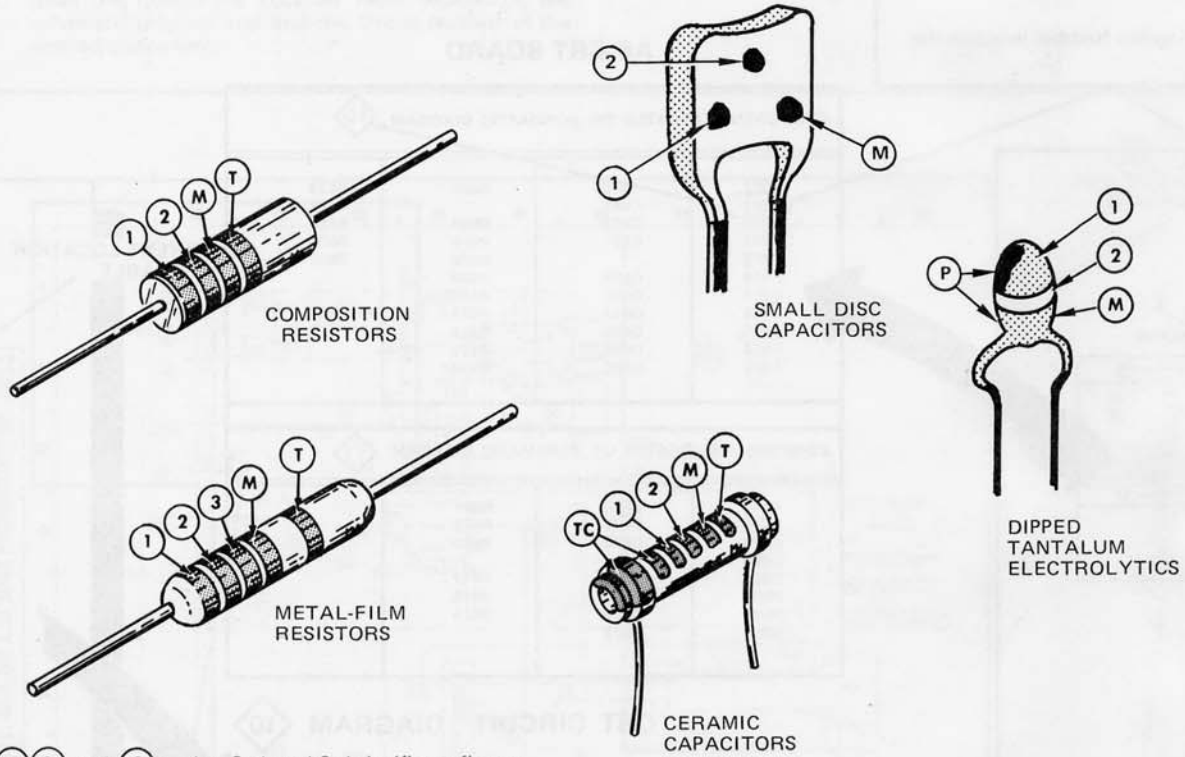
## Assembly Numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number \*(see following illustration for constructing a component number).

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.



### COLOR CODE



① ② and ③ – 1st, 2nd, and 3rd significant figures

Ⓜ – multiplier      Ⓣ – tolerance

ⓉⓈ – temperature coefficient

Ⓟ – polarity and voltage rating

Ⓣ and/or ⓉⓈ color code may not be present on some capacitors

| COLOR  | SIGNIFICANT FIGURES | RESISTORS                |           | CAPACITORS                   |            |             | DIPPED TANTALUM VOLTAGE RATING |
|--------|---------------------|--------------------------|-----------|------------------------------|------------|-------------|--------------------------------|
|        |                     | MULTIPLIER               | TOLERANCE | MULTIPLIER                   | TOLERANCE  |             |                                |
|        |                     |                          |           |                              | over 10 pF | under 10 pF |                                |
| BLACK  | 0                   | 1                        | ----      | 1                            | ±20%       | ±2 pF       | 4 VDC                          |
| BROWN  | 1                   | 10                       | ±1%       | 10                           | ±1%        | ±0.1 pF     | 6 VDC                          |
| RED    | 2                   | 10 <sup>2</sup> or 100   | ±2%       | 10 <sup>2</sup> or 100       | ±2%        | ----        | 10 VDC                         |
| ORANGE | 3                   | 10 <sup>3</sup> or 1 K   | ±3%       | 10 <sup>3</sup> or 1000      | ±3%        | ----        | 15 VDC                         |
| YELLOW | 4                   | 10 <sup>4</sup> or 10 K  | ±4%       | 10 <sup>4</sup> or 10,000    | +100% -9%  | ----        | 20 VDC                         |
| GREEN  | 5                   | 10 <sup>5</sup> or 100 K | ±½%       | 10 <sup>5</sup> or 100,000   | ±5%        | ±0.5 pF     | 25 VDC                         |
| BLUE   | 6                   | 10 <sup>6</sup> or 1 M   | ±¼%       | 10 <sup>6</sup> or 1,000,000 | ----       | ----        | 35 VDC                         |
| VIOLET | 7                   | ----                     | ±1/10%    | ----                         | ----       | ----        | 50 VDC                         |
| GRAY   | 8                   | ----                     | ----      | 10 <sup>-2</sup> or 0.01     | +80% -20%  | ±0.25 pF    | ----                           |
| WHITE  | 9                   | ----                     | ----      | 10 <sup>-1</sup> or 0.1      | ±10%       | ±1 pF       | ----                           |
| GOLD   | -                   | 10 <sup>-1</sup> or 0.1  | ±5%       | ----                         | ----       | ----        | ----                           |
| SILVER | -                   | 10 <sup>-2</sup> or 0.01 | ±10%      | ----                         | ----       | ----        | ----                           |
| NONE   | -                   | ----                     | ±20%      | ----                         | ±10%       | ±1 pF       | ----                           |

(1861-20A)4206-31

Figure 9-1. Color codes for resistors and capacitors.

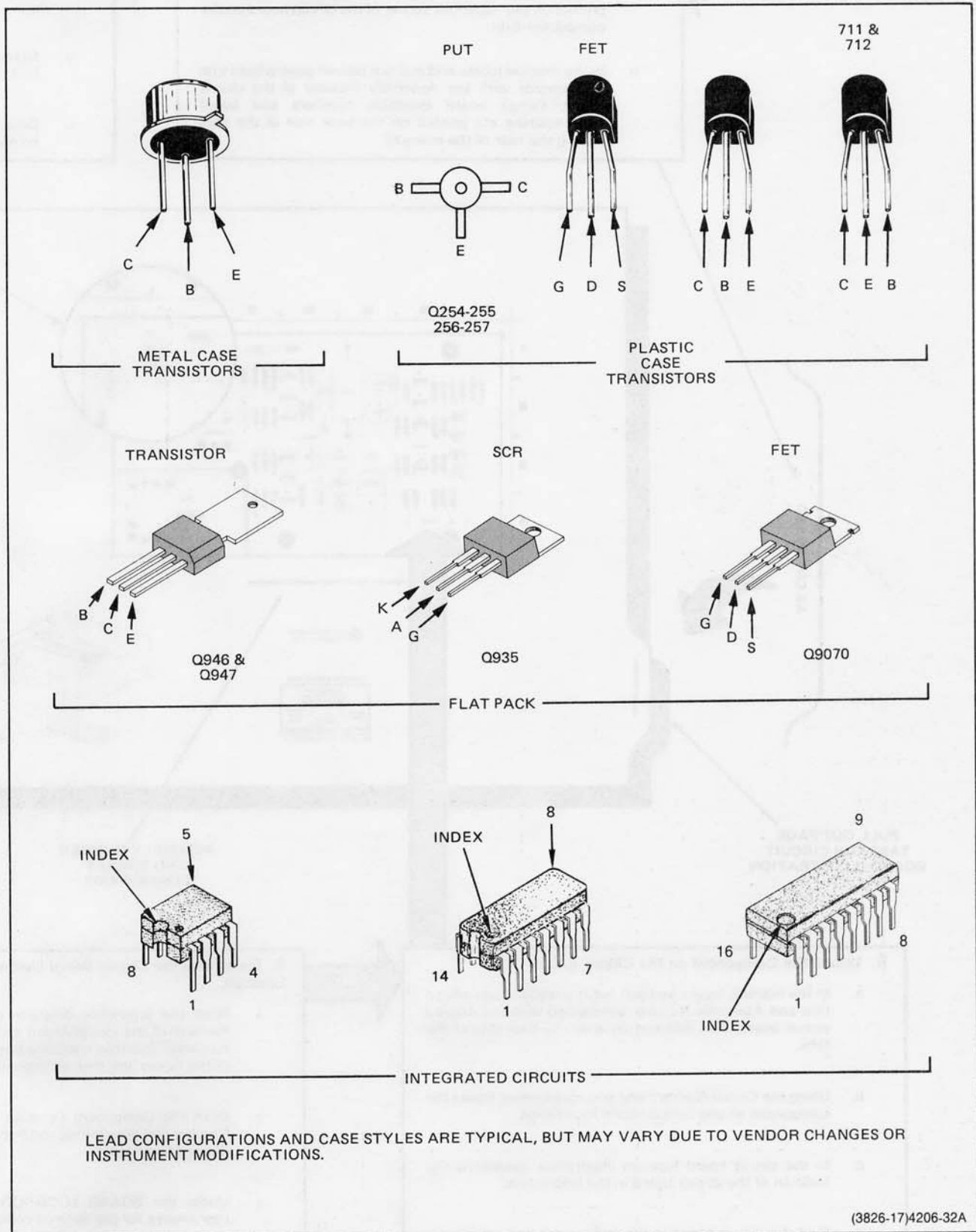


Figure 9-2. Semiconductor lead configurations.

**2215A Service**

To identify any component mounted on a circuit board and to locate that component in the appropriate schematic diagram

**1. Locate the Circuit Board Illustration**

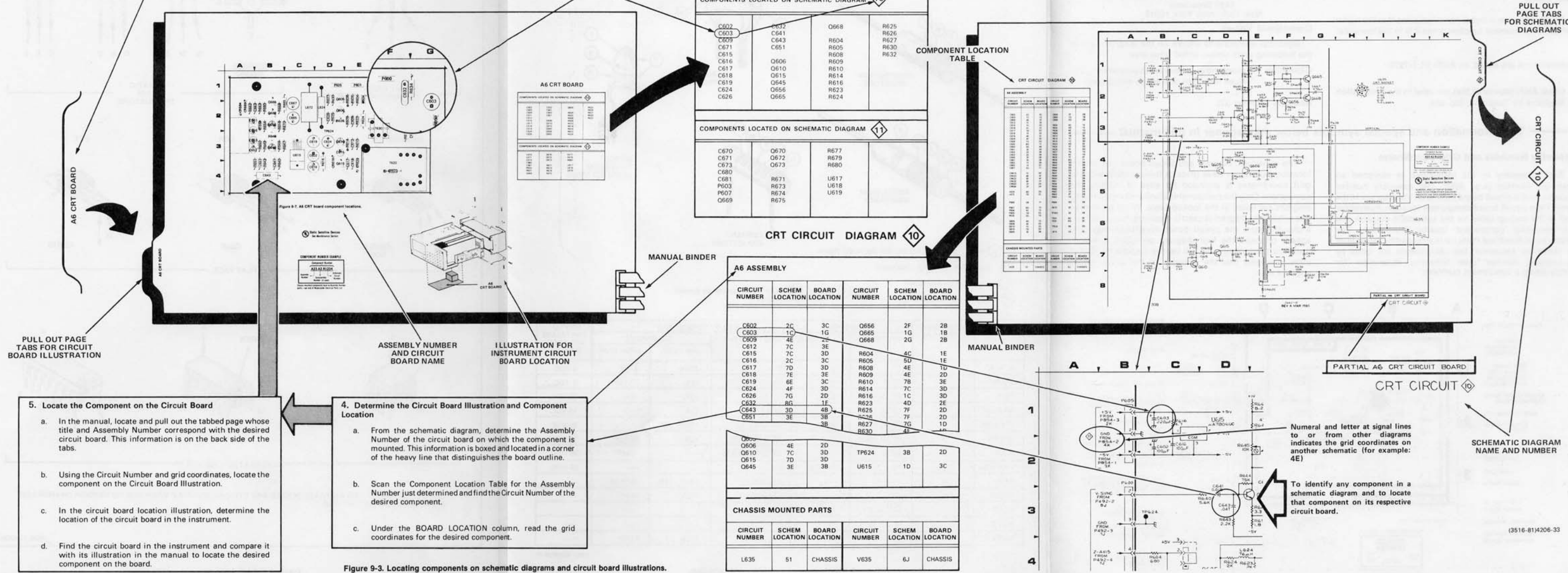
- In the instrument identify the Assembly Number of the circuit board in question. The Assembly Number is usually printed on the upper left corner of the circuit board on the component side.
- In the manual locate and pull out tabbed page whose title corresponds with the Assembly Number of the circuit board. Circuit board assembly numbers and board nomenclature are printed on the back side of the tabs (facing the rear of the manual).

**2. Determine the Circuit Number**

- Compare the circuit board with its illustration and locate the desired component by area and shape on the illustration.
- Scan the table adjacent to the Circuit Board Illustration and find the Circuit Number of the desired component.
- Determine the Schematic Diagram Number in which the component is located.

**3. Locate the Component on the Schematic Diagram**

- Locate and pull out tabbed page whose number and title correspond with the Schematic Diagram Number just determined in the table. Schematic diagram nomenclature and numbers are printed on the front side of the tabs (facing the front of the manual).
- Scan the Component Location Table adjacent to the schematic diagram and find the Circuit Number of the desired component.
- Under the SCHEM LOCATION column, read the grid coordinates for the desired component.
- Using the Circuit Number and grid coordinates, locate the component on the schematic diagram.





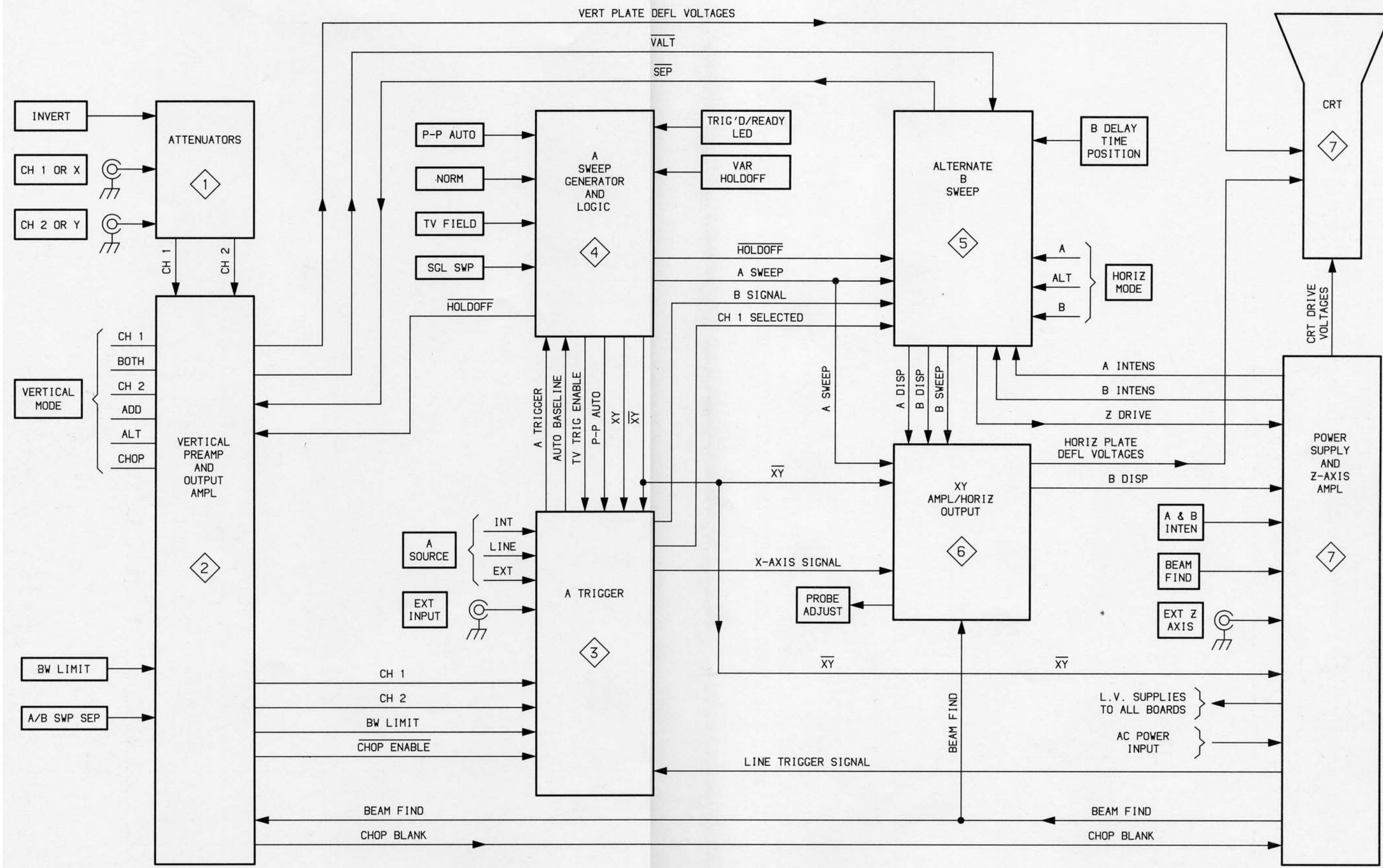


Figure 9-4. Basic block diagram.

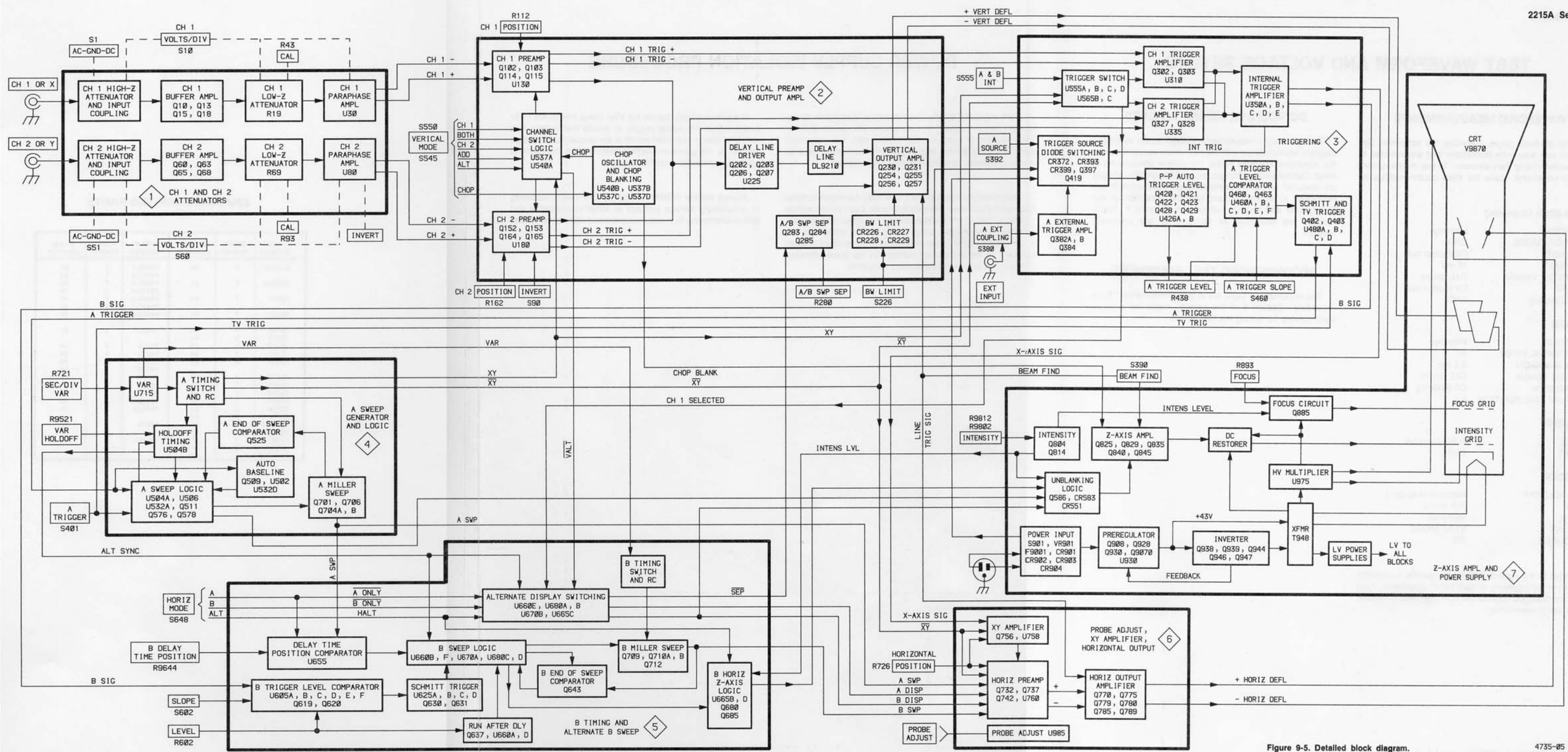


Figure 9-5. Detailed block diagram.

# TEST WAVEFORM AND VOLTAGE SETUPS

## WAVEFORM MEASUREMENTS

On the left-hand pages preceding the schematic diagrams are test waveform illustrations that are intended to aid in troubleshooting the instrument. To test the instrument for these waveforms, make the initial control settings as follows:

### Vertical (Both Channels)

|                    |                  |
|--------------------|------------------|
| POSITION           | Midrange         |
| VERTICAL MODE      | CH 1             |
| BW LIMIT           | Off (button out) |
| VOLTS/DIV          | 10 mV            |
| VOLTS/DIV Variable | CAL detent       |
| INVERT             | Off (button out) |
| Input Coupling     | GND              |

### Horizontal

|                       |               |
|-----------------------|---------------|
| POSITION              | Midrange      |
| HORIZONTAL MODE       | A             |
| A and B SEC/DIV       | 0.5 ms        |
| SEC/DIV Variable      | CAL detent    |
| X10 Magnifier         | Off (knob in) |
| B DELAY TIME POSITION | 5.0           |

### B TRIGGER

|       |                 |
|-------|-----------------|
| LEVEL | Fully clockwise |
| SLOPE | OUT             |

### A TRIGGER

|             |                     |
|-------------|---------------------|
| VAR HOLDOFF | Minimum (fully ccw) |
| Mode        | P-P AUTO            |
| LEVEL       | Midrange            |
| A&B INT     | VERT MODE           |
| A SOURCE    | INT                 |

Changes to the control settings for specific waveforms are noted at the beginning of each set of waveforms. Input signals and hookups required are also indicated, if needed, for each set of waveforms.

## DC VOLTAGE MEASUREMENTS

Typical voltage measurements, located on the schematic diagram, were obtained with the instrument operating under the conditions specified in the Waveforms Measurements setup. Control-setting changes required for specific voltages are indicated on each waveforms page. Measurements are referenced to chassis ground with the exception of the Preregulator and Inverter voltages on Diagram 7. These voltages are referenced as indicated on the schematic diagram.

## RECOMMENDED TEST EQUIPMENT

Test equipment in Table 4-1 in the "Performance Check Procedure", Section 4 of this manual, meets the required specifications for testing this instrument.

# POWER SUPPLY ISOLATION PROCEDURE

Each regulated supply has numerous feed points to external loads throughout the instrument. The power distribution diagram is used in conjunction with the schematic diagrams to determine those loads that can be isolated by removing service jumpers and those that cannot.

The power distribution and circuit board interconnections diagrams are divided into circuit boards. Each power supply feed to a circuit board is indicated by the schematic diagram number on which the voltage appears. The schematic diagram grid location of a service jumper or component is given adjacent to the component number on the power distribution and circuit board interconnect diagrams.

If a power supply comes up after lifting one of the main jumpers from the power supply to isolate that supply, it is very probable that a short exists in the circuitry on that supply line. By lifting jumpers farther down the line, the circuit in which a short exists may be located.

Always set the POWER switch to OFF before soldering or unsoldering service jumpers or other components and before attempting to measure component resistance values.

## CHASSIS MOUNTED PARTS

| CIRCUIT NUMBER | SCHEM NUMBER | SCHEM LOCATION | CIRCUIT NUMBER | SCHEM NUMBER | SCHEM LOCATION |
|----------------|--------------|----------------|----------------|--------------|----------------|
| DL9210         | 2            | 5K             | P9870-1        | 7            | 8P             |
|                |              |                | P9870-2        | 7            | 8N             |
| DS9150         | 7            | 8A             | P9870-3        | 7            | 7N             |
|                |              |                | P9870-4        | 7            | 7N             |
| F9001          | 7            | 5A             | P9870-5        | 7            | 6P             |
|                |              |                | P9870-7        | 7            | 5P             |
| FL9001         | 7            | 5A             | P9870-8        | 7            | 7P             |
|                |              |                |                |              |                |
| J9100          | 1            | 1A             | Q9070          | 7            | 8J             |
| J9376          | 3            | 5A             |                |              |                |
| J9510          | 1            | 6A             | R9100          | 1            | 1A             |
| J9800          | 7            | 4A             | R9272          | 2            | 8S             |
| J9900          | 6            | 2E             | R9273          | 2            | 2S             |
|                |              |                | R9376          | 3            | 5A             |
| P9272          | 7            | 5P             | R9510          | 1            | 6A             |
| P9273          | 7            | 5P             | R9521          | 4            | 3A             |
| P9778          | 7            | 4P             | R9644          | 5            | 5D             |
| P9788          | 7            | 4P             | R9802A         | 7            | 2A             |
| P9070-1        | 7            | 8J             | R9802B         | 7            | 3A             |
| P9070-2        | 7            | 8J             |                |              |                |
| P9070-3        | 7            | 8J             | V9870          | 7            | 2P             |
| P9870-10       | 7            | 4P             |                |              |                |
| P9870-12       | 7            | 3N             | W9272          | 2            | 8S             |
| P9870-14       | 7            | 8P             |                |              |                |



| W9001 (A1 TO A3) |                     |                             |          |                 |                             |
|------------------|---------------------|-----------------------------|----------|-----------------|-----------------------------|
| WIRE NO.         | LINE NAME           | DIAG NO. & GRID COORDINATES | WIRE NO. | LINE NAME       | DIAG NO. & GRID COORDINATES |
| 1                | BEAM FIND           | 7,4F                        | 21       | HORIZ POS       | 6,3B                        |
| 2                | CH 1 POS CW         | 2,2D                        | 22       | +AUTO LEVEL CW  | 3,8M                        |
| 3                | CH 1 POS CCW        | 2,3D                        | 23       | -AUTO LEVEL CCW | 3,8M                        |
| 4                | A/B SWP SEP         | 2,2L                        | 24       | P-P             | 4,8B                        |
| 5                | +8.6 V <sub>G</sub> | 8,4P                        | 25       | SS RESET        | 4,5B                        |
| 6                | NO CONNECTION       |                             | 26       | B ONLY          | 5,2E                        |
| 7                | CH 2 POS CW         | 2,8D                        | 27       | HALT            | 5,2E                        |
| 8                | CH 2 POS CCW        | 2,9D                        | 28       | B SLOPE         | 5,8F                        |
| 9                | CH 2                | 2,6B                        | 29       | TRIG'D LED      | 4,9K                        |
| 10               | BW LIMIT            | 2,4K                        | 30       | SS              | 4,9B                        |
| 11               | CHOP ENABLE         | 3,4C                        | 31       | GND             | 3,6C                        |
| 12               | -8.6 V <sub>H</sub> | 8,5P                        | 32       | CH 1 T          | 3,2C                        |
| 13               | VALT                | 5,2E                        | 33       | CH 2 T          | 3,3C                        |
| 14               | CH 1                | 2,5B                        | 34       | V MODE T        | 3,3C                        |
| 15               | A ONLY              | 5,1E                        | 35       | EXT             | 3,7C                        |
| 16               | B LEVEL             | 5,9F                        | 36       | LINE            | 3,6C                        |
| 17               | TV TRIG ENABLE      | 4,9B                        | 37       | INT             | 3,7C                        |
| 18               | XY                  | 3,2C                        | 38       | GND             | 3,6C                        |
| 19               | A SLOPE             | 3,8N                        | 39       | EXT INPUT       | 3,5C                        |
| 20               | A TRIGGER LEVEL     | 3,8M                        |          |                 |                             |

| P9700 (A4 TO A1) |           |                             |
|------------------|-----------|-----------------------------|
| PIN NO.          | LINE NAME | DIAG NO. & GRID COORDINATES |
| 1                | A DISP    | 6,5E                        |
| 2                | B DISP    | 6,5E                        |
| 3                | B SWP     | 5,6E                        |
| 4                | H.O. 2    | 4,4D                        |
| 5                | H.O. 1    | 4,4D                        |
| 6                | H.O. COM  | 4,4D                        |
| 7                | A SWP     | 4,8N                        |
| 8                | GND       | 5,7E                        |
| 9                | B RETRACE | 5,7E                        |
| 10               | A GATE    | 4,7N                        |

| W9700 (A1 TO A4) |           |                             |
|------------------|-----------|-----------------------------|
| WIRE NO.         | LINE NAME | DIAG NO. & GRID COORDINATES |
| 1                | A DISP    | 6,5D                        |
| 2                | B DISP    | 6,5D                        |
| 3                | B SWP     | 5,6F                        |
| 4                | H.O. 2    | 4,4D                        |
| 5                | H.O. 1    | 4,4D                        |
| 6                | H.O. COM  | 4,4D                        |
| 7                | A SWP     | 4,8M                        |
| 8                | GND       | 4,7M                        |
| 9                | B RETRACE | 5,6F                        |
| 10               | A GATE    | 5,7E                        |

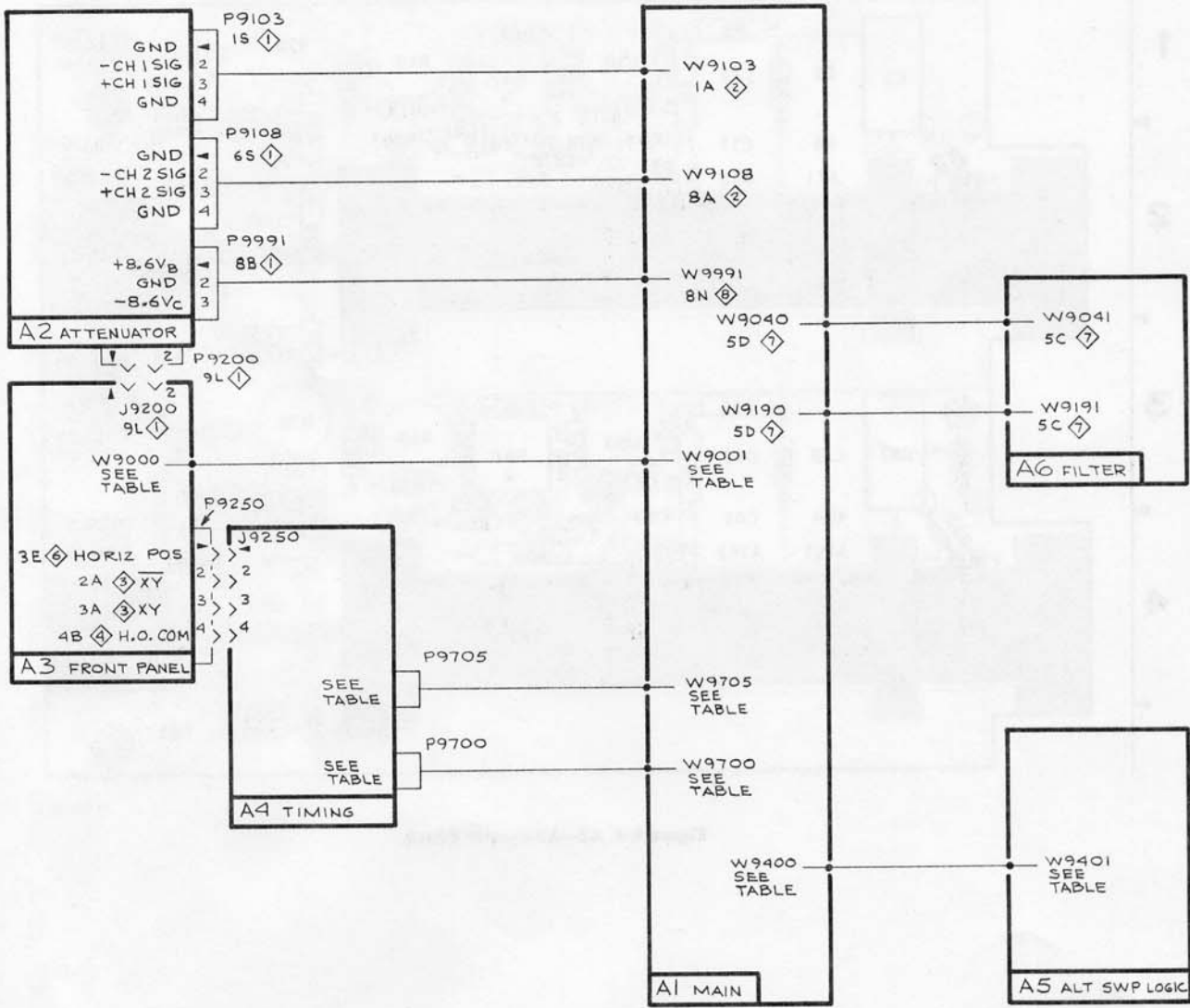
| W9400 (A1 TO A5) |                   |                             |          |                     |                             |
|------------------|-------------------|-----------------------------|----------|---------------------|-----------------------------|
| WIRE NO.         | LINE NAME         | DIAG NO. & GRID COORDINATES | WIRE NO. | LINE NAME           | DIAG NO. & GRID COORDINATES |
| 1                | B SIGNAL          | 5,9F                        | 15       | GND                 | 8,6N                        |
| 2                | B SLOPE           | 5,9F                        | 16       | GND                 | 8,6N                        |
| 3                | GND               | 8,6N                        | 17       | B RETRACE           | 5,6F                        |
| 4                | B LEVEL           | 5,9F                        | 18       | GND                 | 8,6N                        |
| 5                | A DISP            | 5,1S                        | 19       | VALT                | 5,2F                        |
| 6                | B ONLY            | 5,2F                        | 20       | A SWP               | 5,5F                        |
| 7                | SEP               | 5,2S                        | 21       | ALT SYNC            | 5,1F                        |
| 8                | B INTENSITY LEVEL | 7,3C                        | 22       | B SWP               | 5,6F                        |
| 9                | Z DRIVE           | 7,3E                        | 23       | GND                 | 8,6N                        |
| 10               | HALT              | 5,2F                        | 24       | GND                 | 8,6N                        |
| 11               | B DISP            | 5,2S                        | 25       | -8.6 V <sub>A</sub> | 8,6N                        |
| 12               | CH 1 SELECTED     | 5,2F                        | 26       | +5.2 V <sub>A</sub> | 8,5N                        |
| 13               | A ONLY            | 5,1F                        | 27       | +8.6 V <sub>A</sub> | 8,5N                        |
| 14               | DT WIPER          | 5,5F                        |          |                     |                             |

| P9705 (A4 TO A1) |            |                             |
|------------------|------------|-----------------------------|
| PIN NO.          | LINE NAME  | DIAG NO. & GRID COORDINATES |
| 1                | GND        | 6,9E                        |
| 2                | +SWP       | 6,5K                        |
| 3                | -SWP       | 6,7K                        |
| 4                | GND        | 6,9E                        |
| 5                | X AXIS SIG | 6,4E                        |
| 6                | -8.6 Vc    | 6,9E                        |
| 7                | +8.6 Vb    | 6,8E                        |
| 8                | +30 Vb     | 6,8E                        |

| W9705 (A1 TO A4) |            |                             |
|------------------|------------|-----------------------------|
| WIRE NO.         | LINE NAME  | DIAG NO. & GRID COORDINATES |
| 1                | GND        | 8,3N                        |
| 2                | +SWP       | 6,5L                        |
| 3                | -SWP       | 6,7L                        |
| 4                | GND        | 8,3N                        |
| 5                | X AXIS SIG | 6,4E                        |
| 6                | -8.6 Vc    | 8,3N                        |
| 7                | +8.6 Vb    | 8,3N                        |
| 8                | +30 Vb     | 8,2N                        |

| W9000 (A3 TO A1) |                 |                             |          |                 |                             |
|------------------|-----------------|-----------------------------|----------|-----------------|-----------------------------|
| WIRE NO.         | LINE NAME       | DIAG NO. & GRID COORDINATES | WIRE NO. | LINE NAME       | DIAG NO. & GRID COORDINATES |
| 1                | BEAM FIND       | 7,4F                        | 21       | HORIZ POS       | 6,3B                        |
| 2                | CH 1 POS CW     | 2,2D                        | 22       | +AUTO LEVEL CW  | 3,8L                        |
| 3                | CH 1 POS CCW    | 2,3D                        | 23       | -AUTO LEVEL CCW | 3,9L                        |
| 4                | A/B SWP SEP     | 2,2L                        | 24       | P-P             | 4,8C                        |
| 5                | +8.6 Vg         | 8,4N                        | 25       | SS RESET        | 4,5B                        |
| 6                | NO CONNECTION   |                             | 26       | B ONLY          | 5,2E                        |
| 7                | CH 2 POS CW     | 2,8D                        | 27       | HALT            | 5,2E                        |
| 8                | CH 2 POS CCW    | 2,9D                        | 28       | B SLOPE         | 5,9E                        |
| 9                | CH 2            | 2,6B                        | 29       | TRIG'D LED      | 4,9K                        |
| 10               | BW LIMIT        | 2,4K                        | 30       | SS              | 4,9B                        |
| 11               | CHOP ENABLE     | 3,4C                        | 31       | GND             | 3,6C                        |
| 12               | -8.6 Vh         | 8,5N                        | 32       | CH 1 T          | 3,2C                        |
| 13               | VALT            | 5,2E                        | 33       | CH 2 T          | 3,3C                        |
| 14               | CH 1            | 2,5B                        | 34       | V MODE T        | 3,3C                        |
| 15               | A ONLY          | 5,1E                        | 35       | EXT             | 3,7C                        |
| 16               | B LEVEL         | 5,9E                        | 36       | LINE            | 3,6C                        |
| 17               | TV TRIG ENABLE  | 4,9B                        | 37       | INT             | 3,7C                        |
| 18               | XY              | 3,2C                        | 38       | GND             | 3,6C                        |
| 19               | A SLOPE         | 3,8N                        | 39       | EXT INPUT       | 3,5C                        |
| 20               | A TRIGGER LEVEL | 3,8M                        |          |                 |                             |

| W9401 (A5 TO A1) |                   |                             |          |           |                             |
|------------------|-------------------|-----------------------------|----------|-----------|-----------------------------|
| WIRE NO.         | LINE NAME         | DIAG NO. & GRID COORDINATES | WIRE NO. | LINE NAME | DIAG NO. & GRID COORDINATES |
| 1                | B SIGNAL          | 5,9G                        | 15       | GND       | 5,4G                        |
| 2                | B SLOPE           | 5,9G                        | 16       | GND       | 5,4G                        |
| 3                | GND               | 5,4G                        | 17       | B RETRACE | 5,6G                        |
| 4                | B LEVEL           | 5,9G                        | 18       | GND       | 5,4G                        |
| 5                | A DISP            | 5,1S                        | 19       | VALT      | 5,2G                        |
| 6                | B ONLY            | 5,2G                        | 20       | A SWP     | 5,5G                        |
| 7                | SEP               | 5,2S                        | 21       | ALT SYNC  | 5,1G                        |
| 8                | B INTENSITY LEVEL | 5,4P                        | 22       | B SWP     | 5,6G                        |
| 9                | Z DRIVE           | 5,5S                        | 23       | GND       | 5,4G                        |
| 10               | HALT              | 5,2G                        | 24       | GND       | 5,4G                        |
| 11               | B DISP            | 5,2S                        | 25       | -8.6 Va   | 5,4G                        |
| 12               | CH 1 SELECTED     | 5,2G                        | 26       | +5.2 Va   | 5,3G                        |
| 13               | A ONLY            | 5,1G                        | 27       | +8.6 Va   | 5,3G                        |
| 14               | DT WIPER          | 5,5G                        |          |           |                             |



2215A

CIRCUIT BOARD INTERCONNECTIONS

4735-20



**A2—ATTENUATOR BOARD**

| CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER |
|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| AT1            | 1            | C91            | 1            | R9             | 1            | R61            | 1            |
| AT2            | 1            | C93            | 1            | R10            | 1            | R63            | 1            |
| AT51           | 1            | C94            | 1            | R11            | 1            | R64            | 1            |
| AT52           | 1            | C96            | 1            | R13            | 1            | R65            | 1            |
| C2             | 1            | C97            | 1            | R14            | 1            | R67            | 1            |
| C3             | 1            | CR7            | 1            | R15            | 1            | R68            | 1            |





CH 1 & CH 2 ATTENUATORS



| ASSEMBLY A2    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| AT1            | 2D             | 3D             | C96            | 9B             | 4F             | R8             | 2B             | 3C             | R64            | 6G             | 7G             |
| AT2            | 2E             | 3E             | C97            | 7H             | 8H             | R9             | 2G             | 4G             | R65            | 7G             | 8G             |
| AT51           | 6D             | 7D             |                |                |                | R10            | 3G             | 4F             | R67            | 6H             | 6H             |
| AT52           | 6E             | 7E             | CR7            | 1G             | 3G             | R11            | 3G             | 4G             | R68            | 6H             | 7H             |
|                |                |                | CR18           | 2H             | 3H             | R13            | 1G             | 3G             | R69            | 6J             | 7J             |
| C2             | 2B             | 3C             | CR57           | 6G             | 7G             | R14            | 2H             | 3G             | R71            | 7L             | 8L             |
| C3             | 2F             | 3F             | CR68           | 6H             | 7H             | R15            | 2G             | 4G             | R72            | 7L             | 8L             |
| C4             | 2D             | 3D             |                |                |                | R17            | 1H             | 3H             | R73            | 7L             | 7L             |
| C5             | 2D             | 4D             | E90            | 8B             | 3F             | R18            | 2H             | 4H             | R75            | 7L             | 8L             |
| C6             | 1G             | 3F             | E91            | 8B             | 3F             | R19            | 1J             | 3J             | R76            | 7M             | 8L             |
| C9             | 2G             | 4G             |                |                |                | R21            | 3L             | 4L             | R79            | 7N             | 8M             |
| C10            | 3G             | 4F             | L93            | 9B             | 3F             | R22            | 3M             | 4L             | R80            | 7M             | 8M             |
| C11            | 2E             | 3E             | L96            | 9B             | 3F             | R23            | 2M             | 4L             | R81            | 8N             | 8M             |
| C12            | 2E             | 4E             |                |                |                | R25            | 2M             | 4L             | R83            | 8M             | 8L             |
| C13            | 1H             | 3G             | P9103-1        | 2S             | 4S             | R26            | 3M             | 4L             | R84            | 8N             | 9M             |
| C17            | 2H             | 3H             | P9103-2        | 2S             | 3S             | R29            | 2N             | 4M             | R85            | 9N             | 9N             |
| C21            | 2L             | 4L             | P9103-3        | 3S             | 5S             | R30            | 3M             | 5M             | R87            | 8N             | 9N             |
| C30            | 3M             | 5M             | P9103-4        | 3S             | 4S             | R31            | 3N             | 5M             | R88            | 9P             | 9N             |
| C35            | 5N             | 6N             | P9108-1        | 7S             | 8S             | R33            | 3M             | 5L             | R91            | 9M             | 9M             |
| C38            | 4P             | 5P             | P9108-2        | 6S             | 7S             | R34            | 4N             | 5M             | R93            | 9M             | 9M             |
| C52            | 6B             | 7C             | P9108-3        | 8S             | 4E             | R35            | 5N             | 6N             | R96            | 7H             | 8H             |
| C53            | 6F             | 7F             | P9108-4        | 7S             | 8S             | R37            | 4P             | 5N             | R97            | 8H             | 8H             |
| C54            | 6D             | 7D             | P9200-1        | 9L             | 3A             | R38            | 4P             | 5N             | R98            | 8H             | 8H             |
| C55            | 6D             | 7D             | P9200-2        | 9L             | 3A             | R39            | 4P             | 5P             |                |                |                |
| C56            | 6D             | 4C             | P9991-1        | 8B             | 8A             | R41            | 4P             | 5P             | S1             | 4B             | 5B             |
| C59            | 7G             | 8G             | P9991-2        | 9B             | 9A             | R42            | 5P             | 6P             | S10            | 4H             | 5F             |
| C60            | 7G             | 8F             | P9991-3        | 9B             | 9A             | R43            | 5P             | 6P             | S51            | 5B             | 6B             |
| C61            | 6E             | 7E             |                |                |                | R46            | 3H             | 4H             | S60            | 5H             | 6F             |
| C62            | 6E             | 7E             | Q13            | 1H             | 3G             | R47            | 3H             | 5H             |                |                |                |
| C63            | 6H             | 4C             | Q15            | 2H             | 4G             | R48            | 3H             | 5H             | U10            | 2F             | 4F             |
| C67            | 6H             | 7H             | Q18            | 2H             | 3H             | R52            | 6A             | 7B             | U30            | 1N             | 3N             |
| C71            | 7L             | 8L             | Q63            | 6H             | 7G             | R53            | 6F             | 7F             | U60            | 6F             | 7F             |
| C76            | 7M             | 8M             | Q65            | 7G             | 8G             | R54            | 6B             | 7B             | U80            | 6N             | 7N             |
| C77            | 7N             | 8M             | Q68            | 6H             | 7H             | R55            | 7F             | 8F             |                |                |                |
| C80            | 8M             | 8M             |                |                |                | R56            | 6G             | 7F             | W43            | 5P             | 6P             |
| C85            | 9N             | 3E             | R2             | 2A             | 3B             | R57            | 6D             | 7D             | W93            | 9M             | 3F             |
| C88            | 9P             | 9N             | R3             | 2F             | 4F             | R58            | 6B             | 7C             | W94            | 9C             | 2F             |
| C90            | 8B             | 2F             | R4             | 2B             | 3B             | R59            | 7G             | 7G             | W96            | 9C             | 4F             |
| C91            | 8B             | 4F             | R5             | 2F             | 4F             | R60            | 7G             | 8F             |                |                |                |
| C93            | 8B             | 2F             | R6             | 2G             | 3F             | R61            | 7G             | 8G             |                |                |                |
| C94            | 3H             | 4H             | R7             | 2D             | 4D             | R63            | 5G             | 6G             |                |                |                |

| ASSEMBLY A3    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| J9200-1        | 9L             | 9K             | R89            | 9K             | 9K             | S90            | 9K             | 9J             |                |                |                |
| J9200-2        | 9L             | 9K             | R92            | 9K             | 9K             |                |                |                |                |                |                |

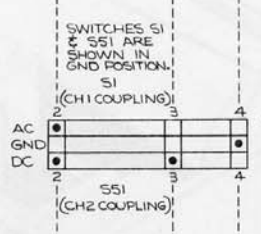
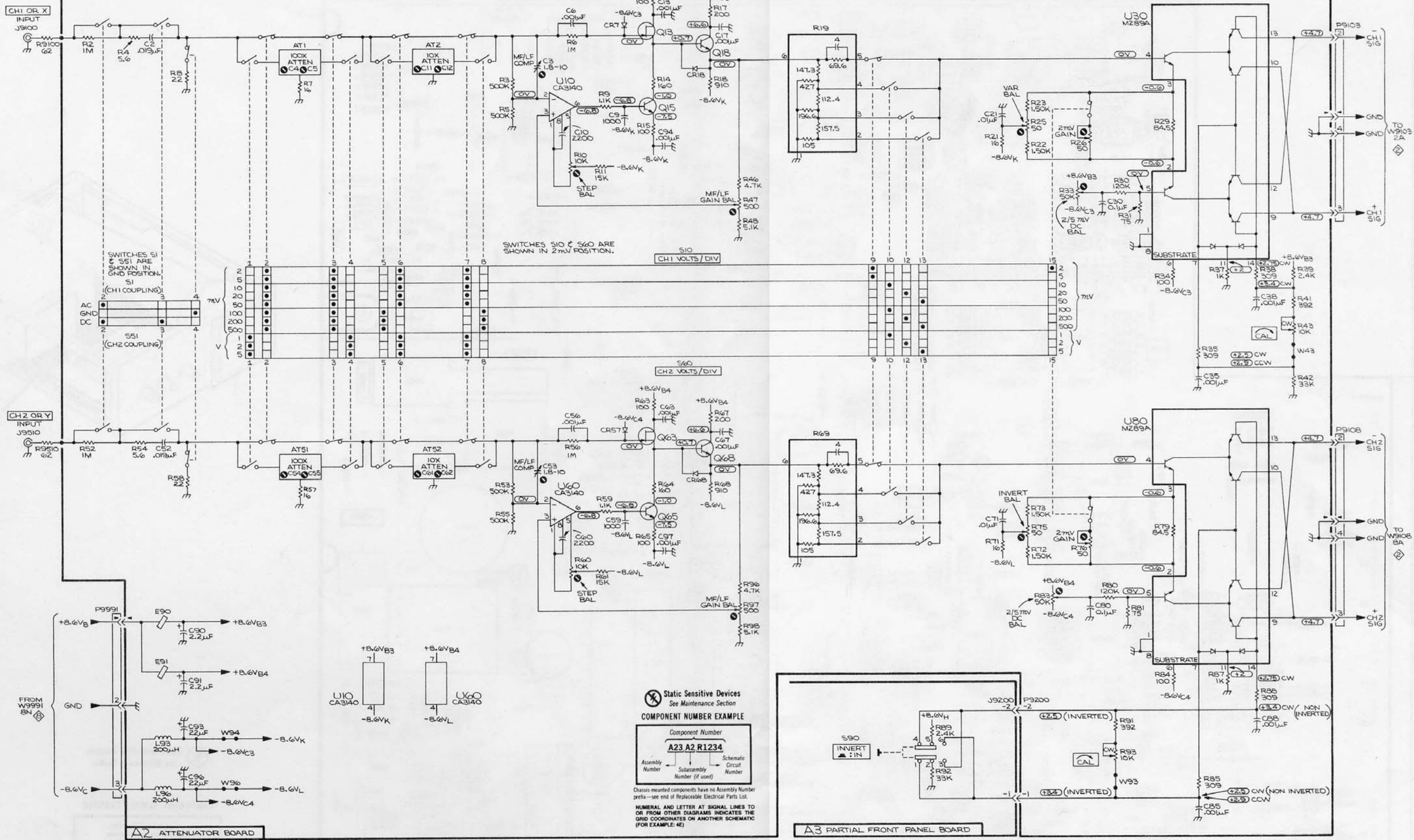
Partial A3 also shown on diagrams 2, 3, 4, 5, 6, 7 and 8.

| CHASSIS MOUNTED PARTS |                |                |                |                |                |                |                |                |                |                |                |
|-----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER        | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| J9100                 | 1A             | CHASSIS        | R9100          | 1A             | CHASSIS        |                |                |                |                |                |                |
| J9510                 | 6A             | CHASSIS        | R9510          | 6A             | CHASSIS        |                |                |                |                |                |                |

A B C D E F G H J K L M N P S

1  
2  
3  
4  
5  
6  
7  
8  
9



Static Sensitive Devices  
See Maintenance Section

COMPONENT NUMBER EXAMPLE

|                              |
|------------------------------|
| Component Number             |
| A23 A2 R1234                 |
| Assembly Number              |
| Subassembly Number (if used) |
| Schematic Circuit Number     |

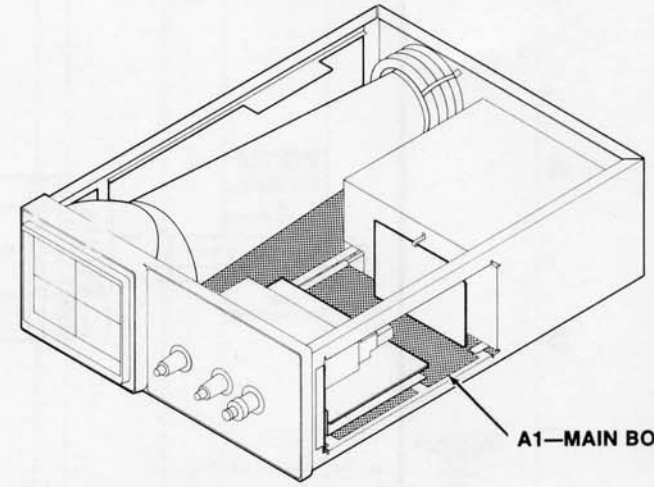
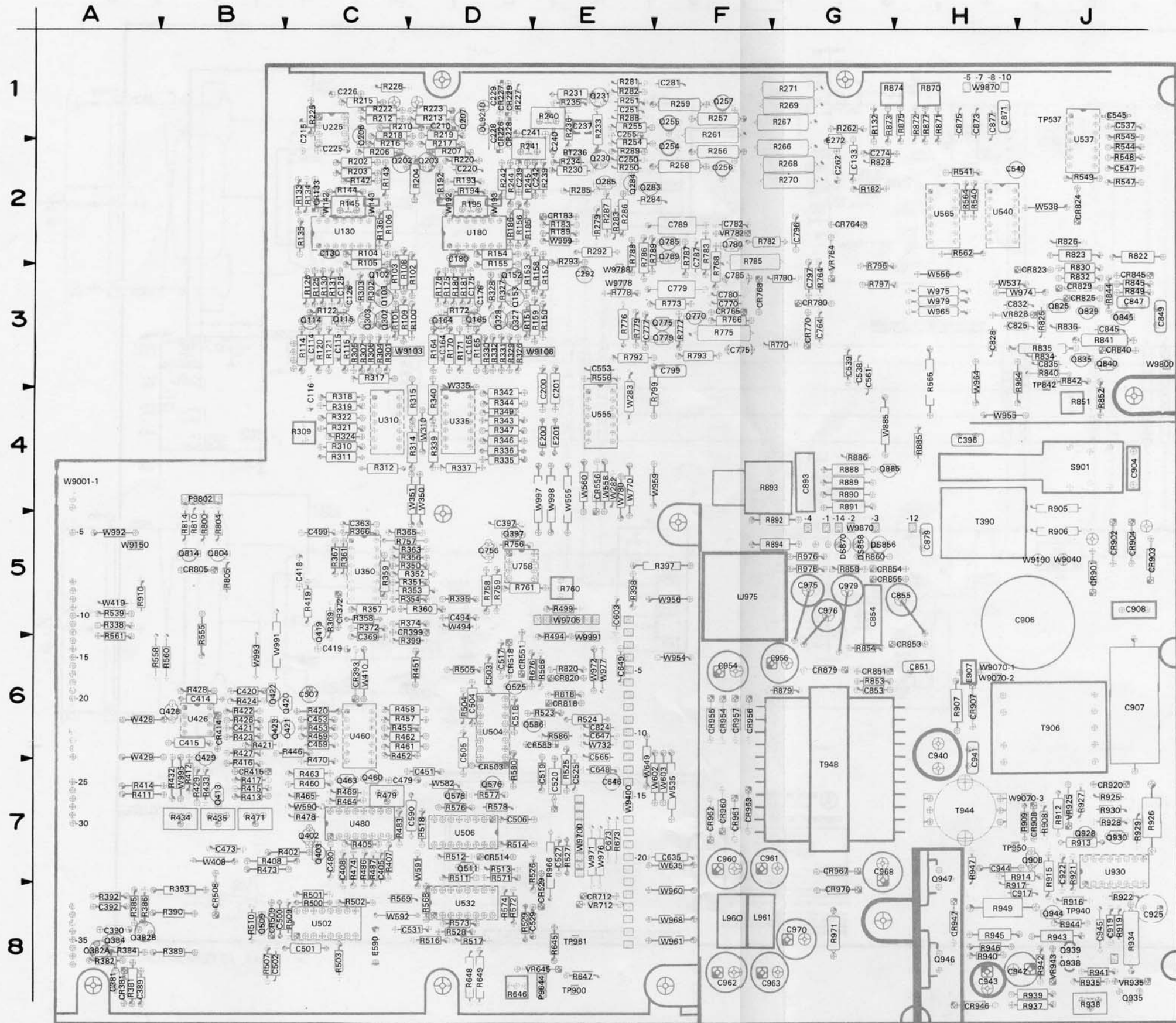
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

NUMERAL AND LETTER AT SIGNAL LINES TO OR FROM OTHER DIAGRAMS INDICATES THE GRID COORDINATES ON ANOTHER SCHEMATIC (FOR EXAMPLE: 4E)

2215A

4735-21

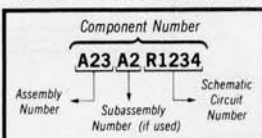
CH1 & CH2 ATTENUATORS



A1—MAIN BOARD

⊗ Static Sensitive Devices  
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Figure 9-7. A1—Main board.



## A1—MAIN BOARD

| CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER |
|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| C114           | 2            | C547           | 2            | CR393          | 3            | Q202           | 2            | R130           | 2            | R262           | 2            |
| C115           | 2            | C553           | 3            | CR399          | 3            | Q203           | 2            | R131           | 2            | R266           | 2            |
| C116           | 2            | C561           | 3            | CR414          | 3            | Q206           | 2            | R132           | 2            | R267           | 2            |
| C125           | 2            | C565           | 3            | CR415          | 3            | Q207           | 2            | R133           | 2            | R268           | 2            |
| C126           | 2            | C590           | 8            | CR503          | 4            | Q230           | 2            | R135           | 2            | R269           | 2            |
| C130           | 2            | C603           | 5            | CR508          | 4            | Q231           | 2            | R136           | 2            | R270           | 2            |
| C133           | 2            | C635           | 5            | CR509          | 4            | Q254           | 2            | R138           | 2            | R271           | 2            |
| C164           | 2            | C646           | 5            | CR514          | 4            | Q255           | 2            | R139           | 2            | R279           | 2            |
| C165           | 2            | C647           | 5            | CR518          | 4            | Q256           | 2            | R142           | 2            | R281           | 2            |
| C175           | 2            | C648           | 5            | CR529          | 4            | Q257           | 2            | R143           | 2            | R282           | 2            |
| C176           | 2            | C649           | 5            | CR551          | 7            | Q283           | 2            | R144           | 2            | R283           | 2            |
| C180           | 2            | C673           | 5            | CR556          | 3            | Q284           | 2            | R145           | 2            | R284           | 2            |
| C198           | 2            | C762           | 6            | CR583          | 7            | Q285           | 2            | R150           | 2            | R285           | 2            |
| C200           | 8            | C764           | 6            | CR712          | 5            | Q302           | 3            | R151           | 2            | R286           | 2            |
| C201           | 8            | C770           | 6            | CR764          | 6            | Q303           | 3            | R152           | 2            | R287           | 2            |
| C210           | 2            | C775           | 6            | CR765          | 6            | Q327           | 3            | R153           | 2            | R288           | 2            |
| C215           | 2            | C777           | 6            | CR768          | 6            | Q328           | 3            | R154           | 2            | R289           | 2            |
| C220           | 8            | C779           | 6            | CR770          | 6            | Q382           | 3            | R155           | 2            | R292           | 2            |
| C225           | 2            | C780           | 6            | CR780          | 6            | Q382           | 3            | R156           | 2            | R293           | 2            |
| C226           | 2            | C782           | 6            | CR805          | 7            | Q384           | 3            | R158           | 2            | R301           | 3            |
| C228           | 2            | C785           | 6            | CR818          | 7            | Q397           | 3            | R159           | 2            | R302           | 3            |
| C229           | 2            | C787           | 6            | CR820          | 7            | Q402           | 3            | R164           | 2            | R303           | 3            |
| C237           | 2            | C789           | 6            | CR823          | 6            | Q403           | 3            | R165           | 2            | R304           | 3            |
| C239           | 2            | C796           | 8            | CR824          | 7            | Q413           | 3            | R170           | 2            | R305           | 3            |
| C240           | 2            | C797           | 8            | CR825          | 7            | Q419           | 3            | R171           | 2            | R306           | 3            |
| C241           | 2            | C799           | 8            | CR829          | 7            | Q420           | 3            | R172           | 2            | R307           | 3            |
| C242           | 2            | C824           | 7            | CR840          | 7            | Q421           | 3            | R175           | 2            | R309           | 3            |
| C250           | 2            | C825           | 7            | CR845          | 7            | Q422           | 3            | R176           | 2            | R310           | 3            |
| C251           | 2            | C828           | 7            | CR851          | 7            | Q423           | 3            | R180           | 2            | R311           | 3            |
| C255           | 2            | C832           | 7            | CR853          | 7            | Q428           | 3            | R181           | 2            | R312           | 3            |
| C262           | 2            | C835           | 7            | CR854          | 7            | Q429           | 3            | R182           | 2            | R314           | 3            |
| C274           | 8            | C845           | 7            | CR855          | 7            | Q440           | 2            | R183           | 2            | R315           | 3            |
| C281           | 2            | C847           | 7            | CR879          | 7            | Q441           | 2            | R185           | 2            | R317           | 3            |
| C292           | 2            | C849           | 7            | CR901          | 7            | Q460           | 3            | R186           | 2            | R318           | 3            |
| C312           | 3            | C851           | 7            | CR902          | 7            | Q463           | 3            | R188           | 2            | R319           | 3            |
| C337           | 3            | C853           | 7            | CR903          | 7            | Q509           | 4            | R189           | 2            | R321           | 3            |
| C363           | 3            | C854           | 7            | CR904          | 7            | Q511           | 4            | R192           | 2            | R322           | 3            |
| C369           | 3            | C855           | 7            | CR907          | 7            | Q525           | 4            | R193           | 2            | R324           | 3            |
| C381           | 3            | C871           | 7            | CR908          | 7            | Q576           | 4            | R194           | 2            | R326           | 3            |
| C389           | 3            | C873           | 7            | CR920          | 7            | Q578           | 4            | R195           | 2            | R327           | 3            |
| C390           | 3            | C875           | 7            | CR945          | 7            | Q586           | 7            | R200           | 2            | R328           | 3            |
| C392           | 3            | C877           | 7            | CR946          | 7            | Q756           | 6            | R202           | 2            | R329           | 3            |
| C396           | 7            | C879           | 7            | CR947          | 7            | Q770           | 6            | R203           | 2            | R330           | 3            |
| C397           | 3            | C893           | 7            | CR954          | 7            | Q775           | 6            | R204           | 2            | R331           | 3            |
| C405           | 3            | C904           | 7            | CR955          | 7            | Q779           | 6            | R206           | 2            | R332           | 3            |
| C408           | 3            | C906           | 7            | CR956          | 7            | Q780           | 6            | R207           | 2            | R335           | 3            |
| C414           | 3            | C907           | 7            | CR957          | 7            | Q785           | 6            | R210           | 2            | R336           | 3            |
| C415           | 3            | C908           | 7            | CR960          | 7            | Q789           | 6            | R212           | 2            | R337           | 3            |
| C418           | 3            | C917           | 7            | CR961          | 7            | Q804           | 7            | R213           | 2            | R339           | 3            |
| C419           | 3            | C919           | 7            | CR962          | 7            | Q814           | 7            | R215           | 2            | R340           | 3            |
| C420           | 3            | C922           | 7            | CR963          | 7            | Q825           | 7            | R216           | 2            | R342           | 3            |
| C421           | 3            | C925           | 7            | CR967          | 7            | Q829           | 7            | R217           | 2            | R343           | 3            |
| C451           | 8            | C940           | 7            | CR970          | 7            | Q835           | 7            | R218           | 2            | R344           | 3            |
| C453           | 3            | C941           | 7            | DS856          | 7            | Q840           | 7            | R219           | 2            | R346           | 3            |
| C459           | 3            | C942           | 7            | DS858          | 7            | Q845           | 7            | R220           | 8            | R347           | 3            |
| C473           | 3            | C943           | 7            | DS870          | 7            | Q885           | 7            | R222           | 2            | R349           | 3            |
| C479           | 3            | C944           | 7            | E200           | 8            | Q908           | 7            | R223           | 2            | R350           | 3            |
| C480           | 3            | C945           | 7            | E201           | 8            | Q928           | 7            | R225           | 2            | R351           | 3            |
| C494           | 8            | C954           | 7            | E272           | 8            | Q930           | 7            | R226           | 2            | R352           | 3            |
| C499           | 8            | C956           | 7            | E590           | 8            | Q935           | 7            | R227           | 2            | R353           | 3            |
| C500           | 4            | C960           | 7            | E907           | 7            | Q938           | 7            | R230           | 2            | R354           | 3            |
| C501           | 4            | C961           | 7            | L142           | 2            | Q939           | 7            | R231           | 2            | R356           | 3            |
| C502           | 4            | C962           | 7            | L143           | 2            | Q944           | 7            | R233           | 2            | R357           | 3            |
| C503           | 4            | C963           | 7            | L192           | 2            | Q946           | 7            | R234           | 2            | R358           | 3            |
| C504           | 4            | C968           | 7            | L193           | 2            | Q947           | 7            | R235           | 2            | R359           | 3            |
| C505           | 4            | C970           | 7            | P9644-1        | 5            | R100           | 2            | R236           | 2            | R360           | 3            |
| C506           | 4            | C975           | 7            | P9644-2        | 5            | R101           | 2            | R239           | 2            | R361           | 3            |
| C507           | 8            | C976           | 7            | P9644-3        | 5            | R102           | 2            | R240           | 2            | R363           | 3            |
| C517           | 4            | C979           | 7            | P9802-1        | 7            | R103           | 2            | R241           | 2            | R365           | 3            |
| C518           | 4            | CR133          | 2            | P9802-2        | 7            | R104           | 2            | R242           | 2            | R366           | 3            |
| C519           | 4            | CR183          | 2            | P9802-3        | 7            | R105           | 2            | R244           | 2            | R367           | 3            |
| C520           | 4            | CR200          | 2            | P9802-4        | 7            | R106           | 2            | R245           | 2            | R369           | 3            |
| C525           | 4            | CR201          | 2            | P9802-5        | 7            | R108           | 2            | R250           | 2            | R372           | 3            |
| C527           | 4            | CR202          | 2            | Q102           | 2            | R109           | 2            | R251           | 2            | R374           | 3            |
| C529           | 4            | CR203          | 2            | Q103           | 2            | R114           | 2            | R254           | 2            | R381           | 3            |
| C531           | 4            | CR226          | 2            | Q114           | 2            | R115           | 2            | R255           | 2            | R382           | 3            |
| C537           | 2            | CR227          | 2            | Q115           | 2            | R120           | 2            | R256           | 2            | R384           | 3            |
| C538           | 2            | CR228          | 2            | Q152           | 2            | R121           | 2            | R257           | 2            | R385           | 3            |
| C539           | 2            | CR229          | 2            | Q153           | 2            | R122           | 2            | R258           | 2            | R386           | 3            |
| C540           | 2            | CR372          | 3            | Q164           | 2            | R125           | 2            | R259           | 2            | R389           | 3            |
| C545           | 2            | CR381          | 3            | Q165           | 2            | R126           | 2            | R261           | 2            | R390           | 3            |







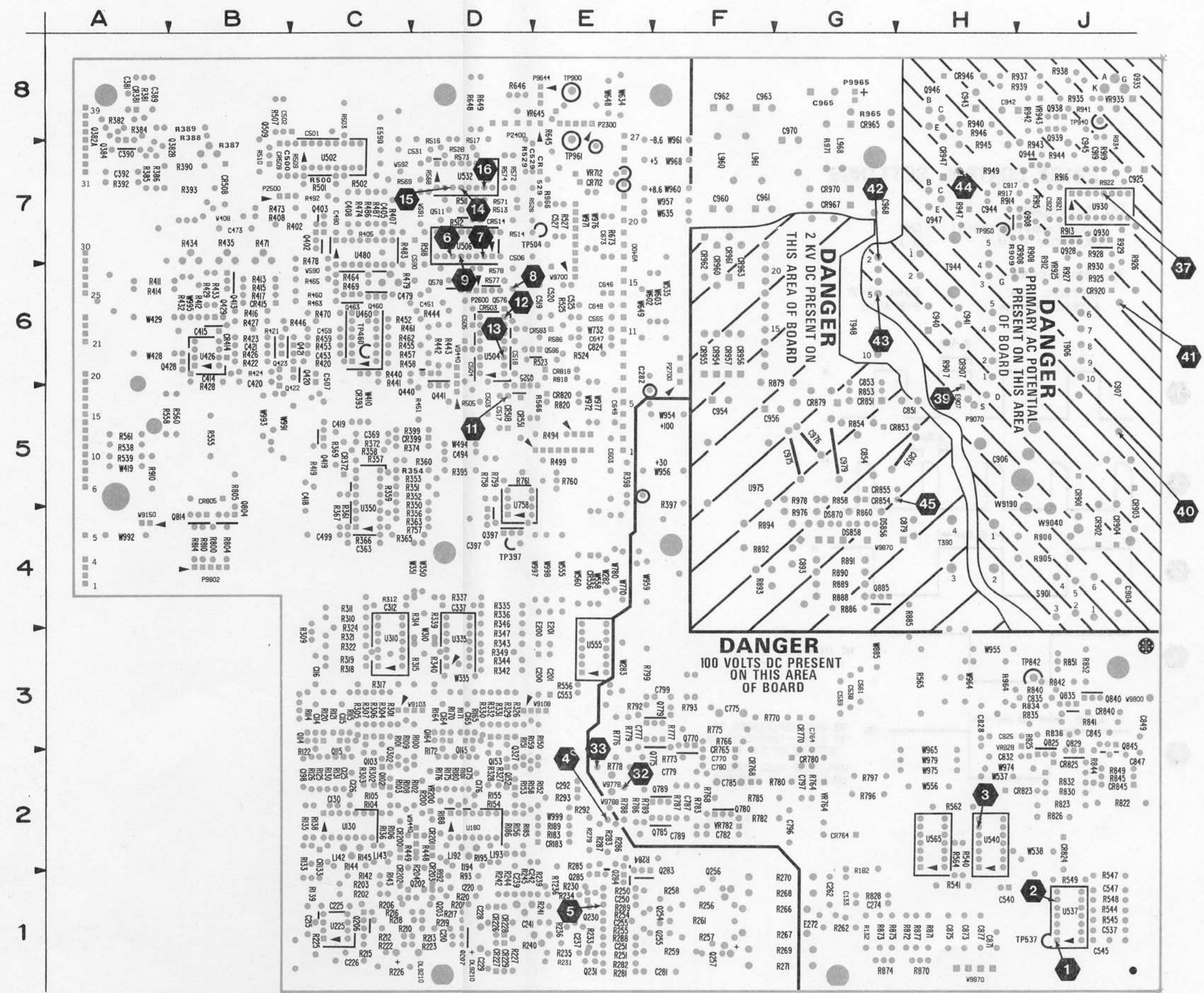


Figure 9-8. Circuit view of A1—Main board.

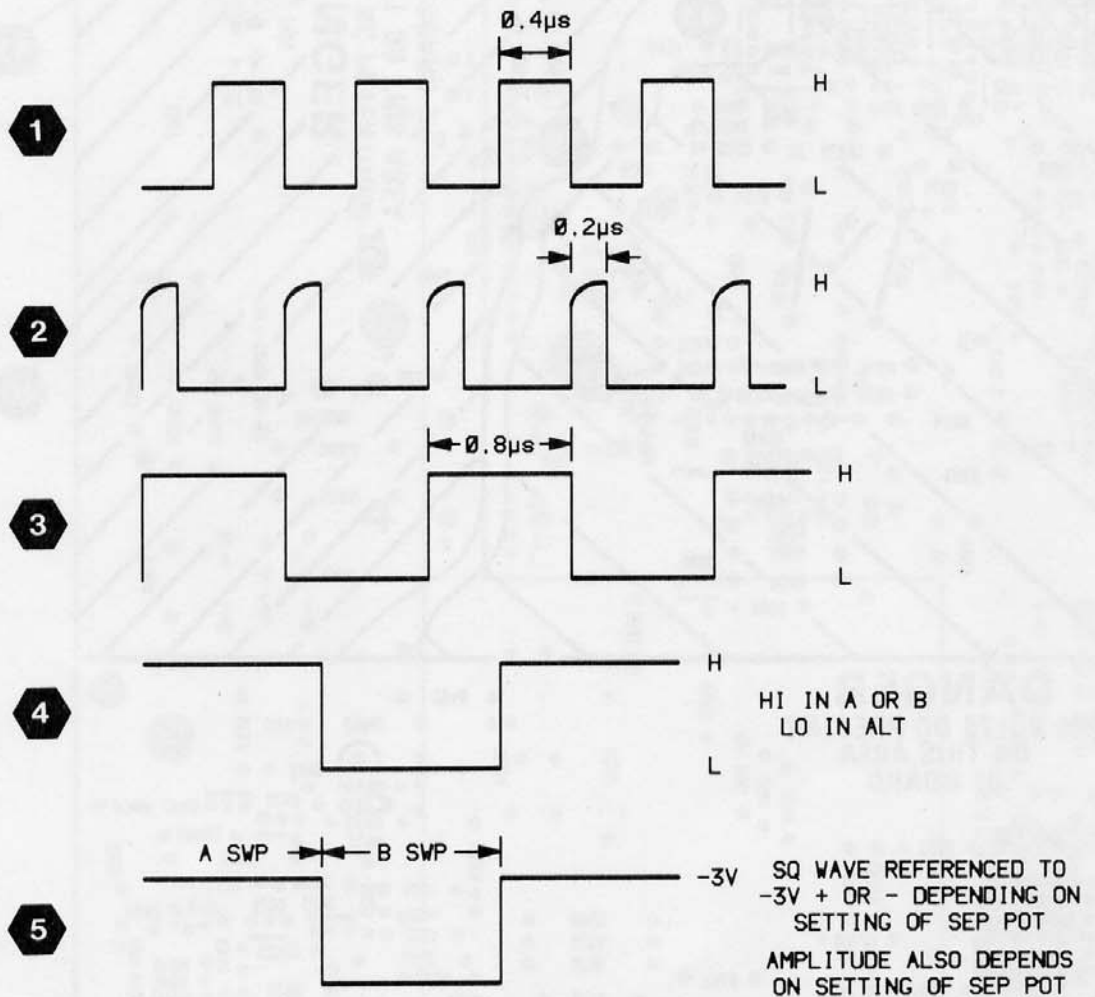
## 2215A CONTROL SETTINGS

### DC Voltages

Input Coupling (both) GND  
 VOLTS/DIV (both) 0.1V

### AC Waveforms

VERTICAL MODE BOTH, CHOP  
 A TRIGGER Mode P-P AUTO



# VERTICAL PREAMP & OUTPUT AMPL



| ASSEMBLY A1    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C114           | 2D             | 3C             | Q254           | 7P             | 1F             | R189           | 6F             | 2E             | R286           | 2N             | 2E             |
| C115           | 3D             | 3C             | Q255           | 3P             | 1F             | R192           | 8H             | 2D             | R287           | 2P             | 2E             |
| C116           | 2E             | 3C             | Q256           | 8P             | 2F             | R193           | 9H             | 2D             | R288           | 2N             | 1E             |
| C125           | 3E             | 3C             | Q257           | 2P             | 1F             | R194           | 8H             | 2D             | R289           | 2N             | 2E             |
| C126           | 3F             | 3C             | Q283           | 3M             | 2E             | R195           | 9H             | 2D             | R292           | 1N             | 2E             |
| C130           | 3F             | 2C             | Q284           | 2N             | 2E             | R202           | 5H             | 2C             | R293           | 1N             | 2E             |
| C133           | 5F             | 2G             | Q285           | 2P             | 2E             | R203           | 5H             | 2C             | R538           | 5E             | 5A             |
| C164           | 8D             | 3D             |                |                |                | R204           | 5H             | 2D             | R539           | 6C             | 5A             |
| C165           | 9D             | 3D             | R100           | 2A             | 3C             | R206           | 4H             | 2C             | R540           | 5E             | 2H             |
| C175           | 9E             | 3D             | R101           | 3A             | 3C             | R207           | 6J             | 2D             | R541           | 5E             | 2H             |
| C176           | 9F             | 3D             | R102           | 2B             | 2D             | R210           | 5J             | 1C             | R544           | 5C             | 1J             |
| C180           | 9F             | 2D             | R103           | 3B             | 2C             | R212           | 5J             | 1C             | R545           | 5C             | 1J             |
| C210           | 5J             | 1D             | R104           | 2B             | 2C             | R213           | 5J             | 1D             | R547           | 4D             | 2J             |
| C215           | 5J             | 1C             | R105           | 3B             | 2C             | R215           | 5J             | 1C             | R548           | 4D             | 2J             |
| C225           | 8J             | 2C             | R106           | 2B             | 2C             | R216           | 4J             | 1C             | R549           | 4E             | 2J             |
| C226           | 4K             | 1C             | R108           | 2B             | 2C             | R217           | 6J             | 1D             |                |                |                |
| C228           | 4L             | 1D             | R109           | 3B             | 3C             | R218           | 4J             | 1C             | RT236          | 5N             | 2E             |
| C229           | 3L             | 1D             | R114           | 2D             | 3C             | R219           | 6J             | 1D             |                |                |                |
| C237           | 5N             | 1E             | R115           | 3D             | 3C             | R222           | 5K             | 1C             | TP537          | 4D             | 1J             |
| C239           | 5M             | 2D             | R120           | 2E             | 3C             | R223           | 5K             | 1D             |                |                |                |
| C240           | 5M             | 1E             | R121           | 3E             | 3C             | R225           | 7J             | 1C             | U130           | 1F             | 2C             |
| C241           | 6M             | 1D             | R122           | 3E             | 3C             | R226           | 4L             | 1C             | U180           | 9F             | 2D             |
| C242           | 5M             | 2D             | R125           | 2E             | 3C             | R227           | 4M             | 1D             | U225           | 7J             | 1C             |
| C250           | 7N             | 2E             | R126           | 2E             | 3C             | R230           | 7M             | 2E             | U537A          | 5D             | 1J             |
| C251           | 3N             | 1E             | R130           | 2F             | 3C             | R231           | 3M             | 1E             | U537B          | 4E             | 1J             |
| C255           | 3N             | 1E             | R131           | 3F             | 3C             | R233           | 5N             | 1E             | U537C          | 5D             | 1J             |
| C262           | 5P             | 2G             | R132           | 5F             | 1G             | R234           | 6M             | 2E             | U537D          | 5C             | 1J             |
| C281           | 2M             | 1F             | R133           | 5F             | 2C             | R235           | 4M             | 1E             | U540A          | 5E             | 2H             |
| C292           | 1N             | 2E             | R135           | 4F             | 2C             | R236           | 5N             | 1E             | U540B          | 5C             | 2H             |
| C537           | 8K             | 1J             | R136           | 4F             | 2C             | R239           | 5M             | 2E             |                |                |                |
| C538           | 5D             | 3G             | R139           | 5G             | 2C             | R240           | 5M             | 1E             | W142           | 2G             | 2C             |
| C539           | 6D             | 3G             | R142           | 2H             | 2C             | R241           | 5M             | 1D             | W143           | 3G             | 2C             |
| C540           | 8J             | 2H             | R143           | 4H             | 2C             | R242           | 5M             | 2D             | W192           | 8G             | 2D             |
| C545           | 5C             | 1J             | R144           | 2H             | 2C             | R244           | 5L             | 2D             | W193           | 9G             | 2D             |
| C547           | 4D             | 2J             | R145           | 3H             | 2C             | R245           | 6L             | 2D             | W282           | 3L             | 4E             |
|                |                |                | R150           | 8B             | 3E             | R250           | 7N             | 2E             | W283           | 3M             | 3E             |
| CR133          | 5F             | 2C             | R151           | 9B             | 3D             | R251           | 3N             | 1E             | W535           | 5D             | 7F             |
| CR183          | 5F             | 2E             | R152           | 8B             | 2E             | R254           | 7N             | 1E             | W537           | 5D             | 3H             |
| CR226          | 4L             | 1D             | R153           | 9B             | 2D             | R255           | 3N             | 1E             | W538           | 5E             | 2J             |
| CR227          | 4L             | 1D             | R154           | 8B             | 2D             | R256           | 8P             | 2F             | W9001-10       | 4K             | 5A             |
| CR228          | 4L             | 1D             | R155           | 9B             | 2D             | R257           | 2P             | 1F             | W9001-14       | 5B             | 5A             |
| CR229          | 4L             | 1D             | R156           | 9B             | 2D             | R258           | 7P             | 2F             | W9001-2        | 2D             | 4A             |
|                |                |                | R158           | 9B             | 2D             | R259           | 3P             | 1F             | W9001-3        | 3D             | 4A             |
|                |                |                | R159           | 9B             | 3D             | R261           | 5P             | 1F             | W9001-4        | 2L             | 4A             |
| Q102           | 2B             | 2C             | R164           | 8D             | 3D             | R262           | 5P             | 1G             | W9001-7        | 8D             | 5A             |
| Q103           | 3B             | 3C             | R165           | 9D             | 3D             | R266           | 7P             | 1G             | W9001-8        | 9D             | 5A             |
| Q114           | 2E             | 3C             | R170           | 9E             | 3D             | R267           | 3P             | 1G             | W9001-9        | 6B             | 5A             |
| Q115           | 3E             | 3C             | R171           | 9D             | 3D             | R268           | 6P             | 2G             | W9103-1        | 2A             | 3C             |
| Q152           | 8B             | 2D             | R172           | 9E             | 3D             | R269           | 4P             | 1G             | W9103-2        | 3A             | 3C             |
| Q153           | 9B             | 3D             | R175           | 9E             | 3D             | R270           | 6P             | 2G             | W9103-3        | 2A             | 3C             |
| Q164           | 8E             | 3D             | R176           | 8F             | 3D             | R271           | 5P             | 1G             | W9103-4        | 3A             | 3C             |
| Q165           | 9E             | 3D             | R180           | 8F             | 3D             | R279           | 3M             | 2E             | W9108-1        | 8A             | 3D             |
| Q202           | 5H             | 2C             | R181           | 9F             | 3D             | R281           | 2L             | 1E             | W9108-2        | 9A             | 3D             |
| Q203           | 6J             | 2D             | R182           | 6F             | 2G             | R282           | 2M             | 1E             | W9108-3        | 8A             | 3D             |
| Q206           | 4J             | 1C             | R183           | 6F             | 2E             | R283           | 3M             | 2E             | W9108-4        | 9A             | 3D             |
| Q207           | 6J             | 1D             | R185           | 7F             | 2D             | R284           | 2N             | 2E             |                |                |                |
| Q230           | 7N             | 2E             | R186           | 7F             | 2D             | R285           | 2P             | 2E             |                |                |                |
| Q231           | 3N             | 1E             |                |                |                |                |                |                |                |                |                |

Partial A1 also shown on diagrams 3, 4, 5, 6, 7 and 8.

TABLE (cont)



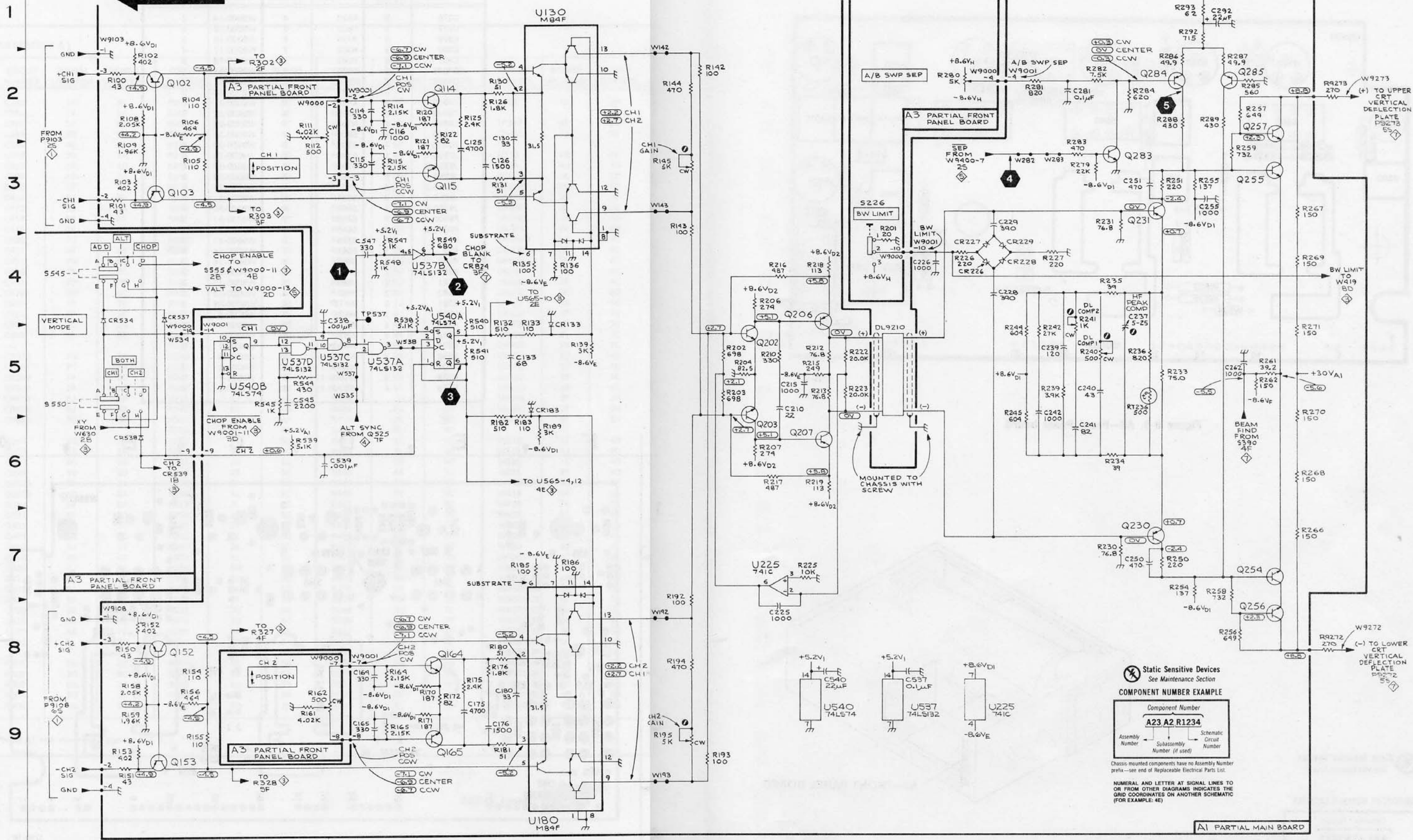
**VERTICAL PREAMP & OUTPUT AMPL** 2 (cont)

| <b>ASSEMBLY A3</b>   |                |                |                |                |                    |                |                |                    |                |                |                |
|--|----------------|----------------|----------------|----------------|--------------------|----------------|----------------|--------------------|----------------|----------------|----------------|
| CIRCUIT NUMBER   | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION     | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION     | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| CR534  | 4A             | 2B             | R162           | 9D             | 1C                 | W534           | 5B             | 3B                 | W9000-8        | 9D             | 4B             |
| CR537  | 4B             | 2B             | R201           | 4K             | 2B                 | W9000-10       | 4K             | 4B                 | W9000-9        | 6B             | 4B             |
| CR538  | 6B             | 2B             | R280           | 2L             | 1C                 | W9000-14       | 5B             | 4B                 |                |                |                |
|  |                |                |                |                |                    | W9000-2        | 2D             | 4A                 |                |                |                |
| R111   | 2D             | 1B             | S226           | 3K             | 2C                 | W9000-3        | 3D             | 4A                 |                |                |                |
| R112   | 3D             | 1B             | S545           | 4A             | 2C                 | W9000-4        | 2L             | 4A                 |                |                |                |
| R161   | 9D             | 1C             | S550           | 5A             | 2B                 | W9000-7        | 8D             | 4B                 |                |                |                |
| <i>Partial A3 also shown on diagrams 1, 3, 4, 5, 6, 7 and 8.</i> |                |                |                |                |                    |                |                |                    |                |                |                |
| <b>CHASSIS MOUNTED PARTS</b>                                     |                |                |                |                |                    |                |                |                    |                |                |                |
| CIRCUIT NUMBER   | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION     | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION     | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| DL9210   | 5K             | CHASSIS        | R9272<br>R9273 | 8S<br>2S       | CHASSIS<br>CHASSIS | W9272<br>W9273 | 8S<br>2S       | CHASSIS<br>CHASSIS |                |                |                |



A B C D E F G H J K L M N P S

← WAVEFORMS



Static Sensitive Devices  
See Maintenance Section  
COMPONENT NUMBER EXAMPLE

|                              |                          |
|------------------------------|--------------------------|
| Component Number             |                          |
| A23 A2                       | R1234                    |
| Assembly Number              | Schematic Circuit Number |
| Subassembly Number (if used) |                          |

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

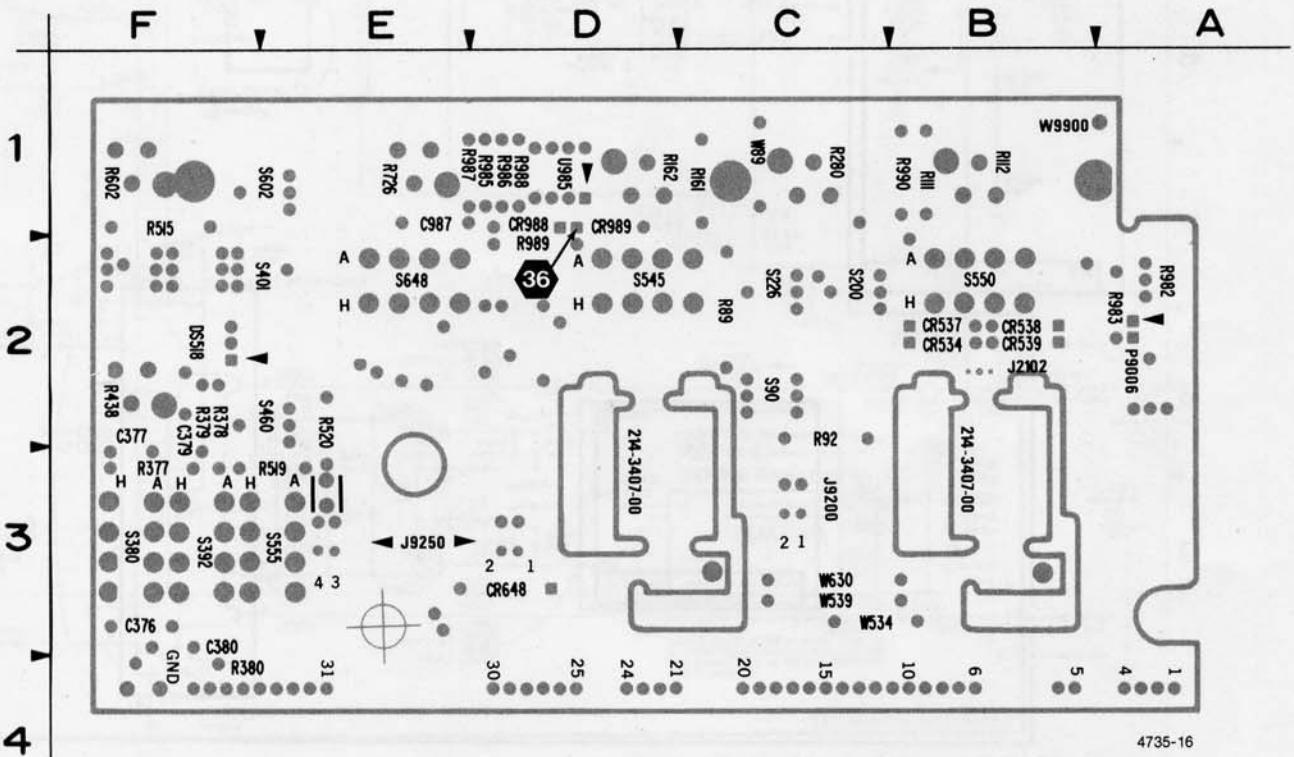
NUMERAL AND LETTER AT SIGNAL LINES TO OR FROM OTHER DIAGRAMS INDICATES THE GRID COORDINATES ON ANOTHER SCHEMATIC (FOR EXAMPLE: 4E)





### A3—FRONT PANEL BOARD

| CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER |
|----------------|--------------|----------------|--------------|----------------|--------------|
| C376           | 3            | R520           | 4            | W9000-14       | 2            |
| C377           | 3            | R602           | 5            | W9000-15       | 5            |
| C379           | 3            | R726           | 6            | W9000-16       | 5            |
| C380           | 3            | R982           | 7            | W9000-17       | 4            |
| C987           | 6            | R983           | 7            | W9000-18       | 3            |
| CR534          | 2            | R985           | 6            | W9000-19       | 3            |
| CR537          | 2            | R986           | 6            | W9000-1        | 7            |
| CR538          | 2            | R987           | 6            | W9000-20       | 3            |
| CR539          | 3            | R988           | 6            | W9000-21       | 6            |
| CR648          | 3            | R989           | 6            | W9000-22       | 3            |
| CR988          | 6            | R990           | 6            | W9000-23       | 3            |
| CR989          | 6            | S90            | 1            | W9000-24       | 4            |
| DS518          | 4            | S226           | 2            | W9000-25       | 4            |
| J9200-1        | 1            | S380           | 3            | W9000-26       | 5            |
| J9200-2        | 1            | S390           | 7            | W9000-27       | 5            |
| J9250-1        | 6            | S392           | 3            | W9000-28       | 5            |
| J9250-2        | 3            | S401           | 4            | W9000-29       | 4            |
| J9250-3        | 3            | S401           | 4            | W9000-2        | 2            |
| J9250-4        | 4            | S401           | 4            | W9000-30       | 4            |
| P9006-1        | 7            | S460           | 3            | W9000-31       | 3            |
| P9006-2        | 7            | S545           | 2            | W9000-32       | 3            |
| R89            | 1            | S550           | 2            | W9000-33       | 3            |
| R92            | 1            | S555           | 3            | W9000-34       | 3            |
| R111           | 2            | S602           | 5            | W9000-35       | 3            |
| R112           | 2            | S648           | 5            | W9000-36       | 3            |
| R161           | 2            | U985           | 6            | W9000-37       | 3            |
| R162           | 2            | W89            | 8            | W9000-38       | 3            |
| R201           | 2            | W515           | 4            | W9000-39       | 3            |
| R280           | 2            | W534           | 2            | W9000-3        | 2            |
| R377           | 3            | W539           | 3            | W9000-4        | 2            |
| R378           | 3            | W630           | 3            | W9000-5        | 8            |
| R379           | 3            | W9900          | 6            | W9000-7        | 2            |
| R380           | 3            | W9000-10       | 2            | W9000-8        | 2            |
| R401           | 4            | W9000-11       | 3            | W9000-9        | 2            |
| R438           | 3            | W9000-12       | 8            | W9520-1        | 4            |
| R519           | 4            | W9000-13       | 5            | W9520-2        | 4            |



4735-16

Figure 9-10. Circuit view of A3—Front Panel board.

TRIGGERING



| ASSEMBLY A1    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C363           | 1M             | 4C             | R306           | 1G             | 3C             | R393           | 7E             | 7B             | R565           | 4F             | 3H             |
| C369           | 7F             | 5C             | R307           | 3G             | 3C             | R395           | 6F             | 5D             |                |                |                |
| C381           | 5C             | 8A             | R309           | 2G             | 4C             | R399           | 6E             | 5C             | TP397          | 6E             | 5D             |
| C389           | 6D             | 8A             | R310           | 2G             | 4C             | R402           | 5N             | 7C             | TP460          | 7J             | 6C             |
| C390           | 4E             | 8A             | R311           | 2G             | 4C             | R405           | 5P             | 7C             |                |                |                |
| C392           | 7D             | 7A             | R312           | 2H             | 4C             | R407           | 5P             | 7C             | U310           | 1G             | 4C             |
| C397           | 6F             | 4D             | R314           | 3J             | 4C             | R408           | 5N             | 7B             | U335           | 4H             | 4D             |
| C405           | 5P             | 7C             | R315           | 1J             | 3D             | R411           | 8H             | 7A             | U350A          | 1L             | 5C             |
| C408           | 5P             | 7C             | R317           | 1F             | 3C             | R412           | 9H             | 6B             | U350B          | 3M             | 5C             |
| C414           | 8J             | 6B             | R318           | 1G             | 3C             | R413           | 9H             | 7B             | U350C          | 3L             | 5C             |
| C415           | 9J             | 6B             | R319           | 2J             | 4C             | R414           | 8H             | 7A             | U350D          | 3K             | 5C             |
| C418           | 8E             | 5C             | R321           | 3J             | 4C             | R415           | 9J             | 7B             | U350E          | 1K             | 5C             |
| C419           | 7F             | 5C             | R322           | 3J             | 4C             | R416           | 8H             | 6B             | U426A          | 8K             | 6B             |
| C420           | 7J             | 6B             | R324           | 3H             | 4C             | R417           | 9J             | 6B             | U426B          | 9K             | 6B             |
| C421           | 9K             | 6B             | R326           | 5G             | 3D             | R419           | 8F             | 5C             | U460A          | 7L             | 6C             |
| C453           | 7M             | 6C             | R327           | 4G             | 3D             | R420           | 7G             | 6C             | U460B          | 7L             | 6C             |
| C459           | 7N             | 6C             | R328           | 5G             | 3D             | R421           | 9J             | 6B             | U460C          | 7L             | 6C             |
| C473           | 4P             | 7B             | R329           | 4G             | 3D             | R422           | 8J             | 6B             | U460D          | 7K             | 6C             |
| C479           | 6M             | 6C             | R330           | 6G             | 3D             | R423           | 9J             | 6B             | U460E          | 7K             | 6C             |
| C480           | 1P             | 7C             | R331           | 4G             | 3D             | R424           | 7J             | 6B             | U460F          | 7K             | 6C             |
| C553           | 3P             | 3E             | R332           | 5G             | 3D             | R426           | 8J             | 6B             | U480A          | 6P             | 7C             |
| C561           | 4D             | 3G             | R335           | 5H             | 4D             | R427           | 9J             | 6B             | U480B          | 5S             | 7C             |
| C565           | 4F             | 6E             | R336           | 5H             | 4D             | R428           | 8K             | 6B             | U480C          | 5L             | 7C             |
|                |                |                | R337           | 5H             | 4D             | R429           | 9K             | 7B             | U480D          | 5M             | 7C             |
| CR372          | 7G             | 5C             | R339           | 6J             | 4D             | R432           | 9K             | 6B             | U555A          | 2D             | 4E             |
| CR381          | 5C             | 8A             | R340           | 4J             | 3D             | R433           | 9K             | 7B             | U555B          | 1E             | 4E             |
| CR393          | 7F             | 6C             | R342           | 3F             | 3D             | R434           | 9K             | 7B             | U555C          | 3E             | 4E             |
| CR399          | 7F             | 5C             | R343           | 3G             | 4D             | R435           | 9K             | 7B             | U555D          | 3E             | 4E             |
| CR414          | 8J             | 6B             | R344           | 5J             | 4D             | R446           | 7M             | 6C             | U565B          | 3F             | 2H             |
| CR415          | 9J             | 6B             | R346           | 6J             | 4D             | R452           | 8K             | 6C             | U565C          | 2F             | 2H             |
| CR556          | 2D             | 4E             | R347           | 6J             | 4D             | R453           | 7L             | 6C             | U565D          | 4F             | 2H             |
|                |                |                | R349           | 6H             | 4D             | R455           | 8L             | 6C             |                |                |                |
| Q302           | 2G             | 3C             | R350           | 1K             | 5C             | R457           | 6K             | 6C             | W310           | 1J             | 4D             |
| Q303           | 3G             | 3C             | R351           | 3K             | 5C             | R458           | 7L             | 6C             | W335           | 4J             | 3D             |
| Q327           | 5G             | 3D             | R352           | 2K             | 5C             | R459           | 7N             | 6C             | W350           | 1K             | 4D             |
| Q328           | 6G             | 3D             | R353           | 2K             | 5C             | R460           | 4K             | 7C             | W351           | 3K             | 4D             |
| Q382A          | 5D             | 8A             | R354           | 2K             | 5C             | R461           | 7P             | 6C             | W410           | 7G             | 6C             |
| Q382B          | 5D             | 8A             | R356           | 1L             | 5C             | R462           | 7P             | 6C             | W419           | 8E             | 5A             |
| Q384           | 5E             | 8A             | R357           | 3L             | 5C             | R463           | 4L             | 6C             | W428           | 8K             | 6A             |
| Q397           | 6F             | 5D             | R358           | 2K             | 5C             | R464           | 5L             | 7C             | W429           | 9K             | 6A             |
| Q402           | 5N             | 7C             | R359           | 2L             | 5C             | R465           | 5M             | 7C             | W555           | 2D             | 4E             |
| Q403           | 5N             | 7C             | R360           | 3L             | 5D             | R469           | 5M             | 7C             | W558           | 2D             | 4E             |
| Q413           | 9J             | 7B             | R361           | 3K             | 5C             | R470           | 5L             | 6C             | W560           | 3D             | 4E             |
| Q419           | 8F             | 5C             | R363           | 1L             | 5C             | R471           | 5L             | 7B             | W9001-11       | 4C             | 5A             |
| Q420           | 7J             | 6C             | R365           | 2M             | 5C             | R473           | 6P             | 7B             | W9001-18       | 2C             | 6A             |
| Q421           | 9J             | 6C             | R366           | 3L             | 5C             | R474           | 6N             | 7C             | W9001-19       | 8N             | 6A             |
| Q422           | 8J             | 6B             | R367           | 4M             | 5C             | R478           | 5N             | 7C             | W9001-20       | 8M             | 6A             |
| Q423           | 9K             | 6B             | R369           | 7F             | 5C             | R479           | 6M             | 7C             | W9001-22       | 8L             | 6A             |
| Q428           | 8K             | 6B             | R372           | 7G             | 5C             | R483           | 6M             | 7C             | W9001-23       | 9L             | 6A             |
| Q429           | 9K             | 6B             | R374           | 7G             | 5C             | R486           | 5S             | 7C             | W9001-31       | 6C             | 8A             |
| Q460           | 4K             | 7C             | R381           | 5C             | 8A             | R487           | 6P             | 7C             | W9001-32       | 2C             | 8A             |
| Q463           | 4L             | 7C             | R382           | 5D             | 8A             | R555           | 1C             | 5B             | W9001-33       | 2C             | 8A             |
|                |                |                | R384           | 5D             | 8A             | R556           | 1D             | 3E             | W9001-34       | 3C             | 8A             |
| R301           | 2G             | 3C             | R385           | 5E             | 8A             | R558           | 2C             | 6A             | W9001-35       | 7C             | 8A             |
| R302           | 2G             | 3C             | R386           | 6D             | 8A             | R560           | 3C             | 6B             | W9001-36       | 6C             | 8A             |
| R303           | 3G             | 3C             | R389           | 6D             | 8B             | R561           | 4D             | 5A             | W9001-37       | 7C             | 8A             |
| R304           | 2G             | 3C             | R390           | 4D             | 8B             | R562           | 2E             | 2H             | W9001-38       | 6C             | 8A             |
| R305           | 3G             | 3C             | R392           | 7D             | 7A             | R564           | 4F             | 2H             | W9001-39       | 4C             | 8A             |

Partial A1 also shown on diagrams 2, 4, 5, 6, 7 and 8.

TABLE (cont)



TRIGGERING



(cont)

| ASSEMBLY A3    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C376           | 5B             | 3F             | R377           | 5B             | 3F             | W539           | 1B             | 3B             | W9000-33       | 2C             | 4E             |
| C377           | 5B             | 3F             | R378           | 6B             | 2E             | W630           | 2B             | 3B             | W9000-34       | 3C             | 4E             |
| C379           | 6B             | 2F             | R379           | 6B             | 2E             | W9000-11       | 4C             | 4B             | W9000-35       | 7C             | 4E             |
| C380           | 5B             | 3F             | R380           | 5B             | 4F             | W9000-18       | 2C             | 4C             | W9000-36       | 6C             | 4E             |
|                |                |                | R438           | 8M             | 2F             | W9000-19       | 8N             | 4C             | W9000-37       | 7C             | 4E             |
| CR539          | 1B             | 2B             |                |                |                | W9000-20       | 8M             | 4C             | W9000-38       | 6C             | 4E             |
| CR648          | 1B             | 3D             | S380           | 4B             | 3F             | W9000-22       | 8M             | 4C             | W9000-39       | 4C             | 4F             |
|                |                |                | S392           | 6B             | 3E             | W9000-23       | 9M             | 4C             |                |                |                |
| J9250-2        | 2B             | 3D             | S460           | 8N             | 2E             | W9000-31       | 6C             | 4E             |                |                |                |
| J9250-3        | 3B             | 3E             | S555           | 2B             | 3E             | W9000-32       | 2C             | 4E             |                |                |                |

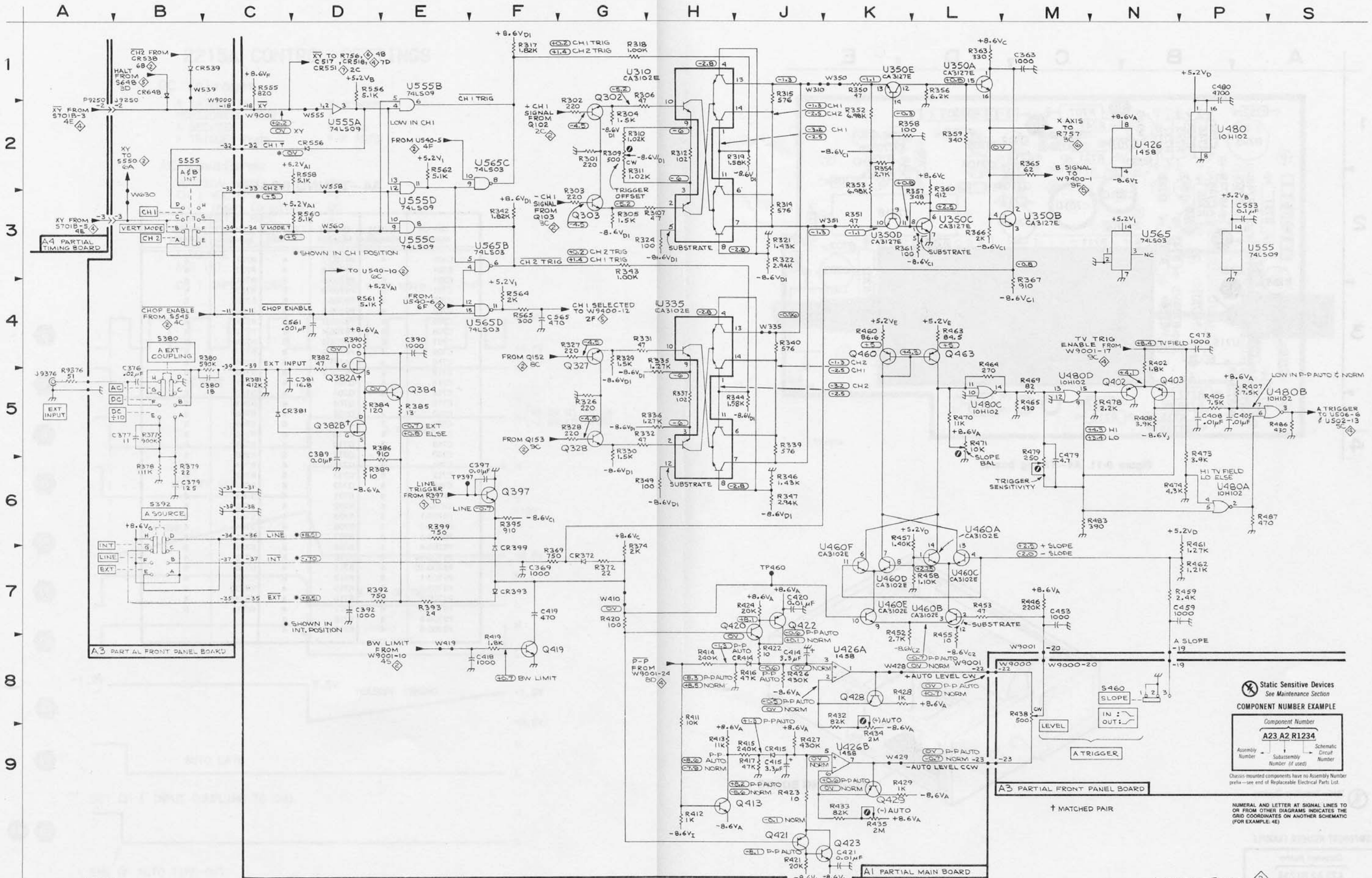
Partial A3 also shown on diagrams 1, 2, 4, 5, 6, 7 and 8.

| ASSEMBLY A4    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| P9250-2        | 2A             | 3E             | P9250-3        | 3A             | 2E             |                |                |                |                |                |                |

Partial A4 also shown on diagrams 4, 5 and 6.

| CHASSIS MOUNTED PARTS |                |                |                |                |                |                |                |                |                |                |                |
|-----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER        | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| J9376                 | 5A             | CHASSIS        | R9376          | 5A             | CHASSIS        |                |                |                |                |                |                |





2215A

4795-23

TRIGGERING 3

Static Sensitive Devices  
See Maintenance Section

COMPONENT NUMBER EXAMPLE

|                  |                              |                          |
|------------------|------------------------------|--------------------------|
| Component Number |                              |                          |
| A23              | A2                           | R1234                    |
| Assembly Number  | Subassembly Number (if used) | Schematic Circuit Number |

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

NUMERAL AND LETTER AT SIGNAL LINES TO OR FROM OTHER DIAGRAMS INDICATES THE GRID COORDINATES ON ANOTHER SCHEMATIC (FOR EXAMPLE, 4E)



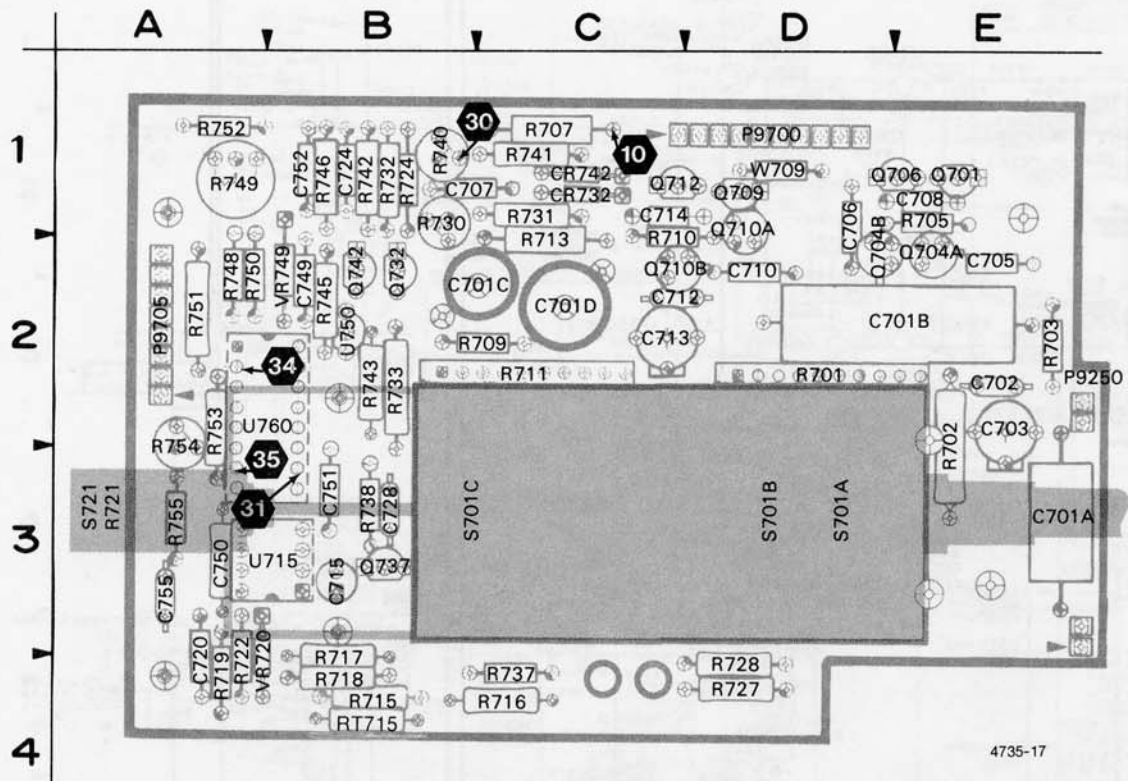
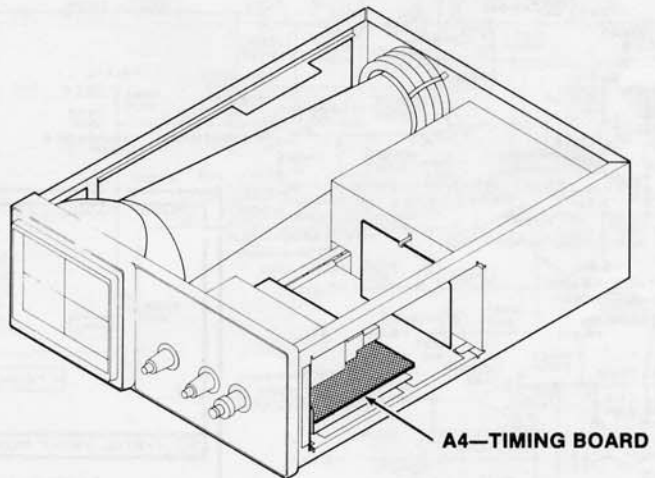
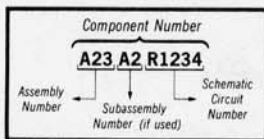


Figure 9-11. A4—Timing board.



 Static Sensitive Devices  
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

## A4—TIMING BOARD

| CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER |
|----------------|--------------|----------------|--------------|----------------|--------------|
| C701           | 4            | P9700-7        | 4            | R721           | 4            |
| C701           | 4            | P9700-8        | 4            | R722           | 4            |
| C701           | 5            | P9700-8        | 5            | R724           | 6            |
| C701           | 5            | P9700-9        | 5            | R727           | 6            |
| C702           | 4            | P9705-1        | 6            | R728           | 6            |
| C703           | 4            | P9705-2        | 6            | R730           | 6            |
| C705           | 4            | P9705-3        | 6            | R731           | 6            |
| C706           | 4            | P9705-4        | 6            | R732           | 6            |
| C707           | 6            | P9705-5        | 6            | R733           | 6            |
| C708           | 4            | P9705-6        | 6            | R737           | 6            |
| C710           | 5            | P9705-7        | 6            | R738           | 6            |
| C712           | 5            | P9705-8        | 6            | R740           | 6            |
| C713           | 5            | Q701           | 4            | R741           | 6            |
| C714           | 5            | Q704           | 4            | R742           | 6            |
| C715           | 4            | Q704           | 4            | R743           | 6            |
| C720           | 4            | Q706           | 4            | R745           | 6            |
| C724           | 6            | Q709           | 5            | R746           | 6            |
| C728           | 6            | Q710           | 5            | R748           | 6            |
| C749           | 6            | Q710           | 5            | R749           | 6            |
| C750           | 6            | Q712           | 5            | R750           | 6            |
| C751           | 6            | Q732           | 6            | R751           | 6            |
| C752           | 6            | Q737           | 6            | R752           | 6            |
| C755           | 6            | Q742           | 6            | R753           | 6            |
| CR732          | 6            | R701           | 4            | R754           | 6            |
| CR742          | 6            | R702           | 4            | R755           | 6            |
| P9250-1        | 6            | R703           | 4            | S701           | 4            |
| P9250-2        | 3            | R705           | 4            | S701           | 4            |
| P9250-3        | 3            | R707           | 4            | S701           | 5            |
| P9250-4        | 4            | R709           | 5            | S721           | 6            |
| P9700-10       | 4            | R710           | 5            | U715           | 4            |
| P9700-10       | 5            | R711           | 5            | U750           | 6            |
| P9700-1        | 6            | R713           | 5            | U760           | 6            |
| P9700-2        | 6            | R715           | 4            | VR720          | 4            |
| P9700-3        | 5            | R716           | 4            | VR749          | 6            |
| P9700-4        | 4            | R717           | 4            | W709           | 5            |
| P9700-5        | 4            | R718           | 4            |                |              |
| P9700-6        | 4            | R719           | 4            |                |              |

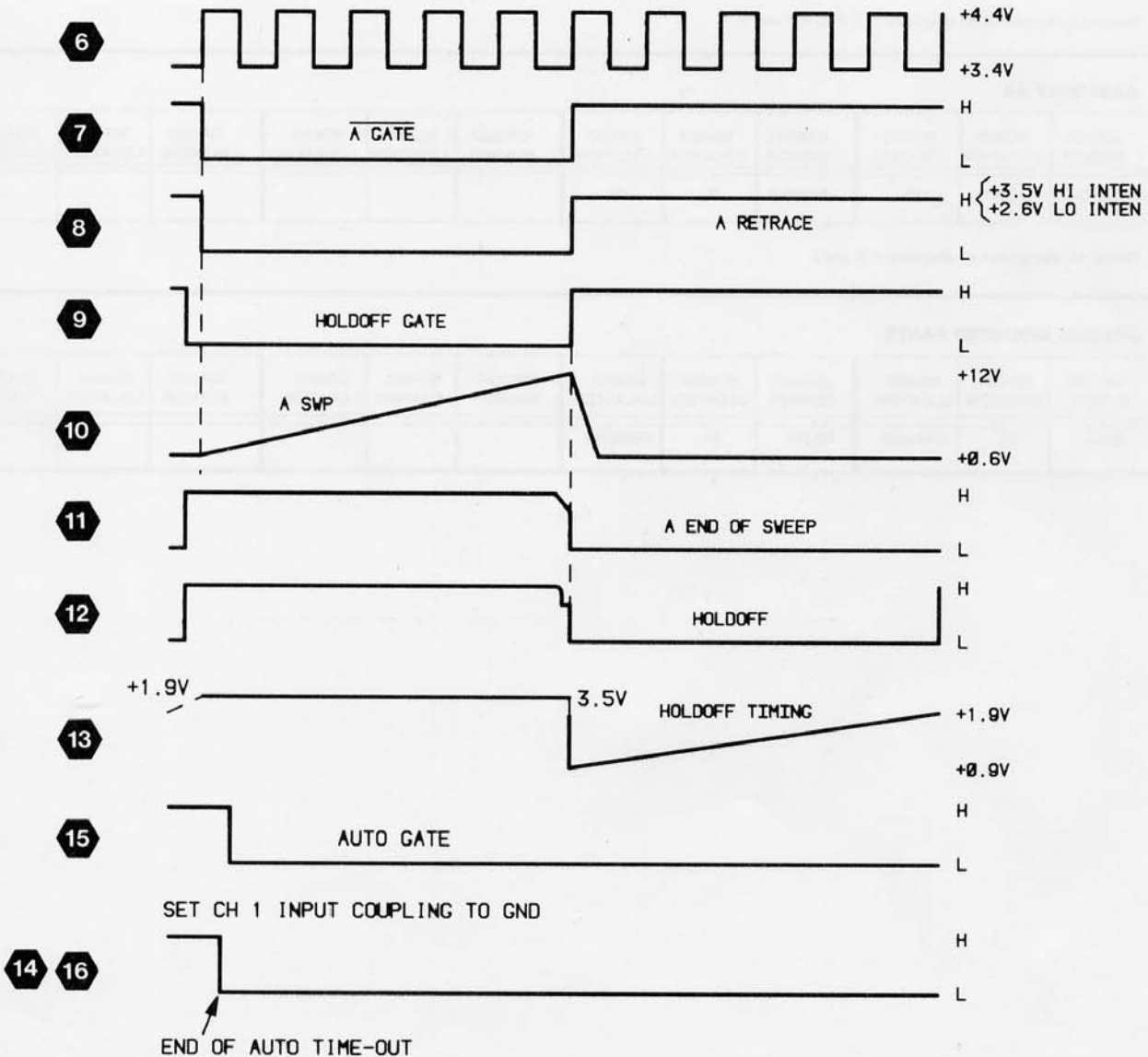
# 2215A CONTROL SETTINGS

## DC Voltages

|                 |          |
|-----------------|----------|
| A INTENSITY     | Midrange |
| HORIZONTAL MODE | A        |
| A SEC/DIV       | 0.1 ms   |
| A TRIGGER Mode  | P-P AUTO |

## AC Waveforms

|                     |                         |
|---------------------|-------------------------|
| VERTICAL MODE       | CH 1                    |
| CH 1 VOLTS/DIV      | 1V                      |
| CH 1 Input Coupling | DC                      |
| HORIZONTAL MODE     | A                       |
| A TRIGGER LEVEL     | Midrange                |
| A TRIGGER Mode      | P-P AUTO                |
| A SOURCE            | INT                     |
| A&B INT             | CH 1                    |
| CH 1 INPUT SIGNAL   | 1-kHz sine wave, 4V P-P |











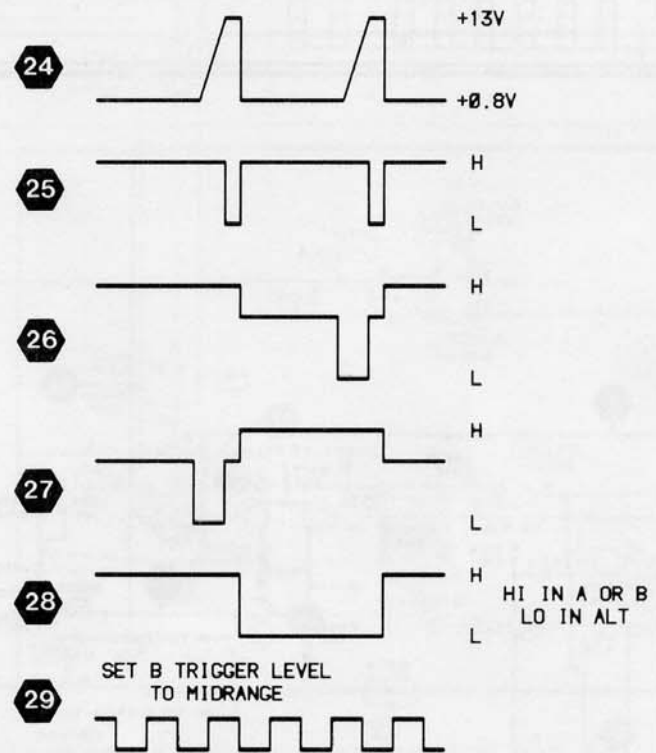
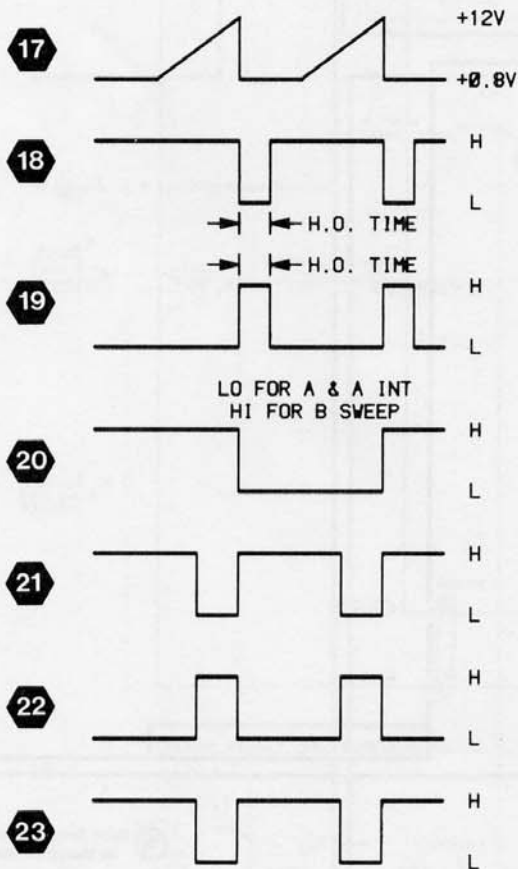
## 2215A CONTROL SETTINGS

### DC Voltages

|                 |              |
|-----------------|--------------|
| Input           | GND          |
| Coupling (both) | NORM (sweep  |
| A TRIGGER Mode  | not running) |

### AC Waveforms

|                       |                        |
|-----------------------|------------------------|
| VERTICAL MODE         | CH 1                   |
| CH 1 VOLTS/DIV        | 5mV                    |
| Input Coupling (both) | DC                     |
| HORIZONTAL MODE       | ALT                    |
| A SEC/DIV             | 50 $\mu$ s             |
| B SEC/DIV             | 5 $\mu$ s              |
| B DELAY TIME POSITION | 5.0                    |
| B TRIGGER LEVEL       | CW-RUN AFTER DELAY     |
| A TRIGGER Mode        | P-P AUTO               |
| A&B INT               | CH 1                   |
| A SOURCE              | INT                    |
| CH 1 INPUT SIGNAL     | 5-div, 1-kHz sine wave |



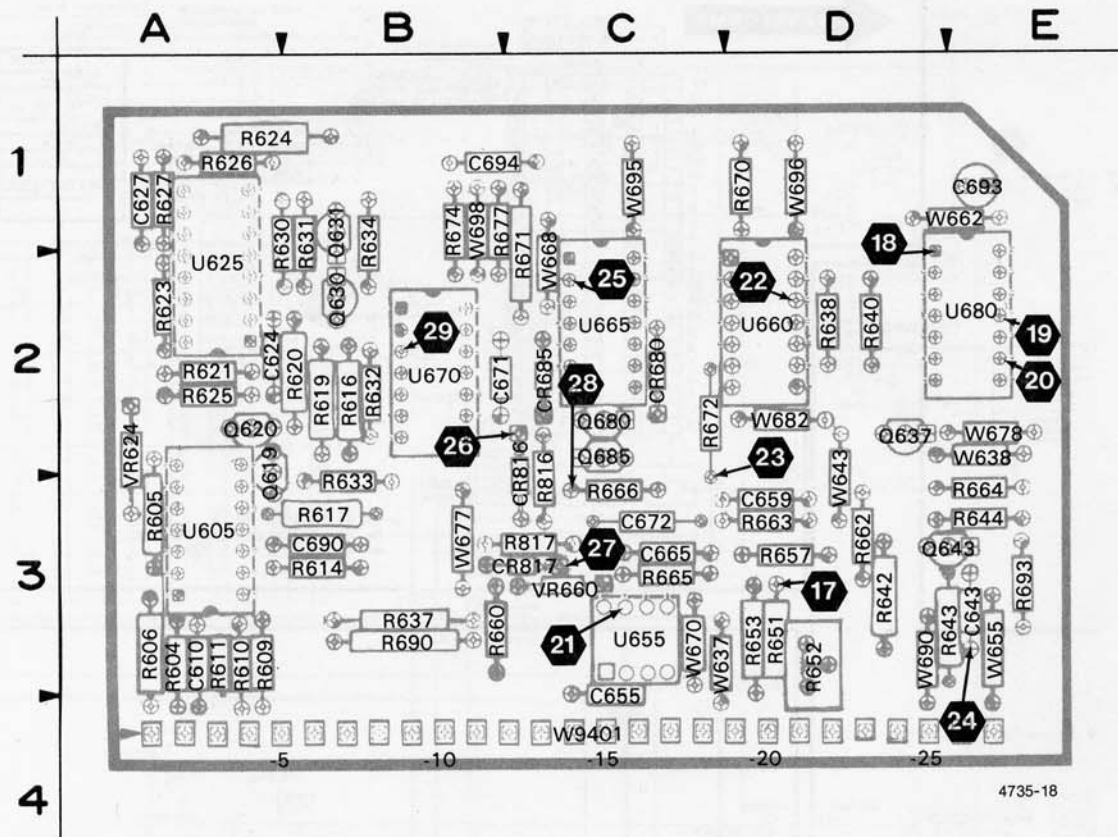
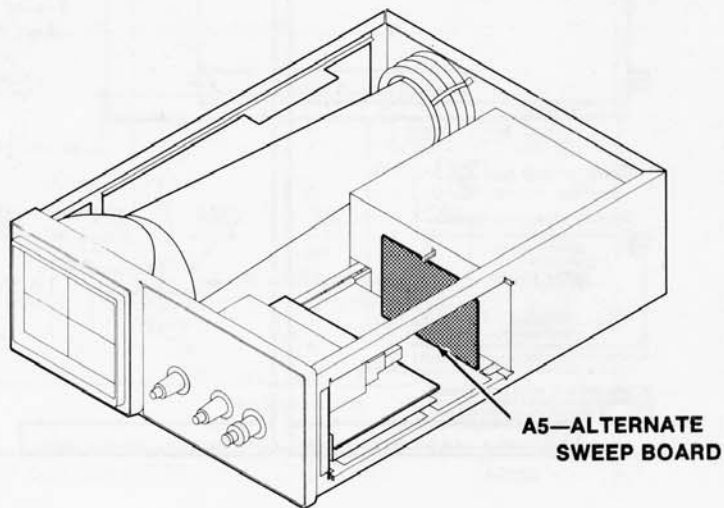
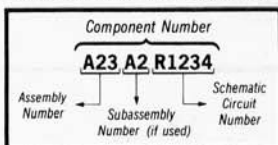


Figure 9-12. A5—Alternate Sweep board.



 Static Sensitive Devices  
See Maintenance Section

**COMPONENT NUMBER EXAMPLE**



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

## A5—ALTERNATE SWEEP BOARD

| CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER |
|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| C610           | 5            | R623           | 5            | U605           | 5            | W677           | 5            |
| C624           | 5            | R624           | 5            | U605           | 5            | W678           | 5            |
| C627           | 5            | R625           | 5            | U605           | 5            | W682           | 5            |
| C643           | 5            | R626           | 5            | U605           | 5            | W690           | 5            |
| C655           | 5            | R627           | 5            | U605           | 5            | W695           | 5            |
| C659           | 5            | R629           | 5            | U605           | 5            | W696           | 5            |
| C665           | 5            | R630           | 5            | U625           | 5            | W698           | 5            |
| C671           | 5            | R631           | 5            | U625           | 5            | W9401-10       | 5            |
| C672           | 5            | R632           | 5            | U625           | 5            | W9401-11       | 5            |
| C690           | 5            | R633           | 5            | U625           | 5            | W9401-12       | 5            |
| C693           | 5            | R634           | 5            | U655           | 5            | W9401-13       | 5            |
| C694           | 5            | R637           | 5            | U660           | 5            | W9401-14       | 5            |
| CR680          | 5            | R638           | 5            | U660           | 5            | W9401-15       | 5            |
| CR685          | 5            | R640           | 5            | U660           | 5            | W9401-16       | 5            |
| CR816          | 5            | R642           | 5            | U660           | 5            | W9401-17       | 5            |
| CR817          | 5            | R643           | 5            | U660           | 5            | W9401-18       | 5            |
| Q619           | 5            | R644           | 5            | U660           | 5            | W9401-19       | 5            |
| Q620           | 5            | R651           | 5            | U665           | 5            | W9401-1        | 5            |
| Q630           | 5            | R652           | 5            | U665           | 5            | W9401-20       | 5            |
| Q631           | 5            | R653           | 5            | U665           | 5            | W9401-21       | 5            |
| Q637           | 5            | R657           | 5            | U665           | 5            | W9401-22       | 5            |
| Q643           | 5            | R660           | 5            | U670           | 5            | W9401-23       | 5            |
| Q680           | 5            | R662           | 5            | U670           | 5            | W9401-24       | 5            |
| Q685           | 5            | R663           | 5            | U680           | 5            | W9401-25       | 5            |
| R604           | 5            | R664           | 5            | U680           | 5            | W9401-26       | 5            |
| R605           | 5            | R665           | 5            | U680           | 5            | W9401-27       | 5            |
| R606           | 5            | R666           | 5            | U680           | 5            | W9401-2        | 5            |
| R609           | 5            | R670           | 5            | VR624          | 5            | W9401-3        | 5            |
| R610           | 5            | R671           | 5            | VR660          | 5            | W9401-4        | 5            |
| R611           | 5            | R672           | 5            | W637           | 5            | W9401-5        | 5            |
| R614           | 5            | R674           | 5            | W638           | 5            | W9401-6        | 5            |
| R616           | 5            | R677           | 5            | W643           | 5            | W9401-7        | 5            |
| R617           | 5            | R690           | 5            | W655           | 5            | W9401-8        | 5            |
| R619           | 5            | R693           | 5            | W662           | 5            | W9401-9        | 5            |
| R620           | 5            | R816           | 5            | W668           | 5            |                |              |
| R621           | 5            | R817           | 5            | W670           | 5            |                |              |

## B TIMING & ALTERNATE B SWEEP

5

| ASSEMBLY A1    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C603           | 9F             | 5E             | R645           | 4E             | 8E             | W649           | 2F             | 6E             | W9400-19       | 2F             | 7E             |
| C635           | 2F             | 7F             | R646           | 5E             | 8D             | W9001-13       | 2E             | 5A             | W9400-1        | 9F             | 5E             |
| C646           | 5F             | 7E             | R647           | 5F             | 8E             | W9001-15       | 1E             | 6A             | W9400-20       | 5F             | 7E             |
| C647           | 3E             | 6E             | R648           | 1F             | 8D             | W9001-16       | 9F             | 6A             | W9400-21       | 1F             | 7E             |
| C648           | 1F             | 6E             | R649           | 2E             | 8D             | W9001-26       | 2E             | 7A             | W9400-22       | 6F             | 7E             |
| C649           | 3F             | 6E             | R673           | 6F             | 7E             | W9001-27       | 2E             | 7A             | W9400-2        | 9F             | 5E             |
| C673           | 7F             | 7E             |                |                |                | W9001-28       | 9F             | 7A             | W9400-4        | 9F             | 6E             |
|                |                |                | VR645          | 5E             | 8D             | W9400-10       | 2F             | 6E             | W9400-5        | 1S             | 6E             |
| CR712          | 6F             | 7E             | VR712          | 6F             | 7E             | W9400-11       | 2S             | 6E             | W9400-6        | 2F             | 6E             |
|                |                |                |                |                |                | W9400-12       | 2F             | 6E             | W9400-7        | 2S             | 6E             |
| P9644-1        | 4E             | 8E             | W602           | 9F             | 6E             | W9400-13       | 1F             | 6E             | W9700-10       | 7F             | 7E             |
| P9644-2        | 5E             | 8E             | W603           | 9F             | 6E             | W9400-14       | 5F             | 7E             | W9700-3        | 6F             | 7E             |
| P9644-3        | 5E             | 8E             | W635           | 2E             | 7F             | W9400-17       | 6F             | 7E             |                |                |                |

*Partial A1 also shown on diagrams 2, 3, 4, 6, 7 and 8.*











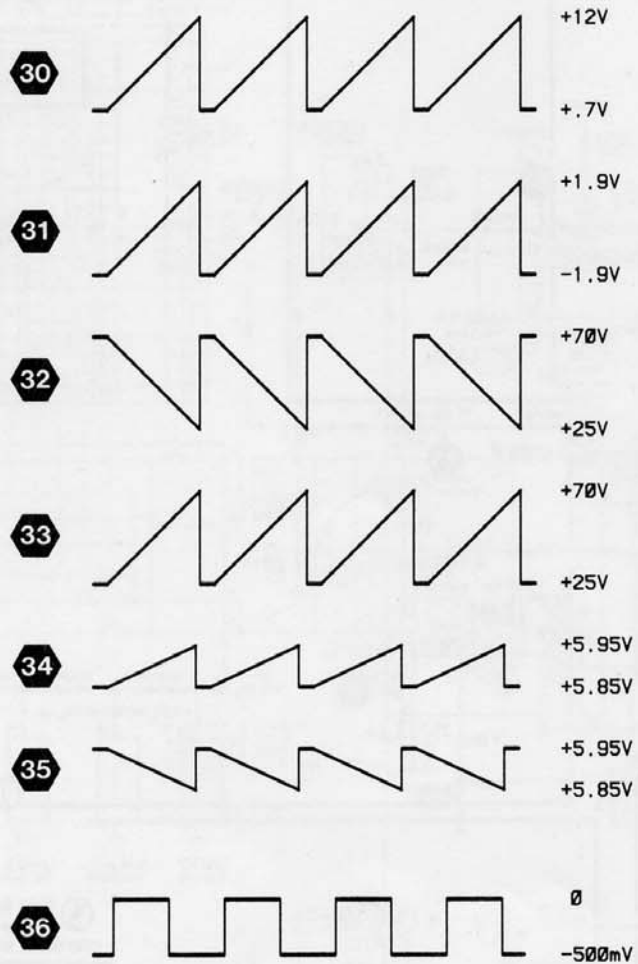
## 2215A CONTROL SETTINGS

### DC Voltages

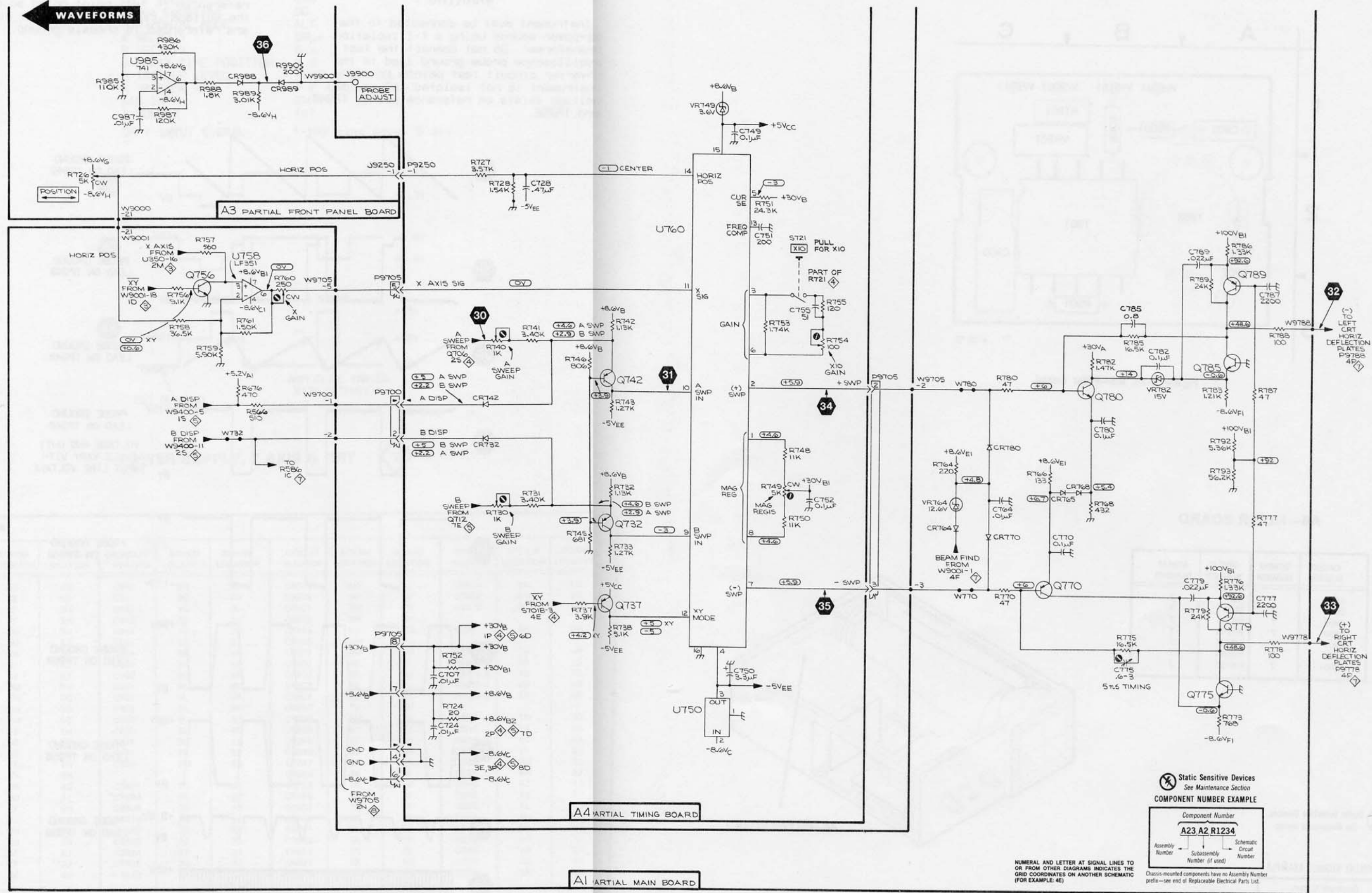
|                       |          |
|-----------------------|----------|
| Input Coupling (both) | GND      |
| HORIZONTAL MODE       | A        |
| A TRIGGER Mode        | P-P AUTO |

### AC Waveforms

|                       |                 |
|-----------------------|-----------------|
| Input Coupling (both) | GND             |
| HORIZONTAL MODE       | A               |
| X10 Magnifier         | Off (knob in)   |
| VAR HOLDOFF           | MIN (fully ccw) |
| A TRIGGER Mode        | P-P AUTO        |







Static Sensitive Devices  
See Maintenance Section

COMPONENT NUMBER EXAMPLE

|                  |                              |                          |
|------------------|------------------------------|--------------------------|
| Component Number |                              |                          |
| A23              | A2                           | R1234                    |
| Assembly Number  | Subassembly Number (if used) | Schematic Circuit Number |

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

NUMERAL AND LETTER AT SIGNAL LINES TO OR FROM OTHER DIAGRAMS INDICATES THE GRID COORDINATES ON ANOTHER SCHEMATIC (FOR EXAMPLE: 4E)

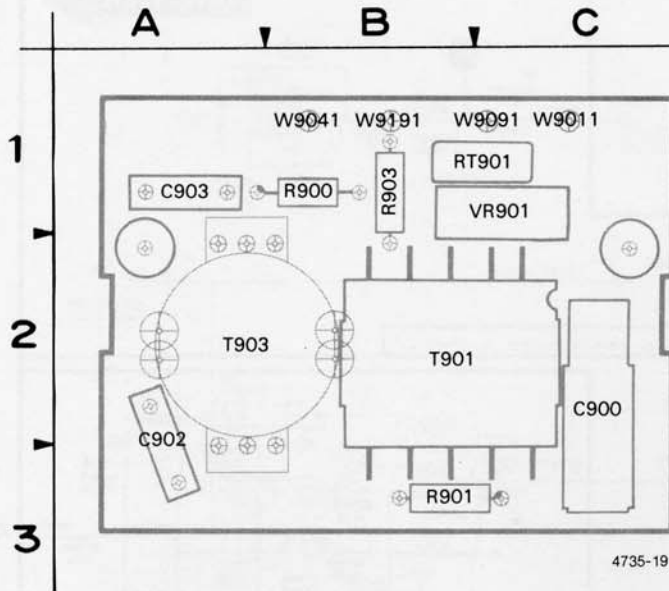
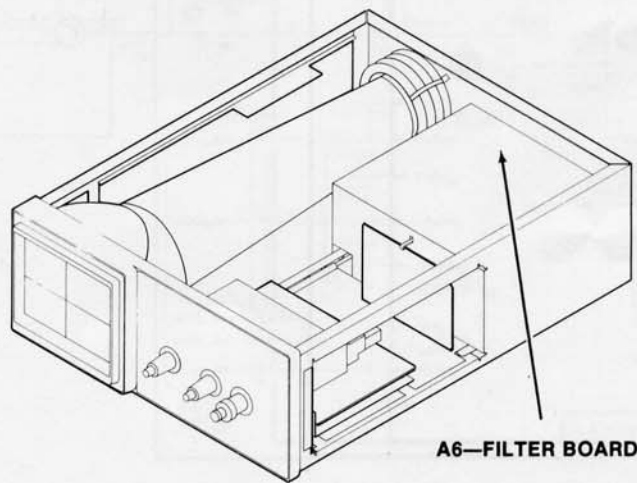


Figure 9-13. A6—Filter board.

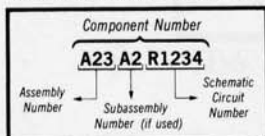
**A6—FILTER BOARD**

| CIRCUIT NUMBER | SCHEM NUMBER | CIRCUIT NUMBER | SCHEM NUMBER |
|----------------|--------------|----------------|--------------|
| C900           | 7            | T901           | 7            |
| C902           | 7            | T903           | 7            |
| C903           | 7            | VR901          | 7            |
| R900           | 7            | W9011          | 7            |
| R901           | 7            | W9041          | 7            |
| R903           | 7            | W9091          | 7            |
| RT901          | 7            | W9191          | 7            |



 Static Sensitive Devices  
See Maintenance Section

**COMPONENT NUMBER EXAMPLE**



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

# POWER SUPPLY WAVEFORMS

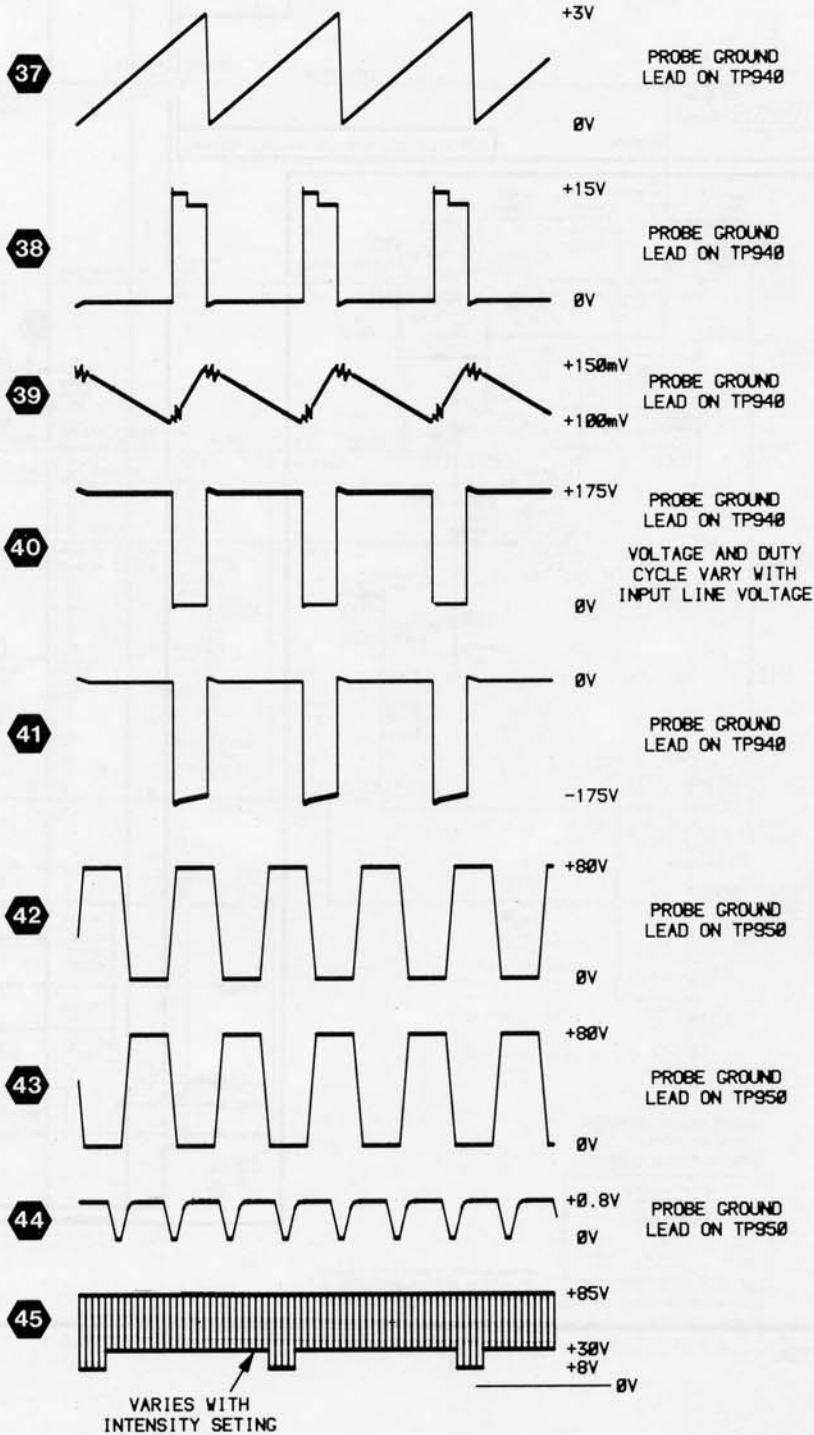
## AC Waveforms

### WARNING

Instrument must be connected to the ac-power source using a 1:1 isolation transformer. Do not connect the test oscilloscope probe ground lead to the inverter circuit test points if the instrument is not isolated. AC-source voltage exists on reference points TP940 and TP950.

## DC Voltages

Preregulator and inverter voltages are referenced to test point noted adjacent to the voltage. Power supply output voltages are referenced to chassis ground.

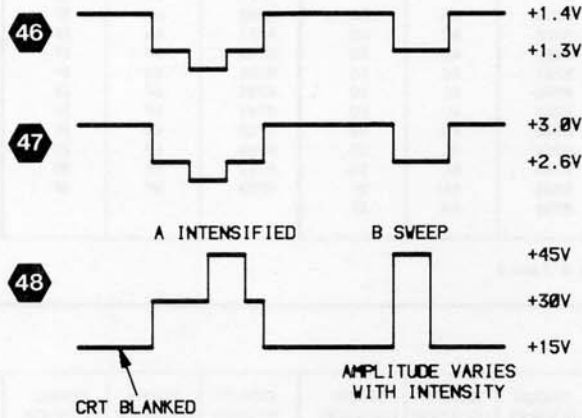




# 2215A CONTROL SETTINGS

## AC Waveforms

|                       |                         |
|-----------------------|-------------------------|
| VERTICAL MODE         | CH 1                    |
| CH 1 VOLTS/DIV        | 5mV                     |
| Input Coupling        | DC                      |
| HORIZONTAL MODE       | ALT                     |
| A SEC/DIV             | 50 $\mu$ s              |
| B SEC/DIV             | 5 $\mu$ s               |
| B DELAY TIME POSITION | 5.0                     |
| B TRIGGER LEVEL       | RUNS AFTER DELAY- CW    |
| A TRIGGER Mode        | P-P AUTO                |
| A&B INT               | CH 1                    |
| A SOURCE              | INT                     |
| CH 1 INPUT SIGNAL     | 1-kHz sine wave, 5 div. |



4735-10

## POWER SUPPLY, Z AXIS & CRT



| ASSEMBLY A1    |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C396           | 6D             | 4H             | C940           | 9G             | 6H             | CR840          | 4H             | 3J             | DS856          | 5M             | 5G             |
| C824           | 3E             | 6E             | C941           | 9G             | 6H             | CR845          | 3H             | 3J             | DS858          | 5M             | 5G             |
| C825           | 3F             | 3H             | C942           | 9D             | 8H             | CR851          | 7M             | 6G             | DS870          | 8L             | 5G             |
| C828           | 4F             | 3H             | C943           | 9C             | 8H             | CR853          | 6M             | 6H             |                |                |                |
| C832           | 2G             | 3H             | C944           | 9F             | 7H             | CR854          | 5M             | 5G             | E907           | 8H             | 6H             |
| C835           | 4H             | 3J             | C945           | 9F             | 8J             | CR855          | 5M             | 5G             |                |                |                |
| C845           | 3H             | 3J             | C954           | 6K             | 6F             | CR879          | 8M             | 6G             | P9802-1        | 3B             | 4B             |
| C847           | 3J             | 3J             | C956           | 7K             | 6F             | CR901          | 5E             | 5J             | P9802-2        | 3B             | 4B             |
| C849           | 3J             | 3J             | C960           | 9L             | 6F             | CR902          | 5E             | 5J             | P9802-3        | 2B             | 4B             |
| C851           | 7M             | 6H             | C961           | 9L             | 8F             | CR903          | 5E             | 5J             | P9802-4        | 3B             | 4B             |
| C853           | 7M             | 6G             | C962           | 9L             | 7F             | CR904          | 5E             | 5J             | P9802-5        | 2B             | 4B             |
| C854           | 6M             | 5G             | C963           | 9L             | 8F             | CR907          | 7J             | 6H             |                |                |                |
| C855           | 3M             | 5G             | C968           | 9L             | 8G             | CR908          | 8H             | 7J             | Q586           | 1D             | 6D             |
| C871           | 4S             | 1H             | C970           | 9L             | 8G             | CR920          | 6J             | 7J             | Q804           | 2B             | 5B             |
| C873           | 5S             | 1H             | C975           | 5L             | 5G             | CR945          | 9F             | 8H             | Q814           | 3C             | 5B             |
| C875           | 6S             | 1H             | C976           | 5L             | 5G             | CR946          | 9J             | 8H             | Q825           | 3F             | 3J             |
| C877           | 7S             | 1H             | C979           | 5M             | 5G             | CR947          | 9J             | 8H             | Q829           | 3G             | 3J             |
| C879           | 8N             | 5H             |                |                |                | CR954          | 6K             | 6F             | Q835           | 4H             | 3J             |
| C893           | 7N             | 4G             | CR551          | 2C             | 6D             | CR955          | 7K             | 6F             | Q840           | 4J             | 3J             |
| C904           | 5D             | 4J             | CR583          | 1C             | 6D             | CR956          | 7K             | 6F             | Q845           | 3J             | 3J             |
| C906           | 5F             | 5H             | CR805          | 2C             | 5B             | CR957          | 7K             | 6F             | Q885           | 1L             | 4G             |
| C907           | 7J             | 6J             | CR818          | 1D             | 6E             | CR960          | 8K             | 7F             | Q908           | 8H             | 7H             |
| C908           | 6H             | 5J             | CR820          | 2D             | 6E             | CR961          | 9K             | 8F             | Q928           | 6F             | 7J             |
| C917           | 8D             | 7H             | CR823          | 3E             | 3J             | CR962          | 9K             | 7F             | Q930           | 6G             | 7J             |
| C919           | 8F             | 8J             | CR824          | 2F             | 2J             | CR963          | 9K             | 8F             | Q935           | 9B             | 8J             |
| C922           | 7F             | 7J             | CR825          | 3G             | 3J             | CR967          | 9K             | 8G             | Q938           | 9D             | 8J             |
| C925           | 6E             | 8J             | CR829          | 3F             | 3J             | CR970          | 9K             | 8G             | Q939           | 9E             | 8J             |

TABLE (cont)



**POWER SUPPLY, Z AXIS & CRT** 7 (cont)

| <b>ASSEMBLY A1 (cont)</b> |                |                |                |                |                |                |                |                |                |                |                |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER            | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| Q944                      | 9F             | 8J             | R858           | 6M             | 5G             | R925           | 6F             | 7J             | TP950          | 9C             | 7H             |
| Q946                      | 9H             | 8H             | R860           | 4M             | 5G             | R926           | 5E             | 7J             |                |                |                |
| Q947                      | 9H             | 7H             | R870           | 4S             | 1H             | R927           | 7F             | 7J             | U930           | 9G             | 7J             |
|                           |                |                | R871           | 4S             | 1H             | R928           | 6F             | 7J             | U975           | 4K             | 5F             |
| R397                      | 6D             | 5E             | R872           | 5S             | 1H             | R929           | 6F             | 7J             |                |                |                |
| R398                      | 6D             | 5E             | R873           | 4S             | 1G             | R930           | 6F             | 7J             | VR828          | 4F             | 3H             |
| R586                      | 1C             | 6E             | R874           | 6S             | 1G             | R934           | 9C             | 8J             | VR925          | 7F             | 7J             |
| R800                      | 2B             | 4B             | R875           | 6S             | 1G             | R935           | 9C             | 8J             | VR935          | 9C             | 8J             |
| R804                      | 2B             | 4B             | R877           | 7S             | 1H             | R937           | 9C             | 8H             | VR943          | 9E             | 8J             |
| R805                      | 2B             | 5B             | R879           | 8N             | 6F             | R938           | 9C             | 8J             |                |                |                |
| R810                      | 3B             | 4B             | R885           | 1K             | 4H             | R939           | 9C             | 8H             | W9040          | 5D             | 5J             |
| R814                      | 3B             | 4B             | R886           | 2L             | 4G             | R940           | 9C             | 8H             | W9190          | 5D             | 5H             |
| R818                      | 1D             | 6E             | R888           | 1L             | 4G             | R941           | 9E             | 8J             | W9800          | 4B             | 3J             |
| R820                      | 2D             | 6E             | R889           | 1M             | 4G             | R942           | 9D             | 8J             | W9001-1        | 4F             | 4A             |
| R822                      | 4E             | 2J             | R890           | 1M             | 4G             | R943           | 9E             | 8J             | W9070-1        | 8H             | 6H             |
| R823                      | 3E             | 2J             | R891           | 1M             | 4G             | R944           | 9F             | 8J             | W9070-2        | 7H             | 6H             |
| R825                      | 3E             | 3J             | R892           | 6N             | 4F             | R945           | 9F             | 8H             | W9070-3        | 8H             | 7H             |
| R826                      | 3E             | 2J             | R893           | 6N             | 4F             | R946           | 9H             | 8H             | W9150-1        | 7B             | 5A             |
| R828                      | 4F             | 2G             | R894           | 6M             | 5F             | R947           | 9H             | 7H             | W9150-2        | 8B             | 5A             |
| R830                      | 3G             | 2J             | R905           | 6D             | 4J             | R949           | 9H             | 8H             | W9400-8        | 3C             | 6E             |
| R832                      | 3G             | 3J             | R906           | 6D             | 5J             | R971           | 9L             | 8G             | W9400-9        | 3E             | 6E             |
| R834                      | 4H             | 3J             | R907           | 9J             | 6H             | R976           | 4L             | 5G             | W9870-10       | 4S             | 1H             |
| R835                      | 4G             | 3J             | R908           | 8H             | 7J             | R978           | 4L             | 5G             | W9870-12       | 3N             | 4G             |
| R836                      | 4G             | 3J             | R909           | 8H             | 7H             |                |                |                | W9870-14       | 8N             | 4G             |
| R840                      | 4H             | 3J             | R910           | 7B             | 5A             |                |                |                | W9870-1        | 8N             | 4G             |
| R841                      | 3G             | 3J             | R912           | 9C             | 7J             | S901           | 5D             | 4J             | W9870-2        | 8N             | 4G             |
| R842                      | 3J             | 3J             | R913           | 8C             | 7J             | T390           | 6D             | 4H             | W9870-3        | 7N             | 4G             |
| R844                      | 3H             | 3J             | R914           | 8D             | 7H             | T906           | 6J             | 6J             | W9870-4        | 7N             | 4G             |
| R845                      | 3H             | 3J             | R915           | 8D             | 7J             | T944           | 9H             | 7H             | W9870-5        | 6S             | 1H             |
| R849                      | 3J             | 3J             | R916           | 8F             | 7J             | T948           | 4J             | 6G             | W9870-7        | 5S             | 1H             |
| R851                      | 7M             | 4J             | R917           | 8D             | 7H             |                |                |                | W9870-8        | 7S             | 1H             |
| R852                      | 7M             | 4J             | R919           | 8F             | 8J             | TP842          | 3J             | 3J             |                |                |                |
| R853                      | 7M             | 6G             | R921           | 8E             | 7J             | TP900          | 9L             | 8E             |                |                |                |
| R854                      | 6M             | 5G             | R922           | 8F             | 7J             | TP940          | 9C             | 8J             |                |                |                |

Partial A1 also shown on diagrams 2, 3, 4, 5, 6 and 8.

| <b>ASSEMBLY A3</b> |                |                |                |                |                |                |                |                |                |                |                |
|--------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER     | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| P9006-1            | 3S             | 2A             | R982           | 3S             | 2A             | S390           | 4E             | 2A             |                |                |                |
| P9006-2            | 3S             | 2A             | R983           | 3S             | 2A             | W9000-1        | 4F             | 4A             |                |                |                |

Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 6, and 8.

| <b>ASSEMBLY A6</b> |                |                |                |                |                |                |                |                |                |                |                |
|--------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER     | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C900               | 5B             | 2C             | R901           | 5B             | 3B             | T901           | 5B             | 2B             | W9011          | 5A             | 1C             |
| C902               | 5C             | 2A             | R903           | 5C             | 1B             | T903           | 5C             | 2A             | W9041          | 5C             | 1B             |
| C903               | 5C             | 1A             |                |                |                |                |                |                | W9091          | 5A             | 1C             |
| R900               | 5C             | 1B             | RT901          | 5B             | 1B             | VR901          | 5B             | 1C             | W9191          | 5C             | 1B             |

| <b>CHASSIS MOUNTED PARTS</b> |                |                |                |                |                |                |                |                |                |                |                |
|------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER               | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| DS9150                       | 8A             | CHASSIS        | P9273          | 5P             | CHASSIS        | P9870-1        | 8P             | CHASSIS        | R9802A         | 2A             | CHASSIS        |
|                              |                |                | P9778          | 4P             | CHASSIS        | P9870-2        | 8N             | CHASSIS        | R9802B         | 3A             | CHASSIS        |
| F9001                        | 5A             | CHASSIS        | P9788          | 4P             | CHASSIS        | P9870-3        | 7N             | CHASSIS        |                |                |                |
|                              |                |                | P9070-1        | 8J             | CHASSIS        | P9870-4        | 7N             | CHASSIS        | V9870          | 2P             | CHASSIS        |
| FL9001                       | 5A             | CHASSIS        | P9070-2        | 8J             | CHASSIS        | P9870-5        | 6P             | CHASSIS        |                |                |                |
|                              |                |                | P9070-3        | 8J             | CHASSIS        | P9870-7        | 5P             | CHASSIS        |                |                |                |
| J9800                        | 4A             | CHASSIS        | P9870-10       | 4P             | CHASSIS        | P9870-8        | 7P             | CHASSIS        |                |                |                |
|                              |                |                | P9870-12       | 3N             | CHASSIS        |                |                |                |                |                |                |
| P9272                        | 5P             | CHASSIS        | P9870-14       | 8P             | CHASSIS        | Q9070          | 8J             | CHASSIS        |                |                |                |



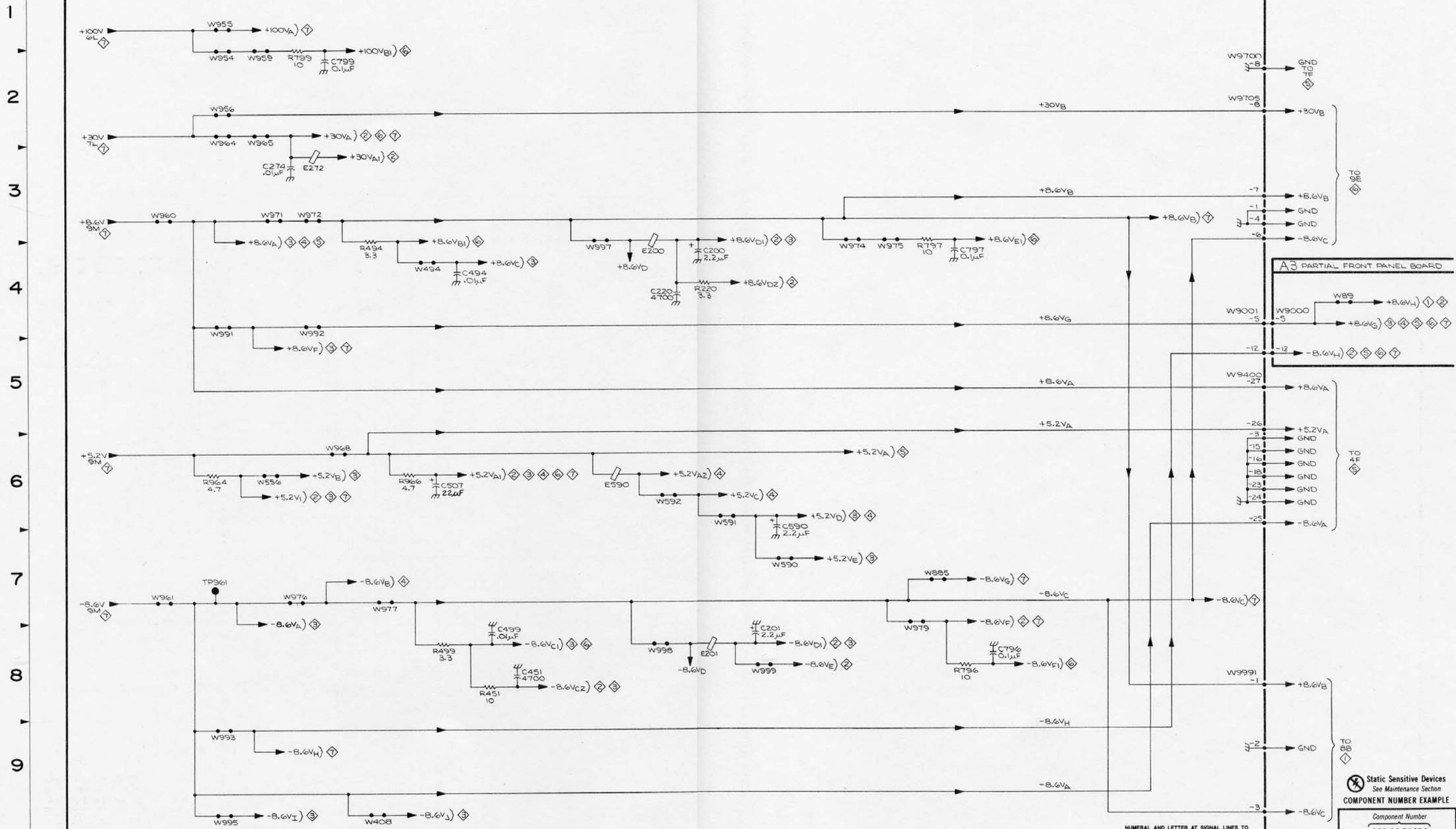
# POWER DISTRIBUTION



| <b>ASSEMBLY A1</b>   |                |                |                |                |                |                |                |                |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| CIRCUIT NUMBER   | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| C200   | 4H             | 3E             | TP961          | 7B             | 8E             | W993           | 9C             | 5B             |
| C201   | 8H             | 3E             |                |                |                | W995           | 9C             | 6B             |
| C220   | 4G             | 2D             | W408           | 9D             | 7B             | W997           | 4G             | 4D             |
| C274   | 3C             | 2G             | W494           | 4E             | 5D             | W998           | 8G             | 4E             |
| C451   | 8F             | 6D             | W556           | 6C             | 2H             | W999           | 8H             | 2E             |
| C494   | 4E             | 5D             | W590           | 7H             | 7C             | W9001-12       | 5P             | 5A             |
| C499   | 8E             | 5C             | W591           | 6H             | 7D             | W9001-5        | 4P             | 5A             |
| C507   | 6E             | 6C             | W592           | 6G             | 8C             | W9400-15       | 6N             | 7E             |
| C590   | 6H             | 7D             | W885           | 7K             | 4G             | W9400-18       | 6N             | 7E             |
| C796   | 8L             | 2G             | W954           | 1C             | 6F             | W9400-23       | 6N             | 7E             |
| C797   | 4K             | 3G             | W955           | 1C             | 4H             | W9400-24       | 6N             | 7E             |
| C799   | 2D             | 3F             | W956           | 2C             | 5F             | W9400-25       | 6N             | 7E             |
|  |                |                | W959           | 1C             | 4E             | W9400-26       | 6N             | 8E             |
| E200   | 4G             | 4E             | W960           | 3B             | 7F             | W9400-27       | 5N             | 8E             |
| E201   | 8H             | 4E             | W961           | 7B             | 8F             | W9400-3        | 6N             | 6E             |
| E272   | 3D             | 1G             | W964           | 2C             | 3H             | W9705-1        | 3N             | 5E             |
| E590   | 6G             | 8C             | W965           | 2C             | 3H             | W9705-4        | 3N             | 5E             |
|  |                |                | W968           | 6D             | 8F             | W9705-6        | 3N             | 5E             |
| R220   | 4H             | 2D             | W971           | 3C             | 7E             | W9705-7        | 3N             | 5E             |
| R451   | 8E             | 6D             | W972           | 3C             | 6E             | W9705-8        | 2N             | 5E             |
| R494   | 4D             | 5E             | W974           | 4J             | 3H             | W9991-1        | 8N             | 5E             |
| R499   | 8E             | 5E             | W975           | 4K             | 3H             | W9991-2        | 9N             | 5E             |
| R796   | 8K             | 2G             | W976           | 7C             | 7E             | W9991-3        | 9N             | 5E             |
| R797   | 4K             | 3G             | W977           | 7D             | 6E             |                |                |                |
| R799   | 2C             | 3E             | W979           | 8K             | 3H             |                |                |                |
| R964   | 6B             | 3H             | W991           | 4C             | 5B             |                |                |                |
| R966   | 6E             | 7E             | W992           | 4C             | 5A             |                |                |                |
| <i>Partial A1 also shown on diagrams 2, 3, 4, 5, 6 and 7.</i>    |                |                |                |                |                |                |                |                |
| <b>ASSEMBLY A3</b>   |                |                |                |                |                |                |                |                |
| CIRCUIT NUMBER   | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION | CIRCUIT NUMBER | SCHEM LOCATION | BOARD LOCATION |
| W89  | 4P             | 1C             | W9000-12       | 5N             | 4B             | W9000-5        | 4N             | 4A             |
| <i>Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 6 and 7.</i> |                |                |                |                |                |                |                |                |



A B C D E F G H J K L M N P S



A PARTIAL MAIN BOARD

A3 PARTIAL FRONT PANEL BOARD

NUMERAL AND LETTER AT SIGNAL LINES TO OR FROM OTHER DIAGRAMS INDICATES THE GRID COORDINATES ON ANOTHER SCHEMATIC (FOR EXAMPLE: 4E)

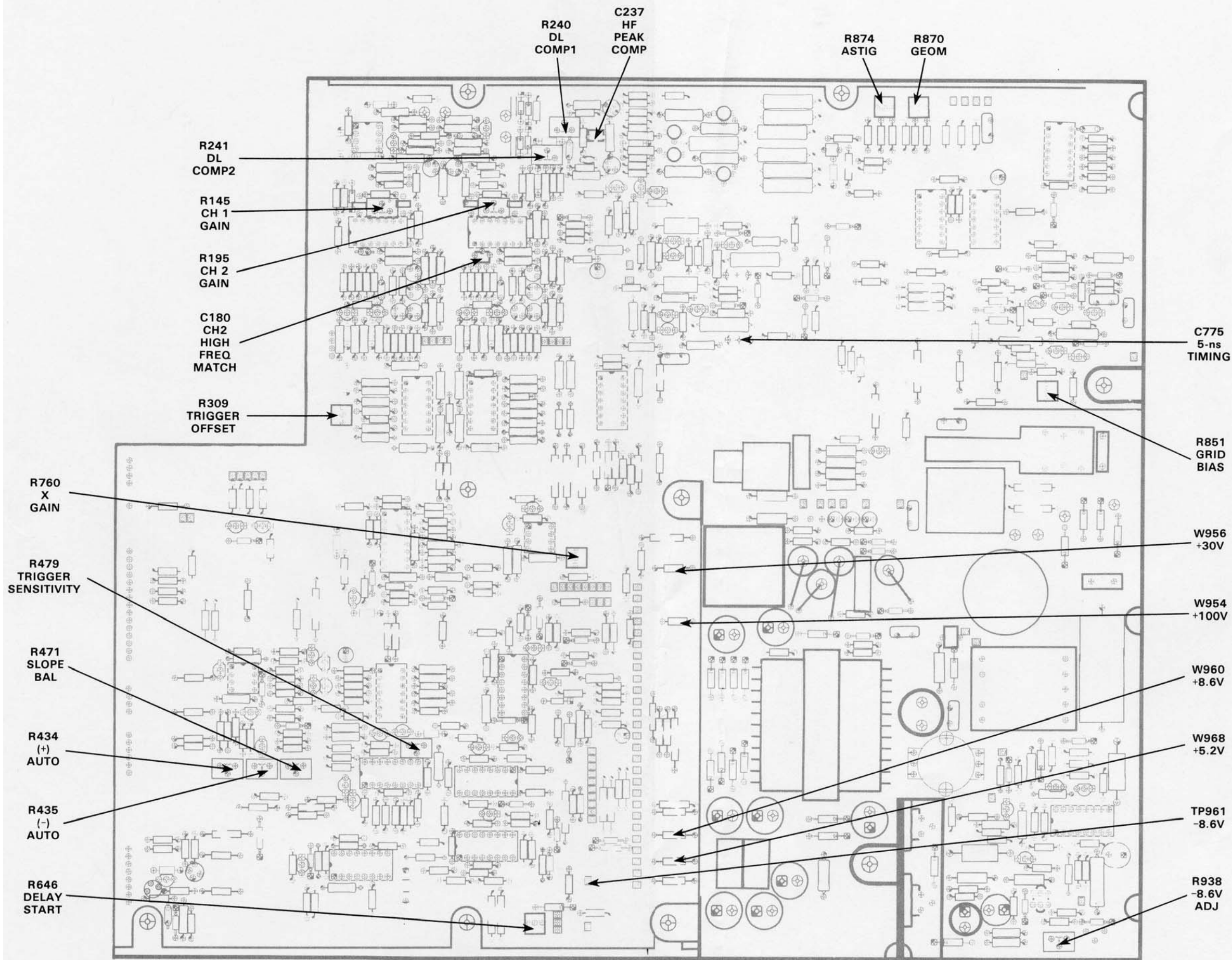
⚡ Static Sensitive Devices  
See Maintenance Section

COMPONENT NUMBER EXAMPLE

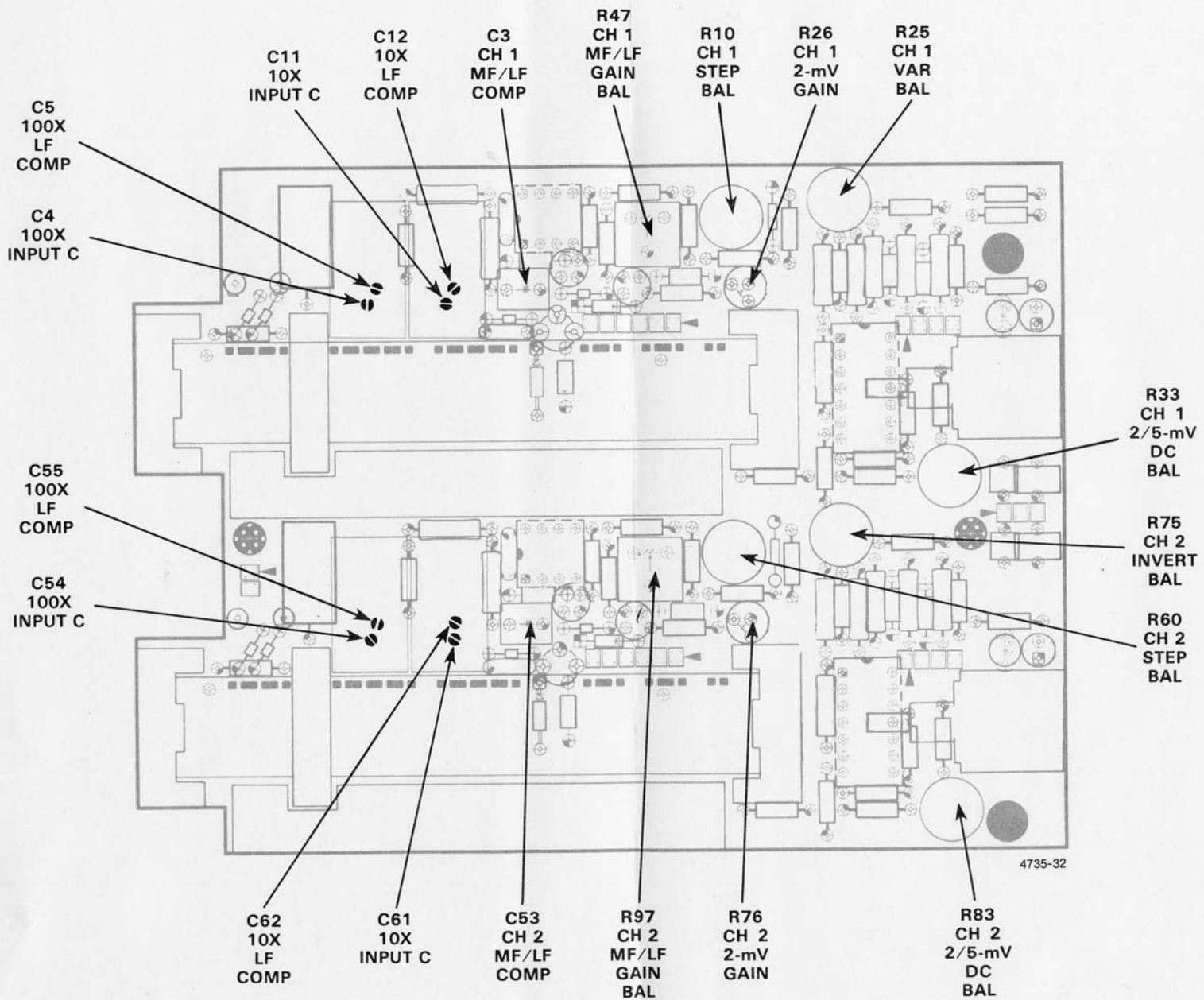
|                  |                              |                          |
|------------------|------------------------------|--------------------------|
| Component Number |                              |                          |
| A23              | A2                           | R1234                    |
| Assembly Number  | Subassembly Number (if used) | Schematic Circuit Number |

Chassis mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

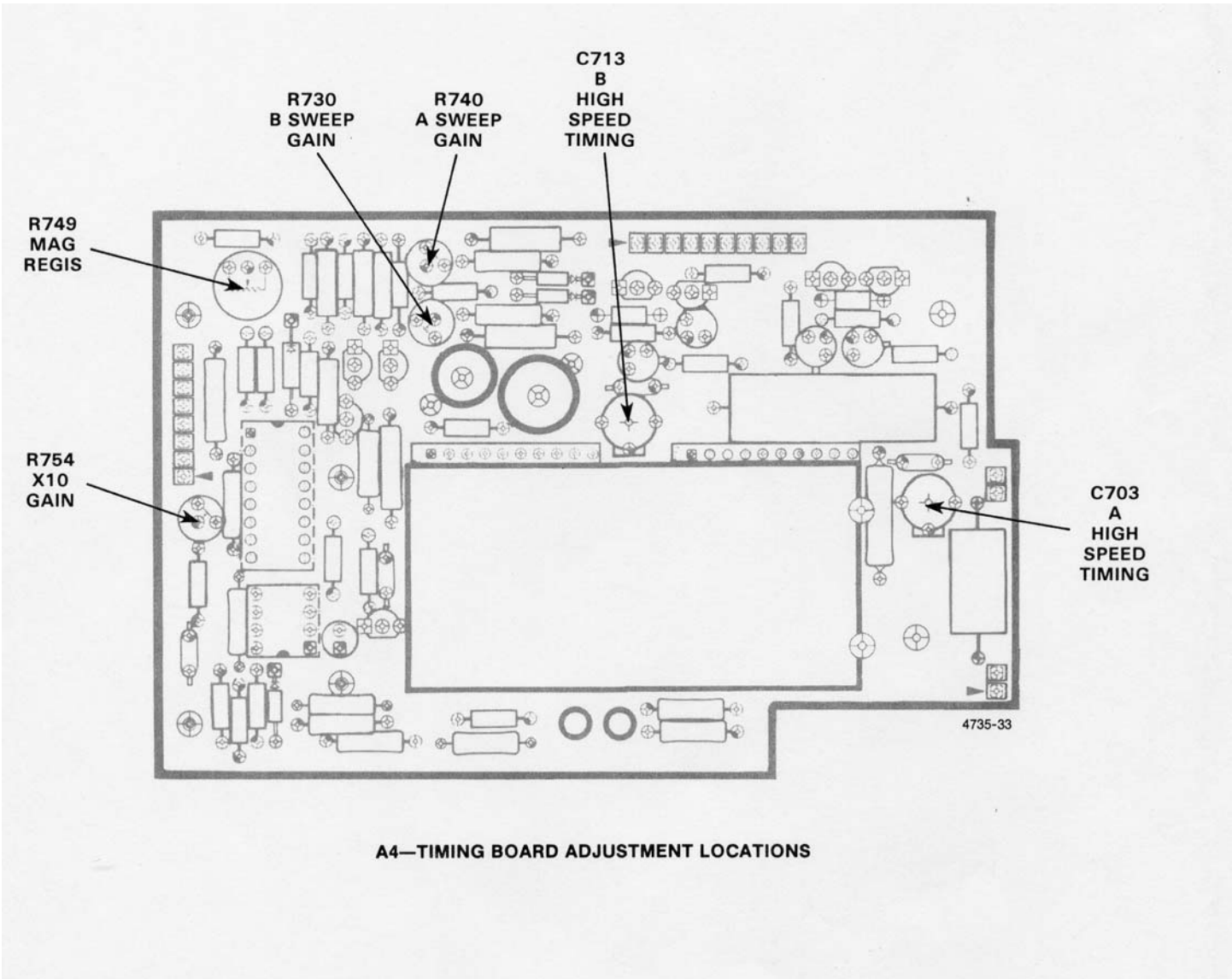




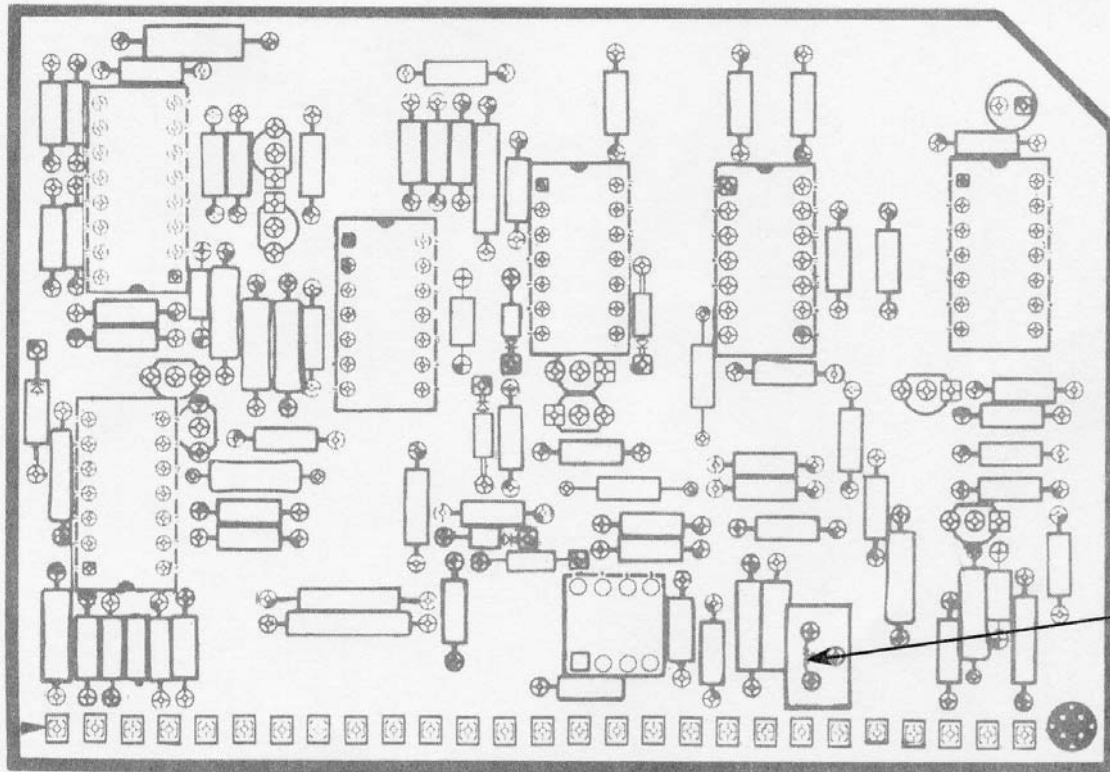
A1—MAIN BOARD ADJUSTMENT LOCATIONS



A2-ATTENUATOR BOARD ADJUSTMENT LOCATIONS



A4—TIMING BOARD ADJUSTMENT LOCATIONS



4735-34

**A5—ALTERNATE SWEEP BOARD ADJUSTMENT LOCATIONS**

**GENERAL NOTES**

- A. Use schematic diagrams, the overall block diagram, circuit board illustrations, and circuit descriptions when analyzing instrument malfunctions and locating test points. The schematic diagrams include typical waveforms and voltages that are intended as an aid in troubleshooting.
- B. Always set the POWER switch to OFF and unplug the line cord before swapping, removing, or replacing components, and before connecting or disconnecting instrument leads and cables.
- C. When analyzing circuit malfunctions, consider connectors and cables as possible causes of failure.

**SPECIFIC NOTES**

1. Set initial front-panel controls as follows:

|                         |                |
|-------------------------|----------------|
| POWER Switch            | ON (button in) |
| A INTENSITY             | Midrange       |
| FOCUS                   | Midrange       |
| Vertical POSITION       | Midrange       |
| VERTICAL MODE           | CH 1           |
| CH 1 VOLTS/DIV          | 0.1V           |
| CH 1 VOLTS/DIV Variable | Cal detent     |
| CH 1 Input Coupling     | GND            |
| Horizontal POSITION     | Midrange       |
| HORIZONTAL MODE         | A              |
| A SEC/DIV               | 0.1ms          |
| A SEC/DIV Variable      | Cal detent     |
| X10 Magnifier           | Off (knob in)  |
| A TRIGGER Mode          | P-P AUTO       |
| A&B INT                 | VERT MODE      |
| A SOURCE                | INT            |

2. Verify the low-voltage power supplies at the following test points:

| SUPPLY | TEST POINT | TOLERANCE       |
|--------|------------|-----------------|
| +5.2V  | W968       | 5.04 to 5.36V   |
| +8.6V  | W960       | 8.43 to 8.77V   |
| -8.6V  | TP961      | -8.56 to -8.64V |
| +30V   | W956       | 29.1 to 30.9V   |
| +100V  | W954       | 97 to 103V      |

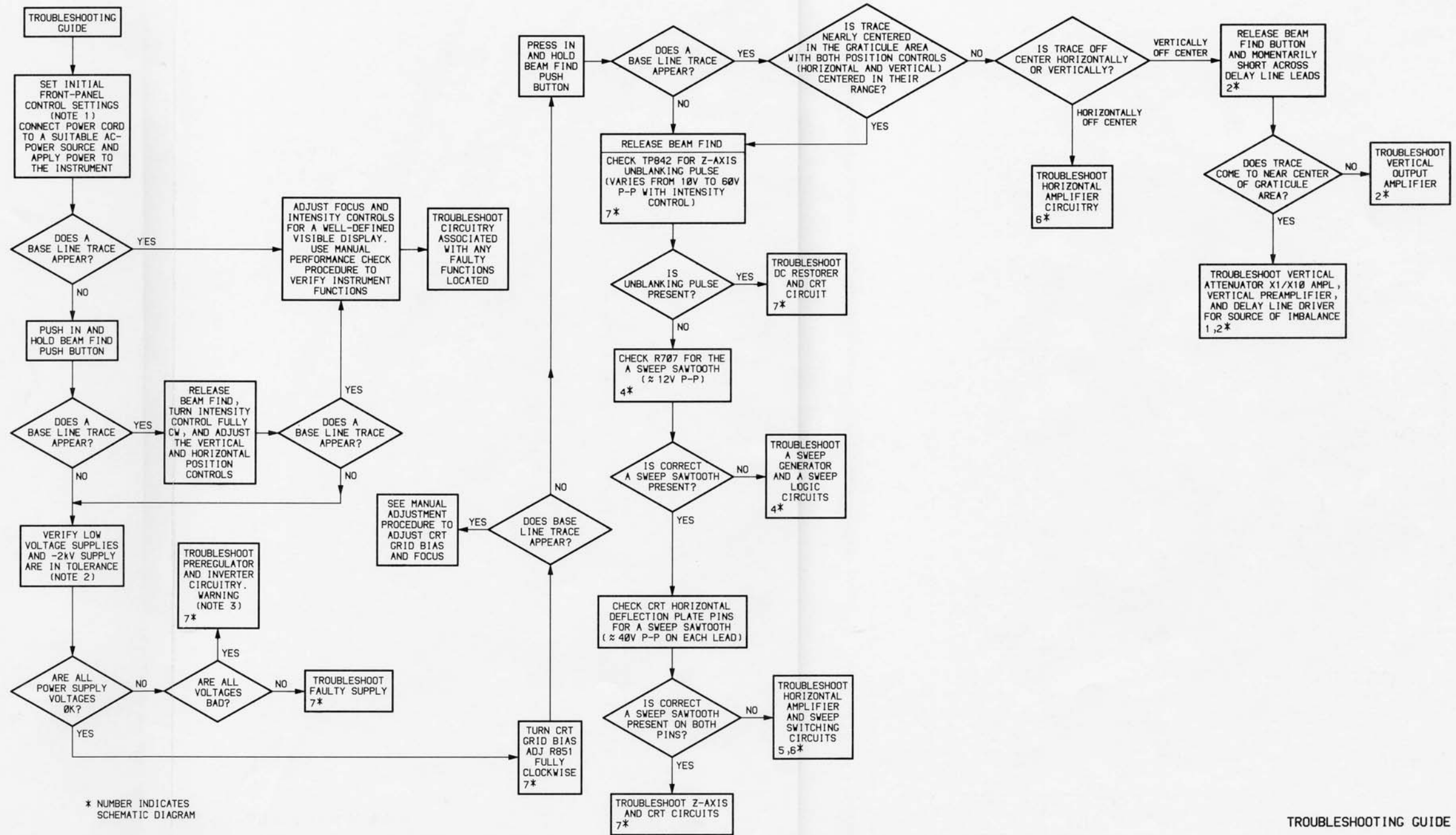
**NOTE**

A HV probe is required to measure the -2kV supply. Turn off the power and make the test equipment connections to the oscilloscope. Set the voltmeter to read at least -3kV, then turn the oscilloscope power back on to take the reading. After obtaining the reading, turn off the oscilloscope power to disconnect the test equipment connections, and replace the CRT socket cover.

Verify the -2kV supply at pin 2 of the CRT socket. The voltage should be between -1900 and -2100V.

3. **WARNING**

The Preregulator and Inverter circuits have a floating common reference with respect to chassis ground. Ac-source potential is present on the common reference points. Connect the instrument to the ac-power source through an isolation transformer to prevent the possibility of personal injury or equipment damage when troubleshooting these circuits. When an autotransformer is also used in the troubleshooting procedure, connect the isolation transformer to the ac-power source, then connect the autotransformer to the isolation transformer. Finally, plug the instrument power cord into the autotransformer outlet.



\* NUMBER INDICATES SCHEMATIC DIAGRAM



# 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.

## 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.

## 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.**

## 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                | OBD      | ORDER BY DESCRIPTION | SO       | SQUARE          |
| BRKT  | BRACKET            | FR      | FRAME or FRONT        | OD       | OUTSIDE DIAMETER     | SST      | STAINLESS STEEL |
| BRS   | BRASS              | FSTNR   | FASTENER              | OVH      | OVAL HEAD            | STL      | STEEL           |
| BRZ   | BRONZE             | FT      | FOOT                  | PH BRZ   | PHOSPHOR BRONZE      | SW       | SWITCH          |
| BSHG  | BUSHING            | FXD     | FIXED                 | PL       | PLAIN or PLATE       | T        | TUBE            |
| CAB   | CABINET            | GSKT    | GASKET                | PLSTC    | PLASTIC              | TERM     | TERMINAL        |
| CAP   | CAPACITOR          | HDL     | HANDLE                | PN       | PART NUMBER          | THD      | THREAD          |
| CER   | CERAMIC            | HEX     | HEXAGON               | PNH      | PAN HEAD             | THK      | THICK           |
| CHAS  | CHASSIS            | HEX HD  | HEXAGONAL HEAD        | PWR      | POWER                | TNSN     | TENSION         |
| CKT   | CIRCUIT            | HEX SOC | HEXAGONAL SOCKET      | RCPT     | RECEPTACLE           | TPG      | TAPPING         |
| COMP  | COMPOSITION        | 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      |

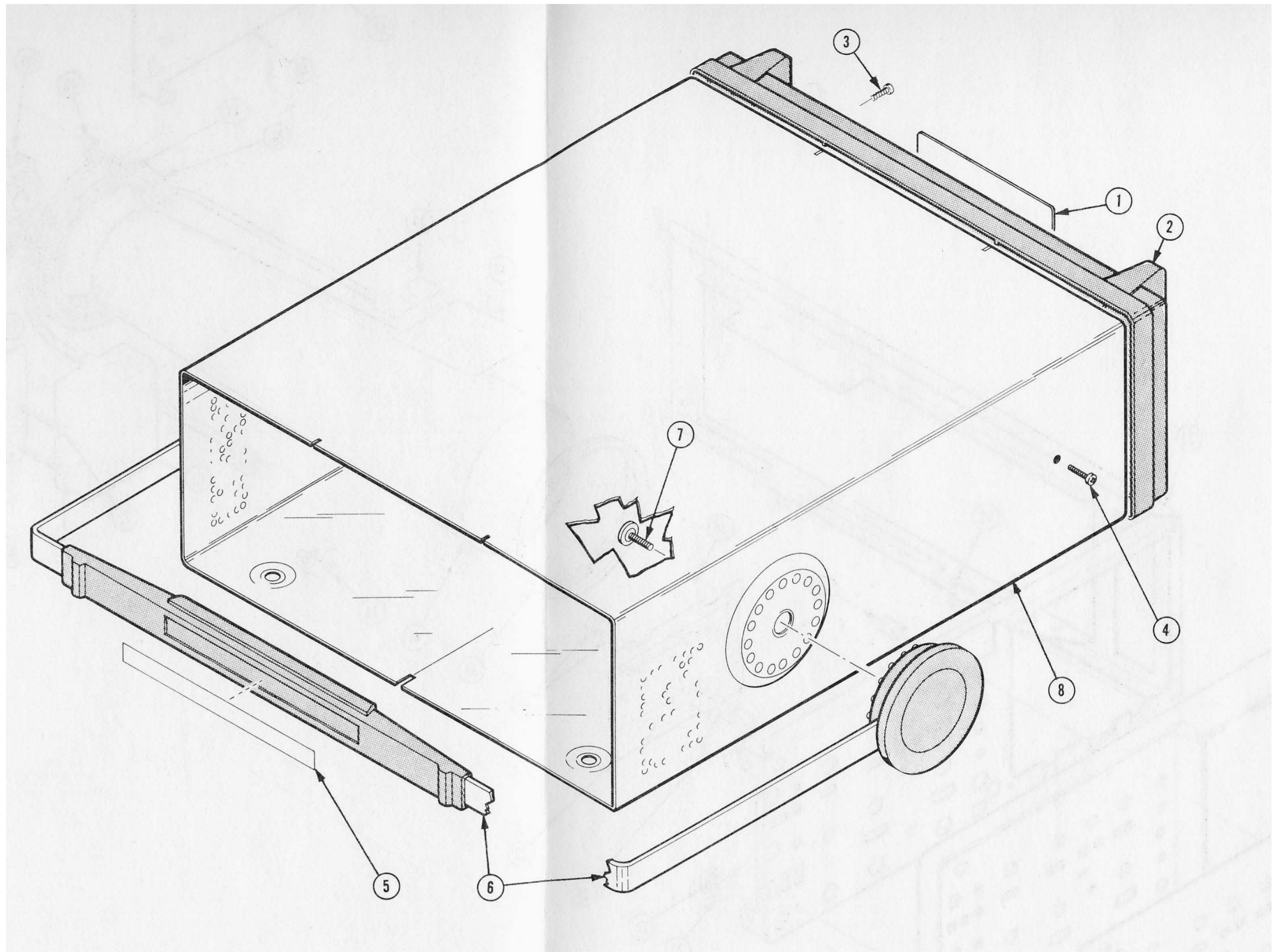
Replaceable Mechanical Parts—2215A Service

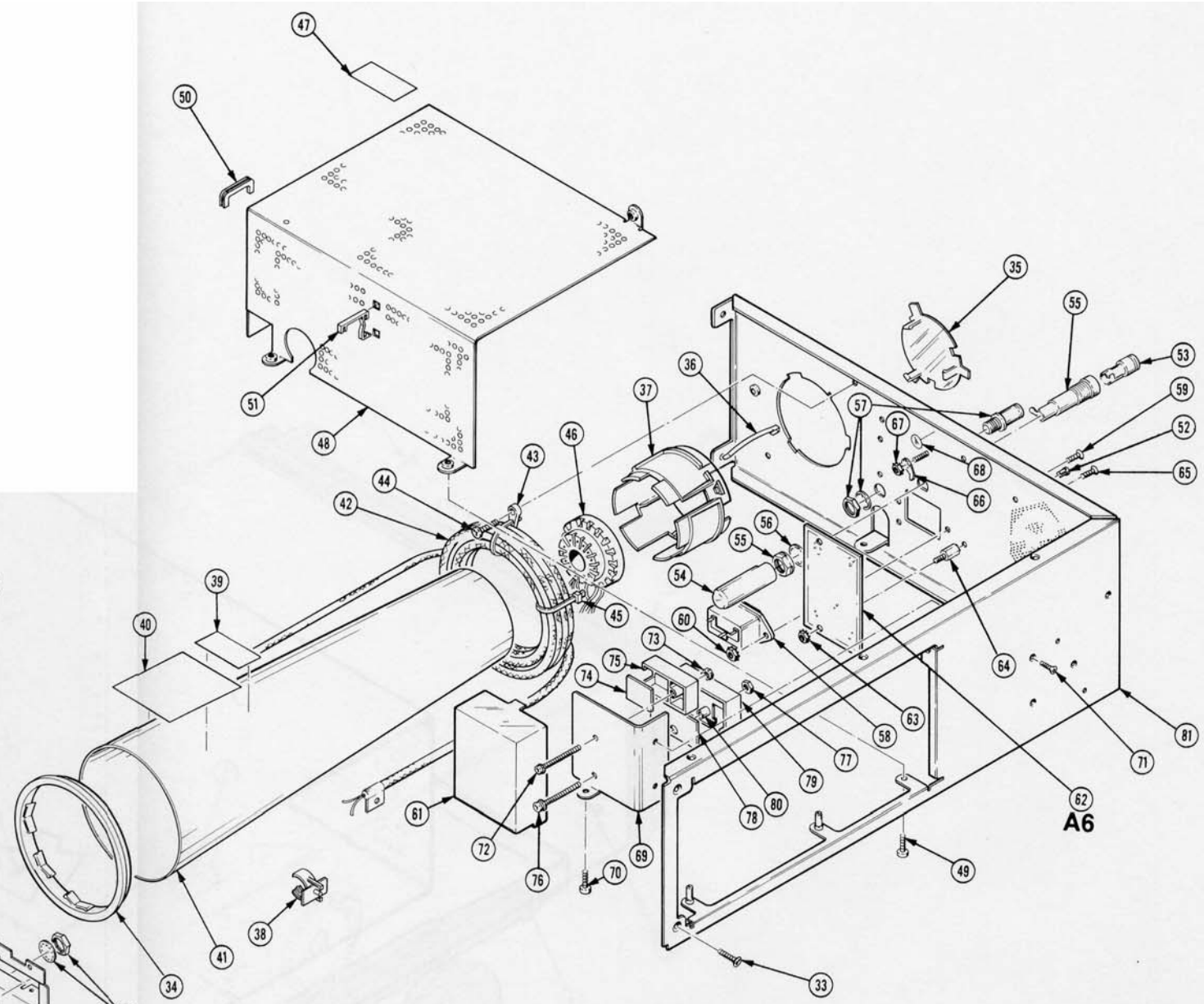
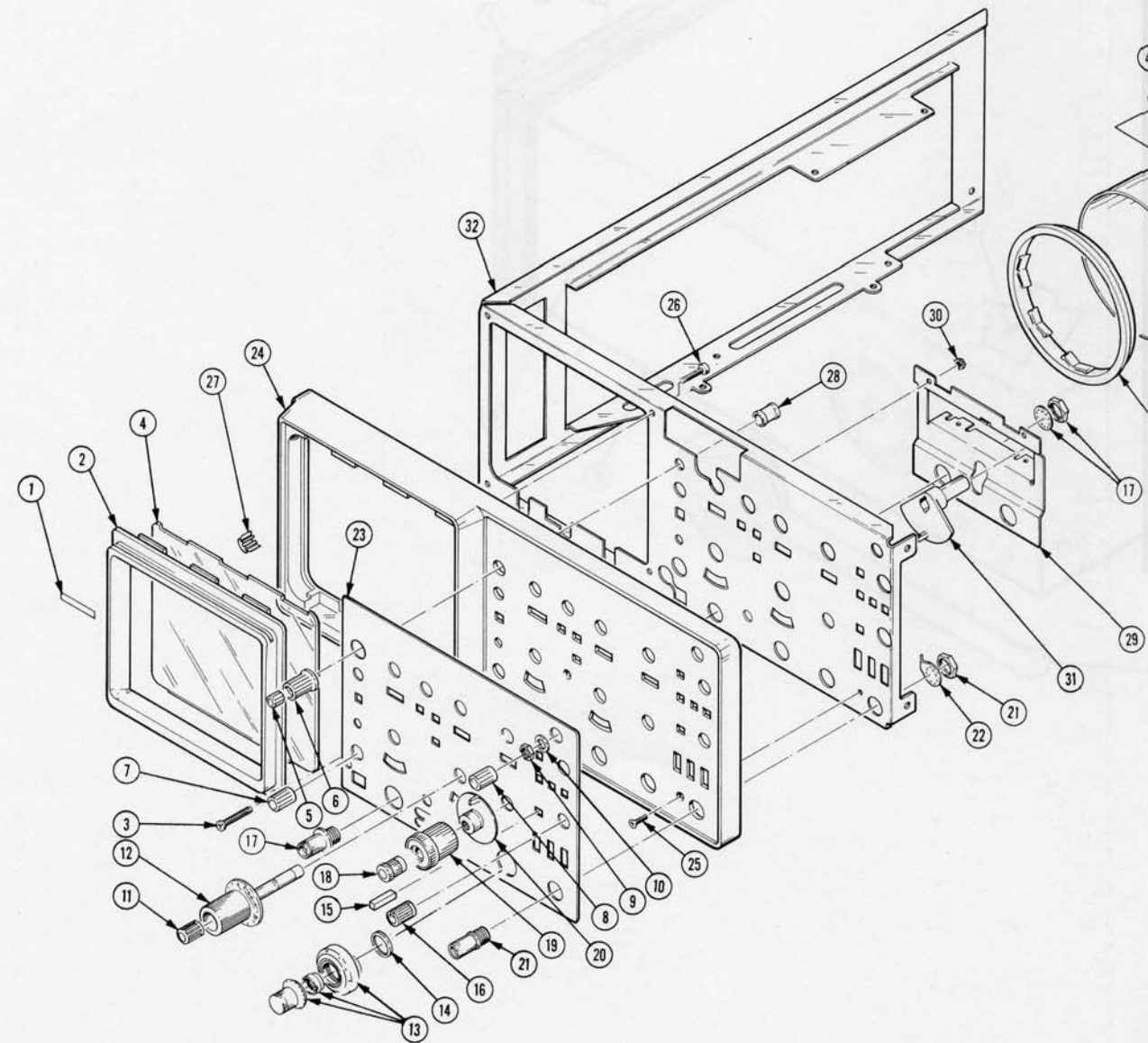
CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer                                      | Address                | City, State, Zip         |
|-----------|---|------------------------|--------------------------|
| 00779     | AMP, INC.   | P.O. BOX 3608          | HARRISBURG, PA 17105     |
| 01536     | CAMCAR DIV OF TEXTRON INC. SEMS PRODUCTS UNIT     | 1818 CHRISTINA ST.     | ROCKFORD, IL 61108       |
| 02768     | ILLINOIS TOOL WORKS, INC., FASTEX DIV.            | 195 ALGONQUIN ROAD     | DES PLAINES, IL 60016    |
| 05129     | KILO ENGINEERING COMPANY                          | 2015 D                 | LA VERNE, CA 91750       |
| 06383     | PANDUIT CORPORATION                               | 17301 RIDGELAND        | TINLEY PARK, IL 60477    |
| 13511     | AMPHENOL CARDRE DIV., BUNKER RAMO CORP.           |                        | LOS GATOS, CA 95030      |
| 22526     | BERG ELECTRONICS, INC.                            | YOUK EXPRESSWAY        | NEW CUMBERLAND, PA 17070 |
| 22670     | G.M. NAMEPLATE, INC.                              | 2040 15TH AVENUE WEST  | SEATTLE, WA 98119        |
| 24931     | SPECIALITY CONNECTOR CO., INC.                    | 2620 ENDRESS PLACE     | GREENWOOD, IN 46142      |
| 30817     | INSTRUMENT SPECIALTIES COMPANY, INC.              |                        | LITTLE FALLS, NJ 07424   |
| 73743     | FISCHER SPECIAL MFG. CO.                          | 446 MORGAN ST.         | CINCINNATI, OH 45206     |
| 77820     | BENDIX CORP., THE, ELECTRICAL COMPONENTS DIVISION | SHERMAN AVE.           | SIDNEY, NY 13838         |
| 78189     | ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION     | ST. CHARLES ROAD       | ELGIN, IL 60120          |
| 80009     | TEKTRONIX, INC.                                   | P O BOX 500            | BEAVERTON, OR 97077      |
| 83385     | CENTRAL SCREW CO.                                 | 2530 CRESCENT DR.      | BROADVIEW, IL 60153      |
| 83486     | ELCO INDUSTRIES, INC.                             | 1103 SAMUELSON ROAD    | ROCKFORD, IL 61101       |
| 86113     | MICRODOT MFG. INC., CENTRAL SCREW - KEENE DIV.    | 149 EMERALD ST.        | KEENE, NH 03431          |
| 89663     | REESE, J. RAMSEY, INC.                            | 71 MURRAY STREET       | NEW YORK, NY 10007       |
| 93907     | TEXTRON INC. CAMCAR DIV                           | 600 18TH AVE           | ROCKFORD, IL 61101       |
| S3109     | C/O PANEL COMPONENTS CORP.                        | P.O. BOX 6626          | SANTA ROSA, CA 95406     |
| S3629     | PANEL COMPONENTS CORP.                            | 2015 SECOND ST.        | BERKELEY, CA 94170       |
| T1105     | J PHILLIP INDUSTRIES INC                          | 5713 NORTHWEST HIGHWAY | CHICAGO, IL 60646        |
| T1336     | PARSONS MFG CORP                                  | 1055 O'BRIEN           | MENLO PART, CA 94025     |

Replaceable Mechanical Parts—2215A Service

| Fig. &<br>Index<br>No. | Tektronix<br>Part No. | Serial/Model No. |        | Qty | 1 | 2 | 3 | 4 | 5 | Name & Description   | Mfr<br>Code | Mfr Part Number |
|------------------------|-----------------------|------------------|--------|-----|---|---|---|---|---|--|-------------|-----------------|
|                        |                       | Eff              | Dscont |     |   |   |   |   |   |  |             |                 |
| 1-1                    | 334-5001-06           |                  |        | 1   |   |   |   |   |   | MARKER,IDENT:MARKED CAUTION                                      | 80009       | 334-5001-06     |
| -2                     | 200-2538-00           |                  |        | 1   |   |   |   |   |   | COVER,REAR:PLASTIC<br>*****ATTACHING PARTS)*****                 | 80009       | 200-2538-00     |
| -3                     | 211-0691-00           |                  |        | 2   |   |   |   |   |   | SCREW,MACHINE:6-32 X 0.625,PNH<br>*****END ATTACHING PARTS)***** | 01536       | ORD BY DESCR    |
| -4                     | 213-0882-00           |                  |        | 1   |   |   |   |   |   | SCREW,TAPPING:6-32 X 0.437 TYPE C                                | 01536       | ORD BY DESCR    |
| -5                     | 334-0076-00           |                  |        | 1   |   |   |   |   |   | MARKER,IDENT:MKD HANDLE,2215A                                    | 80009       | 334-0076-00     |
| -6                     | 367-0289-00           |                  |        | 1   |   |   |   |   |   | HANDLE,CARRYING:13.855,SST<br>*****ATTACHING PARTS)*****         | 80009       | 367-0289-00     |
| -7                     | 212-0144-00           |                  |        | 2   |   |   |   |   |   | SCREW,TPG,TF:8-16 X 0.562 L<br>*****END ATTACHING PARTS)*****    | 93907       | 225-38131-012   |
| -8                     | 390-0790-06           |                  |        | 1   |   |   |   |   |   | CABINET,SCOPE:W/FEET   | 80009       | 390-0790-00     |





A6



Replaceable Mechanical Parts—2215A Service

| 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              | 334-5002-00        |                  |        | 1   | PLATE,IDENT:MKD TEKTRONIX  |   |   |   |   | 80009    | 334-5002-00      |
| -2               | 426-1765-00        |                  |        | 1   | FRAME,CRT:<br>***** (ATTACHING PARTS) *****                                  |   |   |   |   | 80009    | 426-1765-00      |
| -3               | 211-0690-01        |                  |        | 2   | SCREW,MACHINE:6-32 X 0.875,PNH,SST,TORX<br>***** (END ATTACHING PARTS) ***** |   |   |   |   | 86113    | ORD BY DESCR     |
| -4               | 337-2775-00        |                  |        | 1   | SHLD,IMPLOSION:  |   |   |   |   | 80009    | 337-2775-00      |
| -5               | 366-1391-03        |                  |        | 1   | KNOB:DOVE GRAY,0.081 ID X 0.28 O<br>(CH 1,2 V/DIV)                           |   |   |   |   | 80009    | 366-1391-03      |
| -6               | 366-2146-03        |                  |        | 1   | KNOB:DOVE GY,0.235 ID X 0.5 OD   |   |   |   |   | 80009    | 366-2146-03      |
| -7               | 384-1575-00        |                  |        | 1   | EXTENSION,SHAFT:FOCUS W/KNOB,PLASTIC   |   |   |   |   | 80009    | 384-1575-00      |
| -8               | 366-1146-00        |                  |        | 1   | KNOB:GRAY,IF GAIN  |   |   |   |   | 80009    | 366-1146-00      |
| -9               | 210-0583-00        |                  |        | 1   | NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS                                       |   |   |   |   | 73743    | 2X20317-402      |
| -10              | 210-0021-00        |                  |        | 1   | WASHER,LOCK:INTL,0.476 ID X 0.60" OD ST                                      |   |   |   |   | 78189    | 1222-01-00-0541C |
| -11              | 366-1031-03        |                  |        | 2   | KNOB:RED-CAL   |   |   |   |   | 80009    | 366-1031-03      |
| -12              | 366-2148-01        |                  |        | 2   | KNOB:GY,VOLTS/DIV 0.72 OD,0.79 H   |   |   |   |   | 80009    | 366-2148-01      |
| -13              | 331-0328-00        |                  |        | 1   | DIAL,CONTROL:10 TURN FOR 0.25 DIA SHAFT                                      |   |   |   |   | 05129    | 461-S-70         |
| -14              | 210-0840-00        |                  |        | 1   | WASHER,FLAT:0.39 ID X 0.562 INCH OD,STL                                      |   |   |   |   | 89663    | 644R             |
| -15              | 366-2013-00        |                  |        | 8   | PUSH,BUTTON:DIRTY GRAY,0.134 SQ X 0.480                                      |   |   |   |   | 80009    | 366-2013-00      |
| -16              | 366-2049-01        |                  |        | 6   | KNOB:GRAY,0.172ID X 0.41OD   |   |   |   |   | 80009    | 366-2049-00      |
| -17              | 131-0126-00        |                  |        | 2   | CONNECTOR,RCPT.:BNC,FEMALE   |   |   |   |   | 77820    | 9663-1 NT-34     |
| -18              | 366-2052-01        |                  |        | 1   | KNOB:RED,CAL,0.127ID X 0.45OD<br>(A,B SEC/DIV)                               |   |   |   |   | 80009    | 366-2052-01      |
| -19              | 366-1840-03        |                  |        | 1   | KNOB:GY,TIME/DIV,0.127 ID X 0.85   |   |   |   |   | 80009    | 366-1840-03      |
| -20              | 366-1850-00        |                  |        | 1   | KNOB:CLEAR,0.252 ID X 1.2 OD X 0   |   |   |   |   | 80009    | 366-1850-00      |
| -21              | 131-0955-00        |                  |        | 1   | CONN,RCPT,ELEC:BNC,FEMALE  |   |   |   |   | 13511    | 31-279           |
| -22              | 210-0255-00        |                  |        | 1   | TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL                                      |   |   |   |   | 80009    | 210-0255-00      |
| -23              | 333-1862-00        |                  |        | 1   | PANEL,FRONT:   |   |   |   |   | 22670    | ORD BY DESCR     |
| -24              | 386-4850-00        |                  |        | 1   | SUBPANEL,FRONT:<br>***** (ATTACHING PARTS) *****                             |   |   |   |   | 80009    | 386-4850-00      |
| -25              | 213-0881-00        |                  |        | 3   | SCREW,TAPPING:6-32 X 0.25 TYPE C   |   |   |   |   | 01536    | ORD BY DESCR     |
| -26              | 213-0882-00        |                  |        | 2   | SCREW,TAPPING:6-32 X 0.437 TYPE C<br>***** (END ATTACHING PARTS) *****       |   |   |   |   | 01536    | ORD BY DESCR     |
| -27              | 348-0660-00        |                  |        | 4   | CUSHION,CRT:POLYURETHANE   |   |   |   |   | 80009    | 348-0660-00      |
| -28              | 361-1192-00        |                  |        | 1   | SPACER,SLEEVE:0.45 L X 0.25 ID,AL  |   |   |   |   | 80009    | 361-1192-00      |
| -29              | 407-2824-00        |                  |        | 1   | BRACKET,GROUND:PANEL,STEEL<br>***** (ATTACHING PARTS) *****                  |   |   |   |   | 80009    | 407-2824-00      |
| -30              | 210-0586-00        |                  |        | 2   | NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL<br>***** (END ATTACHING PARTS) *****   |   |   |   |   | 78189    | 211-041800-00    |
| -31              | 214-3375-00        |                  |        | 2   | LEVER,SWITCH:AC-GND-DC,PLASTIC   |   |   |   |   | 80009    | 214-3375-00      |
| -32              | 441-1631-00        |                  |        | 1   | CHASSIS,SCOPE:FRONT  |   |   |   |   | 80009    | 441-1631-00      |
|                  | 348-0274-00        |                  |        | AR  | SHLD GSKT,ELEK:FINGER TYPE,24.0 L  |   |   |   |   | 30817    | 97-555CDC        |
| -33              | 213-0881-00        |                  |        | 4   | SCREW,TAPPING:6-32 X 0.25 TYPE C   |   |   |   |   | 01536    | ORD BY DESCR     |
| -34              | 386-4443-00        |                  |        | 1   | SUPPORT,SHIELD:CRT,FRONT,PLASTIC   |   |   |   |   | 80009    | 386-4443-00      |
| -35              | 200-2519-00        |                  |        | 1   | CAP.,CRT SOCKET:NATURAL LEXAN  |   |   |   |   | 80009    | 200-2519-00      |
| -36              | 214-1061-05        |                  |        | 1   | SPRING,GROUND:PLATED   |   |   |   |   | 80009    | 214-1061-05      |
| -37              | 426-1766-00        |                  |        | 1   | MOUNT,RESILIENT:CRT,REAR   |   |   |   |   | 80009    | 426-1766-00      |
| -38              | 344-0347-00        |                  |        | 1   | CLIP,ELECTRICAL:ANODE,0.72 OD,NYLON  |   |   |   |   | 80009    | 344-0347-00      |
| -39              | 334-1379-00        |                  |        | 1   | LABEL:CRT,ADHESIVE BACK  |   |   |   |   | 80009    | 334-1379-00      |
| -40              | 334-1951-00        |                  |        | 1   | MARKER,IDENT:CRT WARNING   |   |   |   |   | 80009    | 334-1951-00      |
| -41              | 337-2774-00        |                  |        | 1   | SHIELD,ELEC:CRT,STEEL  |   |   |   |   | 80009    | 337-2774-00      |
| -42              | -----              |                  |        | 1   | DELAY LINE,ELEC:93NS,150 OHM,ASSY<br>(SEE DL9210 CHASSIS REPL)               |   |   |   |   |          |                  |
| -43              | 346-0121-00        |                  |        | 2   | .STRAP,ELEC COMP:TIE DOWN,5.0 LONG<br>***** (ATTACHING PARTS) *****          |   |   |   |   | 06383    | PLC1.5I-S8       |
| -44              | 213-0882-00        |                  |        | 2   | .SCREW,TAPPING:6-32 X 0.437 TYPE C<br>***** (END ATTACHING PARTS) *****      |   |   |   |   | 01536    | ORD BY DESCR     |
| -45              | 346-0128-00        |                  |        | 1   | .STRAP,TIE DOWN:0.1W X 8.0" LONG,NYLON                                       |   |   |   |   | 06383    | PLT2M            |
| -46              | 136-0202-08        |                  |        | 1   | SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT                                      |   |   |   |   | 80009    | 136-0202-08      |
| -47              | 334-4251-00        |                  |        | 1   | MARKER,IDENT:MKD CAUTION   |   |   |   |   | 80009    | 334-4251-00      |
| -48              | 337-2772-00        |                  |        | 1   | SHIELD,ELEC:POWER SUPPLY,AL<br>***** (ATTACHING PARTS) *****                 |   |   |   |   | 80009    | 337-2772-00      |
| -49              | 211-0305-00        |                  |        | 3   | SCREW,MACHINE:4-40 X 0.437,PNH<br>***** (END ATTACHING PARTS) *****          |   |   |   |   | 01536    | ORD BY DESCR     |
| -50              | 348-0555-00        |                  |        | 1   | GROMMET,PLASTIC:SIL GY,U SHAPE,0.52 ID                                       |   |   |   |   | 80009    | 348-0555-00      |
| -51              | 344-0334-00        |                  |        | 1   | CLIP,CIRCUIT BD:PLASTIC  |   |   |   |   | 80009    | 344-0334-00      |

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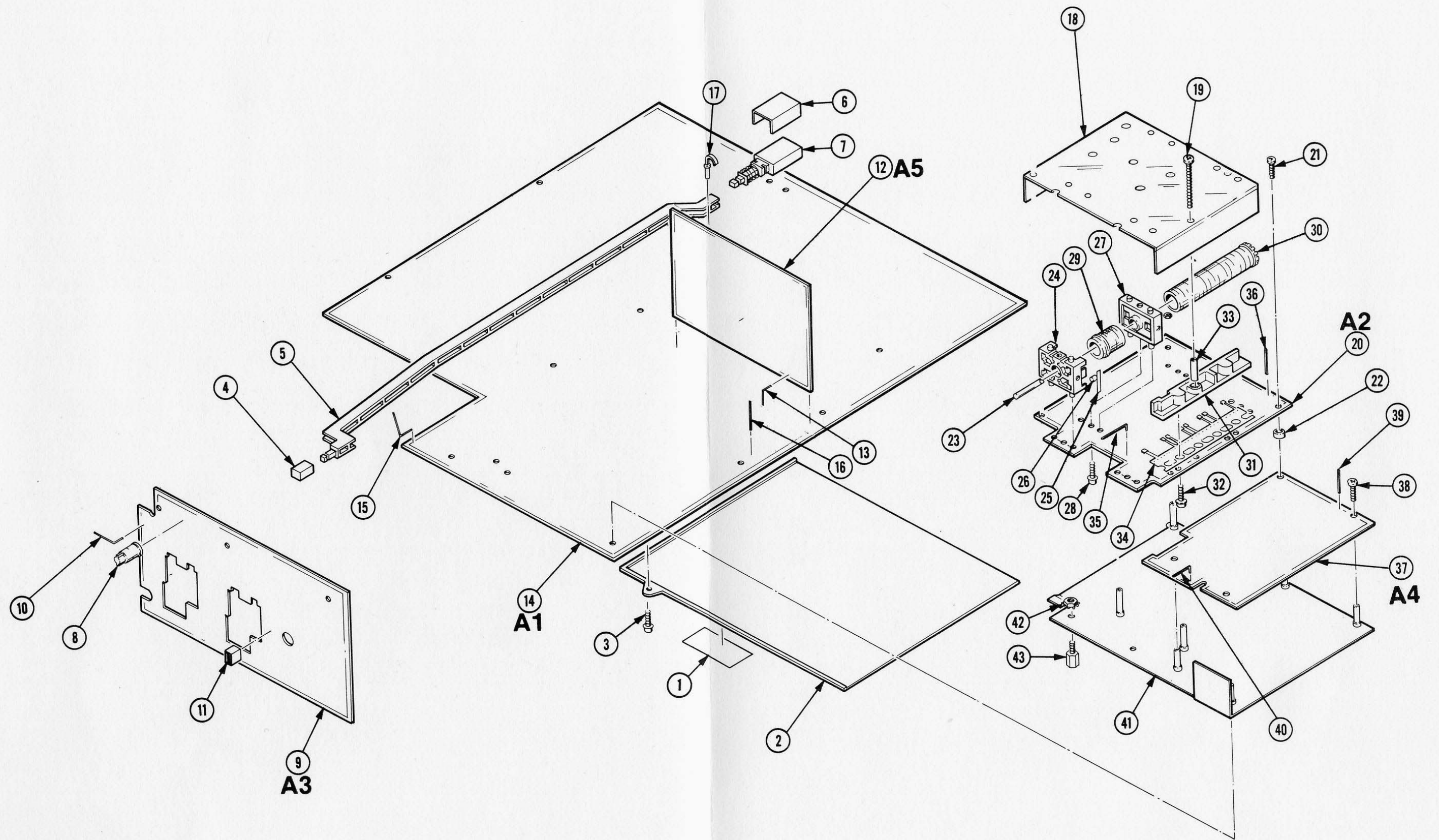
| Fig. &<br>Index<br>No. | Tektronix<br>Part No. | Serial/Model No. |        | Qty | Name & Description                       |   |   |   |   | Mfr<br>Code | Mfr Part Number  |
|------------------------|-----------------------|------------------|--------|-----|--|---|---|---|---|-------------|------------------|
|                        |                       | Eff              | Dscont |     | 1  | 2 | 3 | 4 | 5 |             |                  |
| 2-52                   | 134-0158-00           |                  |        | 2   | BUTTON,PLUG:0.187 DIA,NYLON              |   |   |   |   | 02768       | 207-080501-00    |
| -53                    | 200-2264-00           |                  |        | 1   | CAP.,FUSEHOLDER:3AG FUSES                |   |   |   |   | S3629       | FEK 031 1666     |
| -54                    | 200-1388-03           |                  |        | 1   | COVER,FUSE,LEAD:POLYURETHANE             |   |   |   |   | 80009       | 200-1388-03      |
| -55                    | 204-0833-00           |                  |        | 1   | BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES     |   |   |   |   | S3629       | 031.1653(MDLFEU) |
| -56                    | 210-1039-00           |                  |        | 1   | WASHER,LOCK:INT,0.521 ID X 0.625 INCH O  |   |   |   |   | 24931       | ORD BY DESCR     |
| -57                    | 131-0955-00           |                  |        | 1   | CONN,RCPT,ELEC:BNC,FEMALE                |   |   |   |   | 13511       | 31-279           |
| -58                    | -----                 |                  |        | 1   | FILTER,RFI:1A,250VAC                     |   |   |   |   |             |                  |
|                        | -----                 |                  |        | -   | (SEE FL9001 CHASSIS REPL)                |   |   |   |   |             |                  |
|                        |                       |                  |        |     | ***** (ATTACHING PARTS) *****            |   |   |   |   |             |                  |
| -59                    | 211-0323-00           |                  |        | 2   | SCREW,MACHINE:4-40 X 0.312,FLH,100 DEG   |   |   |   |   | 83385       | ORD BY DESCR     |
| -60                    | 210-0583-00           |                  |        | 2   | NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS   |   |   |   |   | 73743       | 2X20317-402      |
|                        |                       |                  |        |     | ***** (END ATTACHING PARTS) *****        |   |   |   |   |             |                  |
| -61                    | 200-2845-00           |                  |        | 1   | COVER,CKT BD:LINE FILTER                 |   |   |   |   | 80009       | 200-2845-00      |
| -62                    | -----                 |                  |        | 1   | CKT BOARD ASSY:EMI FILTER BOARD          |   |   |   |   |             |                  |
|                        | -----                 |                  |        | -   | (SEE A6 REPL)                            |   |   |   |   |             |                  |
|                        |                       |                  |        |     | ***** (ATTACHING PARTS) *****            |   |   |   |   |             |                  |
| -63                    | 210-0586-00           |                  |        | 2   | NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL    |   |   |   |   | 78189       | 211-041800-00    |
|                        |                       |                  |        |     | ***** (END ATTACHING PARTS) *****        |   |   |   |   |             |                  |
| -64                    | 129-0339-00           |                  |        | 2   | POST,ELEC-MECH:0.27 LONG X 0.25 HEX BRS  |   |   |   |   | 80009       | 129-0339-00      |
|                        |                       |                  |        |     | ***** (ATTACHING PARTS) *****            |   |   |   |   |             |                  |
| -65                    | 211-0303-00           |                  |        | 2   | SCREW,MACHINE:4-40 X 0.25,FLH 100 DEG    |   |   |   |   | 01536       | ORD BY DESCR     |
|                        |                       |                  |        |     | ***** (END ATTACHING PARTS) *****        |   |   |   |   |             |                  |
| -66                    | 210-0202-00           |                  |        | 1   | TERMINAL,LUG:0.146 ID,LOCKING,BRZ,TIN PL |   |   |   |   | 78189       | 2104-06-00-2520N |
|                        |                       |                  |        |     | ***** (ATTACHING PARTS) *****            |   |   |   |   |             |                  |
| -67                    | 210-0457-00           |                  |        | 1   | NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL   |   |   |   |   | 83385       | ORD BY DESCR     |
|                        |                       |                  |        |     | ***** (END ATTACHING PARTS) *****        |   |   |   |   |             |                  |
| -68                    | 334-3379-02           |                  |        | 1   | MARKER,IDENT:MARKED GROUND SYMBOL        |   |   |   |   | 80009       | 334-3379-02      |
| -69                    | 407-2729-00           |                  |        | 1   | BRACKET,HEAT SK:AL                       |   |   |   |   | 80009       | 407-2729-00      |
|                        |                       |                  |        |     | ***** (ATTACHING PARTS) *****            |   |   |   |   |             |                  |
| -70                    | 211-0305-00           |                  |        | 1   | SCREW,MACHINE:4-40 X 0.437,PNH           |   |   |   |   | 01536       | ORD BY DESCR     |
| -71                    | 210-0586-00           |                  |        | 2   | NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL    |   |   |   |   | 78189       | 211-041800-00    |
|                        |                       |                  |        |     | ***** (END ATTACHING PARTS) *****        |   |   |   |   |             |                  |
| -72                    | 211-0302-00           |                  |        | 1   | SCREW,MACHINE:4-40 X 0.75,PNH            |   |   |   |   | 01536       | ORD BY DESCR     |
| -73                    | 210-0586-00           |                  |        | 1   | NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL    |   |   |   |   | 78189       | 211-041800-00    |
| -74                    | 342-0582-00           |                  |        | 1   | INSULATOR,PLATE:TRANSISTOR,CERAMIC       |   |   |   |   | 80009       | 342-0582-00      |
| -75                    | 343-1025-00           |                  |        | 1   | RETAINER,XSTR:                           |   |   |   |   | 80009       | 343-1025-00      |
| -76                    | 211-0691-00           |                  |        | 1   | SCREW,MACHINE:6-32 X 0.625,PNH           |   |   |   |   | 01536       | ORD BY DESCR     |
| -77                    | 210-0408-00           |                  |        | 1   | NUT,PLAIN,HEX.:6-32 X 0.312 INCH,BRS     |   |   |   |   | 73743       | 3040-402         |
| -78                    | 342-0555-00           |                  |        | 1   | INSULATOR,PLATE:HEAT SINK,AL             |   |   |   |   | 80009       | 342-0555-00      |
| -79                    | 343-0969-00           |                  |        | 1   | RETAINER,XSTR:POLYPHENYLENE SULFIDE      |   |   |   |   | 80009       | 343-0969-00      |
| -80                    | 361-1047-00           |                  |        | 1   | SPACER,VAR RES:0.3 X 0.615 X 0.55        |   |   |   |   | 80009       | 361-1047-00      |
| -81                    | 441-1536-01           |                  |        | 1   | CHASSIS,SCOPE:REAR                       |   |   |   |   | 80009       | 441-1536-01      |

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| Fig. &<br>Index<br>No. | Tektronix<br>Part No. | Serial/Model No. |        | Qty | 1 2 3 4 5 | Name & Description   | Mfr<br>Code | Mfr Part Number |
|------------------------|-----------------------|------------------|--------|-----|-----------|--|-------------|-----------------|
|                        |                       | Eff              | Dscont |     |           |  |             |                 |
| 3-1                    | 334-4251-00           |                  |        | 1   |           | MARKER,IDENT:MKD CAUTION   | 80009       | 334-4251-00     |
| -2                     | 337-2773-00           |                  |        | 1   |           | SHIELD,ELEC:POWER SUPPLY,LOWER,PLSTC<br>***** (ATTACHING PARTS) *****                                  | 80009       | 337-2773-00     |
| -3                     | 211-0305-00           |                  |        | 1   |           | SCREW,MACHINE:4-40 X 0.437,PNH<br>***** (END ATTACHING PARTS) *****                                    | 01536       | ORD BY DESCR    |
| -4                     | 366-1480-03           |                  |        | 1   |           | PUSH BUTTON:BLACK,OFF  | 80009       | 366-1480-03     |
| -5                     | 384-1576-01           |                  |        | 1   |           | EXTENSION SHAFT:12.809 L,PLASTIC   | 80009       | 384-1576-01     |
| -6                     | 200-2735-00           |                  |        | 1   |           | COVER,POWER SW:  | 80009       | 200-2735-00     |
| -7                     | -----                 |                  |        | 1   |           | SWITCH,PUSH:DPDT,4A,250VAC,W/BRKT<br>(SEE A1S901 REPL)   |             |                 |
| -8                     | 377-0512-00           |                  |        | 6   |           | INSERT,KNOB:0.125 ID X 0.663 L,AL  | 80009       | 377-0512-00     |
| -9                     | -----                 |                  |        | 1   |           | CKT BOARD ASSY:FRONT PANEL(SEE A3 REPL)  |             |                 |
| -10                    | 131-0608-00           |                  |        | 2   |           | .TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD  | 22526       | 48283-036       |
| -11                    | 136-0499-02           |                  |        | 3   |           | .CONNECTOR,RCPT,:2 CONTACT   | 00779       | 4-380949-2      |
| -12                    | -----                 |                  |        | 1   |           | CKT BOARD ASSY:ALTERNATE SWEEP(SEE A5 REPL)  |             |                 |
| -13                    | 131-0589-00           |                  |        | 27  |           | .TERMINAL,PIN:0.46 L X 0.025 SQ  | 22526       | 48283-029       |
| -14                    | -----                 |                  |        | 1   |           | CKT BOARD ASSY:MAIN(SEE A1 REPL)   |             |                 |
| -15                    | 131-0608-00           |                  |        | 3   |           | .TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD  | 22526       | 48283-036       |
| -16                    | 131-0589-00           |                  |        | 7   |           | .TERMINAL,PIN:0.46 L X 0.025 SQ  | 22526       | 48283-029       |
| -17                    | 343-0088-00           |                  |        | 1   |           | .CLAMP,LOOP:0.062 INCH DIA   | 80009       | 343-0088-00     |
| -18                    | 337-3014-00           |                  |        | 1   |           | CKT BOARD ASSY:ATTENUATOR(SEE A2 REPL)<br>.SHIELD,ELEC:ATTENUATOR TOP<br>***** (ATTACHING PARTS) ***** | 80009       | 337-3014-00     |
| -19                    | 211-0326-00           |                  |        | 2   |           | .SCREW,MACHINE:4-40 X 1.25,PNH,TORX DRIVE<br>***** (END ATTACHING PARTS) *****                         | 83486       | ORD BY DESCR    |
| -20                    | -----                 |                  |        | 1   |           | .CKT BOARD ASSY:ATTENUATOR(SEE A2A1 REPL)<br>***** (ATTACHING PARTS) *****                             |             |                 |
| -21                    | 211-0325-00           |                  |        | 1   |           | .SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX   | 01536       | ORD BY DESCR    |
| -22                    | 361-1191-00           |                  |        | 1   |           | .SPACER,CKT BD:0.222 X 0.125 X 0.25  | 80009       | 361-1191-00     |
|                        | 361-1081-00           |                  |        | 1   |           | .SPACER,LED:PLASTIC<br>***** (END ATTACHING PARTS) *****   | 80009       | 361-1081-00     |
| -23                    | 384-1056-00           |                  |        | 2   |           | .ATTENUATOR BOARD ASSY INCLUDES:<br>.EXTENSION SHAFT:0.125 OD X 6.58 INCH LON                          | 80009       | 384-1056-00     |
|                        | 376-0209-00           |                  |        | 2   |           | .CPLG SHAFT,RGD:0.127 ID,PLASTIC   | 80009       | 376-0209-00     |
|                        | -----                 |                  |        | 4   |           | .SWITCH ASSY (SEE S1,S10,S51,S60 REPL)   |             |                 |
| -24                    | 401-0370-00           |                  |        | 8   |           | ...BEARING,CAM SW:END,0.6 DIA  | 80009       | 401-0370-00     |
| -25                    | 214-1126-01           |                  |        | 6   |           | ...SPRING,FLAT:0.7 X 0.125,CU BE GRN CLR   | 80009       | 214-1126-01     |
|                        | 214-1126-02           |                  |        | 2   |           | ...SPRING,FLAT:RED COLORED   | 80009       | 214-1126-02     |
|                        | -----                 |                  |        | -   |           | ...(S10,S60 ONLY)  |             |                 |
| -26                    | 214-1752-00           |                  |        | 8   |           | ...ROLLER,DETENT:  | 80009       | 214-1752-00     |
| -27                    | 401-0369-00           |                  |        | 2   |           | .BEARING,CAM SW:CENTER,0.6 DIA<br>***** (ATTACHING PARTS) *****  | 80009       | 401-0369-00     |
| -28                    | 211-0325-00           |                  |        | 2   |           | .SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX<br>***** (END ATTACHING PARTS) *****                          | 01536       | ORD BY DESCR    |
| -29                    | 105-0934-00           |                  |        | 2   |           | .ACTUATOR,CAM SW:AC-GND-DC<br>(PART OF S1,S51 ONLY)  | 80009       | 105-0934-00     |
| -30                    | 105-0935-00           |                  |        | 2   |           | .ACTUATOR,CAM SW:ATTENUATOR<br>(PART OF S10,S60 ONLY)  | 80009       | 105-0935-00     |
| -31                    | 343-1020-00           |                  |        | 2   |           | .RETAINER,CONT:ABS GRAY<br>***** (ATTACHING PARTS) *****   | 80009       | 343-1020-00     |
| -32                    | 211-0325-00           |                  |        | 4   |           | .SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX<br>***** (END ATTACHING PARTS) *****                          | 01536       | ORD BY DESCR    |
| -33                    | 361-1193-00           |                  |        | 2   |           | .SPACER,SLEEVE:0.555 L X 0.13 ID,BRASS   | 80009       | 361-1193-00     |
| -34                    | 131-1758-11           |                  |        | 2   |           | .CONT ASSY,ELEC:8 CONTACTS   | 80009       | 131-1758-11     |
|                        | 131-1758-12           |                  |        | 2   |           | .CONT ASSY,ELEC:8 CONTACTS   | 80009       | 131-1758-12     |
| -35                    | 131-0787-00           |                  |        | 2   |           | .TERMINAL,PIN:0.64L X 0.025 SQ   | 22526       | 47359           |
| -36                    | 131-0608-00           |                  |        | 11  |           | .TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD  | 22526       | 48283-036       |
|                        | 136-0252-07           |                  |        | 24  |           | .SOCKET,PIN CONN:W/O DIMPLE  | 22526       | 75060-012       |
| -37                    | -----                 |                  |        | 1   |           | .CKT BOARD ASSY:TIMING (SEE A4 REPL)<br>***** (ATTACHING PARTS) *****                                  |             |                 |
| -38                    | 211-0325-00           |                  |        | 2   |           | .SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX<br>***** (END ATTACHING PARTS) *****                          | 01536       | ORD BY DESCR    |

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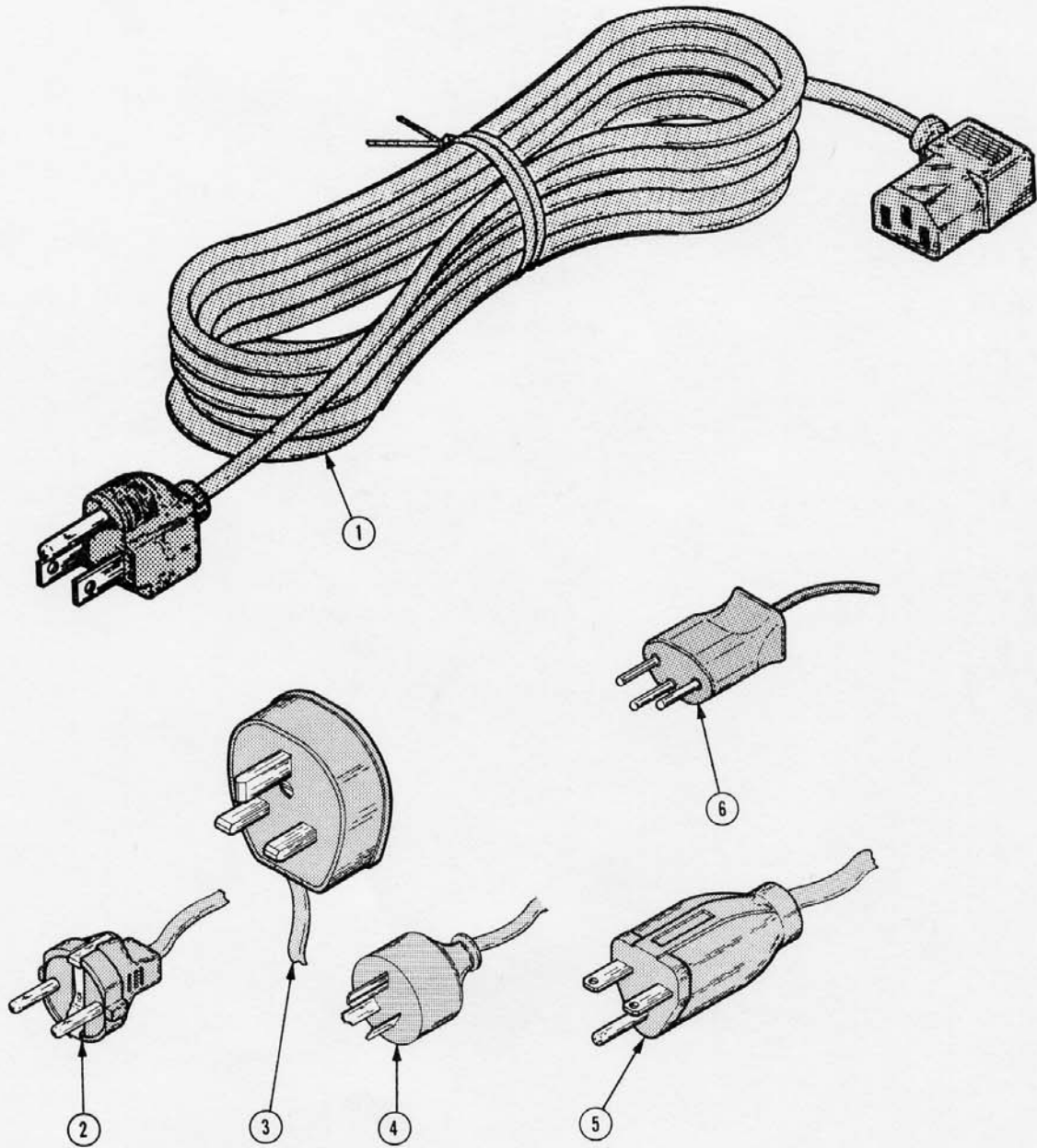
| Fig. & Index No. | Tektronix Part No. | Serial/Model No. |        | Qty | 1 | 2 | 3 | 4 | 5 | Name & Description                         | Mfr Code | Mfr Part Number |
|------------------|--------------------|------------------|--------|-----|---|---|---|---|---|--|----------|-----------------|
|                  |                    | Eff              | Dscont |     |   |   |   |   |   |  |          |                 |
| 3-39             | 131-0608-00        |                  |        | 18  |   |   |   |   |   | ..TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD | 22526    | 48283-036       |
| -40              | 131-0787-00        |                  |        | 4   |   |   |   |   |   | ..TERMINAL,PIN:0.64L X 0.025 SQ            | 22526    | 47359           |
| -41              | 337-2944-00        |                  |        | 1   |   |   |   |   |   | .SHIELD,ELEC:SW BOARDS,BOTTOM              | 80009    | 337-2944-00     |
| -42              | 210-0586-00        |                  |        | 2   |   |   |   |   |   | .NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL     | 78189    | 211-041800-00   |
| -43              | 129-0906-00        |                  |        | 2   |   |   |   |   |   | .SPACER,POST:0.685 L W/4-40 INT & EXT TH   | 80009    | 129-0906-00     |





Replaceable Mechanical Parts—2215A Service

| Fig. &<br>Index<br>No. | Tektronix<br>Part No. | Serial/Model No. |        | Qty | 1 2 3 4 5 |  |  |  |  | Name & Description   | Mfr<br>Code | Mfr Part Number |
|------------------------|-----------------------|------------------|--------|-----|-----------|--|--|--|--|--|-------------|-----------------|
|                        |                       | Eff              | Dscont |     |           |  |  |  |  |  |             |                 |
| STANDARD ACCESSORIES   |                       |                  |        |     |           |  |  |  |  |  |             |                 |
|                        | 070-4732-00           |                  |        | 1   |           |  |  |  |  | MANUAL,TECH:OPERATORS,2215A  | 80009       | 070-4732-00     |
|                        | 010-6122-01           |                  |        | 2   |           |  |  |  |  | PROBE,VOLTAGE:P6122,1.5 METER,10X W/ACCES                              | 80009       | 010-6122-01     |
|                        | 346-0199-00           |                  |        | 1   |           |  |  |  |  | STRAP,CARRYING:  |             |                 |
| 4-1                    | 161-0104-00           |                  |        | 1   |           |  |  |  |  | CABLE ASSY,PWR,:3 WIRE,98.0 L,W/RTANG CONN                             | S3109       | ORD BY DESCR    |
| ALSO AVAILABLE         |                       |                  |        |     |           |  |  |  |  |  |             |                 |
| -2                     | 161-0104-06           |                  |        | -   |           |  |  |  |  | CABLE ASSY,PWR:3 X 0.75MM SQ,220V,98.0L<br>(OPTION A1 EUROPEAN)        | S3109       | ORD BY DESCR    |
| -3                     | 161-0104-07           |                  |        | -   |           |  |  |  |  | CABLE ASSY,PWR:3 X 0.75MM SQ,240V,98.0 L<br>(OPTION A2 UNITED KINGDOM) | S3109       | ORD BY DESCR    |
| -4                     | 161-0104-05           |                  |        | -   |           |  |  |  |  | CABLE ASSY,PWR:3,18 AWG,240V,98.0 L<br>(OPTION A3 AUSTRALIA)           | S3109       | ORD BY DESCR    |
| -5                     | 161-0104-08           |                  |        | -   |           |  |  |  |  | CABLE ASSY,PWR:3,18 AWG,240V,98.0 L<br>(OPTION A4 NORTH AMERICAN)      | T1105       | ORD BY DESCR    |
| -6                     | 161-0167-00           |                  |        | -   |           |  |  |  |  | CABLE ASSY,PWR:3.0 X 0.75,6A,240V,2.5M<br>(OPTION A5 SWITZERLAND)      | S3109       | ORD BY DESCR    |
| OPTIONAL ACCESSORIES   |                       |                  |        |     |           |  |  |  |  |  |             |                 |
|                        | 070-4735-00           |                  |        | -   |           |  |  |  |  | MANUAL,TECH:SERVICE,2215A  | 80009       | 070-4735-00     |
|                        |                       |                  |        | -   |           |  |  |  |  | C-5C CAMERA, OPTION 04   |             |                 |
|                        |                       |                  |        | -   |           |  |  |  |  | 200C SCOPE-MOBILE CART   |             |                 |
|                        | 013-0191-00           |                  |        | -   |           |  |  |  |  | TIP PROBE:W/ACTUATOR   | 80009       | 013-0191-00     |
|                        | 016-0466-00           |                  |        | -   |           |  |  |  |  | ADAPTER,RACK:  | 80009       | 016-0466-00     |
|                        | 016-0677-02           |                  |        | -   |           |  |  |  |  | POUCH,ACCESSORY:2200 SERIES  |             |                 |
|                        | 016-0792-00           |                  |        | -   |           |  |  |  |  | CASE,CARRYING:24.0 X 16.0 X 9.0  | T1336       | 2116BE9         |
|                        | 020-0672-02           |                  |        | -   |           |  |  |  |  | ACCESSORY KIT:   | 80009       | 020-0672-02     |
|                        | 200-2520-00           |                  |        | -   |           |  |  |  |  | COVER,SCOPE:FRONT,ABS  | 80009       | 200-2520-00     |



## **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.

DESCRIPTION

PG 46

**EFFECTIVE ALL SERIAL NUMBERS**

**TEXT CHANGES**

**Page 5-19—5-20 Step 2.**

**Replace 2. Adjust Trigger Sensitivity (R479) with the following procedure.**

**2. Adjust Trigger Sensitivity (R479) and (R627)**

a. Set:

|                  |            |
|------------------|------------|
| VERTICAL MODE    | CH 1       |
| CH 1 VOLTS/DIV   | 0.1 V      |
| AC-GND-DC (both) | AC         |
| A and B SEC/DIV  | 10 $\mu$ s |

e. ADJUST—A Trigger Sensitivity (R479) while rotating the A TRIGGER LEVEL control slowly so that the A Trigger is just able to be maintained.

f. Adjust the A TRIGGER LEVEL control for a stable display.

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

g. Set the HORIZONTAL MODE switch to B.

c. Set the generator to produce a 50-kHz, 2.2-division display.

h. ADJUST—B Trigger Sensitivity (R627) while rotating the B TRIGGER LEVEL control slowly so that the B Trigger is just able to be maintained.

d. Set the CH 1 VOLTS/DIV switch to 1 V.

i. Return the HORIZONTAL MODE switch to A.

**REPLACEABLE ELECTRICAL PARTS LIST CHANGES**

**CHANGE TO:**

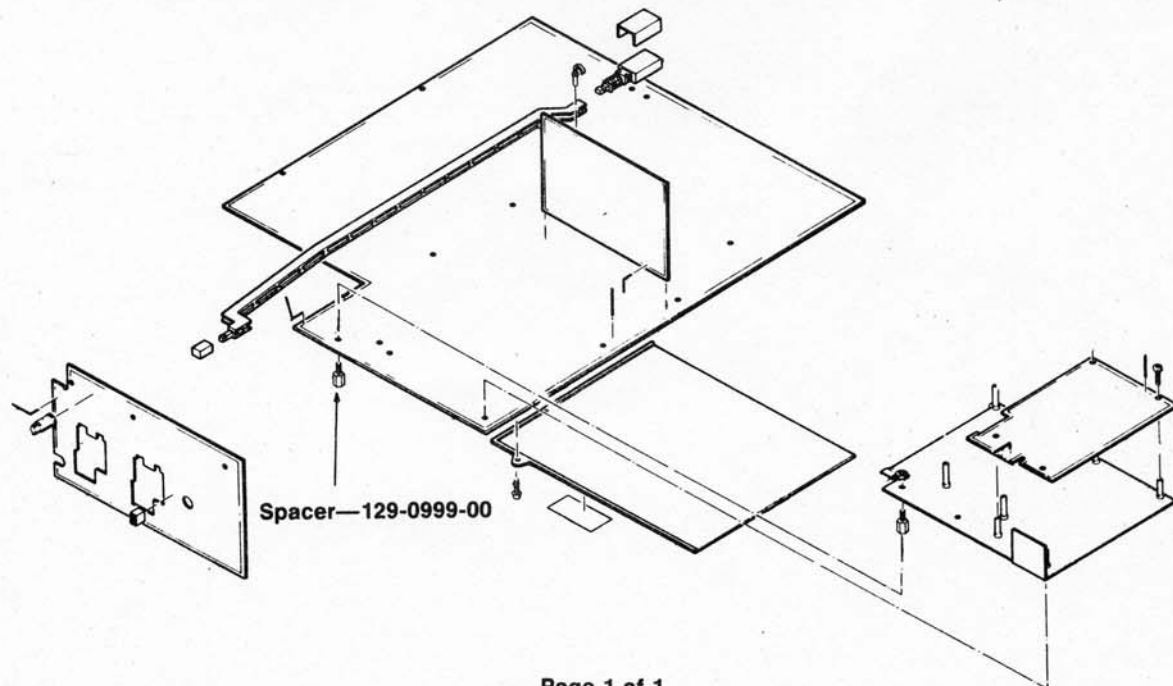
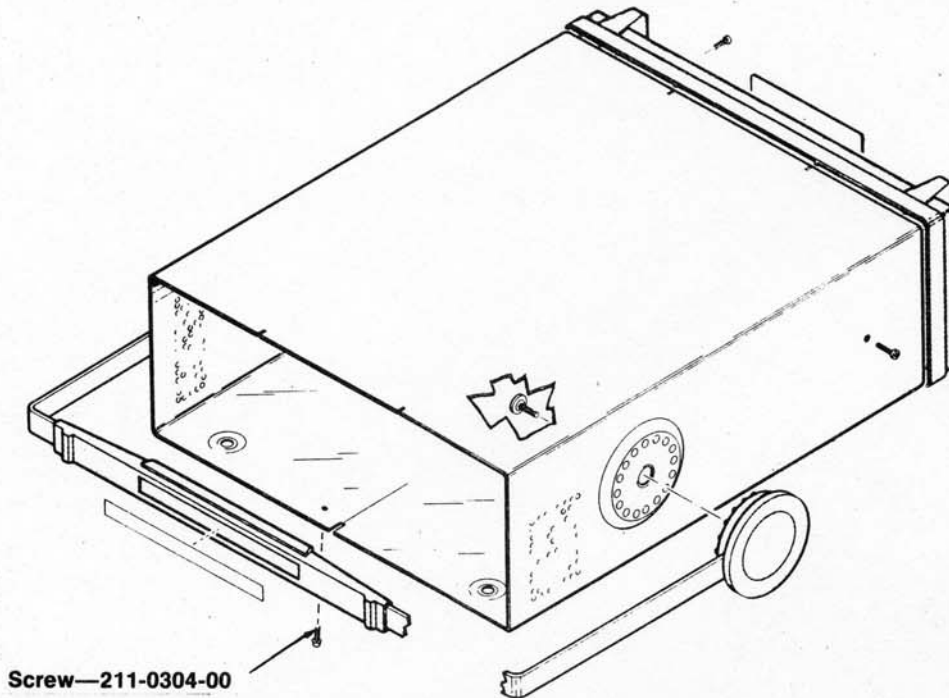
A5R627 311-1921-00 RES,VAR,NONWIR: 250 OHM,10%,0.5W

DESCRIPTION

PG 46

**EFF ALL SERIAL NUMBERS**

As indicated below with the two partial drawings, add a screw (PN: 211-0304-00) to the "Cabinet" exploded view drawing and add a spacer (PN: 129-0999-00) to the "Attenuator Assy & Bottom" exploded view drawing.





DESCRIPTION

PG 46

**EFFECTIVE ALL SERIAL NUMBERS**

**TEXT CHANGES**

**Page 5-19—5-20 Step 2.**

Replace **2. Adjust Trigger Sensitivity (R479) and (R627)** with the following procedure.

**2. Adjust Trigger Sensitivity (R479)**

a. Set:

|                       |            |
|-----------------------|------------|
| VERTICAL MODE         | CH 1       |
| CH 1 VOLTS/DIV        | 0.1 V      |
| Input Coupling (both) | AC         |
| A SEC/DIV             | 10 $\mu$ S |

b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

c. Set the generator to produce a 50-kHz, 2.2-division display.

d. Set the CH 1 VOLTS/DIV switch to 1 V.

e. ADJUST—Trigger Sensitivity (R479) while rotating the A TRIGGER LEVEL control slowly so that the A Trigger is just able to be maintained.